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ASSESSMENT

Pedometer Accuracy and Metabolic Cost in Elementary School Children While Walking, Skipping, Galloping, and Sliding

John D. Smith, Cynthia Schroeder, Rosalyn M. Smith

Abstract

Pedometers are commonly used instruments that measure activity in children. While pedometers were designed to measure activity during walking, children often engage in other locomotor movements, such as skipping, galloping, and sliding. This study assessed the accuracy of two pedometers in children performing these movements and quantified the metabolic cost of these movements. Fifty-three children performed these movements on a motorized treadmill for 3 min at 67 m/min and again at 80.5 m/min. Pedometers were most accurate during walking and least accurate during skipping. Pedometers also tended to underestimate step counts during skipping, galloping, and sliding. Skipping, galloping, and sliding elicited greater metabolic cost compared to walking at the same speeds. In the context of teaching a physical education class, pedometer counts across these locomotor patterns could be used as a proxy measure of metabolic cost. Physical educators can use this information when assessing activity in PE classes that incorporate these kinds of locomotor movements.

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The pedometer is a relatively small device that can be worn inconspicuously on the hip and can gauge physical activity levels by registering steps. Technology has increased the functionality of the pedometer by providing the user with estimates of distance walked, calories burned, and time spent in activity. The pedometer has been the focus of much research because of its relatively low cost and ease of use. Researchers have assessed the reliability (Barfield, Rowe, & Michael, 2004; Jago et al., 2006; Schneider, Crouter, Lukajic, & Bassett, 2003) and validity (Bassett et al., 2000; Crouter, Schneider, Karabulut, & Bassett, 2003; Le Masurier & Tudor-Locke, 2003) of pedometers and found them to be useful for assessing physical activity levels in older (Cyarto, Myers, & Tudor-Locke, 2004; King et al., 2005), younger (Cox, Schofield, Greasley, & Kolt, 2006), obese (Swartz, Bassett, Moore, Thompson, & Strath, 2003), and ethnic (Bennett, Wolin, Puleo, & Emmons, 2006) populations.

Fitness levels of children are of great concern, and pedometers have been used for assessing physical activity levels in this population (Beighle, Morgan, Le Masurier, & Pangrazi, 2006; Rowe, Mahar, Raedeke, & Lore, 2004; Rowlands & Eston, 2005; S. Vincent & Pangrazi, 2002). Pedometers are often used in physical education classes and can be incorporated into the curriculum as a way of motivating students to be more active and more aware of their movement experiences (Pangrazi, Beighle, & Sidman, 2003). Physical education teachers can also use the pedometer as an instrument to gauge intensity levels during PE classes. It must be noted, however, that pedometers were designed to count steps during walking. Pedometers are less accurate when the user walks too slowly or too briskly (Beets, Patton, & Edwards, 2005; Crouter et al., 2003; Melanson et al., 2004), and children in PE classes often engage in different types of locomotor movements at different intensities.

The few studies exploring the accuracy of the pedometer during different locomotor movements (Smith & Schroeder, 2008, 2010) suggest that the pedometer is less accurate during skipping, galloping, and sliding than during walking. These studies, however, employed a self-selected pace, and since speed was not tightly controlled, further exploration into this topic is necessary. Additionally, registered step counts during these movements may not accurately reflect activity intensities. As no studies have assessed intensity in locomotor movements such as skipping, galloping, and sliding, it is necessary that this is further quantified for PE teachers when they are designing curriculum.

This study assessed the accuracy of two pedometer models in children walking, skipping, galloping, and sliding at two controlled speeds. It was hypothesized there would be no difference between the actual steps and pedometer steps at a given speed for any of the locomotor movements. This study also quantified metabolic cost during these locomotor movements, and it was hypothesized there would be a significant difference in energy expenditure between the locomotor movements.

Method

The university's institutional review board reviewed and approved this study. Parental consent and child assent was received, and 53 fifth- and sixth-grade children participated in the study (Table 1). Exclusion criteria included inability of children to perform the desired locomotor movements or children wearing shoes other than laced athletic footwear. Each child performed four counterbalanced trials (walking, skipping, galloping, and sliding) at 67.0 $m.min^{-1}$ for 3 min and at 80.5 $m.min^{-1}$ for another 3 min. All data collection was carried out in the gymnasium at the participating elementary school. Prior to data collection, the investigators asked the students to perform the locomotor movements up and down the court to show proficiency of the movements. After students were deemed proficient in adequately performing the skill without extra or missed movements within the skill (i.e., an extra hop in a skip or a missed hop in a skip), height was measured on a Seca 214 portable height rod (Itin Scale Co., Brooklyn, NY) and weight was determined on a balance scale (Detecto, Webb City, MO), both without shoes, after which a Polar HR monitor was fitted around the chest. The investigators then demonstrated the skills on a PROFORM XP 550s motor-driven treadmill (Icon Health and Fitness, Logan, UT), and students practiced on the treadmill, at which time the speed was briefly increased to 67.0 $m.min^{-1}$ and 80.5 $m.min^{-1}$ for familiarization of the protocol. Proficiency evaluation, demonstration, familiarization, and instruction typically lasted approximately 5 to 10 min.

Table 1
Participant Characteristics

Characteristic	Total (N = 53) $M \pm SD$	Boys (n = 27) $M \pm SD$	Girls (n = 26) $M \pm SD$
Age (years)	11.3 ± 0.6	11.4 ± 0.7	11.3 ± 0.5
Height (in.)	57.3 ± 4.3	57.3 ± 5.1	57.3 ± 3.3
Weight (lb)	97.6 ± 25.8	94.6 ± 26.4	100.6 ± 25.2

Students were then fitted with a Velcro Walk4Life pedometer belt (Walk4Life, Plainfield, IL) around the waistline at the hip. An SW-701 Digiwalker (New-Lifestyles, Lee's Summit, MO) was then fitted on the anterior mid-line of the right thigh and another contralaterally on the left. A New-Lifestyles NL-800 pedometer (New-Lifestyles, Lee's Summit, MO) was fitted just laterally to each of the SW-701 pedometers. Pedometers were checked before each session via the shake test. Pedometers were reset and carefully placed in a slotted container, held upright, and shaken in the vertical plane 50 times (S. Vincent & Sidman, 2003). If a pedometer failed to record at least 49 counts or recorded 51 or more counts (±2% error), it was not used.

Twenty-one students also consented to have metabolic data collected. These students were fitted with a Cosmed K4b^2 (Cosmed Srl, Italy) portable oxygen analyzer, which was calibrated per manufacturer instructions with 16% O_2 and 3.99% CO_2 before testing.

Before the first trial began, the student was instructed to straddle the treadmill while it was brought up to 67.0 m·min^{-1}. The pedometers were reset to 0 and closed, and the student was told to begin when ready. Once the student began, time was kept with the timer on the treadmill and at least two investigators counted the steps. Each step, or belt contact, with the lead foot elicited a count on a hand-tally counter (Lab Safety Supply, Model No. 77270, USA) from the two investigators. While walking and skipping consisted of alternate lead legs, the gallop and slide maintained the right lead throughout the trials. Hand-tally counts were doubled for the skip, gallop, and slide for statistical analysis since the trail leg also contacted the ground. Students were not allowed to hold onto the handrails during the trials other than when sliding, when they could use one hand for balance if needed. At 3 min, the students were instructed to straddle the treadmill and remain still.

At the end of each 3 min, heart rate and a rating of perceived exertion was recorded via the children's OMNI scale (Robertson et al., 2000), and the analyzer was marked for those wearing it. The investigators recorded the pedometer and hand-tally counts, and the student was allowed to get a drink of water and briefly rest, if needed. When the student was ready, the treadmill was brought up to 80.5 $m \cdot min^{-1}$ for the student to complete the second phase of the trial in the same manner. To provide rest between locomotor skills, investigators had students rest while another performed a trial.

Statistical Analyses

All analyses were performed via SPSS 23.0 for Windows (IBM SPSS, Armonk, NY). Since the actual counts (AC) from the hand tally represent the real number of step taken, single measures intraclass correlation coefficients (ICC) from a two-way mixed effects ANOVA along with 95% confidence intervals (95% CI) produced intertester reliability coefficients for determining the degree of objectivity of AC between investigators. Repeated measures ANOVAs determined differences between counts obtained by each pedometer and AC during walking, skipping, galloping, and sliding. Alpha was set at .05 for all tests, and when the main effect was significant, adjustment for multiple comparisons was made via the Bonferroni adjusted form of the least significant difference (LSD). Alpha for these comparisons was set at .01 (.05/5).

Intraclass correlation coefficients were also calculated in the same manner for assessing the reliability between right and left pedometers. An alpha value of > 0.80 denoted statistically significant intramodal reliability. The following guidelines determined the level of agreement of the ICC calculated for each comparison: ≤ 0.79 is low agreement, 0.80 to 0.89 is moderate agreement, and ≥ 0.90 is considered high agreement (W. Vincent, 2005, p. 196). Bland-Altman plots of AC versus the average of the right and left pedometer readings provided an indication of overrepresentation or underrepresentation of steps and agreement between the measures (Bland & Altman, 1986). Scores below 0 indicate an overestimation by the pedometers, and scores above 0 indicate an underestimation of the pedometers. These plots show the variability in pedometer scores while showing the mean error score and the 95% prediction interval. Error scores of 0 indicate that no difference between the actual steps taken and those registered by the pedometer. Percent error was calculated as [(Steps Detected by Pedometer – AC) / AC] × 100.

Repeated measures ANOVAs also determined differences in heart rate (HR), oxygen consumption (VO_2), ventilation (VE), respiratory exchange ratio (RER), and rating of perceived exertion (RPE) between locomotor trials of each speed.

Results

Agreement of Steps Between Investigators

There was a mean difference of less than one step count between hand-tally counts of investigators during walking, skipping, galloping, and sliding trials at each speed. There was also high intramodal reliability and level of agreement between the investigators during all movements at each speed (Table 2).

Table 2
Intramodal Reliability Between Hand-Tally Counts During Four Locomotor Movements

Locomotor movement	Intraclass correlation coefficient	95% confidence interval
Walking		
67.0 $m \cdot min^{-1}$	0.999	0.998 to 0.999
80.5 $m \cdot min^{-1}$	0.995	0.991 to 0.997
Skipping		
67.0 $m \cdot min^{-1}$	0.999	0.999 to 1.000
80.5 $m \cdot min^{-1}$	0.999	0.999 to 1.000
Galloping		
67.0 $m \cdot min^{-1}$	0.997	0.994 to 0.998
80.5 $m \cdot min^{-1}$	0.999	0.998 to 0.999
Sliding		
67.0 $m \cdot min^{-1}$	0.998	0.997 to 0.999
80.5 $m \cdot min^{-1}$	0.997	0.995 to 0.999

Tests of Pedometer Differences

There was a significant main effect for differences in step counts during walking, $F(4, 49) = 6.9$, $p = .001$; skipping, $F(4, 49) = 23.7$, $p = .001$; galloping, $F(4, 49) = 21.5$, $p = .001$; and sliding, $F(4, 49) = 34.2$, $p = .001$, at 67.0 $m{\cdot}min^{-1}$. Walking step counts registered by both NL-800s were not significantly different than AC ($p > .01$). For all other locomotor trials, step counts registered by the SW-701 and NL-800 on the right and left side were significantly lower than AC ($p < .01$). Additionally, there were no significant differences in step counts between the right and left SW-701 ($p > .01$) nor the right and left NL-800 ($p > .01$) for any of the locomotor trials. Table 3 shows means and standard deviations for step counts.

There was also a significant main effect for differences in step counts during walking, $F(4, 49) = 4.64$, $p = .003$; skipping, $F(4, 49) = 49.6$, $p = .001$; galloping, $F(4, 49) = 27.1$, $p = .001$; and sliding, $F(4, 49) = 73.6$, $p = .001$, at 80.5 $m{\cdot}min^{-1}$. Again, the step counts registered by both NL-800s were not significantly different than AC during walking at this speed ($p > .01$). As with the slower speed, step counts registered in all other locomotor trials by the SW-701 and NL-800 on the right and left side were significantly different than AC ($p < .01$) in the faster speed. Furthermore, there were no significant differences in step counts between the right and left SW-701 ($p > .01$) and the right and left NL-800 ($p > .01$) for any of the locomotor trials (Table 3).

Agreement of Steps Between Pedometers

Intramodal reliability and level of agreement was lowest in the SW-701 pedometers during walking at each speed. Low agreement was also noted in the SW-701 during galloping at both speeds and in the SW-701 during sliding during the faster speed. Intramodal reliability was considered moderate and high in both pedometer models during all other locomotor movements (Table 4).

Table 3
Step Counts After Treadmill Walking for 3 Min

Locomotor movement	Actual count *M* ± *SD*	SW-701 Right *M* ± *SD*	SW-701 Left *M* ± *SD*	NL-800 Right *M* ± *SD*	NL-800 Left *M* ± *SD*
Walking					
67.0 m·min-1	364.8 ± 31.0	329.4 ± 50.1*	326.1 ± 63.6*	363.6 ± 28.9	361.5 ± 27.6
80.5 m·min-1	389.1 ± 22.0	379.7 ± 25.5*	370.0 ± 49.2*	388.1 ± 21.7	388.2 ± 21.9
Skipping					
67.0 m.min-1	628.6 ± 85.3	495.7 ± 50.1*	491.4 ± 53.9*	459.4 ± 67.4*	460.2 ± 67.1*
80.5 m.min-1	657.3 ± 77.8	473.0 ± 55.3*	470.3 ± 59.3*	429.1 ± 62.2*	431.1 ± 60.2*
Galloping					
67.0 m·min-1	574.5 ± 31.7	501.7 ± 56.6*	501.3 ± 51.4*	441.4 ± 88.2*	446.4 ± 65.7*
80.5 m·min-1	603.1 ± 77.2	512.6 ± 54.4*	508.8 ± 55.6*	445.7 ± 72.5*	444.4 ± 73.8*
Sliding					
67.0 m·min-1	614.1 ± 59.8	506.2 ± 60.6*	502.2 ± 57.9*	454.8 ± 67.5*	448.1 ± 68.9*
80.5 m·min-1	645.0 ± 58.5	471.8 ± 71.5*	468.7 ± 61.5*	418.1 ± 68.9*	412.5 ± 70.8*

*Significantly different from actual counts for given trial and speed.

Table 4
Intramodal Reliability Between Right and Left Pedometers During Four Locomotor Movements

Locomotor movement	Intraclass correlation coefficient		95% confidence interval	
	SW-701	NL-800	SW-701	NL-800
Walking				
67.0 m·min^{-1}	0.509	0.921	0.276 to 0.685	0.867 to 0.954
80.5 m·min^{-1}	0.557	0.973	0.340 to 0.718	0.976 to 0.992
Skipping				
67.0 m·min^{-1}	0.900	0.994	0.832 to 0.941	0.989 to 0.996
80.5 m·min^{-1}	0.934	0.973	0.888 to 0.961	0.954 to 0.984
Galloping				
67.0 m·min^{-1}	0.790	0.939	0.662 to 0.873	0.897 to 0.964
80.5 m·min^{-1}	0.786	0.927	0.656 to 0.871	0.877 to 0.957
Sliding				
67.0 m·min^{-1}	0.813	0.883	0.693 to 0.889	0.802 to 0.932
80.5 m·min^{-1}	0.716	0.828	0.553 to 0.827	0.715 to 0.898

Bland-Altman Plots

Table 5 displays the mean error scores and the 95% prediction intervals of AC minus the average of the right and left pedometer steps during the five locomotor movements, and Figure 1 illustrates this table with the Bland-Altman plots. The most accurate condition was the NL-800 during walking at 80.5 m·min^{-1}, which had a 95% prediction interval that was within ± 13.8 steps from 0. Skipping at 80.0 m·min^{-1} with the SW-701 was the least accurate condition, with a 95% prediction interval that was within ± 470.7 steps from 0. Table 5 provides the mean error scores and 95% prediction intervals for all conditions, and Figure 1 illustrates the Bland-Altman plots for walking and galloping.

Table 5
Mean Error Scores (Hand Tally – Average of Right and Left Pedometers) in Number of Steps, With Percent Error

	Intraclass correlation coefficient		95% confidence interval	
Locomotor movement	SW-701 ***M ± SD*** (% error)	NL-800 ***M ± SD*** (% error)	SW-701	NL-800
Walking				
67.0 m·min^{-1}	37.1 ± 56.0 (-11.2)	3.88 ± 30.1 (-0.2)	196.2, -107.3	63.7, -57.5
80.5 m·min^{-1}	14.5 ± 28.6 (-3.7)	0.95 ± 6.46 (-0.2)	72.3, -42.9	13.8, -11.9
Skipping				
67.0 m·min^{-1}	135.1 ± 109.0 (-19.7)	168.8±123.9 (-25.0)	353.1, -82.9	416.7, -78.9
80.5 m·min^{-1}	185.7 ± 119.3 (-26.6)	227.3 ± 121.7 (-33.0)	424.4, -53.0	470.7, -17.7
Galloping				
67.0 m·min^{-1}	73.0 ± 72.3 (-11.9)	130.6 ± 100.0 (-21.7)	217.6, -71.5	330.6, -69.3
80.5 m·min^{-1}	92.4 ± 99.5 (-14.0)	158.0 ± 118.0 (-24.8)	291.5, -106.6	394.2, -78.1
Sliding				
67.0 m·min^{-1}	107.3 ± 92.0 (-16.6)	160.0 ± 97.5 (-25.3)	297.6, -77.0	355.0, -34.9
80.5 m·min^{-1}	174.7 ± 103.9 (-26.1)	299.7 ± 94.3 (-35.0)	382.6, -33.1	418.2, 41.1

Tests of Metabolic Differences

Heart rate. There was a significant main effect for HR, $F(7, 45) = 303$, $p = .001$. HR was significantly greater at 80.5 m/min compared to 67 m/min for each locomotor movement ($p < .05$).

For the slower speed, walking HR was significantly lower than HR for all other movements ($p < .05$) and sliding HR was significantly greater than HR for all other movements ($p < .05$). HR during skipping at the slower speed was not significantly different than HR during galloping at the lower speed ($p = 1.0$).

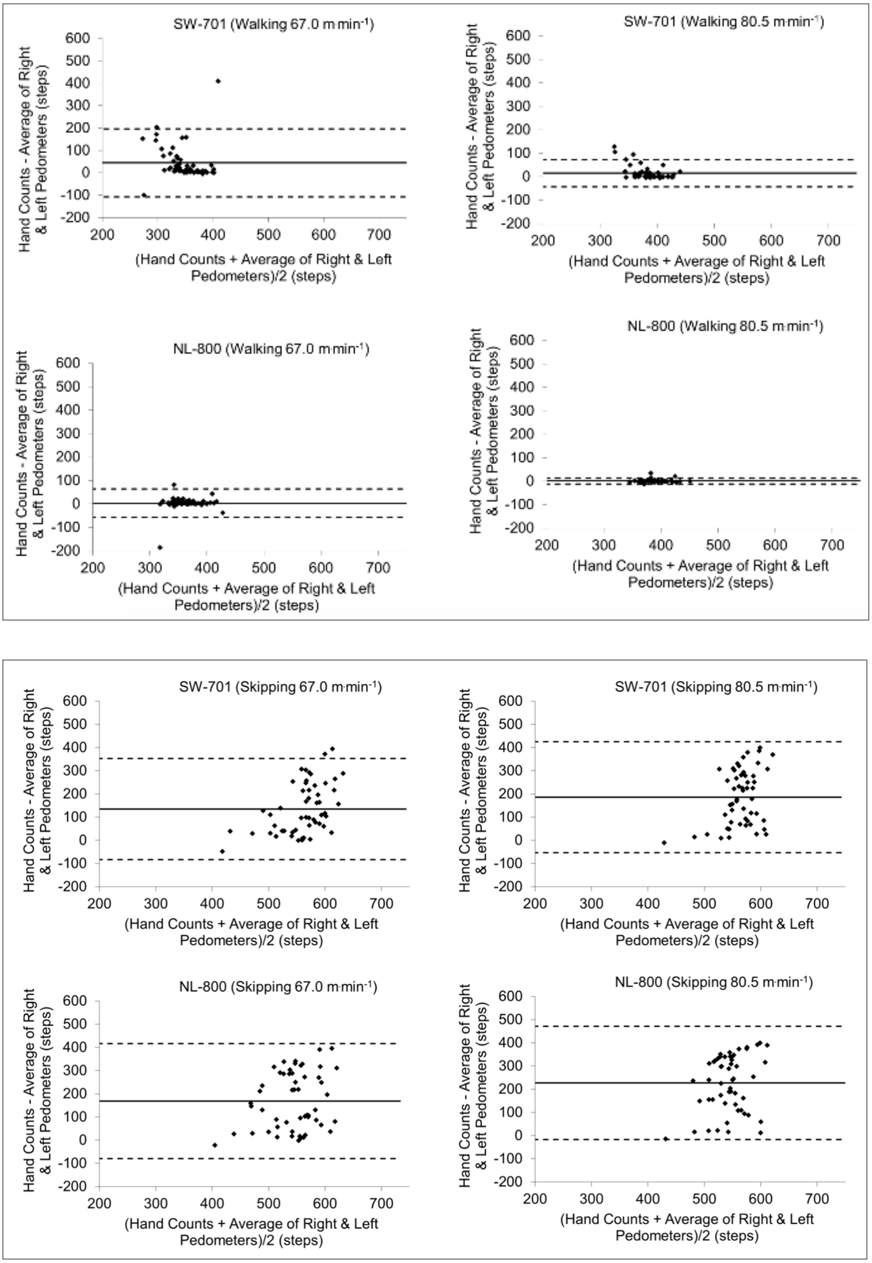

Figure 1. Agreement of pedometer scores of children walking at two speeds on the treadmill. Illustrated are the most accurate (walking) and the least accurate (skipping) of the locomotor skills assessed.

HR during walking at 80.5 m/min was also significantly lower than HR for all other movements ($p < .05$), and HR for sliding was significantly greater than HR for all other movements ($p < .05$). Again, HR during skipping at the faster speed was not significantly different than HR during galloping at the faster speed ($p = .86$). Figure 2 shows these HR responses.

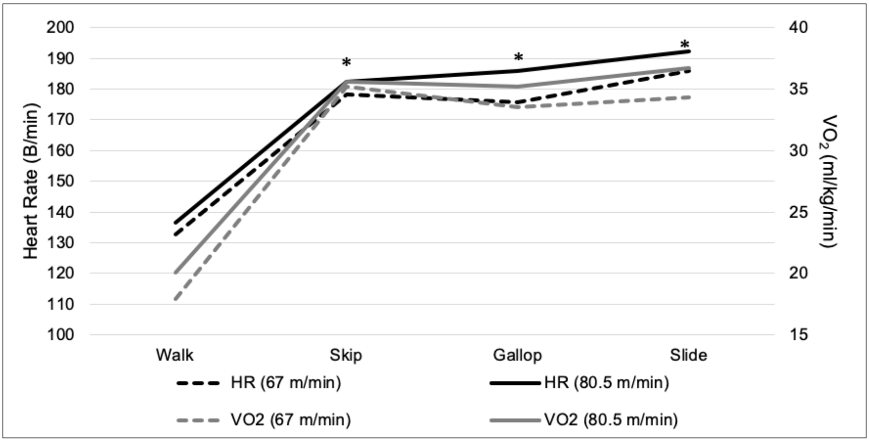

Figure 2. Heart rate and VO_2 responses to different locomotor movements. Heart rate and VO_2 were significantly greater during skipping, galloping, and sliding compared to walking at the same speeds (*$p < .05$).

Oxygen consumption. There was also a significant main effect for VO_2, $F(7, 14) = 103$, $p = .001$. VO_2 was significantly greater at 80.5 m/min compared to 67 m/min for each locomotor movement ($p < .05$) except skipping ($p = .63$).

For the slower speed, walking VO_2 was significantly lower than VO_2 for all other movements ($p < .05$). There were no significant differences in VO_2 between galloping, skipping, and sliding movements at 60 m/min ($p > .05$).

VO_2 while walking at 80.5 m/min was significantly lower than VO_2 for all other movements at 80.5 m/min ($p < .05$), and VO_2 during sliding was significantly greater than VO_2 during all other movements ($p < .05$) except skipping ($p = .37$). There was also no significant difference in VO_2 between skipping and galloping ($p = .74$) at this faster speed. Figure 2 shows the VO_2 responses.

Ventilation. There was a significant main effect for VE, $F(7, 14) = 41.7$, $p = .001$. VE was significantly greater at 80.5 m/min compared to 67 m/min for sliding only ($p < .001$). There were no significant differences in VE between speeds for any of the other movements ($p > .05$).

VE during movement at 67 m/min was significantly lower during walking compared to all other movements ($p < .05$); however, there was no significant difference in VE between skipping, galloping, and sliding at this speed ($p > .05$).

At the faster speed, VE during walking was still significantly lower than VE during all other movements ($p < .05$) and similar to the VE at the slower speed. There was no significant difference in VE between skipping, galloping, and sliding at 80.5 m/min ($p > .05$). Figure 3 shows the ventilatory responses during the locomotor movements.

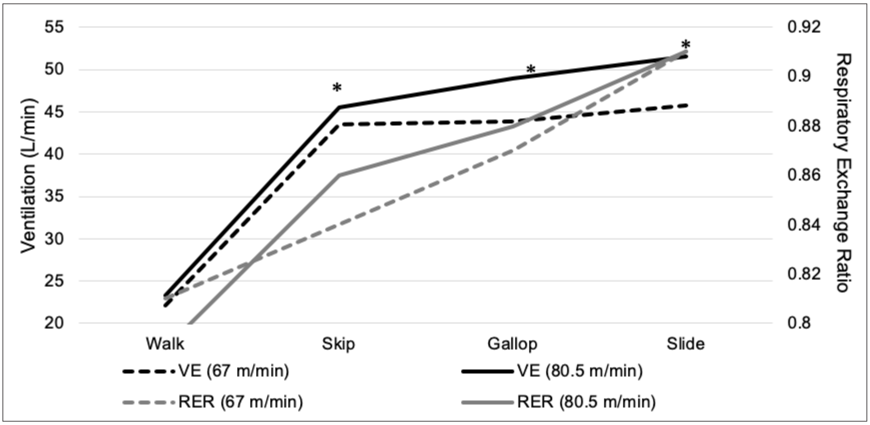

Figure 3. Ventilation and respiratory exchange ratio responses to different locomotor movements. Ventilation and respiratory exchange ratio were significantly greater during skipping, galloping, and sliding compared to walking at the same speeds (*$p < .05$).

Respiratory exchange ratio. While a significant main effect was found for RER, $F(7, 14) = 10.9$, $p = .001$, no differences existed between the speeds for any of the skills ($p > .05$).

The only significant difference in RER at 67 m/min existed between walking and sliding ($p = .001$). RER was not significantly different between any of the other movements at this speed ($p > .05$).

Walking at 80.5 m/min elicited a significantly lower RER compared to all other movements ($p < .05$), and there was no significant difference in RER between any of the other movements at this speed ($p > .05$). Figure 3 also shows RER responses.

Rating of perceived exertion. Finally, a main effect for RPE was also evident among the different skills and speeds, $F(7, 45) = 28.0$, $p = .001$. The faster speed was perceived as significantly harder than the slower speed for all movements ($p < .05$) except walking ($p = 1.0$).

For 67 m/min, walking was perceived as significantly easier compared to all other movements ($p < .05$) and skipping was perceived to be significantly easier than sliding at this speed ($p = .001$). All other movements were not perceived to be significantly different at 67 m/min.

Walking at 80.5 m/min was also perceived as significantly easier compared to all other movements at 80.5 m/min ($p < .05$). Skipping was also perceived significantly easier than galloping ($p = .038$) and sliding ($p = .001$), and there was no significant difference in perceived effort between galloping and sliding at this speed ($p > .05$). Figure 4 shows RPE responses.

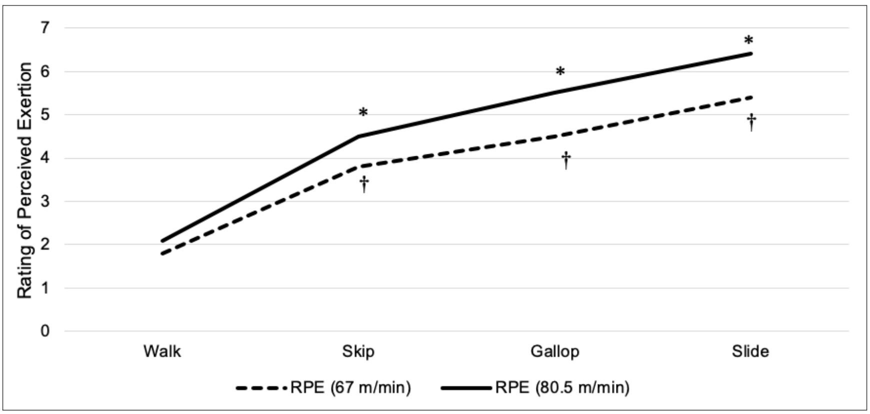

Figure 4. Rating of perceived exertion for different locomotor movements. Perceived exertion was rated significantly higher in all other movements compared to walking ($^{*}p < .05$). While there was no significant difference in perceived exertion between speeds during walking, ratings were significantly higher between speeds for all other movements ($^{\dagger}p < .05$).

Percent Change With Increasing Speed

An increase in speed elicited an increase in steps, HR, VO_2, VE, RER, and RPE within each locomotor movement. Figure 5 shows how an increase in speed during galloping and sliding, compared to the other movements, resulted in the greatest increases in metabolic and perceptual demand, although this is not reflected in increases in step counts.

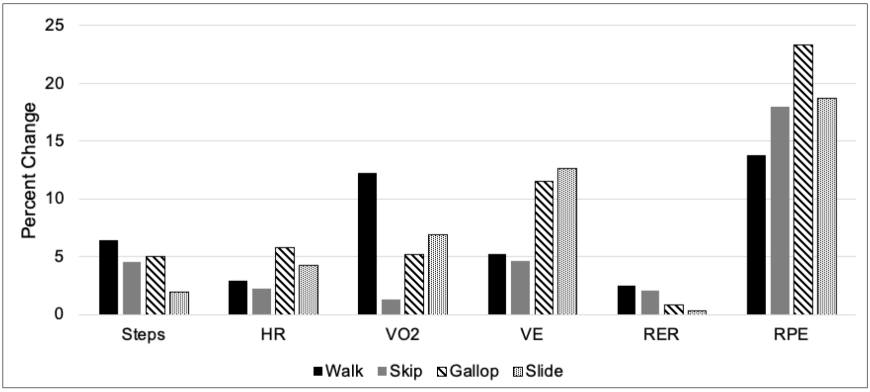

Figure 5. Percent change from 60 m/min to 80.5 m/min for each locomotor movement.

Discussion

This study explored the accuracy of pedometers during various locomotor movements at two speeds. The SW-700 and the NL-800, a spring-levered and piezoelectric pedometer, respectively, were chosen for this study because of the vast literature examining their accuracy in a variety of populations and circumstances. The SW-701 has been determined to be one of the better performing pedometers on the market (Crouter et al., 2003; Schneider et al., 2003) and the NL-800 is more sensitive to tilts or slower walking speeds (Melanson et al., 2004). Because significant differences were found between actual counts and pedometer counts for all locomotor skills at all speeds except with the NL-800 during walking at either speed, the null hypothesis for this study was not retained.

The NL-800 also had the lowest error scores for walking at either speed, thus deeming it the more accurate of the two pedometers during walking, and this is in agreement with previous literature (Crouter, Schneider, & Bassett, 2005). The SW-700 has also been explored for accuracy in the literature and found to be less so for walking at slower speeds (Beets et al., 2005) compared to faster (Karabulut, Crouter, & Bassett, 2005) or self-paced walking

(Schneider et al., 2003). The difference in accuracy in this study is in some agreement with the stated studies, with greater mean error (11.2%) at the slower speed compared to the faster speed (3.7%). The findings of accuracy between the SW-700 and NL-800 for walking were expected, as it has been suggested that piezoelectric devices are more accurate than spring-levered devices during walking (Nakae, Oshima, & Ishii, 2008.). One case during walking at the slower speed with the SW-701 could be considered an outlier, as could three cases at the faster speeds (Figure 1), thus steps on these devices may not have registered properly due to tilt (Duncan, Schofield, Duncan, & Hinckson, 2007) or another circumstance such as gait.

In locomotor movements other than walking, both pedometers underestimated step counts at each speed. Some suggest an acceptable error of no more than 3% in controlled conditions (Hatano, 1993) and 10% in free-living conditions (Schneider, Crouter, & Bassett, 2004), both of which were surpassed in every non-walking locomotor movement at each speed. This may be explained by the force generated with each step during the stride of the locomotor movements and the sensitivity of the pedometer to register a step. For example, the skip, which includes a step and a hop for each stride, may generate a force great enough to be registered by the pedometer for either the step or hop, but not always both. The same can be said for the gallop and the slide, which involve a lead leg and a trail leg. For each of the non-walking movements, the SW-701 had less error than the NL-800. The SW-701 was designed to register a count with a vertical force of 0.35Gs (Tudor-Locke, Ainsworth, Thompson, & Matthews, 2002), so it may be that one of the steps during the strides of the non-walking movements was less than that.

To the authors' knowledge, no studies have examined the forces generated during these types of movements. One may also presume that since the NL-800 is thought to be more accurate, error in these movements would be less, which is contrary to these findings. It could be that one of the steps in the stride did not generate a force great enough to have a significant contribution in propelling the body forward. It is obvious that movement in these skills requires both legs to move the body, but that the contribution of one leg is much less than that of the other.

This study also explored differences in pedometer readings on the right and left side. While level of agreement was found to be low in the right and left SW-701 during walking and galloping at each speed and during sliding at the faster speed, significance between these step counts were not statistically different. Since manufacturer guidelines suggest placing the pedometers on the right side, one would be encouraged to do so. Should this not be feasible during a physical education class, placing the device on the left side is still a viable option and would produce similar results.

This study also quantified the metabolic cost of performing these locomotor movements, and since significant differences were evident, the alternate hypothesis was retained. Walking elicited the lowest energy expenditure of all the locomotor skills at either speed, whereas sliding produced the greatest. Skipping, galloping, and sliding clearly generated greater metabolic cost compared to walking and thus can be considered movements that require greater effort. The magnitude of these changes is pronounced, for example, as indicated by a 32–40% increase in HR during skipping, galloping, and sliding at either speed compared to walking. Supporting these findings are student's perception of exertion, where skipping, galloping, and sliding were rated much higher than walking.

Physiologically and perceptually, it is clear that an increase in speed causes an increase in energy expenditure and rating of effort for all movements. It is also clear that an increase in speed elicits an increase in actual step counts, and while this was the case for step counts registered on the pedometer during walking, it was not for the other movements. In almost all cases, step counts registered by both pedometers was lower at the faster speeds during skipping, galloping, and sliding, with error being the highest at this faster speed. This may be attributed to the students performing movements on the treadmill, as they had only performed them overground prior to this study. Some studies have shown changes in kinematics from overground to treadmill walking (Alton, Baldey, Caplan, & Morrissey, 1998), while others suggest changes are minimal (Riley, Paolini, Della Croce, Paylo, & Kerrigan, 2007). Since no studies have examined gait during skipping, galloping, or sliding, it may be that performing these movements on a moving belt at a constant speed can result in inconsistent patterns, thus increasing error in the pedometers.

Step counts during these locomotor movements are higher than those during walking at either speed, thus suggesting the higher counts relate to greater metabolic demand. In other words, while the pedometers showed substantial error in accurately measuring step counts during skipping, galloping, and sliding, counts registered during these movements were higher than those for walking, reflecting the greater energy cost of the activity. The physical educator should consider this when incorporating these kinds of movements into the lesson. If using pedometers in a lesson during which these types of locomotor movements occur, the physical educator can expect a greater metabolic demand and higher step counts, thus reflecting more intense activity.

Conclusion

Pedometers have been available for many years and continue to be a viable tool for measuring physical activity in children during nonstructured (Fukushima et al., 2016; Hazell et al., 2016; Stearns et al., 2016; Vandenbroucke, Seghers, Verschueren, Wijtzes, & Baeyens, 2016) and structured (Burns, Brusseau, & Hannon, 2015; Fu, Brusseau, Hannon, & Burns, 2017; Jones, Brusseau, Kulinna, & van der Mars, 2016) periods. Tudor-Locke et al. (2006) noted, evaluation of pedometers under controlled conditions alone is not sufficient for accuracy to be determined. Comparison to other measures of activity (actual counts as well as accelerometer counts), the environment tested (overground and treadmill movement), and other factors should be considered. Results of this study suggest the NL-800 reflects greater accuracy during walking and that the SW-701 has less error during all other locomotor skills for each speed. Since physical education classes involve a variety of movements other than walking, the SW-701 seems to be a better choice should a teacher be inclined to use pedometers. These pedometers are acceptable for tracking steps during walking, and while accuracy is in question during skipping, galloping, and sliding, the increases in step counts during these movements reflect the greater metabolic demand. Physical education teachers can now be aware that changes in locomotor movements, specifically skipping, galloping, and sliding, will result in increases in energy expenditure and that these increases can be substantial. If asking students to perform locomotor skills other than walking, physical educators must be aware of the duration and intensity they are prescribing so as to administer the activity appropriately. Students enjoy the novelty of performing various locomotor movements, and since energy expenditure is increased, it can also benefit the cardiovascular system.

Pedometers are an economical tool that can be used for tracking physical activity and motivating the user to be active. This study is the first to show evidence that changing locomotor movements in children results in changing metabolic cost, and this is also reflected by increases in step counts on the pedometer. A limitation of these findings, however, is that the movements were conducted at the same absolute speed on a treadmill. Future studies should explore the accuracy of the pedometers and metabolic cost of these locomotor movements during overground traversing since these skills are not normally performed on a treadmill. While skipping, galloping, and sliding are common locomotor movements performed by children, other movements commonly instructed in physical education classes, such as crab walking, bear walking, and even tumbling, can also be explored.

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PEDAGOGY

Aligning Critical Physical Education Teacher Education and Models-Based Practice

Glenn Fyall and Michael W. Metzler

Abstract

In 1999, the New Zealand government released a new Health and Physical Education (HPE) curriculum that reflected a fundamental shift from the traditional and dominant skill mastery approach. The "new" HPE curriculum was based on humanistic principles and supported by constructivist notions of teaching and learning, within a critical pedagogy. Since this time, and a subsequent curriculum revision in 2007, the HPE curriculum writers have suggested that physical education (PE) teachers and physical education teacher education (PETE) students in New Zealand have struggled to understand the epistemological complexities and pedagogical implications of critical pedagogy in their practice. Therefore, this paper highlights the findings of a study that explored a New Zealand PETE program, in light of HPE within the New Zealand Curriculum (NZC). Additionally, and in light of the findings, the authors consider an examination of Kirk's (2013) concept of models-based practice as it could apply to the preparation and professional development of physical education teachers in New Zealand. The case study included nine volunteer participants, from a cohort of 32 students, who were nearing graduation from a critically

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oriented PETE program in New Zealand. Semistructured interviews were deployed and analyzed and reoccurring themes central to the purpose of the study identified and explored. The participants viewed movement contexts as being pivotal for learning in physical education and that the NZC had multiple educational aims and purposes. Participants also believed that PE teachers were required to move beyond direct instruction and implement a variety of teaching styles to achieve these multiple aims. However, the participants also shared misunderstandings and paradigmatic uncertainty around the critical and humanistic underpinnings of the NZC and failed to demonstrate an understanding of how this is enacted through critical pedagogy. The implications of this theory to practice nexus are further discussed in light of recent research debate around models-based practice.

> Physical education (PE) has no essential transcendental characteristics. Since the historical records show it has changed over time, how then can we avoid the position at the other extreme, that it has no meaning at all, at least, only the meaning that we arbitrarily select or choose to give it? (Kirk, 2010, p. 11)

In the latter part of 20th century, teachers, teacher educators, and scholars keenly debated what they believed to be the content and curricula of PE and physical education teacher education (PETE). Unfortunately, the debate largely remained unresolved (Fernandez-Balboa, Barrett, Solomon, & Silverman, 1996). However, some consensus emerged, suggesting that "movement" is fundamental to any description or conceptualization of PE (e.g., Jewett, Bain, & Ennis, 1995). Fernandez-Balboa et al. (1996) stated that "although we agree that movement is the common thread of our content, many of the shapes that content has taken may not be appropriate" (p. 54). Today, there is general agreement that movement is an appropriate *context* for PE, but a growing number of physical educators believe that PE *curricular*, defined by movement and the acquisition of physical skills alone, may reduce it to mere physical activity with little educative value (Culpan & Bruce, 2007; Fyall, 2017; Philpot, 2016; Philpot & Smith, 2011).

Siedentop and Tannehill (2000) suggested that curricular models are founded on assumptions. These assumptions include identifying the educational needs of a community or society. Intuitively, the educational community or societal needs will be influenced socially and culturally and therefore will be interpreted in a variety of ways. For example, in the United States, Metzler, McKenzie, van der Mars, Barrett-Williams, and Ellis (2013) promote the Health Optimizing Physical Education curriculum model, highlighting the need "for children and youths to be more physically active and more regularly engaged in other healthy behaviors" (p. 42). The justification by Metzler et al. (2013), to emphasize health promotion in the PE curriculum, was founded on evidence-based, public health needs.

In the context of this study, in Aotearoa New Zealand during the 1990s, PE curriculum writers considered and advocated for—or in Kirk's (2010) words, "arbitrarily selected" (p. 11)—PE content and aligned pedagogies that drew from the critical and humanistic paradigms (Gillespie & Culpan, 2000). In this sense, the New Zealand Curriculum (NZC) writers interpreted a physically educated person from a sociocultural perspective, where physical contexts provided the backdrop for learning "in, through and about movement" (Culpan & Bruce, 2007, p. 6). Most notably, the NZC architects considered the work of Freire (1970), Giroux (1983), Kirk (1988), Tinning (1991), Lawson (1992), Sage (1993), van Holst, (1993), Jewett (1994), McLaren (1995), and Fernandez-Balboa (1997a), who promoted critical pedagogy (CP) in PE, as an alternative to existing Western political and educational philosophy (Culpan, 2004; Culpan & Bruce, 2007).

Consequently, in 1999, after significant educational debate and political contestation, the New Zealand government released a radically different Health and Physical Education (HPE) curriculum. Fundamentally, the principles and objectives of this document reflected a shift from the entrenched skill mastery approach, supported by technocratic perspectives of teaching and learning (Tinning, 1991), to one that was informed by notions of humanism and CP. The concept of CP was aligned with and supported by constructivist perspectives of teaching and learning (Culpan & Bruce, 2007; Ministry of Education, 1999, 2007).

Culpan (2004), one of the curriculum writers, suggested that leading up to its release, "the major critique [of HPENZC] was The Education Forum, a select group of conservative school principals, with strong affiliations to the New Zealand Business Round Table (prominent businesspeople with strong new right views)" (p. 238). Culpan (2004) proposed that the Education Forum's (EF, 1998) critique included the suggestion that health and PE should be restricted "to a traditional paradigm of skills development" (p. 239). Culpan (2004) also promoted that the notion of student-centeredness had epistemologically and pedagogically challenged the EF's conception of teaching and learning, as, in their view, the teacher was necessarily the focal point of the teaching and learning process. In the EF's (1998) view, teachers are professionally equipped in knowledge and procedures and are capable of making effective pedagogical decisions in the best interest of the individual learner. This perspective considers that effective student-centered teaching identifies the learners different *modes of learning* and consequently implements a variety of *teaching styles* appropriate to the learner's needs. This is evidenced in the following excerpts from the EF's (1998) submission on the draft curriculum:

> Far from recognizing its fallibility, the draft elevates the "needs" notion to the prime determinant of a needs-based curriculum poised on the principle of student-centeredness . . . a consequence of this needs-based approach is the significant side-lining of the work of the teacher to that of facilitator . . . the notion of student-centered learning is woolly, imprecise, unanalysed and undefended. (EF, 1998, p. 33)

Additionally, the EF dismissed the concept of student-centeredness as promoted in the draft curriculum, and recommended to the government that it

> . . . reject the notion of child-centeredness as promoted within the draft . . . [and] note that there is a more academically credible and rigorous "student-centered" approach which seeks to identify differences in modes of learning and consequently in effective teaching styles, maintains the importance of knowledge and disciplinary procedures, upholds the need for teachers who are authorities in both content and procedures. (p. 38)

In the context of this paper, this point will be discussed further in subsequent sections, but it is worthy of mention that the release and subsequent implementation of the NZC has raised many concerns about the epistemological and pedagogical challenges now presented to physical educators in New Zealand (e.g., Barker, 2008; Burrows, 2005).

More recently, growing evidence in New Zealand suggests that PE teachers and PETE students may struggle to understand the pedagogical complexities of PE within the NZC and the implementation of its critical foundations through a critical pedagogy (Fyall, 2016, 2017; Philpot, 2016; Philpott & Smith, 2011).

Critical Pedagogy

CP arises from the need to create an environment where conscientization can occur and where social and cultural inequities can be exposed (Freire, 1970). The evolution of CP from critical theory consistently demonstrates a passion for devolving hierarchy and power inequity within an educational setting and a will for promoting social change (Fernandez-Balboa, 1997b; Freire, 1970; Giroux, 1983; Kincheloe, 2008; McLaren, 1995). Gur-Ze'ev (n.d.) accurately described this as

> a critical dialogue between educators and educated that (are) committed to demolishing hierarchies and power relations, within which students are empowered (ideally) to the degree of being able to decipher the hidden codes, power relations, and manipulations that build and represent reality, knowledge and identities. ("Critical Theory's Critiques," para. 6)

Culpan and Bruce (2007) described CP, as it is intended for PE within the NZC, as emancipatory and empowering. It is emancipatory in the sense that CP "enables people to obtain the knowledge, skills and power necessary to gain a greater degree of control over their individual and collective lives" (Culpan & Bruce, 2007, p. 3). It is empowering, enabling individuals and groups to identify hegemonic practices and take action to promote social change.

Essential, then, to the educational success of CP is providing students with an appropriate environment and accompanying learning opportunities that promote critical thinking, questioning, and discussion within a power neutral classroom (Macdonald, 2003). Similarly, Culpan and Bruce (2007) proposed that critical thinking, within the NZC, requires teachers to consider this not only as a process of problem solving and questioning that promote higher order thinking skills, but also as an examination and questioning of educational assumptions, inequality, and hegemony in a social, political, and historical sense. Intuitively, and in the context of the NZC, where students are required to examine, question, evaluate, and challenge taken-for-granted assumptions about issues and practices (Ministry of Education, 1999, 2007), it is expected that teachers are capable of designing and implementing student learning opportunities that promote these outcomes. However, as some have suggested, this provides significant pedagogical and epistemological challenges to many PE teachers in New Zealand (Barker, 2008; Burrows, 2005; Culpan, 2008). Specifically, as Culpan (2008) outlines, it appears that PE teachers in New Zealand struggle to align curricular aims with appropriate epistemological decisions and pedagogical strategies. Therefore, the pedagogical approaches of physical educators in New Zealand schools generally do not reflect the principles and objectives of the NZC.

Many have argued that the challenges facing advocates of CP are far larger than teachers and students merely embracing epistemological and pedagogical change; they are far more deeply rooted concerns (Ennis, 1997; Kincheloe, 2008; O'Sullivan, Siedentop, and Locke, 1992; Sicilia-Camacho & Fernandez-Balboa, 2009; Tinning, 2002). Kincheloe (2008) encapsulated this, suggesting that critical pedagogues are continually challenged by "competing ethical claims" and "institutional morality" and that educational sites are not "neutral" sites waiting to be shaped by educational professionals:

> Although such professionals do possess agency . . . these contexts are shaped in the same way language and knowledge are constructed, as historical power makes particular practices seem natural—as if they could have been constructed in no other way. (Kincheloe, 2008, p. 1)

In this sense, the authors suggest that those advocating for critical perspectives within education may be seen as counterproductive to their intended aims because they attack the hierarchies, values, and beliefs of traditional educational settings. It is suggested that those subscribing to traditional educational settings, where entrenched teacher-centered perspectives dominate, find critical perspectives challenging (Ennis, 1997; Fernandez-Balboa, 1997b; Tinning, 2002). In this belief, it is suggested that critical pedagogues assume a position of moral superiority and are often criticized and alienated for it (Sicilia-Camacho & Fernandez-Balboa, 2009). Therefore, the authors propose that it is futile to conclude that critical pedagogues cannot be part of or affected by the values, beliefs, and agendas of the dominant culture and that it would be just as futile to suggest that education, and therefore PE, is not bound and influenced by the same dominant cultural assumptions.

Sicilia-Camacho and Fernandez-Balboa (2009) stated that this perceived position of moral superiority "has been criticised, resisted and rejected" (p. 452). Such resistance has not gone unnoticed by researchers and scholars within PETE, where there have been calls for more integrating and conciliatory perspectives (Ennis, 1997; Sicilia-Camacho & Fernandez-Balboa, 2009; Tinning, 2002). This perspective, Ennis (1997) continued, enables teachers to feel capable and competent—not alienated—when implementing CP. Similarly, Tinning's (2002) call for a more "modest" approach to this concern suggests that implementation of CP within PETE may require significant rethinking if it is to meet its intended aims and become widely accepted in practice. Similarly, Sicilia-Camacho and Fernandez-Balboa (2009) suggested that those whose intend to promote CP may consider doing so in a less universalizing and imposing manner,

> in a way that, far from preaching universalizing principles and imposing 'liberating' prescriptions and seeing people as objects to be liberated, recognizes people as ethical beings capable of reflecting on, deciding about and participating in, the construction of their own identity and their world. (p. 452)

Despite the introduction and subsequent revision of a more socially just and critically conscious health and PE curriculum in Aotearoa New Zealand, evidence and commentary in the literature indicates that the pedagogical approaches of physical educators in schools generally do not reflect those principles and objectives originally intended by curriculum writers in New Zealand (Culpan, 2008). This critique appears to be founded on the premise that intended curriculum outcomes should reflect the espoused philosophical nature of the subject-based curriculum and broader curriculum (i.e., national) that guides the subject area. Furthermore, it appears that teachers face a requirement to appropriately align epistemological choices with pedagogical decisions. As Kirk (2005) suggested, "although this sounds like common sense … [and] although it makes perfect sense, it is not at all common" (p. 213).

This apparent inability of PE teachers in New Zealand to align curricular aims with appropriate epistemological decisions and pedagogical strategies has the authors pondering the possibilities of models-based practice (MBP) within a critically oriented curriculum and associated PETE program. These possibilities may indeed enable PE teachers and PETE students to consider a more conciliatory and modest approach to CP (Tinning, 2002) and indeed begin to activate their own sense of agency (Sicilia-Camacho & Fernandez-Balboa, 2009).

Models-Based Practice

Kirk (2013) wrote,

> A models-based approach has been advocated as a means of overcoming the serious limitations of the traditional approach to physical education. One of the difficulties with this approach is that physical educators have sought to use it to achieve diverse and sometimes competing educational benefits, and these wide-ranging aspirations are rarely if ever achieved. Models-based practice offers a possible resolution to these problems by limiting the range of learning outcomes, subject matter and teaching strategies appropriate to each pedagogical model and thus the arguments that can be used for educational value. (p. 973)

In a special edition of the *Journal of Teaching in Physical Education*, Dyson, Kulinna, and Metzler (2016) clarified that MBP can be applied on two levels—superordinate and instructional. The superordinate level includes curriculum, when a PE program staff, district policy makers, or national educational authorities choose to define the overarching goals, structures, and content for school programs. At the instructional level, MBP is also applied at the level of the instructional units taught and learned in those curriculums. At the instructional level, teachers make decisions to design, implement, and assess short-term student learning opportunities and their commensurate educational outcomes. The study described here includes the superordinate and instructional levels of MBP, as described by Dyson, Kulinna, and Metzler (2016), as it is strongly contextualized in the NZC and also reflected in a well-defined instructional and pedagogical plan within this curriculum (Ministry of Education, 2007).

Historically, Kirk (2005) and Metzler (2011) proposed that at the instructional level, when implemented effectively, MBP may offer a good way of aligning teaching and learning assumptions, curricular aims, and pedagogical strategies with specific learning objectives in PE. For example, instructional models for PE include Teaching Games for Understanding (Bunker & Thorpe, 1982), Sport Education (Siedentop, 1994), Teaching Personal and Social Responsibility (Hellison, 2011), and Cooperative Learning (Dyson & Casey, 2016). These instructional models include more holistic educative perspectives that include the development of cognitive, affective, and moral skills alongside the traditionally privileged performance skills. In this case, effective implementation of these models requires and encourages teachers to work collaboratively with students as a result of implementing constructivist-based learning environments.

In this constructivist view, PE teachers (re)consider the traditional power relationship evident in educational contexts, where the teacher controls and monitors the learning, and move to one where students are empowered to plot, monitor, and gain greater ownership and direction of their own learning. Constructivist notions of teaching and learning appear to align with the holistic and emancipatory educational aims of CP, as it is suggested in the NZC, where there is a need for provision of educational environments that allow for critical thinking, questioning, and discussion in a power-neutral classroom (Culpan & Bruce, 2007; Macdonald, 2003; Ministry of Education, 2007). However, as Culpan (2008) in New Zealand, and Curtner-Smith (1999) and Kirk (2005) suggested from an international perpsective, physical educators have made some use of MBP and constructivist pedagogy; however, more often than not they default to direct instruction alone, with an emphasis on sport skill development.

The *Journal of Teaching in Physical Education* (2016, Vol. 35, Issue 4) devoted a special edition to discuss and debate the merits of MBP across a range of countries and contexts. At superordinate and instructional levels, the models discussed included Health Optimizing Physical Education (Dudley, Goodyear, & Baxter, 2016), Cooperative Learning (Dyson, Colby, & Barratt, 2016), Personal and Social Responsibility (Gordon, Jacobs, & Wright, 2016), Sport Education (Hastie & Wallhead, 2016), Tactical Games (Harvey & Pill, 2016), and Outdoor and Adventure Education (Sutherland & Legge, 2016). It appears that while the use of MBP in PE contexts appears to have challenged physical educators in the past, there appear to be a resurgence and growing interest, particularly from academics, in the possibilities of MBP in PE. This has provided the authors with a valuable reminder and further insight into the possibilities for the use of MBP, particularly within the context of a critically oriented PETE program that seeks to graduate knowledgeable and competent PE teachers in Aotearoa New Zealand.

The genesis of this paper originates from a research study looking to investigate the beliefs of a cohort of PETE students nearing graduation after having recently completed a 4-year critically oriented PETE program in New Zealand. The research question asked, what are the graduating PETE students' beliefs about CP and the pedagogical strategies required to implement HPE within the NZC?

With the above discussion in mind, this paper discusses the findings of this study in light of the literature related to critically oriented PETE programs, the NZC, and the possibilities that MBP may provide in this space.

Method

The Research Setting: The Critically Oriented PETE Program

The participants were enrolled in the 4-year critically oriented PETE program. Staff and official program documentation (College of Education, 2014) espouse a socio-critically oriented philosophy and an accompanying constructivist, student-centered approach.

The program's underpinning philosophy emphasizes emancipatory and transformative pedagogies (i.e., CP) that align with the successful implementation of the NZC. The PETE program is physically and philosophically located within the College of Education, which has recently merged with the university.

The PETE program is a 4-year, professionally-focused Initial Teacher Education program integrating courses in PE pedagogy, sport and exercise science, sociology of sport and PE, and studies in professional practice. Students are required over the 4 years to complete 24 weeks of teaching practice in primary and secondary schools. Students must also pursue broader studies in education, health education, outdoor education, and an additional subject of their choice (College of Education, 2014, p. 21). Upon graduation, students gain provisional teacher registration and are qualified to teach PE and their chosen subject in New Zealand secondary schools (College of Education, 2014).

The underpinning philosophy and content of the PETE program at the heart of this study reflect a critical orientation (see Fyall, 2017, for a more elaborate description). The program emphasizes empowering preservice PE teachers to challenge epistemological and pedagogical assumptions that are taken for granted and, important, to locate and problematize this within a social, historical, and political educational context (Curtner-Smith, 2007; Macdonald & Brooker, 1999; Tinning 2002, 2010). In New Zealand, such programs aim to produce teachers with a socially critical perspective who are capable of teaching within a CP. In this sense, the courses in pedagogy and sociology become important, as course content and pedagogies emphasize critical theory and CP, and constructivist, student-centered perspectives of teaching and learning. These courses are considered pivotal in the deconstruction and any subsequent reconstruction of the taken-for-granted assumptions that many students have when entering PETE programs (Curtner-Smith, 2007; O'Sullivan, 2005). Courses in sociology explore concepts such as functional theory, critical theory, humanism, and postmodern notions of education, and the relationship of these to the philosophy of the NZC. The pedagogy courses focus on a range of theoretical perspectives of learning and seek to align these perspectives of learning with appropriate pedagogical models and teaching styles. (For further detail, examples of these include Mosstons's Spectrum of Teaching Styles, Mosston & Ashworth, 2002; Cooperative Learning, Dyson & Casey, 2016; Peer Teaching, Metzler, 2011; Experiential Learning, Kolb, 2015; and an array of games-based teaching models such as Teaching Games for Understanding, Bunker & Thorpe, 1982; Game Sense, Light, 2013; and play-teach-play, Graham, 2008.) Course content is promoted through a combination of lectures and practical workshops where students are required to "micro-teach" and critically reflect on their ability to conceptualize and implement the course content.

Participants

In this case study research, voluntary participation was offered to all 32 members of a graduating year cohort from a critically oriented PETE program in Aotearoa New Zealand. As a consequence, 28 students agreed to participate. Purposeful sampling was then employed and nine information-rich cases who represented a "typical" Year 4 student cohort were sought (Gratton & Jones, 2004). A typical Year 4 student cohort reflected the following: gender (55% female, 45% male), an average age of 22.9 years, and an ethnicity makeup of 90% New Zealand European and 10% Maori or Pasifika origin. This resulted in four male and five female participants, with an average age of 23.1 years (*SD* = 1.4), being invited to participate in the study. Seven of the nine participants were of New Zealand European origin, one identified as being New Zealand Maori, and the other as Pasifika descent (See Table 1 for demographic details of the participants).

Table 1
Demographic Information for the Nine Case Study Interview Participants

Participant	Gender	Ethnicity	Age (years)
Pauline	Female	NZ European	23
Brigid	Female	NZ European	23
Emily	Female	NZ European	22
Candice	Female	NZ European	22
Alice	Female	Pasifika	22
Graeme	Male	NZ/Maori	23

Table 1 (cont.)

Participant	Gender	Ethnicity	Age (years)
Andrew	Male	NZ European	23
John	Male	NZ European	27
Robert	Male	NZ European	23

Note. Mean age of participants 23.1 (*SD* = 1.4).

Ethical Considerations

The study was reviewed and approved by the appropriate ethical committee at the university. Consent to participate was gained on a voluntary basis from each participant. The interviews were conducted by the lead author, and the participants were known to the researcher. However, cognizant of considerations of power, gender, race, culture, religion, and class, and the implications of these during the research process, the researcher consequently adopted an inclusive, empowering and empathetic framework (Mutch, 2005). With this in mind, the researcher maintained confidentiality of the interview participants throughout the process, and this paper uses pseudonyms when identifying and reporting the interview data (Mutch, 2005).

Data Collection

This research employed a semistructured interview method commonly engaged in by educational researchers (Cohen, Manion, & Morrison, 2007). The main purpose of the interview was to gain an in-depth understanding of the participating students' perspectives, beliefs, and experiences in an environment where they felt at ease to express their understanding in their own terms (Gay, Mills, & Airasian, 2009).

Preceding the interviews, a semistructured interview schedule was developed and piloted with three students from a different year group. Feedback resulted in some minor adjustments to the schedule mainly to reduce repetitiveness (Gay et al., 2009). A guiding interview schedule of seven questions resulted and was used for each interview. This enabled the researcher to ask each participant "the same basic questions in the same basic order" (Cohen et al., 2007, p. 353), but allow flexibility as the conversation evolved. Table 2 shows the interview questions.

Table 2
Semistructured Interview Question Schedule

1. What do you believe HPE within the NZC is all about? What is its philosophy and what is it trying to achieve? Can you identify and explain any course experiences or practicum examples that clarify your beliefs?
2. What is critical theory and how does this relate to critical pedagogy within HPE in the NZC?
3. What do you believe are the pedagogical (teaching) approaches that best suit and are consistent with implementing critical pedagogy and HPE in the NZC?
4. How does humanistic theory embed itself in HPE in the NZC and what does this look like in your teaching?
5. Can you identify and explain any course experiences or practicum examples that clarify your beliefs about these pedagogical (teaching) approaches?
6. How does your knowledge of learning theory (or how knowledge is constructed - epistemology) influence your pedagogical decision?
7. Can you identify and explain any course experiences or practicum examples that clarify your beliefs about these epistemological beliefs (understanding about how people learn) and how you consider this when you consider your teaching approach or pedagogical choice?

The interviews followed the conventional sequence—a personal introduction, a statement assuring the confidentiality of the interview, and double-checking the student's permission to have the interview audio taped. Each interview was recorded digitally for accuracy and lasted between 45 min and 1 hr, enabling the researcher to replay and improve the quality of the transcripts (Silverman, 2006). After the interview data were transcribed verbatim, member checks were conducted where participants were sent electronic versions of the transcripts and asked to validate the accuracy. All participants were comfortable with the original transcripts being used for the analysis phase of the study. Information for each interview participant was then included in the thematic analysis and resulting reporting of the data.

Data Analysis

Data generated from the semistructured interviews were analyzed and reoccurring themes identified and explored (Mutch, 2005). The answers to each interview question from all nine participants were grouped, and then through constant comparison and inductive analysis, key themes began to emerge (Denzin & Lincoln, 2005). This process of analysis was aided by Rossman and Rallis' (1998) coding system, where text information from each transcript and from each question were categorized according to the frequency of reoccurring words or phrases. This coding system enabled a systematic analysis and reduction of the data to a number of smaller identifiable and discrete categories (Rossman & Rallis, 1998).

The final decision on a theme was considered and only determined if at least seven of the nine participants articulated the coded theme. Initially, the data analysis reflected three major themes: (1) Movement and the Multiple Aims of Health and Physical Education, (2) HPE in the NZC: An Area of Paradigmatic Uncertainty, and, (3) The Teaching Continuum and Moving Beyond Direct Instruction. However, further analysis and coding revealed two subthemes within the second major theme, HPE in the NZC: An Area of Paradigmatic Uncertainty. Specifically, these subthemes have been titled Critical Theory and Critical Pedagogy as Challenging Inequality and also Humanism: Complexity or Confusion? These three major themes, and two subthemes, are outlined in the Findings section and further elaborated in the Discussion section.

Findings

This section reports the findings from the analysis of the interview data, reflecting the key themes, and further discusses these in light of the expressed research question and the literature relating to critically oriented PETE programs and MBP.

Movement and the Multiple Aims of Health and Physical Education

The evidence presented by the participants suggests they were developing a broader definition of health and PE, as promoted in the PETE program at the center of the study and that supported and promoted the NZC's multiple aims and objectives. Indeed, the participants saw, for example, a need for their students to consider and enhance personal and social relationships extending into societal and cultural settings and therefore create the conditions that promote the well-being of self, others, and society.

> It's looking at ways they can be more active, not just . . . [physically] active but in relationships and also the wider community . . . perhaps helping others to live healthy and active lifestyles. (Andrew)

The most notable discourse that emerged in this theme was that the participants believed that movement and activity were an important context for learning and implementing the NZC objectives—therefore, an important aspect for teachers to consider in their pedagogical choices. Graeme's response reflects this well:

> Well I'm a great believer that Physical Education is a great tool that allows us to use movement for our lessons. So in terms of PE we can use movement and get outdoors and you know we can teach those principles and values and especially the vision of the curriculum document in such a unique way that others [curriculum areas] can't. Then also by using movement, [PE] is about how it can implement interpersonal skills, you know, how it can implement relationships with society, within the school communities. The underpinning philosophy for me is that we've got movement to use. I think these things can be more easily achieved . . . very easily implemented through the uniqueness of sport and PE.

Similarly, all the other participants referred to "movement" (consisting of a variety of movement-related contexts, such as sport, outdoor education activities, recreational activities, and dance) as being the key context for learning within the NZC. This was constantly referred to throughout the interviews. Pauline, for example, referred to the physical context as an overarching term:

> It's Physical Education, [we] learn to relate to other people, manage themselves with, like, inter-personal skills and stuff, all within the physical context, yeah I reckon movement, like sports and dance and outdoor recreation and being involved physically is really important for learning in PE.

Further analysis suggested that while this broad definition could be articulated, there was little evidence to suggest how this could be specifically enacted in the classroom, particularly "in, through and about" movement. This reaffirms some of the critique of the draft HPENZC, where leading up to and continuing after its release many suggested that the enormity of change posed by HPENZC and its subsequent revision, the NZC, presented many challenges for PE teachers, PETE program staff, and their students in New Zealand (Barker, 2008; Burrows & Ross, 2003; Culpan, 2008; EF, 1998).

HPE in the NZC: An Area of Paradigmatic Uncertainty

Subsequent interview questions explored the concepts of critical theory, CP, and humanism in relation to HPE within the NZC. Participants were asked to define and discuss how these concepts are embedded in HPE in the NZC. Additionally, participants were asked to draw on course and practicum experiences, which promoted these concepts, to further articulate their understanding and implementation of these concepts in practice.

Critical Theory and Critical Pedagogy as Challenging Inequality

All of the participants keenly responded to Questions 2 and 3 related to their perceptions of critical theory and its alignment to CP. However, although their responses were expressed in a number of ways, these questions resulted in one unanimous subtheme. In this instance, all of the participants saw CP, and its underpinning critical theory, as a way of challenging inequality. The following interview excerpts reflect this theme well. Alice, for example, saw critical theory as an examination of those who are advantaged and those who are disadvantaged:

> Who's advantaged, who's disadvantaged and why and that kind of stuff. When I hear the word "critical" I automatically think about critical thinking, critical views, you are looking at both sides. I also see like critical theory as critically analyzing something, looking at both sides of the fence. And you know for people to be able to see it from both sides of the fence and not look at it from just the top layer really and go down deeper and critically look at it, the positives, negatives, advantages, disadvantages.

When asked to consider his teaching practicum experience and relate this to CP, Robert was not specific, but he stated:

> I think it's around health and wellbeing and it was all around critical thinking, critical knowledge . . . you know, it allowed them [students] to look at both sides on the fence, to really go deeper . . . [to] come up with debate, I allowed them to think. You don't have to agree with it . . . they had to critically think themselves, with shared learning, think about it and delve deeper yeah.

Andrew, who believed he understood things well, contributed the idea that exploring power and hegemony may play a part in CP and the overall philosophy of HPE:

> I think I've got a good grasp of that, like it took me some time to understand it but just this year doing socio-cultural aspects of Physical Education I think I've gained a much better understanding of that. I think it's important to incorporate that into my teaching, that is, one thing I think is important. So, just looking at things from a much wider perspective. Looking at who's advantaged, who is disadvantaged and the sort of balances of power and hegemonic relationships and all sorts of things.

When asked to give examples, he continued the theme of advantaged versus disadvantaged and expressed the difficulty in implementing this in his teaching practicum classes:

> Looking at who's advantaged and who is disadvantaged . . . Yeah I think it's quite hard to incorporate it sometimes you need to know your students quite well cause it's deeper like even myself I've found it hard sometimes to think of things critically . . . to critically think. (Andrew)

All the participants stopped short of utilizing critical theory, defining CP as it is intended in HPE in the NZC and as it was promoted in the program content. It appeared that the participants were only beginning to grapple with the notion of critical theory and had limited or no knowledge of its application to CP. Analysis revealed that participants' beliefs around critical theory were limited and their understanding appeared superficial. The participants believed that critical theory embedded itself in wider societal issues, in essence, as a topic for discussion. Brigid's interview excerpt reflects this common position by all nine participants:

> So, like critical pedagogy, on TP [Teaching Practicum] we looked at the rules of sport and applied the ethics associated with that … (pause) … so being able to look at both sides of it and not just one side and making sure that no one is unfairly advantaged.

Humanism: Complexity or Confusion?

Further interview questions explored the concept of humanism, the second paradigmatic concept underpinning HPE in the NZC and embedded in the NZC philosophy. The researcher's field notes reflected that their articulations were often fragmented and the participants would often stop mid-sentence and begin on a different line of discussion. All of the participants, despite prompting from the interviewer to draw on their practicum experiences, struggled to offer substantial information around humanism and its relationship to PE in the NZC. Candice, who appeared the least confident of the participants, offered,

> Uumm, humanism is like humans so I guess like people and relating to people and, uumm (pause), humanistic values I don't know (sigh, pause) . . . I just don't know (sigh).

Brigid, who with previous questions had been very free to converse and "think out loud," took a different approach to this question and appeared to be less keen and sure of herself. She replied,

> When I think of it just logically, I'd say Humanism would be, uumm, relating well to others totally off topic, uumm, no, I'm stuck . . . (pause).

Similarly, Emily also struggled to articulate any meaningful definition and appeared to be unsure of her response. When questioned, she stated,

> Oh ah, testing my brain. Uumm, humanism, uumm . . . (pause) . . . what to do with people and, uumm . . . (pause) . . . how people perceive ideas and how they, uumm . . . (pause) . . . I guess how they, uumm, interact and display them, I guess?

When prompted to reflect on her teaching practice experiences to enhance this definition, Emily responded, but continued to be unconfident in her reply:

> Argh, how would I see that in PE? Uumm, I think the interaction thing is a big thing in Physical Education, not just between individual teacher and student, but between student to student, groups of students with teacher in the classroom, and with other staff, other people involved, uumm, and I guess it's, uumm aahh, I suppose I think Physical Education has placed quite a lot on it, you know, they, it's all about working with people, interacting with people or being a person and being involved and interacting . . . (pause) . . . I guess?

Unlike the descriptions and definitions given for critical theory, where the students were confident in expressing their views, albeit with limited insight, the students appeared to struggle with the concept of humanism and had much difficulty defining it, let alone articulating their ability to enact it when teaching.

The Teaching Continuum and Moving Beyond Direct Instruction

The common belief held by the participants reflected that a variety of pedagogical strategies may be required for implementing HPE in the NZC. Analysis also suggested that the participants were describing a continuum of teaching styles, consisting of a teacher-centered approach at one end and a learner-centered approach at the other. It also became apparent that in describing this continuum, the participants saw merit in teachers shifting between the direct teacher-centered approaches and more facilitative student-centered approaches. The following vignettes encapsulate this theme where the participants believed that a variety of learning contexts were required and an accompanying variety of teaching styles were required to meet these contexts.

> It just depends on the class, like, if the class is quite capable of working by themselves, then for some reason I don't need to directly teach them anything and they can do it themselves then. I can put them into group work and they can go and, you know, TGfU, inquiry-based sort of stuff; otherwise, if I need to tell them something I'll tell them (pause) it just all depends. (Pauline)

When asked to draw on her course or practicum experiences to elaborate further in this area, Alice added,

> Oh yeah, I used many different contexts and different teaching styles. I remember using a dance context where I had them working in groups, working together. I did a stomp class and split the class into groups and wanted to see if it would work. I gave them an outline and they investigated group dynamics and all that kind of stuff, so I don't know, sometimes it doesn't always work, but I think it's something, as a teacher, I believe you need to learn to do . . . (pause) . . . through group work, or like stuff outside the classroom, or just whatever fits the class, uumm, teaching might be teacher directed if needed or student led if needed.

Robert began to describe varieties of indirect pedagogical approaches and again justify his belief that teachers can draw from a number of different pedagogical approaches and instructional models. As is evidenced in the following quote, such decisions depend entirely on the needs and characteristics of the learners, or as he stated, the "type of kids and what you are teaching":

> (pause) . . . Uumm specific examples, I don't know, I guess doing things in groups or doing tasks individually, doing in pairs, cooperatively, working as a whole class, having discussions or play-teach-play stuff works. I think I mean depending on what type of kids and what you are teaching, you could probably use all different styles . . . (pause) . . . but like I said, it depends on the situation. Usually, I try and steer away from drills, uumm, I find them boring. If it was something I wanted them to learn, it would possibly be some sort of activity or game. Yeah, I think so long as the information

> is getting put across, the teacher becomes more facilitative. You're not quite so important in their learning at that stage. I think it's important for the students to actually have the opportunity to learn themselves . . . so it's more independent because it's their learning and their understanding. If it's not their understanding, they're not going to learn.

Commonly, the participants eluded to "different ways of teaching" and articulated these to learning theory. For example, Emily quoted,

> . . . If I am being direct and behaviorist, you know, learning skills and rewarding positive behavior modification and using positive reinforcement. Alternatively, depending on what you are doing, students might get more of an understanding of something as a result of learning through constructivism, like TGfU and experiential learning, cooperative learning and group work, inquiry stuff, you know, so they can link old information to new and build on it.

It appears that the case study participants believed that pedagogical processes could be placed on a continuum. At one end of the continuum lay a teacher-centered approach where decisions around learning contexts and content were firmly in the hands of the teacher. At the other end of the continuum lay the student-centered approach where control over and power to make such decisions shifts to the students. Epistemologically, the participants' unanimously believed that the teacher-centered approach has epistemological origins in behaviorist discourse. Conversely, the student-centered approach, was unanimously supported as emanating from constructivist learning theory. It appeared that all participants believed that successful implementation of HPE within the NZC involved a knowledge and implementation of a variety of teaching styles and instructional models based on knowledge of learning theory. Furthermore, any decisions on the appropriate teaching style or instructional model should be determined by the characteristics of the students and the content being taught. The participants also added that where possible, learner-centered, constructivist pedagogical approaches should be favored, as these were more in line with curriculum aims and the characteristics, needs, and assumptions of contemporary 21st century students.

Discussion

Based on these findings, several conclusions may be drawn from this study. First, the participants beliefs and behaviors were likely influenced by the content, pedagogies, and experiences within the 4-year PETE program. The program may have encouraged the participants to explore personal philosophical positions and question particular decisions regarding their personal beliefs about PE. The net effect of this meant that the participating PETE students had begun to dissect and evolve their previous conceptualization of PE and PE teaching. Specifically, the nine participants saw, to varying extents, the underpinning philosophy of the curriculum as having multiple aims, where, through a variety of contexts, not exclusively sport, students can learn and consider this knowledge from a personal, social, and societal perspective.

Stothart (2000) suggested that while sport is firmly entrenched within New Zealand culture and historically has a firm place within PE contexts, sport and PE should not be considered synonymously. The participants confirmed Stothart's view by expressing that HPE in the NZC has multiple aims and objectives and requires a variety of movement contexts for successful teaching and learning to occur. The participants comments demonstrated consistency with the NZC intentions, where the contexts for learning are stated as "play, games, sport, exercise, recreation, adventure, and expressive movement in diverse physical and social environments" (Ministry of Education, 2007, p. 23). Therefore, consistent with the critical and humanistic aims and intentions of the NZC, the participants' beliefs suggested that they had a clear understanding that the HPE curriculum philosophy extends beyond the traditional sport performance discourse.

At face value, the participants understanding of the multiple aims and objectives may appear to connect philosophical theory with practice, and to some extent it does; however, it is suggested that the participants were still grappling with the theory. The study findings suggest that the participants may still have some way to go before they can include and reflect such thinking into their practice. This appears to be, in part, due to a lack of knowledge, lack of understanding, and confusion around the philosophical underpinnings of the HPE learning area.

Specifically, one source of confusion lay in the participants' apparent inability to articulate and conceptualize humanistic philosophy as it relates to the NZC. They could articulate an understanding of holism and need to holistically educate their students, but this appeared superficial at best. This articulation fell short of conceptualizing humanistic education as a means of comparing and contrasting the traditional, dominant skill performance model with the humanistic, holistic view of education as proposed in the NZC.

According to Culpan and Bruce (2007) and Gillespie and Culpan (2000), a humanistic curriculum that is wide ranging and extends beyond the traditional sport performance discourse, such as the NZC, requires PETE programs to develop, implement, and model pedagogical approaches that are humanistic and critical in nature. These pedagogical approaches should therefore reflect the capacity for promoting independence, positive self-direction, curiosity, and creativity for the learner. Learning is promoted through inquiry and discovery and ultimately leads to the holistic development of the learner (e.g., physical, cognitive, affective, and moral domains of learning). Therefore, accompanying teaching approaches should be constructivist and learner-centered in their epistemological justification and applied *in*, *through*, and *about* movement (Culpan, 2004).

Another area of concern to the authors was reflected in the participants' lack of knowledge and understanding around critical theory and its application to CP. The participants believed that critical theory embedded itself in wider societal issues, in essence, as a topic for discussion. Drawing on the work of Apple (2004), the authors propose that these topics or issues have evolved from those involving class, the economy, and the state and include "issues of sexuality and the body, disability, post colonialism and many more" (Apple, 2004, p. 187). However, Apple (2004) continues to suggest that unlike the participants in this study, critical pedagogues should seek to challenge the very nature of the systems and structures they are a part of and seek to change the dominant conservative culture and epistemology associated with many educational settings (Apple, 2004). However, despite much prompting and attempts by the interviewer to consider and relate these considerations to their own teaching and learning experiences, and to indeed "challenge" the "dominant conservative culture" and epistemology, the students struggled to appropriately define critical theory and make the appropriate connections to their own epistemological beliefs.

The authors suggest that this may, in no small part, be attributed to the PETE programs inability to inform and equip the participants with appropriate knowledge around critical theory and CP. Despite the espoused "critically oriented" philosophy of the program, and the emphasis on criticality within the pedagogy and sociology courses, it appears that the participants were still struggling to make appropriate adjustments and connections. This apparent lack of content and curriculum knowledge, suggested by the participants, may have implications for critically oriented PETE programs in New Zealand and internationally.

The authors propose that neophyte PETE students and early career PE teachers may be subjected to political manipulation, as this lack of content knowledge may "open the way" for an apprenticeship model of learning (Lave & Wenger 1991). In this sense, the learner is subordinated to established practices where empowerment and change may only be possible through achievement of compatibility with and confidence in established practices. While the apprenticeship model of learning may emphasize the importance of ensuring culture and context receive recognition in educational contexts, it does not bring into question the epistemological assumptions or the associated pedagogical practices evident in PE. Essentially, in the view of the researchers, the apprenticeship model of learning becomes problematic in introducing a curriculum underpinned by differing paradigmatic assumptions, if PETE students must align pedagogical practices with epistemological beliefs and a variety of learning outcomes. Fundamentally, this theory to practice nexus may require greater scrutiny by those charged with deciding on curriculum and pedagogical knowledge presented in critical PETE programs.

However, given these concerns, the majority of participants demonstrated an understanding and application of behaviorist and constructivist teaching approaches. In conceptualizing a teaching continuum consisting of teacher-centeredness at one end and student-centeredness at the other, the participants believed that by aligning learning theory and a variety of teaching styles, with an appropriate instructional model they could effectively teach and implement the NZC. Depending on the nature of the students and the content involved, the teacher could, in the best interests of the students, make a decision around the best approach to choose.

This appears consistent with the many cogent arguments that MBP presents a sound rationale for aligning and implementing curriculum objectives and aims (e.g., see Kirk, 2006; Metzler, 2011). When considering CP, and therefore the emancipatory concerns of the NZC, PE teachers need to enact learner-centered, constructivist pedagogies on a teacher-centered/student-centered continuum. Therefore, when choosing an instructional model, PE teachers in New Zealand should align curriculum learning objectives and learning theory with the appropriate instructional model. That is, to educate critically and humanistically, they would need to choose instructional practices close to the learner-centered end of the continuum and select an instructional model, or models, founded on similar epistemology. On the other hand, direct instruction-based models would shift toward the teacher-centered end of the continuum when the teacher considered that the learner-required scaffolding.

According to van Nieuwerburgh (2010), knowledge of a variety of teaching approaches (and the authors would suggest "aligned" instructional models) has merit. He further suggested that in this way, PE teachers could move to a genuinely learner-centered approach by the fact that pedagogical decisions would be based on the best interests of the learner (van Nieuwerburgh, 2010). Adopting such a continuum approach to student-centered teaching and learning may support the assertion that humanistic and learner-centered practices may be appropriate in some situations, but in others, however, it may be more supportive to be more directive. For example, if the need is to develop independent thinking, self-esteem, or self-confidence, the teacher and perhaps the student would agree to use a more learner-centered approach. On the other hand, if the learner requires new skills or additional information, the teacher may employ a more directive approach. This could be interpreted as being learner centered in that the best interests of the student are being addressed as the professional knowledge and experience of the teacher enables and ironically empowers them to make such decisions.

A continuum approach appears to have resonance with the EF (1998), which voiced significant critique around the draft HPENZC. In the EF's (1998) view, teachers, who are considered authorities in both "content and procedures," are professionally equipped to identify individual learning needs and task requirements. Therefore, in the best interests of the student, the notion of student-centeredness relies on the teachers' decisions to align the learners' needs, the content, and the task requirements to an appropriate "style," or "model" as the authors have argued, of teaching.

Concluding Remarks

This discussion does not seek to be an *everythingism* with regard to CP, but rather an alternative where PETE students can begin to ". . . explore their own ethics and activate their own sense of agency" (Sicilia-Camacho & Fernandez-Balboa, 2009, p. 456). Indeed, the argument presented subscribes more to van Nieuwerburgh's (2010) and the EF's (1998) definitions of student-centeredness, and therefore conflicts with the curriculum architects' definition and subsequent dismissal of the EF's position (Culpan, 2004).

However, given the academic discourse calling for a reasonable and more conciliatory approach to implementing CP (Bain, 1997), and one that modestly (Tinning, 2002) promotes CP as the coming together of critical theory, humanism, and pedagogy (Kincheloe, 2008), the researchers believe that MBP may provide an appropriate vehicle to do so. The researchers believe that this compromise is a beginning point where PETE students can feel more confident and competent when conceptualizing and implementing CP within the NZC.

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PEDAGOGY

Measured Effectiveness and Decision-Making Processes of National Board and Non-Board Certified Physical Education Teachers

Jennifer E. Houston, Pamela Kulinna, Hans van der Mars, Kent Lorenz

Abstract

The conceptual framework for this study was the Five Core Propositions of the National Board Certification (NBC) for teachers. This study evaluated teaching effectiveness and the decision-making processes employed by NBC and non-NBC physical education teachers. Process measures of teaching effectiveness were used (e.g., Academic Learning Time–Physical Education and the System of Observing Fitness Instruction Time), along with stimulated recall interviews. Four teachers (2 with/without certification) were given an experimental teaching unit and explicit student learning outcome objective that they implemented over three lessons. All analyses suggested NBC physical education teachers were not more effective than their non-NBC counterparts, and teacher decisions were similar. Three themes emerged across groups: (a) previous lessons painted the future, (b) mind on the physical, and (c) goal-directed instruction. The NBC organization claims that the process of certification is designed to develop/retain/recognize accomplished teachers; however, these outcomes need more study in this setting.

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Teaching Effectiveness and Decision-Making Processes

Teachers and effective teaching have been examined for decades, with studies offering key characteristics and practices a teacher must possess and use to be successful. To be successful, teachers should obtain a profound level of content knowledge, pedagogical knowledge, and pedagogical content knowledge (e.g., Shulman, 1986; Ward, Kim, Ko, & Ki, 2015). Effective teachers have an ability to present a topic of instruction and reconstruct it to where learners can comprehend the instructional content. Beyond the need for deep content knowledge, Clark and Peterson (1976) discovered that teaching is a highly intellectual process that includes continual professional judgments throughout a lesson. Housner and Griffey (1985) in their study describing the decision-making processes of physical education teachers found that during teaching, experienced teachers focused most of their attention on individual student performance, while inexperienced teachers attended most frequently to the interest level of the entire class. Others have expanded the body of research in this area and found teachers to undergo two kinds of intellectual processes: (a) evaluation (i.e., Did it work? What else could/should I have done? How could I have done better?) and (b) common wisdom (i.e., there is more to discipline than just maintaining it: how the students feel about being disciplined affects how they will respond next time; e.g., Tripp, 2012).

Next to smoking, physical inactivity has been the major contributor to a growing epidemic of chronic and preventable disease in the United States (U.S. Department of Health and Human Services, 2008). Therefore effective physical education teachers should provide health optimizing physical education classes where teachers are responsible for providing opportunities for moderate to vigorous physical activity (MVPA; Sallis et al., 2012, p. 126). Although the Institute of Medicine recommended that physical education teachers provide opportunities for students to engage in MVPA at least 50% of class time, according to Chow, McKenzie, and Louie (2009), students in physical education classes generally do not reach this recommended goal (Kohl & Cook, 2013). Increasingly, physical education programs and physical education teachers may be considered effective to the extent that they contribute to the goals of children's physical activity and health (Rink & Hall, 2008).

National Board for Professional Teaching Standards

Community of Practice

The theoretical framework of community of practice guided this study. Communities of practice are formed by people who engage in a process of collective learning in a shared domain. In other words, communities of practice are groups of people who share a concern or a passion for something they do and learn how to do better as they interact regularly (Wegner, 2011). This theory was used during the research phase and development of the National Board Certification Standards (National Board for Professional Teaching Standards [NBPTS], n.d.). Social scientists have used versions of the concept of community of practice for a variety of analytical purposes, but the origin and primary use of the concept has been in learning theory. The first applications of the community of practice were in teacher training, and it has evolved in the interest of peer-to-peer professional development activities (Wegner, 2011), such as the National Board Certification (NBC) process.

Five Core Propositions

In 1987, the NBPTS (2014) set out to identify and recognize expert teachers who have assimilated the necessary qualities to teach. NBPTS published a set of Five Core Propositions, which formed a framework from which all of the NBPTS evolved, have become the standard for the education profession in the United States (Berg, 2003), and provide a conceptual framework for this study. The Five Core Propositions include (a) teachers are committed to students and their learning, (b) teachers know the subjects they teach and how to teach those subjects to students, (c) teachers are responsible for managing and monitoring student learning, (d) teachers think systematically about their practice and learn from experience, and (e) teachers are members of learning communities. Each certificate area includes content-specific standards, but all standards are grounded in the Five Core Propositions, which articulate the actions that accomplished teachers employ to advance student learning (NBPTS, 2016).

Of the 12 standards specific to physical education, this study focused on four: Standard III, Curricular Choices; Standard IV, Wellness Within Physical Education; Standard V, Learning Environment; and Standard VIII, Assessment.

National Board Certified Teachers (NBCTs) have been examined in over 200 studies, with studies attempting either to compare abilities of NBCTs or to compare their students' achievement test scores with non-NBCTs (NBPTS, 2014). In multiple classroom studies, students of NBCTs achieved higher performance scores than students of non-NBCTs (e.g., Goldhaber & Anthony, 2007). Some of the benefits to achieving NBC have been reported as strengthening teaching practice, helping students succeed, career advancement, providing portability, offering higher salary potential, and enhancing education (NBPTS, 2014). According to Goldhaber and Anthony (2007), the NBPTS model not only can help separate more effective teachers from their noncertified counterparts, but can also identify the more effective teachers among their applicants.

NBC in Physical Education

Only six published research studies were located on NBCTs in physical education (Phillips, 2008; Rhoades & Woods, 2012; Woods & Rhoades, 2010, 2012, 2013). This is complicated by the fact that few ecologically valid standardized achievement tests can easily measure student-learning outcomes in physical education. Woods and Rhoades (2010) noted that linking NBCT to increased student learning in physical education is a major and complex undertaking because learning in physical education cannot be easily measured through achievement test scores. Woods and Rhoades (2010) discovered that 79% of NBCTs who teach physical education (NBCPETs) are female, 78.9% are Caucasian, 71.1% hold a master's degree, and 55.1% work in an elementary setting. In addition, the mean age of NBCPETs is 45 years with approximately 20 years of teaching experience. Through the inductive and deductive methods recommended by Miles and Huberman (1984) and the process of constant comparison (Lincoln & Guba, 1985), several themes emerged in regard to the subjective warrants of NBCPETs. These include a joy of helping and working with children, continued association with sport and physical activity, lack of aspirations to coach, and enjoyment of physical activity (Woods & Rhoades, 2010). However, the most frequent reasons for pursuing NBC relate to financial incentives, the challenge, and professional development. Woods and Rhoades (2012) investigated the self-perception of teacher change as a result of certification. The themes that emerged from their study included more teaching reflection, a greater focus on student learning and assessment, and an elevation in their perceived status and credibility as teachers. Further, Woods and Rhoades (2013) investigated the teaching efficacy beliefs of NBCPETs. Not only did the NBCPET's produce strong scores on the Personal Teaching Efficacy (PTE) scale, their PTE scores were higher than their General Teaching Efficacy (GTE) scores. Some of the themes that emerged relating to their perceptions about their own teaching success included differentiated instruction, persistence, connection with and care for students, and work in a content area conducive to influencing students (Woods & Rhoades, 2013).

NBCPET Outcomes. Phillips (2008) compared NBCPETs with non-NBCPETs on selected student outcomes measure. Phillips sought to describe the differences of teachers with and without NBC in relation to their percentages of student competency in physical education. Compared to students of non-NBCPETs, students of NBCPETs had significantly higher levels of performance in motor skill competency, fitness knowledge, and fitness testing, and reported higher levels of outside physical activity (Phillips, 2008). Motor skill competency was defined as student ability to perform the skill safely and having adequate skill to make performing in the activity enjoyable and to allow continuity in performance (Rink & Williams, 2003, p. 485). Because of the paucity of research studies in this area (i.e., only Phillips, 2008), this study sought to confirm and extend the Phillips' finding, to learn more about the differences between NBCPETs and non-NBCPETs in their decisions and student outcomes related to skill performance. Because South Carolina is the only state to use the South Carolina Physical Education Assessment Program (SCPEAP), this study sought to implement other means of assessment, including skill competency and game knowledge.

The research questions guiding this study included (a) do students in classes taught by NBCPETs accumulate higher levels of academic learning time in physical education (ALT-PE) and MVPA compared to students taught by non-NBCPETS? (b) are there differences in posttest skill achievement scores across groups? and (c) what are the information cues and decisions made during interactive teaching of the provided Experimental Teaching Unit (ETU)?

Method

Participants and Setting

Two female NBCPETs and two female non-NBCPETs, along with their students, served as study participants. For a "level playing field," the comparison teachers were matched as closely as possible on (a) gender, (b) age, (c) ethnicity, (d) teaching level, (e) teaching experience, and (f) district. All four teachers were Caucasian and certified physical education teachers. The NBCTs reported 9 and 24 years of teaching, while the non-NBCTs reported 12 and 24 years of teaching. The ethnic breakdown of all four schools was similar with 64–72% Caucasian, 5–8% Black, 14–20% Hispanic, and 5–11% other. Similarly, the two elementary schools had an enrollment at 475 and 514, while the middle schools had 800 and 1,280 students. Each teacher and school was assigned a pseudonym. All four teachers had been trained in the use of the Dynamic Physical Education Curriculum (Pangrazi & Beighle, 2013), yet only the two elementary teachers reported implementing the curriculum into their programs. The two secondary teachers did not have a district-adopted curriculum. However, both mentioned using parts of the Fitness for Life curriculum (Corbin & Le Masurier, 2014).

Research Design and Procedures

Research design. This study, using a mixed-method design, utilized quantitative and qualitative data collection and analysis. Because the experimental teaching units (ETU) were considered an intervention, this study was conducted using a pre–post intervention design.

Experimental teaching units. ETUs were used with three planned lessons in this study so that the content taught was standardized. Although it controlling all outside factors is impossible, all four teachers were asked which physical activity/sport they felt their students had the least amount of experience with. All four teachers responded with soccer. Hence, two game play dimensions of soccer were selected as the target objectives of the the ETUs. Teachers were provided with explicit instructional objectives (i.e., correct technical execution when shooting on goal and providing support during a 4-v-4 game of modified soccer).

While the objectives were predetermined and agreed on by the teachers, teachers were given freedom on how to plan, design, and instruct around the respective objectives. This method differs slightly from those in previous studies (e.g., Solmon & Lee, 1996) in which all teachers taught the same lesson. This accommodated the differing schedules of the four teachers and each teacher's independent approaches to teaching skills and games. Providing the teachers with an ETU establishes an objective learning environment, which is directly related to the National Board Standard V for physical education teachers, which states accomplished physical education teachers establish high learning expectations and create well-managed classrooms that engage students in a safe and respectful culture of learning (NBPTS, 2016).

Prior to the start of the ETU, the secondary school teachers were asked to rank their students by ability level. Three students were chosen at random from each skill level (i.e., high-, medium-, and low-skilled). They (for the most part) made sure those three students were in the same area of the field each day to ensure the researcher was able to film those students. If those students were spread out around the entire playing area, it would not have been possible to get them all on film together.

For the elementary school teachers, the objective of the ETU was for students to demonstrate technically correct shooting (i.e., penalty kick but without a goalkeeper) on goal in soccer. The students were not assessed on achievement of a goal, but instead on their motor skill proficiency as dictated by the state standards for Grades K–5. The criteria for correct performance included (a) student approaches the ball at an angle; (b) student runs up to ball with the last step being a slight jump, landing on the supporting leg beside the ball; (c) kicking leg comes through with the ball being contacted with the instep or laces of the foot (not the toes); (d) the kicking leg follows through in direction of the goal; and (e) the student hops with the opposite foot, landing on the kicking foot. The observation instrument was modified from Fronske (2008).

Teachers in the secondary schools were given the ETU objective to have students develop their offensive support (a tactical dimension of game play in invasion games) during a modified 4-v-4 soccer game, using the offensive support definition of Mitchell, Oslin, and Griffin (2006). Support was defined as being in a proper position to receive a pass from a teammate and either move the ball further up the field or shoot toward the goal (Mitchell et al., 2006). For example, the student appears to support the ball carrier by being in or moving to an appropriate position to receive a pass.

Procedures. All lessons included a 10- to 15-min segment focused on warm-up fitness-related content that preceded the activities specific to the ETU. Only the segment of each lesson related to the ETU was videotaped (average of 18 min, 12 lessons, 3 lessons for each teacher). For assessment of student achievement, all students in the observed classes were pretested and posttested on the targeted soccer outcome measures (i.e., shooting technique and support). For the pretest and posttest, students were assessed individually and given two opportunities to shoot on goal (two for the pretest and two for the posttest). This was done so the researcher could focus on the skill being performed in assessing skills.

At the secondary level, students were grouped into teams of four, and two groups were placed on the modified soccer field at one time to play a modified, 7- to 8-min soccer game; teams were designated by colored vests. Following the pretest, each teacher was asked to provide a class list with all students ranked by their level of skill (low-, medium-, or high-skilled). Three students were then chosen, one of each level, for purposes of data collection. The teacher was also asked to keep these three students in the same general area during each ETU portion of the lessons, which ensured these students would be visible on the video for subsequent data collection. The target students were observed in sequence during the ETU portion of the lesson.

Student learning outcomes assessed. Two proxy measures of student learning were selected. The first, ALT-PE, was defined as the amount of observed time students spent in motor activities at appropriate success rates (Siedentop, Tousignant, & Parker, 1982). The second, MVPA, measured use of the System for Observing Fitness Instruction Time (SOFIT; physical activity component only) and was defined as the amount of observed time students spent engaged in physical activities that require energy for at least a brisk walk (McKenzie, Sallis, & Nader, 1991).

One additional variable was the decision-making and thought processes employed by NBCPETs and non-NBCPETs as measured via the stimulated recall interviews (e.g., Clark & Peterson, 1986).

Instruments

Academic Learning Time–Physical Education. Many descriptors have been applied to the concept of student engagement with the subject matter as a powerful predictor of achievement (Parker, 1989). However, Berliner in 1979 coined the phrase "academic learning time," which refers to the portion of allocated time a student was actually involved with the subject matter (Parker, 1989). ALT-PE is an application of this concept in the physical education setting (Parker, 1989). ALT-PE is specifically defined as being the percentage of class time that students are appropriately/successfully engaged in physical education content activities (for validation and protocol information, see Parker, 1989). Using the ALT-PE instrument allows the researcher to assess a teacher's curricular choices (Standard III), the learning environment (Standard V), and assessment practices (Standard VIII; NBPTS, 2016).

System for Observing Fitness Instruction Time. Students' MVPA levels were collected via SOFIT (McKenzie, 2006; McKenzie et al., 1996). The system includes three coding levels: student physical activity, lesson context, and teacher behavior. However, this study used only the students' PA level coding level. The categories include (1) lying down, (2) sitting, (3) standing, (4) walking, and (5) very active or vigorous (McKenzie, 2006; McKenzie et al., 1996). The sum of the proportion of time spent walking and very active or vigorous constitutes MVPA (McKenzie, 2006; McKenzie et al., 1996). For validation and protocol information, see McKenzie et al. (1996).

Measuring physical activity levels of students during physical education directly relates to the National Board Standards III (curricular choices), IV (wellness in physical education), and VIII (assessment). Engagement in light, moderate, and vigorous physical activity has been reported to have substantial health benefits and is being promoted as a national objective for disease prevention (Office of Disease Prevention and Health Promotion, 2017). School physical education has been recognized as the most widely available resource for promoting physical activity among children and adolescents (McKenzie, Marshall, Sallis & Conway, 2000). By providing opportunities to engage in MVPA during physical education, and thus measuring the actual physical activity levels, physical education teachers implement programs in support of lifelong physical activity and wellness (NBPTS, 2016). Both the ALT-PE and SOFIT measurements were taken during live lessons and game play.

***Z* pretest and posttest gain data.** For the assessment of the technical execution of shooting on goal (elementary school level), five critical elements were selected (Fronske, 2008). For a trial to be considered "correct," students needed to demonstrate all five elements. Students were given two trials to execute the skill. Each time a student attempted the skill, trained observers evaluated the presence or absence of the critical element. If a critical element was present, the student received a point. If not, they received a 0. Each trial was worth a potential 5 points (10 points total). During the pretest, students had no previous instruction from the teacher, but during the posttest, students were told to remember what they were taught by their teacher during the soccer unit. Students were tested in groups of five, with each student taking a turn until all five students had gone, and then the group would take another turn.

For the tactical assessment of offensive support (secondary level), the definition developed by Mitchell et al. (2006) was used, and interval recording was used for collecting the data (McKenzie & van der Mars, 2015). During the pretest, students were told to play, concentrating on offense and defense. During the posttest, students were asked to remember what they were taught during the soccer unit about offensive tactics. An alternating "observe" and "record" sequence (with each 6 s in length) was used. During the observe interval, the trained observers made three determinations: (a) whether the target student's team was on offense or defense (if on defense, no further decisions needed to be made); (b) if on offense, whether the student was handling the ball or "off the ball"; and (c) if on offense and "off the ball," whether the student provided appropriate support or inappropriate support to her or his teammate who was in possession of the ball on offense.

Stimulated recall. This study followed the stimulated recall method (pre-active, interactive, and reactive phase) and a tool for evaluating participating teachers' decision-making and thought processes. Immediately following each lesson, the lead author used the stimulated recall technique to elicit reports of the cues attended to and the decision-making processes used during each participant's interactive teaching (Housner & Griffey, 1985). Teachers were shown short segments of a lesson from the video recordings in sequential order. After viewing each segment, the teachers were asked to respond to a set of questions. Peterson and Clark's (1978) recommendations provided the framework for the stimulated recall questions: (a) What are you doing in this segment and why? (b) What were you noticing about the students? (c) How were the students responding? (d) Were you thinking of any alternative actions or strategies at that time? (e) Did any student reactions cause you to act differently than you had planned? and (f) What was your ultimate objective for today's lesson? Stimulated recall interviews followed each of the three-recorded lessons and lasted between 5 and 15 min (12 total lessons), depending on responses across the four teachers. In addition, the lead investigator also took field notes, noting key aspects of the teaching practices and format of the lessons employed by all four teachers.

Observer training and reliability. In training for data collection of the student outcome variables during the videotaped ETU lesson segments and of the pretest and posttest outcome measures, all observers followed the standardized protocols for ALT-PE and SOFIT (Sallis et al., 2012; Siedentop et al., 1982). Data collection began only after interobserver agreement (IOA) percentages of at least 75% were obtained, via the scored-interval method (van der Mars, 1989). IOA checks were conducted on 25% of the videotaped ETU lesson segments and 25% of the students' pre–post test performance. The scored-interval method is the most rigorous way of estimating observer reliability in that it reflects the degree to which two independent observers saw the target behavior occur at the same time (van der Mars, 1989). See Table 1.

Table 1
Interobserver Agreement Percentages for ALT-PE and SOFIT Observation System Categories and Pretest and Posttest Outcome Measures

Variable	%	Variable	%	Variable	%	Critical element	%	Variable	%
Transition	96	Interim	100	Standing	89	#1	97	GC	81
Management	100	Waiting	84	Walking	77	#2	78	PS	71
Technique	78	Off-task	66	Vigorous	82	#3	72	PE	80
Rules	100	On-task	86			#4	72	AS	100
Skill Practice	93	Cognitive	89			#5	83		
Scrimmage	82	ALT-PE	82						
M	91		84		83		80		83

Note. Only those variables observed during the lessons are reported. GC = game context; PS = player status; PE = player engagement; AS = appropriate support

Data Analysis

ALT-PE and SOFIT. Descriptive statistics (i.e., means and standard deviations) were calculated for all the observed categories of the ALT-PE and SOFIT observation systems (i.e., the process measures). Students' MVPA percentage levels were recorded as the number of intervals accumulated in walking and being very active combined during the physical education class. A repeated measures multivariate ANOVA compared the levels of performance of the NBCPETs and the non-NBCPETs on the data from the SOFIT and ALT-PE instruments.

Student skill outcomes. Using the shooting technique skill at the elementary level, pretest and posttest score differences as nominal data may be inappropriate, as a score of 3 for one student might not be the same as a score of 3 for another student. Because there are five critical elements for the skill of shooting on goal, one student might have correctly performed the first three elements, while another student correctly performed the last three, yet they receive the same score. Moreover, it is possible, albeit unlikely, for students to earn the same score by performing different elements correctly. Therefore, to test for between-group differences on the student outcome measure (i.e., gain scores), a chi-square test of independence was conducted.

Students taught by the NBCPET were compared to those taught by the non-NBCPET in the secondary schools on their ability to demonstrate offensive support (Mitchell et al., 2006) when their team was in possession during a modified soccer game. Mean between-group differences on the pretest to posttest gain scores for offensive support were compared via an analysis of variance (ANOVA).

Field notes/observations/interviews. Transcripts of the stimulated recall interviews were analyzed with the constant comparison method (Saldaña, 2013). Data analysis began with a particular incident, which was then compared with another incident. In the first cycle, two researchers established their individual personal coding scheme and initial themes separately. Researchers then compared their initial codes and themes and negotiated findings (collapsed and reduced themes). Data trustworthiness was demonstrated through peer debriefing, negative case analysis, and member checking. Two member checks were conducted during this study. The first consisted of returning all interview transcripts to teachers and asking them to make any needed or desired changes to the transcripts. The teachers made only minor editorial and semantic changes. The second member check involved sending the intervention participants a draft of the themes of this study and asking for their comments regarding the authors' interpretations. A search for disconfirming evidence was then conducted by two researchers, who independently searched for negative cases that could provide an alternative viewpoint or disprove the themes. No negative or disconfirming cases were identified in this process. The first author achieved NBC in 2006. This created an inherent bias potentially in that the researcher might have valued the NBPTS as an avenue for the creation of highly qualified physical education teachers. On the other hand, the researcher also believes that the NBPTS attracts highly qualified teachers and merely provides a method of recognition.

Results

With exception of the Off-Task category in the ALT-PE observation system, and the Player status behavior category for assessing offensive support, all IOA percentages met the S-I criterion of 75%, indicating observer reliability (van der Mars, 1989) for both the ALT-PE and SOFIT instruments. See Table 1.

ALT-PE and SOFIT

Students taught by NBCPETs were engaged in motor activity at an appropriate success rate (ALT-PE) 33.8% of the time as compared to 27% of the time for students taught by non-NBCPETs. As Figure 1 shows, non-NBCPET students on average reached higher MVPA levels compared to NBCPET students (46.3%, and 42%, respectively). In addition, the non-NBCPET students had a lower percentage of sitting compared to NBCPET students, with an average of 1.9% and 3%, respectively. For both student groups, the most prevalent student behavior, which is a critical finding from a public health perspective, was standing (i.e., a sedentary behavior), with percentages at 54.6% for NBCPET students and 51.4% for non-NBCPET students.

The effect of board certification status on students' ALT-PE and MVPA levels across the observed classes were examined with repeated measures multivariate analysis of variance analyses (RM-MANOVA).

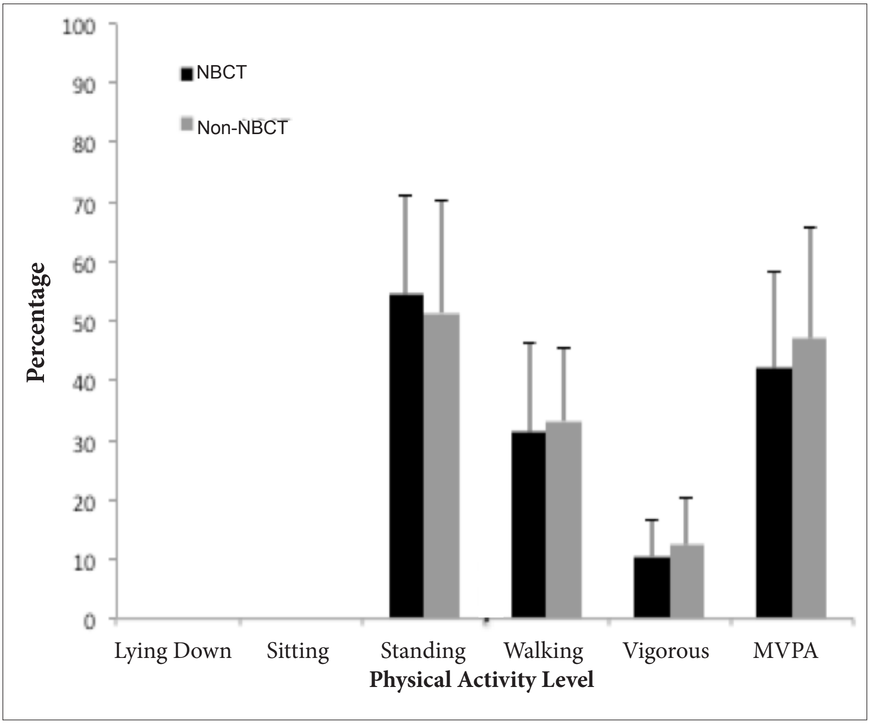

Figure 1. Mean learner involvement levels (with standard deviations) across NBCPETs and non-NBCPETs during ETU portion of lessons.

Students' mean ALT-PE levels were 33.8% (*SD* = 11.32) and 27% (*SD* = 15.04) for NBCTs and non-NBCTs, respectively. However, this between-student group difference was not statistically significant, $F(2, 4)=4.455$, $p = .096$. Students' mean MVPA levels were 42% (*SD* = 16.3) and 46.37% (*SD* = 18.6) for NBCTs and non-NBCTs, respectively. However, this between-group difference in MVPA levels was not statistically significant, $F(2, 4) = .886$, $p = .480$.

Figure 2 shows how the NBCPETs and non-NBCPETs and their students spent their class time during the ETU. On average, NBCPETs and non-NBCPETs spent a similar amount of time (19%) in transition, while the non-NBCPETs spent more time performing management duties (1.4% as compared to 0% for NBCPETs). The most noticeable differences occurred in the subject matter motor categories of skill practice and scrimmage. NBCTs spent more time engaged in skill practice than the non-NBCPETs (26% and 14%, respectively), while the non-NBCPETs spent more time engaging students in scrimmaging than their NBCPET counterparts did (38% and 49%, respectively).

Figure 2 also includes the mean learner involvement levels throughout the ETU. Non-NBCPET students spent more time in interim and waiting than NBCPET students (10% and 14% as compared to 14% and 19%, respectively). Non-NBCPET students spent more time on-task (19% compared to 16%) than NBCPET students. Off-task behavior was negligible to nonexistent for both student groups. Cognitive engagement was also similar for both student groups (15.5% and 12.0% for non-NBCPETs and NBCPETs, respectively).

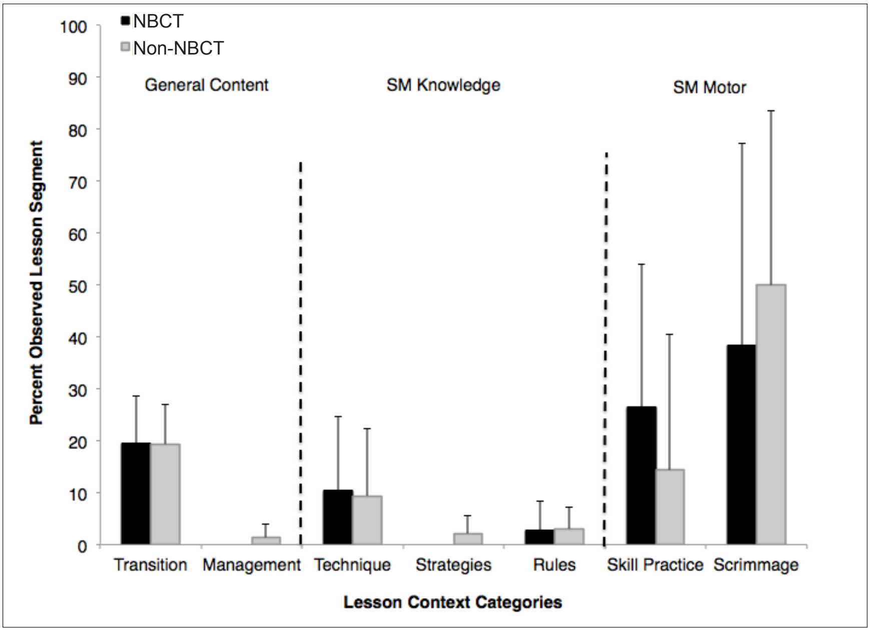

Figure 2. Mean use of class time (with standard deviations) across NBCPETs and non-NBCPETs during ETU portion of lessons.

Figure 3 presents secondary students' pretest, posttest, and gain score data for support. Students taught by the NBCPET had a mean pretest score of 26.6% and a mean posttest score of 50.0% (time observed in support). The students taught by the non-NBCPET had a mean pretest score of 28.5% and a mean posttest score of 34.0%. No significant differences in support were found during the pretest or posttest between students taught by the NBCPET and the non-NBCPET, $F(1, 2) = .064$, $p > .05$, $F(1, 2) = 1.0$, $p > .05$, nor was there a statistically significant difference on the groups' gain scores, $F(1, 2) = 2.00$, $p > .05$.

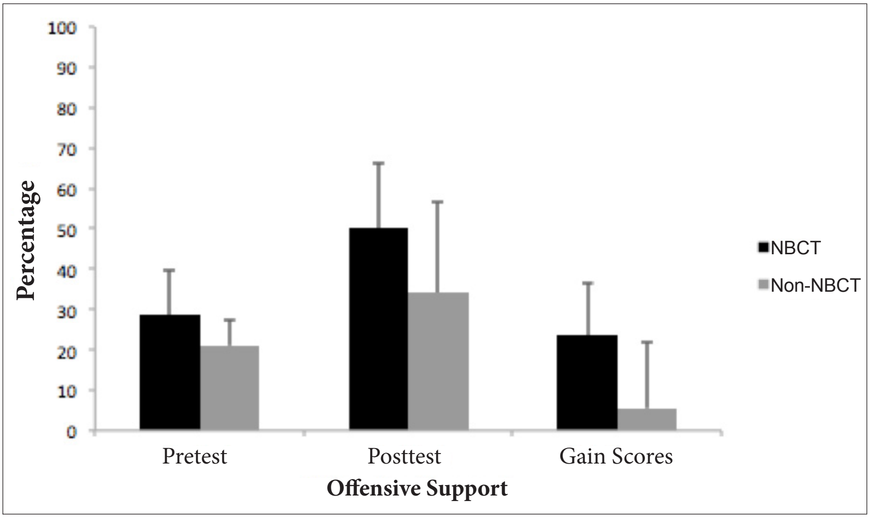

Figure 3. Mean pretest, posttest, and gain scores (with standard deviations) for Offensive Support for students of NBCPETs and non-NBCPETs.

Student skill outcomes. Figure 4 presents student achievement data (pretest, posttest, and gain scores) for students in elementary school on their technical execution of shooting on goal in Soccer. Students taught by NBCPETs and non-NBCPETs improved from pretest to posttest. The students taught by the NBCPETs had an average pretest score of 2.5, an average posttest score of 5.0, and an average gain score of 3.0. Students taught by the non-NBCPETs had an average pretest score of 3.0, an average posttest score of 5.0, and an average gain score of 2.0. However, students' gain scores were not affected by the teachers' NBC status, $\chi^2(1) = .376$, $p > .05$.

Overview and Key Themes

This section of the results is presented in two stages. These include (a) descriptive overview of teaching and (b) key teaching themes.

Teachers approached the lessons and instructed similarly. All teachers were observed beginning their lessons with a warm-up and fitness activity, with the subsequent activity incorporating the ETU. All four teachers designed their soccer ETUs into stations, offering

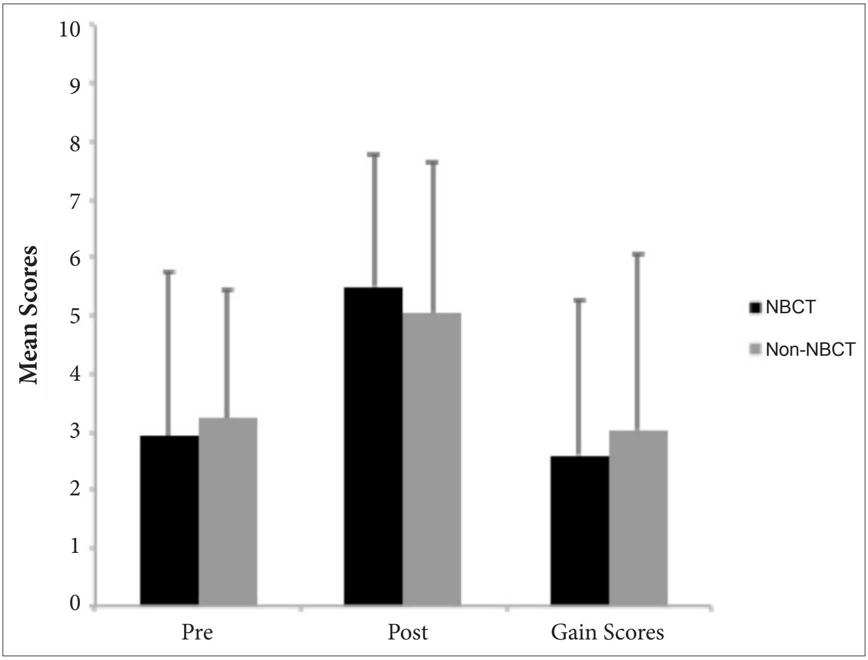

Figure 4. Mean pretest, posttest, and gain scores (with standard deviations) for Shooting on Goal for students of NBCPETs and non-NBCPETs.

specific skills per station in which students were expected to move from one station to another after a given time. This segment then was followed with a small-sided (4-v-4 or 5-v-5) modified game.

In addition, none of the four teachers identified the learning objectives to their students during any of the observed lessons, a key component necessary according to the NBCTs. Although two of the participating teachers did realize this mistake. Jessica asked her students to shoot on a goal as if they were playing kickball, but she never gave her students the necessary five critical elements. She later explained, "I'm not sure if in the beginning they knew what my overall objective was for them." Katie (secondary NBCT) told her students to move the ball down the field by yelling, "I'm open," but she never instructed the students on how to create open space or how to move to an appropriate space to receive a pass. Sallie (secondary non-NBCT) also forgot to mention the objective to her students. Instead, she spoke with her students on how to move the ball down the field toward the goal, later expressing after watching herself on video, “I guess I would probably tell them what the objective was, since I didn’t do that this time.”

The next sections present example responses to the stimulated recall questions and emergent themes including (a) previous lessons painted the future, (b) mind on the physical, and (c) goal-directed instruction.

Theme 1: Previous lessons painted the future. Participating teachers were asked, “What were you doing during this segment?” Research members found that all four participants were referencing a monitoring and observational instructional method, as they all described watching the students to see if they were implementing skills from the previous lesson. For example, after the first ETU lesson following the pretest, Sallie (secondary non-NBCT) explained that she was

> checking to see that they were building on their past learning, making sure that they were passing correctly, dribbling correctly, and then just a general understanding of what they were supposed to be doing.

Similarly, Beth (elementary NBCT) commented, “I was monitoring the students, seeing if they were following the original directions, which was passing with your partner and throwing, the skills that we learned last week. . . .” Jessica (elementary non-NBCT) went further and related the skill of shooting on goal to a previous activity: “What I did was I had them dribble up, but I’ve done that before with the fifth graders. Plus with them I feel it’s like kickball.”

Theme 2: Mind on the physical/technical. All teachers reported thinking of alternative ways to decrease student wait time and increase physical activity. For example, Katie (secondary NBCT), during the second ETU lesson, explained, “I was thinking of maybe how to add in more stations so that there are less people at each station. . .” She followed by commenting on her station design: “Instead of having ‘em dribble there and dribble back, I had ‘em dribble and then dribble on the outside, so another person could go to decrease the wait time.” Sallie (secondary non-NBCT) made a similar comment after the first day of observations when her students also participated in stations geared toward specific skills such as dribbling and passing: “I just think they would get more turns to—yeah, more turns…you would have partners versus a group of three or four, and they would be moving…a lot more." Beth (elementary NBCT) said, "I wanted them to learn the game first," even though the primary learning objective was shooting on goal. In addition, Beth admitted that she wanted to teach her students different ways to kick and "I don't think it was until my third lesson that I actually showed them how to do a goal kick. I was like, 'I should have probably of done that at the beginning so we could see some improvement.'"

Theme 3: Goal-directed instruction . . . or lack thereof. Goal-directed instruction was the third common theme that emerged. It was clear that all four teachers were not only concerned with meeting a specific objective for the lesson, but also wanted to ensure students were following the teacher's directions. Both Katie (secondary NBCT) and Jessica (elementary non-NBCT) asked a variety of questions regarding the study via e-mail. Jessica (elementary non-NBCT) was concerned before the study even started because her students were used to engaging in each activity for 2 weeks (2 days of instruction) and this study would potentially give her the opportunity to engage her students in one activity for a much longer time. In an e-mail, she sent this question: "My concern is that only having PE once per week that my students will not get my curriculum and when they are assessed they will not know what I'm assessing them on if they have been doing other activities." Katie (secondary NBCT) asked questions specifically about the learning outcome of offensive support: "What do you mean exactly when you say offensive support? How do you teach the students how to move the ball offensively?" Similar to Beth (elementary NBCT), Jessica (elementary non-NBCT) also admitted her focus was not on the learning outcome, but rather the learning outcomes of the district-approved curricular model.

At the secondary level, students were expected to develop their ability to provide offensive support, which implies students need to be involved in modified game play to practice and come to understand its role in the game. However, the first day of the soccer ETU, Katie (secondary NBCT) provided a lecture on the rules of soccer. During the second and third day, the students were engaged in several skill stations, working on skills such as heading, dribbling through cones, and juggling the soccer ball. Katie's (secondary NBCT) students did not engage in a modified soccer game until the final days of the ETU, one of which was the posttest day. When asked whether she (secondary NBCT) felt her lesson plans aligned with the learning outcome, Katie replied,

> I really try to incorporate the learning objectives into my lessons, to slowly get them to that objective. It is kinda hard in our short week to be able to do that and try to make a really big difference. I try to create drills and opportunities for them to be able to meet those objectives when the time came. That way, they could be confident in that.

Discussion

This study intended to determine whether differences would appear in student process or achievement (i.e., outcome) measures, based on board certification status of physical education teachers. In neither case (elementary or secondary), did any appreciable differences emerge. Although a visual analysis of the results implies a difference in the numbers, there were no statistically significant differences between the two groups. Previously, NBCTs were shown to demonstrate greater teacher effectiveness than their non-NBCT counterparts (e.g., Goldhaber & Anthony, 2007). However, the results of this study align with other classroom research on the effect of NBC where no between-group differences were observed (e.g., Gaudreault & Woods, 2012; Sanders, Ashton, & Wright, 2005). In previous studies, students' ALT-PE percentages have generally ranged from 15% to 42%, and the ALT-PE levels of students in the present study were similar to upper levels reported in previous research (e.g., Shute, Dodds, Placek, Rife, & Silverman, 1982; van der Mars, 2006). From a teaching process perspective, it might be argued that all four participants in this study (regardless of NBC status) demonstrated effective teaching throughout the ETU intervention. In addition, these percentages are acceptable and typical in public schools (Parker, 1989).

To provide a health-optimizing physical education classes, teachers are responsible for providing opportunities for MVPA (Sallis et al., 2012, p. 126). Although the Institute of Medicine (Kohl & Cook, 2013) recommends that physical education teachers provide opportunities for students to engage in MVPA at least 50% of class time, according to Chow et al. (2009), students in physical education classes generally do not reach the recommended goal (Kohl & Cook, 2013). In this study, regardless of teachers' NBC status, students' MVPA was below the recommended 50% level throughout the ETU lessons. Rather, the most predominant activity level for students in both groups was being sedentary, even in the secondary classes where a substantial amount of "scrimmage" was observed. Researchers noted that in spite of the inherent activity level of the scrimmage, students chose to stand around and not participate.

One extensive descriptive study of student physical activity levels in physical education involved observations in third-grade classes in 95 elementary schools across four states (McKenzie et al., 1996). Authors reported students accumulated only 25% of vigorous activity and 12% of the MVPA recommended per week by national objectives for health purposes (McKenzie et al., 2000). Moreover, middle school students who participated in coeducational physical education classes have been shown to be engaged in an average of 48.5% MVPA (McKenzie et al., 2000). Similarly, in the observed ETU lesson portions in this study, students' MVPA levels averaged 47% for those taught by non-NBCTS and 42% for those taught by NBCTs, which is close to the recommended 50% of class time.

In regard to teacher thought processes, both the NBCPETs and non-NBCPETs demonstrated similar teaching formats and thought processes, with few minor differences. Based on interviews and observations/field notes, the NBCPETs' and non-NBCPETs' methods of instruction and thought processes of teaching the provided ETUs were indistinguishable.

According to Proposition 4 of the Five Core Propositions, NBCTs think systematically about their practice and learn from their experiences (NBPTS, n.d.). From the resulting data, it appears that both NBCPETs and non-NBCPETS were either unwilling or unable to shift their focus from their typical practices to those presented as part of the ETU where specific learning outcomes were targeted. Beth, an NBCPET, however, reflected on her lessons and noted that she was intending on altering the timing for introducing the ETU objective, demonstrating competency of Proposition 4 (teachers think systematically about their practice and learn from experience) of the NBCTs.

Both the NBCPETs and non-NBCPETs had their "Mind on the Physical," focusing attention on physical activity levels rather than the given ETU. As a consequence of the heavy emphasis on the public health concerns around the levels of overweight and inactivity and the importance of reducing the risk of chronic diseases during childhood, the teachers focused on physical activity. The achievement of the U.S. Department of Health and Human Services recommendation of 50% of class time engaged in MVPA has been shown to be challenging (e.g., Scruggs et al., 2003), especially when other goals need to be met (i.e., developing motor skills and developing knowledge and understanding about health behaviors). Proposition 2 of the Five Core Propositions states teachers must know the subject area they teach and how to teach that subject to students (NBPTS, n.d.). According to Phillips (2008), not only do NBCTs have to demonstrate appropriate content development, but also this content development has to be a means to an end, a key missing component found among all participating teachers. In this study, the NBCPETs and non-NBCPETs lacked a command of the knowledge and understanding of the essential components of the learning objective of the soccer ETU (e.g., Ward, 2013).

There is a need for further research on NBCPETs and the NBPTS program as a whole. In this study, researchers examined the thought process, decision making, and instructional approaches in elementary and secondary settings among NBCPETs and non-NBCPETs. Throughout the ETU implementation, it became increasingly clear that NBCPETs and non-NBCPETs were uncomfortable deviating from their district curriculum, in spite of the ETU's goal of targeting specific student learning outcomes. In addition, both secondary teachers were unfamiliar with the tactical dimension of game play in soccer (i.e., support), which is a key concept of teaching students to be competent game players (Mitchell et al., 2006).

This study was not without limitations. First, there were only a limited number of site visits (three per teacher). Second, the degree to which findings might be generalized to other teachers was limited. Finally, this study was done with intact classes, and some students may have been experienced soccer players. The NBPTS program claims that it can successfully identify the more accomplished teachers among the applicants (Goldhaber & Anthony, 2007). The lack of differences in thought and decision-making processes in this study leaves two possible explanations. First, the non-NBCPETs were also worthy of NBC status. The number of questions asked by all participants prior to and during the study might support this claim. The second explanation might be that the "holistic" screening process used by the NBPTS assessors is not sufficiently sensitive to capture the critical dimensions of exceptional or accomplished performance in teaching physical education. The lack of sufficient generic and specialized content knowledge across all participants (but importantly among the two NBCPETs) may indicate that the current process does not capture whether the NBC applicant has the expected breadth and depth of content knowledge.

The NBPTS (2014) claims that the process of certification is designed to develop, retain, and recognize accomplished teachers. In addition, completion of NBC is supposed to signify that a teacher has developed and demonstrated advanced teaching knowledge, skills, and practices (NBPTS, 2014). However, the results of this study showed no difference in learning between students of NBCPETs and non-NBCPETs. Students who were taught by non-NBCPETs received the same lesson and gained the same amount of skill as the students with teachers with the NBC status. This leaves several questions: If the process measures were not different, does the non-NBCPET deserve NBC status as well? Or maybe the impact of NBC had faded and these once-accomplished teachers were no longer using best practices? Or perhaps all of the teachers studied were effective teachers with positive student outcomes.

Conclusion

Based on the student outcome measures on shooting on goal and offensive support as well as the ETU process measures (ALT-PE and SOFIT), and given the design and limitations of this study, the following conclusions can be drawn. NBC status did not reflect a higher level of effectiveness for delivering instruction. That is, instructional methods and approaches remained similar and indistinguishable, and NBC status in physical education did not produce differences in student learning outcomes. Further analysis on NBCPETs' versus non-NBCPETs' thought processes/decision making and instructional practices should continue. Moreover, the process for awarding board certification deserves further study for assurance that it truly discriminates between accomplished teachers and those still developing.

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PEDAGOGY

A Qualitative Investigation of PE Teachers' Perceptions of Introductory/Warm-Up Activities in K–12 PE

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Abstract

A physical education lesson usually consists of four parts (introductory activity, fitness component, lesson focus, and closing game). The first part of the lesson, the introductory/warm-up activities, has the potential to set the tone for the rest of the lesson. It also provides an opportunity for students to get into instant activity upon entering the gym or playing field. This study investigated physical education (PE) teachers' perceptions of introductory/warm-up activities in their physical education lessons. For this study, 26 K–12 PE teachers were interviewed through an electronic survey, which was e-mailed to the participants. Analysis of the interview data revealed four themes concerning introductory/warm-up activities: (1) importance of introductory/warm-up activities in a PE lesson, (2) the practical nature of the introductory/warm-up activities, (3) how introductory/warm-up activities benefit students, and (4) using music to enhance the introductory/warm-up activities. Data show that introductory/warm-up activities are an important aspect of any PE lesson that PE teachers use to prepare their students for the rest of the activities for the lesson.

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A typical physical education lesson usually consists of four parts: first, the introductory activity; second, the fitness component; third, the lesson focus; and fourth, the closing game or activity (Darst, Pangrazi, Sariscsany, & Brusseau, 2012). Many K–12 physical education (PE) teachers focus much of their thought process for planning on having appropriate and proper activities that enhance student learning. One portion of the lesson that K–12 PE teachers plan for is the introductory/warm-up activities. The introductory/warm-up activities portion of the lesson for some K–12 PE teachers may not be their main concern when planning their lesson. Strand and Scantling (1999) stated that introductory/warm-up activities help prepare students for vigorous activities and increase the amount of class time they spend in physical activity. Pangrazi and Beighle (2013) defined introductory/warm-up activities as engaging students in immediate activity upon arrival to class. The introductory activity serves as a physiological warm-up, preparing students for physical activity. Moreover, it provides an opportunity for PE teachers to establish classroom management among their students. Another definition of introductory/warm-up activities is a period of preparatory exercises that enhance competition or training performance (Fradkin, Zazryn, & Smolgia, 2010). The types of introductory activities and warm-ups students can perform could be jogging, skipping, tag games, stretching, and other locomotor games, all with the purpose of preparing students for physical activity.

The literature dealing with introductory/warm-up activities in PE is limited. Available literature was primarily from a practitioner's perspective. For example, Strand and Scantling (1999) provided Early Bird Specials for a basketball unit. This article outlines a number of activities related to basketball in which students can participate during introductory/warm-up activities. Darst, van der Mars, and Cusimano (1998) provided examples of introductory/warm-up activities intended to increase student heart rates, warm up the body, and stretch muscles, and thus prepare them for their fitness routines. The introductory/warm-up activities discussed in the article are unique, challenging, and appropriate for middle school students. One last article reviews introductory/warm-up activities for elementary students (Mobley, 2003). Once again, these introductory/warm-up activities for elementary students are appropriate, are fun, and provide many opportunities for students to be active before other aspects of the class occur. These articles in the literature strictly provide how-to activities that K–12 PE teachers can implement into their daily lessons.

As valuable as the practitioner articles are, documents created by the national organization Society of Health and Physical Educators (SHAPE America) emphasize the importance of introductory/warm-up activities. These documents titled Appropriate Instructional Practice (AIP) Guidelines in Physical Education are written for elementary (National Association for Sport and Physical Education [NASPE], 2009a), middle school (NASPE, 2009b), and high school (NASPE, 2009c) physical education. The AIP documents are broken down into five categories: (1) Learning Environment, (2) Instructional Strategies, (3) Curriculum, (4) Assessment, and (5) Professionalism. Within each category, two specific instructional practices are discussed: an appropriate instructional practice and an inappropriate instructional practice. The purpose of these documents is to give

> specific guidelines for recognizing and implementing developmentally appropriate physical education activities and practices . . . practices that are in the best interests of children (appropriate) and those that are counterproductive or even harmful (inappropriate) need to be identified for the benefit of the students. (NASPE, 2009b, p. 7)

For each category within the AIP documents, appropriate and inappropriate instructional practice of introductory/warm-up activities are provided. For example, an appropriate instructional practice states, "Physical education classes begin with an instant activity, anticipatory set and physical warm-up; proceeds to the instructional focus and fitness activities; and close with a physiological cool-down and review of instructional objectives." The example of the inappropriate instructional practice states, "PE classes have no identifiable structure (e.g., students start class by performing the activity of the day with no introduction or warm-up)." These brief statements from the AIP documents reinforce that introductory/warm-up activities are an important part of the PE lesson and benefit students. Thus, this study investigated PE teachers' perceptions of introductory/warm-up activities in their PE lessons.

Method

Participants

Twenty-six veteran PE teachers (10 male, 16 females) from four states (California, North Dakota, Oklahoma, and Utah), representing 22 schools (6 elementary, 10 junior high, and 6 high schools), participated in the study. Teaching experience of the participants ranged from 1 to 20 years. The university institutional review board approved the study before implementation. Participants provided their informed consent for voluntary participation before study implementation.

Instrument

No instrument that examined physical education teachers' perception of introductory/warm-up activities, along with potential benefits to students, was identifiable in the literature. As such, the investigator constructed a survey from the literature regarding introductory/warm-up activities and from conversations with K–12 PE teachers. A 15-item survey was constructed. The survey instrument consisted of (1) five yes/no questions, (2) one multiple-choice question, and (3) nine open-ended questions (see Table 1).

Table 1
PE Teachers Perceptions of Introductory/Warm-up Activities Survey

Gender:	Male __		Female __		
Age:	21–30 __	31–40 __	4–50 __	51– older __	
Years Teaching:	1–5 __	5–10 __	11–15 __	15–20 __	20+ __
Grades You Teach:	K–6 __	7–9 __	10–12 __		

The following survey questions will ask you your perceptions of introductory/warm-up activities that you teach and use in your PE classes. For many of the questions, you will be asked to briefly explain your thoughts and feelings in regards to introductory/warm-up activities. I would appreciate your help with this study. Thank you.

1. Do you feel introductory/warm-up activities play an important part of your lessons? Please explain your answer.

Table 1 (cont.)

2. Do you have your student participate in an introductory/warm-up activity for your lessons?

   YES NO

3. On average, how long are your introductory/warm-up activities?

   3 to 5 minutes 6 to 7 minutes Longer than 7 minutes

4. Do you feel introductory/warm-up activities do a sufficient job of increasing heart rate and warming up the body?

   YES NO

5. What kind of introductory/warm-up activities do you have your student participate in? Please explain your answer.

6. Do the introductory/warm-up activities your students participate in allow them to experience success? Please explain your answer.

7. Do you ever allow your students the opportunity to choose the type of introductory/warm-up activities they participate in?

   YES NO

8. If you answered YES to the previous question, do you feel your students are motivated or "into" the activity? Please explain your answer.

9. Do you use music during your introductory/warm-up activities?

   YES NO

10. If you answered "YES" to the previous question, what have you observed when music is playing. Please explain your answer.

11. Do you feel the introductory/warm-up activity sets the tone for the rest of your class activities? Please explain your answer.

12. Do your introductory/warm-up activities come across as being competitive?

    YES NO

13. If you answered YES to the previous question, do your students like the introductory/warm-up activities competitive? Please explain your answer.

14. How much time do you spend in thinking about and planning your introductory/warm-up activities? Please explain your answer.

15. Do you find "stations" or "whole-class" introductory/warm-up activities more beneficial for your students? Please explain your answer.

Content validity on constructed statements and readability of survey items were established with four experienced K–12 PE teachers. The survey was further pilot-tested with five experienced K–12 PE teachers who did not participate in the study. The survey was sent electronically to the participants via Qualtrics Survey Company.

Procedures

Upon university institutional review board approval, a nonprobability sample of convenience was employed for data collection. An introductory e-mail explaining the intent of the study, with a link to the electronic survey, was sent to all voluntary participants. After reviewing and selecting the I Agree section of the e-mail, participants provided their informed consent to participate in the study. Surveys were electronically sent on two occasions; with the second e-mail communication reminding those who had not completed the survey. The survey concluded with participants selecting the Submit button, thus electronically submitting the instrument to the investigator through Qualtrics.

Data Analysis

The investigators used framework analysis methodology for participant response, as outlined in Check and Schutt (2011), to correlate and review participants' open-ended responses to generate preliminary coding categories. Framework analysis incorporated four stages: (1) familiarization, (2) thematic, (3) identification, and (4) charting and interpretation (Rabiee, 2004).

Introductory/warm-up activities content themes. The investigators read and reread the survey responses, identifying key themes and phrases. From all the survey responses, the most frequent introductory/warm-up activities content themes were (1) importance of introductory/warm-up activities in a PE lesson, (2) the practical application of the introductory/warm-up activities, (3) how introductory/warm-up activities benefit students, and (4) using music to enhance the introductory/warm-up activities.

Results

Importance of Introductory/Warm-up Activities in a Physical Education Lesson

Overwhelmingly, PE teachers felt that introductory/warm-up activities were an important aspect of their lessons. Throughout this theme, the PE teachers stated that introductory/warm-up activities helped students get ready for class activities. Emily stated, "My warm-up activities set the tone for the class and prepares the students minds and bodies." Kathy stated, "My warm-up gets them ready for whatever sport or activity we are doing that day." Moreover, Paul explained that students understand the importance of introductory/warm-up activities: "They also tend to ask for time to stretch/warm-up if I ever skip it. I think they feel like it helps to get them ready for more intense workouts throughout the period." In addition, the PE teachers stated that introductory/warm-up activities served as a routine that they use as a management tool among their students. Roland stated, "Having an effective warm-up routine allows for students to be on-task right after changing clothes." Jennifer said, "They help me if they are similar, meaning they can help set up a routine and structure." Bob shared, "In our classes, the introductory activities are also a consistent time for students to get aerobic exercise."

The Practical (What Types of Activities) Application of the Introductory/Warm-Up

Activities. The second theme that emerged from the survey data was the practical application of the introductory/warm-up activities. The PE teachers' responses to this survey question varied. For example, Doug and Carrie stated that they have their students participate in dynamic stretching, static stretching, jogging drills, calisthenics, and tag games. Sally stated that "…sometimes I do games that get them running and moving. Other times we do short circuits. Or we will do some laps or running to have a fast warm-up." Along this line of practical application of introductory/warm-up activities, the PE teachers were asked if they have their students participate in stations or whole-class introductory/warm-up activities. For this survey question, a majority of the PE teachers indicated they use whole-class introductory/warm-up activities. The main reason the PE teachers used whole-class introductory/warm-up activities included convenience, ease in administering the activity, and ability to keep students on task. The last of which leads to more effective management of students.

How introductory/warm-up activities benefit students. The benefits of introductory/warm-up activities were the third theme from the data. Jan stated,

> I think it is also good for students to get the restless energy out during the warm-up before we get to the lesson. I have noticed that when this happens the students listen and pay attention better to class instructions.

Mark felt that his introductory/warm-ups better prepared his students for the Fitnessgram, stating, "I have noticed that the warm-ups prepare my students for the Fitness Gram testing later on." Martha indicated another way introductory/warm-up activities benefit students: "Many times they provide a review and practice time of the concepts learned in our previous class which prepare students to build onto these concepts with the next skill more successfully." The last benefit of introductory/warm-up activities is that it prepares the students for the class activities. Emily and Martha shared their thoughts: "It gets them into game mode and they are ready for PE rather than just another class!" (Emily) and "I think it focuses them mentally and gradually works them into the intensity we want them to be at for the class activity" (Martha).

Using music to enhance the introductory/warm-up activities. The final theme from the data dealt with music enhancing the introductory/warm-up activities. Kathy said, "Depending on the beat and speed of the music. I choose faster music so they are getting a better workout." Kim felt that "it helps create a fun and positive atmosphere. Students enjoy singing and dancing along to the music." Jennifer explained, "I try to use music that is current and that they know so they tend to be motivated to move. It just makes it so much more fun." Doug shared, "They are more engaged, active, and less distracted when the music is playing."

Discussion

This study investigated PE teachers' perceptions of introductory/warm-up activities in their PE lessons. Qualitative results from the study found introductory/warm-up activities as a valuable part of their PE lesson. Four major themes came to the forefront from the data. As previously stated, the themes included (1) importance of introductory/warm-up activities in a PE lesson, (2) the practical nature of introductory/warm-up activities, (3) how introductory/warm-up activities benefit their students, and (4) using music to enhance the introductory/warm-up activities.

PE teachers' statements indicated the importance of introductory/warm-up activities as a routine that prepares students for the class activities. Pangrazi and Beighle (2013) feel that introductory/warm-up activities help children to warm-up physiologically and prepare them for physical activity throughout the lesson. PE teachers also felt introductory/warm-up activities were an excellent management routine. Barney and Lynn (2000) concluded, ". . . the development of routine procedures to begin each class provides consistent expectations for students and increases management efficiency" (p. 9). A second theme the PE teachers discussed was the practical applications of introductory/warm-up activities, more specifically the types of activities in which students participated. Many of the PE teachers discussed having their students participate in dynamic and static stretching activities, jogging, calisthenics, and tag games. The literature from practitioners is full of activities PE teachers can implement into their daily lessons. A majority of the PE teachers discussed using whole-class introductory/warm-up activities for the purpose of better managing their students. PE teacher comments regarding whole-class introductory/warm-up activities included "It is hard to monitor every small group at once," "stations are harder to monitor the kids that are trying to slack off," and "students tend to be less active and stand around more when they are in stations." The final comment once again emphasizes the importance of introductory/warm-up activities for managing students.

Another theme that the PE teachers alluded to was the benefits introductory/warm-up activities have for their students. Mark indicated that the introductory/warm-ups helped prepare his students for their Fitnesgram testing. Rodriguez, Santonja, Lopez-Minarro, Sainz de Baranda, and Yuste (2008) studied whether an improvement in sit-and-reach scores could be achieved in school children (fifth graders) and adolescents performing 5 min of hamstring stretching exercises in PE classes. For this study, an experimental group participated in a program of hamstring-stretching exercises for a school term prior to the sit-and-reach test. A control group participated in usual PE classes, not participating in hamstring-stretching activities prior to their sit-and-reach testing. The experimental group showed significant improvements in passive straight leg stretches while the control group showed no significant difference. The researchers concluded that sit-and-reach scores improved following 5 min of stretching exercises in the warm-up and cooldown sessions when done twice per week throughout the school term.

Finally, the PE teachers discussed how music enhances the introductory/warm-up activities. Within this theme, components of using music during the introductory/warm-ups emerged. For example, PE teachers found that students like music that is current and familiar to them. Barney, Pleban, and Gishe (2016) studied the effects of music on fourth-grade student's enjoyment in two activities during PE class. In this study, contemporary popular music was played during a PE class. Students noted, "A lot of the songs were cool, because I knew them," "I liked the songs. The beat is awesome," and "The songs were awesome. I was singing along." Another component from this theme was that the students were more active when music was playing during the introductory/warm-up activities. Barney and Prusak (2015) studied the effects of physical activity rates of elementary students when music was playing during activity. Pedometers were used for measuring activity rates. The study found that students in lessons with music were more active. The results from the Barney and Prusak study are consistent with the results of this study: Music is a positive tool for getting students active during the introductory/warm-up activities.

Conclusions

This study investigated PE teachers' perceptions of introductory/warm-up activities in their PE lessons. Because of the paucity of research dealing with introductory/warm-up activities in PE, along with much of the literature written for the practitioner, this study only helps strengthen and add to the literature.

Results from this study appear to coincide with much of the results reported in practitioner literature in that introductory/warm-up activities are an important part of the lesson from the PE teacher's perspective. Darst et al. (1998) and Pangrazi and Beighle (2013) stated that introductory/warm-up activities help set the tone of the rest of the lesson and prepare students physiologically for physical activity (NASPE, 2009b). Using music helps create a positive atmosphere for students to participate in the introductory/warm-up activities. Barney et al. (2016) stated that music is a tool that can assist PE teachers in creating an environment where students feel comfortable participating in activities. Results from the study dealing with using music during introductory/warm-up activities hint that implementing music is and can be advantageous for the students (Brewer, Barney, Prusak & Pennington, 2016).

Study Limitations

This study is one of the first dealing with introductory/warm-up activities as described by Pangrazi and Beighle (2013). This limits the ability to compare, replicate, or follow previous research. These findings have the potential to provide practical application to the K–12 PE teacher and PE teacher education programs.

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PEDAGOGY

Combining Attentional Focus Strategies: Effects and Adherence

Cheryl Coker

Abstract

This study explored the influence of instructions that combine internal and external foci. Fifty-one subjects were randomly divided into 3 groups: internal only, external only, and a combined internal and external focus. The task was the overhand lacrosse throw for accuracy from a stationary position to a target located on a wall 6 m away. Following a 10-trial pretest, instructions were provided according to attentional focus group assignment and participants performed 8 blocks of 10 practice throws. Following a 2-day period of no practice, retention and transfer tests were performed. A significant Group × Block interaction was found, F (14, 336) = .57, indicating that the external focus group was more accurate than the combined focus group on the first and second practice blocks. This external focus benefit diminished in later trials and no significant differences for group were found for retention or transfer. Participants performed significantly better on the retention test than on the pretest. Subjects were also asked to estimate what percentage of the practice trials they actually focused on the instructions provided. Responses ranged from 10% to 95% (M = 64%), raising questions regarding how learners use instructional information.

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Typically, when a motor skill is introduced, the key elements or characteristics of the optimal movement pattern are highlighted for the learner. Often, in an attempt to assist the learner in understanding the movement requirements, this description directs learners' attention to their own body movements. This was demonstrated by Porter, Wu, and Partridge (2010), who found that 84.6% of elite track and field coaches gave instructions that focused on body and or limb movements. Numerous studies however, have indicated that this strategy should be reconsidered. Specifically, evidence suggests that learning and performance are enhanced when the learners' attention is instead directed to the effects of their movements (see Wulf, 2013, for a review).

A question of interest with respect to instructional focus is whether the external focus benefit was independent of individual differences. Wulf, Shea, and Park (2001) conducted a series of studies that examined what focus participants would adopt when given a choice and the resulting performance effects on a balancing task. On the first day of practice in Experiment 1, participants were asked to switch between an internal and external focus from trial to trial. Participants were then asked to select the focus condition they deemed most advantageous and were instructed to use it exclusively during practice the second day. No instructions regarding which focus to adopt were given during the retention test. Results indicated that of the 17 participants, 10 elected to adopt an internal focus for practice on Day 2, but no performance differences between the two focus groups were found. During the retention test however, only four participants maintained an internal focus (and one switched from an external to an internal focus) and the external group performed significantly better.

In the second experiment, more practice time was given and participants could explore the two strategies (internal vs. external focus) without restrictions. At the end of practice the second day, they were then asked which focus they perceived as more effective and were instructed to use only that strategy during the retention test. Results indicate that during practice, the total time spent utilizing each focus was similar. After the second day of practice, 16 of 20 participants elected to adopt an external focus for the retention test and this group was found to perform significantly better than their internal focus counterparts. The authors concluded that given sufficient experience with a task, learners are able to select the strategy that leads to better performance and learning and that the benefits of an external focus do indeed appear to be independent of individual differences as hypothesized (Wulf et al., 2001).

An alternative explanation, however, may be plausible. According to models proposed by Fitts and Posner (1967) and Gentile (2000), a characteristic of the first stage of learning is to develop an understanding of a movement's requirements. Given that participants were only given eight 90-second trials in the first experiment of Wulf et al.'s (2001) study, it is possible that the participants were still trying to acquire the movement pattern needed for successful performance and felt that the internal focus would best assist them in doing so. Once an initial pattern was established and the performer moved to the next stage of learning, they were able to determine that the external focus would be more beneficial for skill refinement. The findings of Perkins-Ceccato, Passmore, and Lee (2003) lend support to this notion. In their study, high and low skilled golfers performed pitch shots under different attentional focus schedules. Half of the participants in each skill level group were first directed to adopt an internal focus, while the other half were provided with external focus instructions. Upon completion of 50% of the practice trials, groups switched their focus to the other condition. According to the results, the low-skilled golfers, who first adopted an internal focus of attention and then switched to an external focus of attention, performed significantly more consistently than their counterparts, who performed using the opposite schedule. The high-skilled golfers, however, benefited from the opposite schedule. Those who attended first to the external focus instructions performed significantly better than those focused internally. The authors surmised that "in the execution of the pitch shot, once the fundamentals have been learned well, performance will benefit more by concentrating on where to hit the shot than by attending to the action of the golf stroke that will produce the shot" (Perkins-Ceccato et al., 2003, p. 598). However, until the learner understands the "fundamentals to the extent where monitoring of the swing is no longer necessary" (Perkins-Ceccato et al., 2003, p. 599), concentrating on the target (external focus) would not be beneficial.

The results of the Perkins-Ceccato et al. (2003) study suggest a possible link between skill level and attentional focus. Given the variable rate at which individuals progress in skill development, it is also conceivable that the attentional focus adopted by the participants in Wulf et al. (2001) was a function of skill level. More specifically, the 10 individuals who elected to adopt the internal focus on the second day in Experiment 1 may still have been trying to develop an understanding of the movement's requirements. The provision of attentional focus instructions that are exclusively internal or external may not accommodate individual learning rates. Exploration of matching attentional focus to skill level, however, would be difficult as transitions between learning stages cannot be clearly delineated. Alternatively, instructions coupling internal and external foci could provide the information needed initially for the learner to determine the pattern of movement and for advancement into more automatic processing as skill level increases. Consequently, this study investigated the influence of instructions that combine internal and external attentional foci on the performance and acquisition of a novel motor skill.

Method

Participants

Fifty-one individuals (26 women and 25 men; $M_{age} = 23.5 \pm 4.37$) from a university population volunteered to participate in this study. None had prior experience with lacrosse. The study was approved by the university institutional review board, and written informed consent was obtained prior to experimental testing.

Task

The task was the overhand lacrosse throw for accuracy from a stationary position. The target was located on a wall 6 m from where the participant stood with its outside/lower boundary at a height of 1.57 m from the floor. The target was 1.27 m in diameter total and consisted of five concentric circles of equal zones. Scores were recorded according to the zone in which the ball made initial contact, with the inner circle receiving 5 points, the next zone 4 points, and so on with the outer ring receiving a score of 1. Any ball not hitting the target received a score of 0.

Procedures

The researcher used a random number table to randomly divide participants into three groups (N = 17), which differed in the attentional focus instructions they received: internal only, external only, and a combined internal and external focus. All participants were shown the basic technique of the overhand lacrosse throw and given three practice trials where they threw at a blank wall from a distance of 4 m. A 10-trial pretest was then performed. Following the pretest, additional instructions were provided according to attentional focus group assignment. The internal group was instructed to snap the top wrist during the throw. The external group was instructed to throw the basket (of the stick) toward the target. Finally, the combined group was cued to focus on snapping the top wrist toward the target. In addition to the verbal instructions, all groups received two demonstrations of the movement (performed without the ball).

Participants then performed eight blocks of 10 practice throws with a goal of accuracy. Attentional focus checks and reminders were given every five trials for the first 20 throws and after every 10 trials thereafter. Following a 48-hr period of no practice, participants performed a retention test consisting of three blocks of 10 throws. Next, they performed a transfer test consisting of three blocks of 10 transfer throws from a 9-m distance from the target. No instructions or reminders were given on the second day.

Attentional Focus Verification

One criticism of the research examining attentional focus is the lack of verification as to whether participants did indeed adopt the attentional focus they were directed to use. Consequently, interviews examining the use of the instructional cue provided during the acquisition phase were conducted following the study (as suggested by Wulf & Prinz, 2001) . Participants were asked two questions. First, they were asked to reflect back to the practice period and estimate the percentage of trials they adopted (focused on) the instructional cue provided. Next, an open-ended question asked participants to reflect on the times they chose to abandon their assigned cue to see if they could identify a pattern or rationale for doing so, or if they felt that it was a random occurrence.

Data Analysis

The average pretest scores for each group were analyzed in a one-way analysis of variance (ANOVA). To determine whether learning occurred, the researcher calculated and analyzed the average pretest and retention scores for each group in a 3 (Group) × 2 (Test) ANOVA. For the practice, retention, and transfer segments, the total score on each 10-trial block was calculated for each participant. The practice data were analyzed in a 3 (Groups) × 8 (Block) ANOVA with repeated measures on the second factor. The retention and transfer data were analyzed in separate 3 (Groups) × 3 (Block) repeated-measures ANOVAs. The range and mean for attentional focus verification percentages were calculated for each group, and means were analyzed using a one-way ANOVA. Correlations between percentage of time focused on instructions provided and practice, retention, and transfer scores for each group were assessed using Pearson's correlation coefficient. Alpha levels for all tests were set at $p < .05$. Finally, responses to the question that asked participants to reflect on the times they chose to abandon their assigned instructional cue and reason for doing so were examined and patterns identified according to response frequency.

Results

Pretest vs. Retention

No significant differences were found between the external ($M = 2.62$, $SD = .51$), internal ($M = 2.55$, $SD = .70$), and combined ($M = 2.26$, $SD = .83$) focus groups. A significant effect, however, was found for test, $F(1, 48) = 8.34$, indicating participants were more accurate ($p < .001$) on the retention test ($M = 3.05$, $SD = .68$) than on the pretest ($M = 2.48$, $SD = .70$).

Practice

Figure 1 shows the average performance scores for the internal, external, and combined groups for the eight practice trial blocks. A significant Group × Block interaction was found, $F(14, 336) = .57$, and Tukey post hoc analysis indicated that the external focus group was more accurate than the combined focus group on the first ($M = 2.74$, $SD = .64$ vs. $M = 1.94$, $SD = .92$) and second ($M = 2.93$, $SD = .8$ vs. $M = 2.09$, $SD = .99$) practice blocks.

Retention and Transfer

Figure 1 shows the average performance scores for the internal, external, and combined groups for three trial blocks for the retention and transfer tests. No statistical main effects or interactions were found for either test.

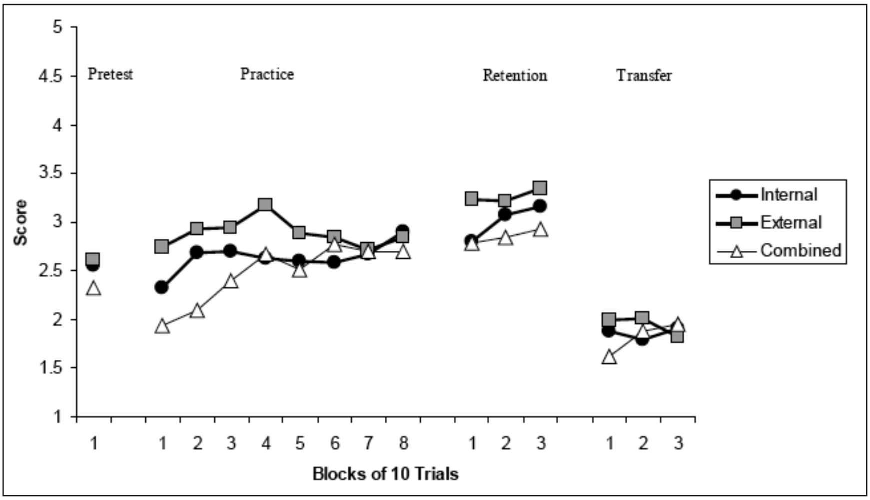

Figure 1. Average performance scores of the internal, external, and combined groups for the pretest, practice trials, retention, and transfer tests.

Attentional Focus Verification

According to self-reports, the average percentage of time focused on instructions across groups was 64% with a range of 10% to 95%. Table 1 shows group means, standard deviations, and ranges. Analysis of variance revealed no significant differences between groups with respect to percentage of time focused on instructions provided with means of 59.29%, 64.18%, and 67.06% for the internal, external, and combined groups, respectively. A significant correlation was, however, found between reported percentage of time focused on instructions and practice score for the internal focus group ($r = .529$; $p = .029$). This same relationship, however, did not exist for the external and combined groups. Furthermore, no correlation was found between instruction use and retention or transfer accuracy.

Table 1
Group Means, Standard Deviations, Minimums, and Maximums for Percentage of Practice Trials Participants Reported Focusing on Instructions Provided

Group	*M*	*SD*	Min	Max
Internal	59.29	25.18	10	90
External	64.18	15.96	30	85
Combined	67.06	16.87	30	95

Six themes emerged from the postexperiment interview question that asked participants to reflect on the times they chose to abandon their assigned instructional cue and reason for doing so (see Table 2). Thirty-seven percent reported that they stopped focusing randomly; 22% indicated that their focus on the instructions faded as the practice session progressed; 14% adopted their designated focus when an error occurred; 12% focused more toward the end of the practice session; and 10% indicated that they focused at the beginning of the practice session and subsequently when an error occurred; and 4% lost focus in the middle of the practice session but regained it toward the end.

Table 2
Frequency of Responses for Each of the Six Themes Regarding Instruction Use That Emerged by Group and Overall

Instruction use theme	Internal (N = 17)	External (N = 17)	Combined (N = 17)	TOTAL (N = 51)
Random lack of focus	6	3	10	19
Focus faded as practice session progressed	3	5	3	11
Focused when an error occurred	3	3	1	7
Did not focus in beginning but did at the end of the practice session	3	3	0	6
Focused in the beginning of the practice session and then when an error occurred	0	3	2	5

Table 2 (cont.)

Instruction use theme	Internal ($N = 17$)	External ($N = 17$)	Combined ($N = 17$)	TOTAL ($N = 51$)
Lost focus in the middle of the practice session but regained toward the end	1	0	1	2
Other	1	0	0	1

Discussion

This study examined the effects of instructions that directed learners to both their own body movements (internal focus) and the external effects of those movements (external focus). It was hypothesized that instructions combining both internal and external focus information would be beneficial as they would assist the learner in developing an understanding of the movement's requirements while allowing for more automatic control processes to occur during skill execution. This hypothesis, however, was not supported by the data. Instead, the external focus group significantly outperformed the combined group for the first two practice trial blocks. This external focus benefit seen early in practice, however, diminished in later trials, and although this group scored higher than both the internal and combined groups on the retention test, the difference did not reach a significant level. These data therefore not only refute the hypothesis regarding the combination of instructions but also conflict with previous findings of Wulf and colleagues revealing an external focus advantage.

The poorer performance of the combined group early in practice is likely indicative of additional processing demands imposed by the nature of the attentional focus instructions. These results certainly bring into question the ability of participants to focus internally on movements and externally on movement effects concurrently. This notion is supported by the attentional focus verification data. Although the combination group reported relatively greater instruction use, they also reported a more random lack of focus during the trials. This may reflect difficulty in adopting a style of focus whereby internal and external foci are coupled.

The attentional focus verification data provide additional insights into the results of this study, raising questions regarding how learners use instructional information. Although participants used the instructions provided, it is clear that they did not use them all of the time. In fact, instruction use averaged 64% overall with means of 59.29%, 64.18%, and 67.06% for the internal, external, and combined groups, respectively. Marchant, Clough, and Crawshaw (2007) reported similar findings with external instruction use at 77.14% and internal instruction use at 77.3% for participants learning a dart-throwing task and suggested that "even with specific instructional direction, participants will inevitably use their own strategies from time to time" (p. 489).

Support for the notion that participants will sometimes abandon the instructions given for their own strategies was provided by participants' responses when asked to identify when they chose not focus on the instructions given. These responses also shed light on why differences were not found beyond the second block of practice. Thirty percent of those in the external group indicated that their focus faded as the practice session progressed, while 18% indicated that they focused in the beginning of practice and then only when an error occurred. It is therefore possible that the external focus group did indeed abandon the instructions provided as practice progressed, which could also explain the lack of a significant effect between the external and internal groups.

Another interesting pattern that emerged from the self-report data was when focus was lost by the internal and combined groups. Thirty-five percent of the participants in the internal group and 59% in the combined group reported that their loss of focus on the instructional cues occurred randomly. The high percentage reported by the combined group, as indicated previously, may be attributed to the additional processing demands imposed by the combined internal and external focus instructions.

Results of the correlation analysis between the percentages of trials during which the instructions were attended to and practice, retention, and transfer scores also raise questions. These data only indicate the existence of a relationship between percentage of instruction usage and practice score for the internal focus group. No relationship was found for either the external or combined groups, nor was there a relationship for any of the three groups with respect to retention or transfer scores. This seems to indicate that it did not seem to matter if participants in the external and combined groups used the instructions provided. If this is indeed the case, it is possible that the lack of effect between groups is due to limitations in the instructions provided. However, the ability of participants to accurately estimate the percentage of instruction usage must also be considered.

Finally, two of the six themes regarding instruction use that emerged from postexperiment interviews involved error detection/correction. These two themes were (1) focused on instructions when an error occurred and (2) focused in the beginning of practice and then when an error occurred. Comparison of the three groups on these categories revealed that the external focus group cited these two themes twice as often (35%) as the internal (18%) and combined (18%) groups. These data suggest that the external focus group utilized the instructions to guide the learning process more so than the internal or combination groups. This is interesting given that the correlation data found no relationship between the percentage of instruction use and performance for this group.

While the attentional focus verification data presented in this study is insightful, more research is necessary so that its implications can be truly understood. The findings of this study demonstrated that participants used the instructions they were given. They did not, however, use them all of the time. Given this, an important line of inquiry involves where they chose to direct their attentional focus. Furthermore, why did they choose to abandon the instructions for their own strategies and is the type of attentional focus instructions they received a contributing factor? As suggested by Marchant et al. (2007), the addition of open-ended qualitative questioning should be included in future studies so that participants' use of instructions during the learning process can be better understood. In the meantime, physical educators can prompt students to maintain their focus on instructional cues through verbal reminders.

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PEDAGOGY

Unleashing the Powers Within: Delving Into Our Own Talents to Provide Effective CPD

Rosemary Keegan

Abstract

Teaching is a dynamic process and requires teachers to be become lifelong learners who can demonstrate their ability to change their instruction practice in line with educational needs. Continuing professional development (CPD) is the means by which teachers develop the knowledge and skills to enhance their teaching and learning experience of their students. CPD has the potential to provide the tools to enable the smooth implementation of new pedagogical methodologies and subject content. Due to my current geographical location, there were few CPD courses or programs available for me to attend. Through this research, I wanted to complete a self-reflective study, by developing my own knowledge and skills in the area of action research (AR), and to establish if AR was an effective form of CPD. If I successfully concluded that AR was an effective form of CPD, I subsequently wanted to establish if AR could contribute to a lifelong structured program of CPD. As a result of self-reflection and research, I identified AR as a skill that had the potential to satisfy the shortcomings in my own CPD. In collaboration with students and colleagues, an AR study was implemented in the physical education program to bring about enhancements in my teaching strategy. This case study demonstrates that I became a skilled reflective practitioner, and by embedding an AR approach into my teaching strategy, I could provide enhancements in teaching and in the learning experience of students. By developing my

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skills of a practitioner researcher, I could use AR as a means to support and complement my own CPD requirements. AR proved to be a useful form of CPD in physical education. It supported and complemented the role of CPD to give me the opportunity to update my skills and knowledge, to engage in reflection, and to collaborate with students and colleagues. It satisfied my need to implement enhancements in my teaching and in the learning experience of my students. AR appears to support a model of effective CPD that could contribute to a lifelong and sustained program of development for a teacher. But it should only be undertaken in conjunction with a broader structured program of CPD.

Teaching can be considered a dynamic, fluid, and complex process that requires professional integrity, requiring teachers to become "continuous learners" throughout their careers (Armour, 2006). This changing world in which we live requires teachers to be high-level knowledge workers who can constantly expand and adapt their own professional knowledge, as well as that of their profession (Schleicher, 2012). They must be fully engaged in the process of lifelong learning and able to evolve and adapt throughout their career (European Commission, 2004, pp. 2–3). The ability to adapt and implement change must be reflected in changes to classroom practice of the teacher, resulting from a change in their attitudes and beliefs over time, and also a change in the learning outcomes of students (Guskey, 2002). Just as teachers are seen as the pivot around which the educational system operates, teachers are a vital component in implementing change and in reforming the educational system, yet in many cases they are also considered as a major obstacle to change (Prawat, 1992). Not only do they need to be adaptable, but teachers also have a responsibility to extend the boundaries of their professional knowledge through a commitment to reflective practice, through research, and through a systematic engagement in continuous professional development from the beginning to the end of their careers (European Commission, 2010, p. 12). One of the main methods of helping teachers bring about change is through the assistance of continuing professional development (CPD) programs.

Reason for This Research

I have been a qualified physical education (PE) teaching for 28 years. CPD is an integral part of my profession and I have always endeavored to keep up to date with changes in my profession as a means of enhancing my knowledge and skills. Many CDP courses have not lived up to my expectations and have often been inadequate. In general, there are persistent concerns within our profession about the quality of CPD provision (Schleicher, 2012). Many of these courses that I have attended, specifically in PE, though enjoyable, were often lacking in depth and challenge (Armour & Yelling, 2007). I have resided in Kuwait for 14 years. PE is recognized as an important element in the curriculum but would not be held in the same esteem as the sciences or mathematics or other academic subjects. Coupled with the harsh climatic conditions during most of the year, and the demographic size of the country, the direct provision of PE CPD is not easily available or accessible. As I reflected on the pattern and direction of my own professional development, it has been sporadic and lacking in a clear focus and functional goals. In an effort to rectify this matter, I needed to (i) identify my short- and long-term teaching needs, (ii) identify the best possible strategy to meet these needs (by developing a sustained and effective CPD program), (iii) develop the knowledge and skills to be able to implement my own effective CPD, and (iv) be able to evaluate and plan further programs to meet my own needs over my career as a teacher in a systematic manner.

Without the option to attend externally provided CPD courses, and based on my own assessment of what skills I wanted to develop, I devised a plan to fulfill these needs. I did this by reflecting on my current teaching skills, my current knowledge, and how effective I was as a teacher. I videoed myself teaching and used this data to subjectively observe what teaching and learning was taking place in my lessons. I also reviewed my class notes and spent much more time writing down my observations. Based on this analysis, I established that I want to (1) enhance my skills of reflection and evaluation (de Vries, van de Grift, & Jansen, 2014), (2) develop my knowledge and skills in action research (AR) so that I could bring about enhancements in my teaching and learning, (3) embed this approach into my teaching strategy, and (4) evaluate the success of AR. I became proactive in meeting these needs through my own means. I carried out a literature review in the PE sector to identify how this might be achieved.

Literature Review

Effective CPD

Despite the emergence of research in recent years, it is widely recognized that the organization and delivery of CPD has been flawed and requires greater planning and organization. In fact Borko (2004) described them as being "woefully inadequate" (p. 4). Many teachers stated that often CPD courses were contextually sterile and did not provide the knowledge or support that teachers needed (Armour & Yelling, 2007; Opfer & Pedder, 2010). I endeavored to identify the purpose of CPD and what constituted effective CPD so that I could apply this to my own professional development. Day (1999) described professional development as

> the process by which, alone and with others, teachers review, renew and extend their commitment as change agents to the moral purpose of teaching; and by which they acquire and develop critically the knowledge, skills and emotional intelligence essential to good professional thinking, planning and practice with children, young people and colleagues throughout each phase of their teaching lives. (p. 4)

Day's (1999) description of CPD, as a dynamic and a lifelong learning process, with the ultimate goal based on providing the best possible learning experience for students to enhance their learning outcome, resonated with me. De Vries, Jansen, and van de Grift (2013) suggested that CPD should include offering teachers opportunities to update their knowledge and skills, engage in reflection, and collaborate with colleagues. The fundamental view is that it should support teachers to develop a set of qualities that will enable them to be innovative, to "review evidence of effective practice, and to engage with current innovation and research in order to keep pace with the evolving knowledge society" (European Commission, 2004, pp. 2–3). In a more practical way, teachers must be able to (a) connect the professional development strategies that they have been instructed upon, to their own students and context, (b) make them relevant and meaningful, (c) support them in attending to the new issues and problems, and (d) understand the issues and translate these new understandings into practice (Prawat,1992; Thompson &

Zeuli, 1999). It is believed that CPD is more likely to be effective in improving teacher's knowledge and skills if it focuses on academic subject matter (content); gives teachers opportunities for "hands-on" work (active learning); and, with a clear link to classroom teaching and learning, is integrated into the daily life of the school (coherence), with an emphasis on continuous, long-term, sustained professional learning, which is collaborative, classroom based, and research informed (Armour & Yelling, 2007; Darling-Hammond & Richardson, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Opfer & Pedder, 2010).

Based upon the perspective identified in the literature, CPD cannot be a random series of one-off courses. It must be part of a systematic, well-structured long-term process that includes regular opportunities and experiences planned systematically to promote growth in the profession, that will bring about successful change in teachers' practice, for school improvement and pupil achievement (Bolam & Weindling, 2006; Wells, 2014).

CPD for Physical Education Teachers

CPD specifically for PE teachers has been similarly flawed. The content of professional development has generally focused primarily on sport-specific courses, and there is little evidence of a systematic sustained program of learning or learning progressions (Armour & Yelling, 2007). Casey and Kirk (2010), in their argument for implementing change within the PE teaching profession, have been critical of their reticence and their procrastination in adapting to change. They believe that the responsibility lies at the feet of the PE teaching body and have stated that PE teachers need to take responsibility for the "evolution of practice" in how the profession teaches this subject. They have supported the concept of collaboration with relevant professionals including researchers and PE departments for facilitating changes and the introduction of new pedagogies (Casey & Kirk, 2010; Goodyear & Casey, 2013). It is widely reported that the numbers of people involved in sport and physical activities are decreasing as these activities compete with emerging technologies and an ever increasing sedentary way of life. PE teachers need to proclaim and educate others about the importance of their subject. PE teachers, however, must change and embrace new teaching strategies that have the potential to enhance teaching and learning in this subject to meet the modern world so that is not subsumed by it. As has been reported in other areas of the curriculum, Armour, Quennerstedt, Chambers, and Makopoulou (2015) similarly suggested that the core focus of PE CPD should be "practice" itself (i.e., embedded and contextualized), should ensure that learning is dynamic (active and requiring time for reflection), and should be never-ending (continuing).

Action Research and Professional Development

The aim of AR is to explore new ways of doing things, new ways of thinking, and new ways of relating (Kemmis, 2010). It is widely used for professional development and has been successful, particularly in education (Jaipal & Figg, 2011; van Looy & Goegebeur, 2007). Halton (2004), in his study on professional development in Ireland, noted that through doing AR, teachers honed their intuitive skills and developed new ones to communicate their ideas, concepts, and research results in an understandable language and form so that their insights form part of the body of educational knowledge generated through practice. AR has often been termed as practitioner-research/practitioner inquiry. "Practitioner-research" is a practical way of looking at your own work to check that it is as you would like it to be, and has been described as a form of self-reflective practice (Brydon-Miller & Maguire, 2009; McNiff, 2002). Practitioner-researchers believe that the teacher's role extends to being a decision maker, consultant, curriculum developer, analyst, activist, and school leader—as well as contributing to an enhanced understanding of the contexts of educational change (Cochran-Smith & Lytle, 1999). They believe this is an inherent part of the teachers' role. This has emerged as a significant pathway for effective professional learning (Wells, 2014). Teachers' professional learning can be augmented by positioning teachers as practitioner-researchers and professionals who are capable of generating change within their local educational communities (Wells, 2014). It is this emerging role of teachers as "pro-active" in their own professional learning/development and giving credence and value to their own expertise that they develop over time and that is often titled "experience" that led me to reflect on what value I could utilize toward my own development. Casey (2013) concluded that this form of research could offer a means of coping with the systematic demands for CPD, in that it ensures the learners (both the teacher and their students) are the focus of any research. Individuals who engage in practitioner-research develop their inquiry according to interests that are real to them and that arise from their practices (Clayton et al., 2008). Like effective CPD, AR that "augment[s] existing work conditions appears to support and sustain changes to teaching practice and student learning" (Jaipal & Figg, 2011, p. 71). As a word of caution, Halton (2004) advised that AR was not a way of achieving professional development on the cheap; it was expensive in terms of time and resources, and teachers may need to be persuaded to get involved. Carr and Kemmis (1993) stated that AR helped practitioners to theorize their practice, to revise their theories self-critically in the light of practice, and transform their practice into praxis. I was encouraged and enlightened by the potential support that AR offered to a practicing professional. In using AR, I could be self-critical and could generate educational theories based on my own findings (Cochran-Smith & Lytle, 1999).

Action researchers have described the positive benefits of this method, especially when the process is collaborative and shared across a number of peers and the students involved (Brydon-Miller & Maguire, 2009; Cain, 2011). One of the appealing virtues of this approach is that it enables teachers to tap into their own expertise, strengths, talents, skills, and knowledge and to share with other teachers who have similar interests and needs (Jaipal & Figg, 2011; Koshy, 2010). Many researchers have recommended the use of "active learning" in professional communities where school-based professional learning is ongoing, where it can become sustained and job embedded, and where teachers are actively encouraged to collaborate (Darling-Hammond & Richardson, 2009). In adopting this approach, teachers could safely have their ideas challenged and debated, to ensure that the chosen action is valid and reasonable, and as a result, these professional communities can contribute to professional development while maintaining teachers' professional identities (Altrichter, 2005; Clayton et al., 2008). This concept of active learning involves teachers who can share self-defined common learning/professional interests and can interact and discuss, analyze, and problem solve, and this would result in professional learning (MacPhail, Patton, Parker, & Tannehill, 2014). For this discourse to be effective, teachers must have a shared sense of value, a clear vision, and a shared sense of responsibility through the school system to fulfill their obligation to teach their students in the best possible learning environment (Bolam, McMahon, Stoll, Thomas, & Wallace, 2005).

Action Research and Physical Education

Much has been written about the need for PE teachers to be more reflective about their practice through AR, yet despite this a dearth of research has been carried out in this area (Casey, Dyson, & Campbell, 2009). Kirk (1993) argued that AR has the potential to bring about educational change that incorporates a concern for more effective teaching and learning, deepening and broadening teachers' understanding of their work and the subject matter and leading to better forms of PE. Lopez-Pastor, Monjas, and Manrique (2011) concluded, from a 15-year study of PE teachers, that AR has the potential to enhance teaching practices, to improve practical knowledge, and teaching for all teachers. A number of curriculum researchers have called upon teachers to work together in a community of practice, supported by university–teacher collaboration to aid in pedagogical change (Goodyear & Casey, 2013). Armour and Yelling (2007) also encouraged PE teachers to use this approach to set the CPD agenda based on their collaborative assessment of their pupils' learning needs. When questioned about this approach, teachers have stated that they enjoy this involvement with their peers in learning with and from professional colleagues in their self-selected professional learning networks or communities (Armour & Yelling, 2007). Lopez-Pastor et al. (2011) found that using AR in a collaborative way provides enormous benefits in developing teacher learning in PE. But change seems to be gradually beginning to take hold, and Gubacs-Collins (2007) noted that the emphasis on AR was increasing in PE.

Research suggests that great benefits may be had from this type of intervention. I wanted to establish if I could reap similar benefits from my teaching and if I could conclude if it constitutes an effective form of CPD. I was encouraged and enlightened by the concept of AR, and the recognition that my years of experience could be useful and recycled for this purpose.

AR is not without its critics, and reservations have been expressed about teacher research. Hancock (2001) identified possible difficulties that teachers might face including a lack of expectations that teachers should research and write about their professional practice, the demanding nature of teaching that leaves little time and energy for research, the lack of confidence and marginalization of teachers to be able to carry out research, and the mismatch between available research methodologies and teachers' professional ways of working classrooms.

Method

Study Design

The theoretical and conceptual framework underpinning this intervention lay in social-constructivism. Creswell (2009) described social constructivism in terms of individuals seeking an understanding of the world in which they live and work, coupled with the need to develop subjective meaning of this experience. This approach tends to use interviews and observations to allow data from multiple perspectives on an issue to be gathered and examined. Action researchers actively engage in a process of construction from which they abstract and develop meaning from their interpretation of the data collected (Koshy, 2010). This research was a self-reflective case study into my own practice. I decided to engage in this study as a form of CPD, to identify ways to enhance my own practice in a systematic, coherent, and progressive manner (Armour & Yelling, 2007). I drew upon Schön's (1983) "reflection-in and on-action" to guide my incremental changes for enhancement. As a result of this self-reflective study, I wanted to establish if acquiring and implementing the skills necessary for AR was an effective form of CPD and if AR could support a program of structured sustained professional development. This research was part of a larger study that also used AR to measure the impact on student learning during implementation of a peer- and self-assessment strategy in PE. The findings from that aspect are not reported here. This intervention received ethical approval from the ethics committee of Dublin City University.

I adopted a cyclical approach to reviewing my work and reflecting upon it to see if it was as I wanted it to be, based on a cyclical pattern of plan, act, observe, and reflect. I reflected on my practices, planned an action to enhance or alter that practice, implemented that plan, observed the enhancements, and reflected upon the outcome (Koshy, 2010). See Figure 1.

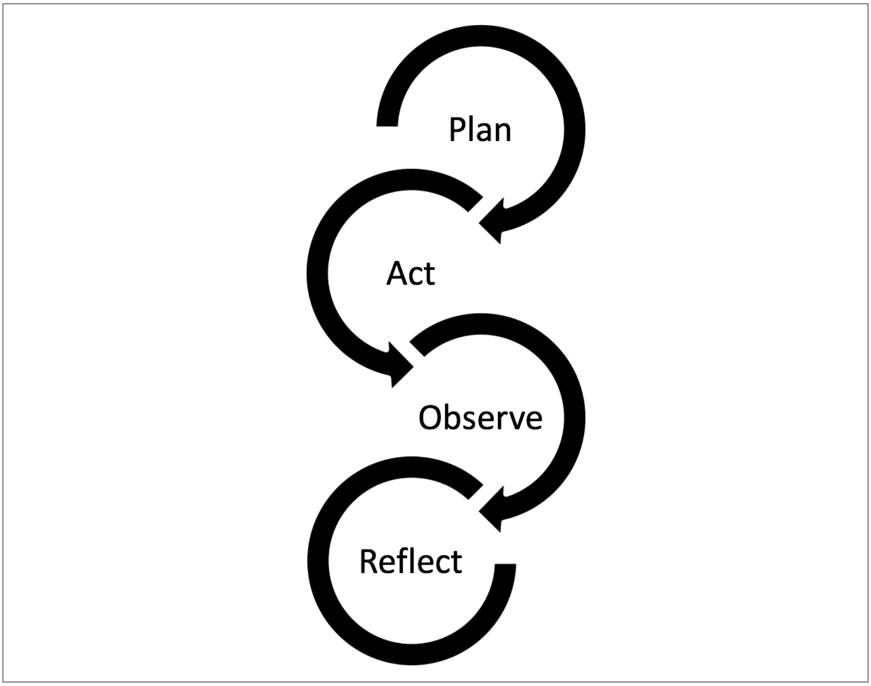

Figure 1. Plan, act, observe, and reflect: Process of action research.

Having reviewed the literature, I established the following basic principles to implement an effective AR project. I drew upon and adopted the following, which were informed by the steps developed by the theorists McNiff (2010), Bassey (1998), and Casbon and Walters (2004). I believed these steps provided a clear chronological order for me to follow. Many steps were overlapping in all three researchers. See Table 1 for the steps I followed.

Table 1

Combined Steps Devised for This Intervention Based on Research

Stage	Steps	Authors
Plan	Review current practice,	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
	Identify an area to be improved,	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004

Table 1 (cont.)

Stage	Steps	Authors
Act	Imagine a way forward,	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
	Try it out,	McNiff, 2010; Casbon & Walter, 2004
Observe	Monitor the action	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
Reflect	Evaluate its success	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
	Continue using the action if it is successful or,	McNiff, 2010; Bassey, 1998
	Try another option if it wasn't,	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
	Evaluate the new practice, and	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004
	Modify the ideas and practices in light of the evaluation.	McNiff, 2010; Bassey, 1998; Casbon & Walters, 2004

These steps are often simplified in the research into plan, act, observe, and reflect (Koshy, 2010). See Figure 1. The cycle of plan, act, observe, and reflect took place on two levels, (1) a macro level, one overarching cycle for the intervention as a whole, and (2) a micro level, in the preparation and completion each week for each lesson.

Macro Level: The Overarching Plan, Act, Observe and Reflect – The Intervention

- Plan the intervention based on the information available
- Act and implement the intervention
- Observe and record as the intervention unfolds
- Reflect and analyze the outcome of the intervention

Micro Level

- Plan the lessons weekly based on the information available
- Act and deliver the lessons
- Observe and record the outcome of the lessons

- Reflect and evaluate the lessons and modify ideas and practices

One overall cycle took place during the intervention and then a cycle took place within each week to plan and implement each lesson based on the outcome from the previous lesson.

Background

The intervention was carried out in a school in the Middle East that offers a British school curriculum from KS1–KS4. I have worked in this school for 10 years. I am currently head of secondary PE. The PE program is similar to any English school in that a wide variety of activities are taught. We use a modular-based approach to delivering our program. There are some cultural sensitivities and climate conditions to consider in relation to what we can offer; generally speaking, our program is not unlike a standard PE program on offer in the United Kingdom. The modules delivered during the 12-week intervention included 2 weeks of athletics, 4 weeks of gymnastics, 4 weeks of volleyball, and 2 weeks of mini-games.

Participants

"I" became the central focus of my inquiry (Whitehead & McNiff, 2006). I had a vision and belief in what I was doing and in what I wanted to achieve. This conviction was an important element that served to enhance the process in my teaching and learning (Bechtel & O'Sullivan, 2007).

I carried out this intervention in collaboration with 17 Year 7 female students aged 11 to 12 years. I selected this group of students from this class because it was smaller than average, but it provided me with a greater opportunity to engage more fully with the students and to watch more closely how the intervention impacted their individual learning over the time, but the group was not too small to be too intense on the students taking part. With the opportunities available and the various data collection tools in operation, the students provided the data in relation to the quality of the teaching and learning throughout the intervention. I also drew upon the support of the three other PE teachers in my department. They became my informal community of practice and provided support in terms of pedagogical discussion. They are all extremely experienced PE teachers, trained in the United Kingdom with a combined total of 40 years of teaching experience between them.

Data Collection and Analysis

AR uses qualitative analysis and I analyzed the data inductively. I used a wide variety of data collection techniques. I used small group interviews with the students before and after the intervention. I transcribed the data about their understanding, learning experiences of PE and how it was delivered. I recorded my thoughts and observations after each lesson in my field notes. I videotaped elements from each lesson, and after each lesson I objectively reviewed these data. At the end of every lesson, the students completed a Student Weekly Log Book (SWLB), which encouraged them to reflect upon each lesson and answer a standard series of questions. I also noted the outcome of discussions with colleagues in my PE department. These include

- preintervention and postintervention interviews with the students about teaching and learning in PE;
- direct observations;
- video recordings of lessons as objective data for analysis;
- the SWLB, subjective data from students; and
- field notes, my own observations throughout the intervention including weekly evaluations of each lessons and ideas to modify practices.

I used Braun and Clarke's (2006) model of thematic analysis to systematically organize and analyze the data and arrange it into manageable chunks. Each piece of data had three distinct features: (1) identifying the object, (2) source, and (3) feature/theme (e.g., if a piece of data was coded T-V-M, it represented the subject of the data came from the Teacher, the source was from the Videotape, the data theme referred to Modified practice). I searched for meanings within these codes so that I could express what was happening and relate it to the research question. I then grouped these coded pieces of data into various themes, for example, modified practice (M), AR, CPD, teacher as active researcher (T/AR). I separated the themes and identified the themes that related specifically to (1) AR, (2) the use of AR to enhance my professional development, (3) AR and professional development. See Table 2 for the process.

I used member checks with my colleagues and the students after the intervention. I held a meeting with the participants and I shared the data that I wrote up with the students to ensure my representations were consistent with the intentions of their statements. All students were satisfied that I represented their sentiments accurately. To further enhance the validity and reliability of the findings, I used triangulation of data between my own personal observations after each lesson recorded in my field notes (subjective), the video recordings taken in each lesson (objective), and the opinions and observations of the students and colleagues who were directly and indirectly part of the intervention and recorded and quoted in my field notes.

Table 2
Phases of Thematic Analysis

Phase	Process description
1	Data Familiarization
	Transcribing data, reading and rereading data and noting initial ideas.
2	Initial Code Generation
	Coding interesting features and collating data.
3	Searching Themes
	Collating codes into potential themes.
4	Reviewing Themes
	Checking if themes work, generating a thematic map.
5	Defining and Naming
	Refine the specifics of each theme and the themes overall story, generating clear definitions for themes.
6	Producing the Report
	Final analysis, extract selection relating to research questions and literature.

Note. Adapted "Using Thematic Analysis in Psychology," by V. Braun and V. Clarke, 2006, *Qualitative Research in Psychology, 3*(2), p. 87.

Findings

I wanted to establish if embedding AR into my teaching strategy would constitute effective CPD. This AR, as a form of CPD, was "teacher-led" and became embedded in my teaching. This study was personal to my needs; it was practical and collaborative. From the data analyzed, it was clear that the student learning was enhanced through the use of AR. Clear learning objectives were set, and the students reflected on these at the end of every lesson. They completed the SWLB, or were questioned orally, to record their own learning outcomes, identifying what they achieved in the lesson and what they did to contribute to the learning of others.

In the postintervention interviews, 78% of the students believed that they had learned a lot more as a result of the intervention, while 67% of students said that they would like to be involved in this type of intervention again. The students enjoyed being asked for their opinion and were very articulate in contributing feedback. In the postintervention interview, Student A stated, "I learned teamwork from talking to my partner, she listened to me and took my advice, and every time I told her, she did it better." Student B agreed: "Actually, you can help yourself and your partner, you can learn what mistakes they make, and try and not make the same mistakes. You can help them by doing the right position and then they don't do it the wrong way." The feedback from the SWLB helped me to determine the pace and the content pace of the next lesson. Eleven of the 17 students improved their performance grade by the end of the intervention. Prior to the intervention, only two students had top marks for effort, at the end of the intervention, this had increased to six students. The students were learning more and were more committed in lessons with the new approach of AR. The outcome of CPD is to enhance student learning through the use of AR as a form of CPD; this has been achieved in this regard. As Hunzicker (2011) suggested, "When professional development is supportive, job embedded, instructionally focused, collaborative and ongoing, teachers are more likely to consider it relevant and authentic, which is more likely to result in teacher learning and improved teaching practice" (p. 178). As a teacher, I became much more reflective in my teaching, and this became more embedded as a routine part of my teaching strategy.

I developed a new relationship with my colleagues on a professional level. We informally formed a community of practice. I regularly discussed with them the intervention and what I was trying to achieve. I was pleased with the interest that they demonstrated, and I actively encouraged them by regularly asking their advice. When I discussed with them the issue of reluctant performers in the volleyball module after Week 7, Colleague X suggested that I involve the specific students in leading the warm-up for the lessons and they also advised giving them responsibility for peer assessing within a small group. This new role gave the reluctant student a greater sense of responsibility within the lesson and the student's effort levels increased. My colleagues engaged with the new ideas in the strategy and were keen to discuss the intervention, asking how it was going and offering advice on ways to overcome similar issues. They were also learning and benefiting from our exchanges. This would support the view expressed in the research that CPD is most likely to be effective when teachers engage in collaborative learning with their peers formally and informally within the context of the teaching environment (Armour & Yelling, 2007; Webster-Wright, 2009). On completion of the intervention, I provided a formal CPD to my colleagues to discuss the process and the findings. They were eager to know the findings, and in the feedback they provided, they stated after the in-service that they wanted to know more.

In relation to the impact it had on my teaching strategy, this initial cycle/intervention took place over 12 weeks. The cycle of plan, act, observe, and reflect became embedded in my teaching strategy during this time. Weekly, I reviewed my field notes, the video data collected, and the information from the SWLB to plan the next lesson. This process made me more reflective in my teaching and directed me to be more objective in my appraisal of each lesson. The video evidence gathered during each lesson was the most objective data I collected. This research reinforced the importance of "reflections-in and on-actions" (Schön, 1983) to enhance my practice. This analysis gave me a greater understanding of the teaching and learning in my PE lessons. After Lesson 8, I recorded in my field notes that "this study is helping me to make a concerted effort to focus much more on what I am doing and why I am doing it." I also wrote, "I believe most of the students are more focused in the lessons with definite and clear objectives to focus upon." From the video evidence, I also saw students who shied away from answering questions and who also slowed their efforts in class when they felt I was not able to see them. To correct this, I become more conscious of my position/location in the lesson, being able to see as many students as possible all the time. I also noted in Week 2 that I needed to slow down a little in giving instructions and to reduce the amount of talk time that I used.

Effective CPD

On a macro level, I have completed a single cycle of plan, act, observe, and reflect. AR advocates that reflection on the outcome of a cycle should provide the direction for the next cycle. It is not a discrete unit of work but a continuous spiral, with one cycle feeding into the next. It supports the view that CPD should be a systematic and lifelong approach throughout a teacher's career. In this way, AR developed my professional disposition and encouraged me to be a continuous learner (Mills, 2011). In line with the expectations of bringing about a change in my practice, I achieved the three main goals of professional learning as outlined by Guskey (2002): (i) I changed my teaching strategy, (ii) I became a far more reflective teacher, and (iii) I changed my beliefs and attitude to the way I teach. I too have grown in confidence in producing this piece of work describing my experience.

AR as a Form CPD

Based on the checklist for effective professional development by Hunzicker (2011), AR ticked all the boxes; it accommodated my level of experience and career stage; it satisfied my individual needs; it became job embedded; it focused on student learning and my own instructional needs; it was collaborative and engaged me physically; cognitively, and emotionally; and it required a commitment over time and is ongoing. Because this intervention took place over 12 weeks, it supports the view that more successful CPD programs tend to be long term and offers follow-up and reflection, beyond the 1-day in-service training often offered (Birman, Desimone, Porter, & Garet, 2000; Guskey, 2002). This research endorses the suggestion by Hunzicker (2011) that the more time teachers engage in professional development, the more likely their teaching practice will improve, and it is most effective if teachers have multiple opportunities to interact with information and ideas over several months. I believe that the enhancements in my practice will be sustainable as they have become embedded in my practice. As suggested, this AR intervention is not a finite process, but I will embark on another cycle of self-reflective analysis to sustain my commitment to my own CPD.

Conclusion

In the absence of enabling CPD structures, it would be easy for teachers to abandon attempts to engage in sustained and meaningful professional development (Makopoulou & Armour, 2011). But I was determined to pursue CPD of my own making. This AR intervention, as a form of CPD, was successful in empowering me to be think critically about my practice as I endeavored to enhance my teaching and the learning experience of my students. It provided me with the tools to dissect my own classroom-based practice and carry out a research-informed study to address practical issues of concern to me. In this regard, AR had the capacity to transform my practice and support my collaborative practices, as well as to give me professional autonomy (Kennedy, 2014).

The principle of embedding CPD in the environment of the classroom while using current teaching as a starting point is worthy of further investigation and consideration (Rose & Reynolds, 2007). It provided me with the tools to address practical concerns within my own teaching and to seek solutions to enhance my practice and the learning of the students. I acknowledge that for effective CPD the teacher must be positively disposed to enhancing their own professional development. This form of CPD acknowledges the teacher as a learner, where the provision is directed at working *with* the teacher to address the teacher's individual needs; it must be constructive and progressive over the working life of the teacher, and it must take account of the individuality of the teacher (Tannehill et al., 2013).

Practitioner-research offers the opportunity for individual teachers to understand the impact that their teaching has on their students, to gather evidence to support or disclaim, and to take an idea and see what results their teaching achieves (Casey & Kirk, 2010), and that is why it is such a complementary component of CPD. When I now look at the range of CPD on offer, I am more focused and critical on what I want, and I am no longer afraid to take the initiative to "go it alone" and find the solutions myself or engage colleagues in a debate over my concerns. I would encourage principals and managements to support teachers at school in developing more collaborative and research-informed approaches to developing CPD (Opfer & Pedder, 2010). Darling-Hammond and Richardson (2009) identified the importance of active learning, collaboration, involvement in sustained communities of learning, embedding of learning in teacher practice, the development of collaborative approach, and encompassing individual and collective responsibility for this to become an ongoing process.

If it is to become an effective form of CPD, AR must be carried out by a teacher, it must become embedded in the teacher's daily teaching practice and developed over the career of the individual (Casey, 2013; Clayton et al., 2008). Casey and Dyson (2009) concluded that it would require a strong willingness to change, and it takes perseverance through trial and error to achieve it. PE teachers should take greater steps toward using AR, especially in the achievement of real pedagogical change (Casey & Dyson, 2009).

There were challenges in undertaking this approach. It required an enormous amount of time and patience. Trial and error are its cornerstone. I had to research and plan on my own this intervention, though I shared and discussed issues with my colleagues. I had to ensure that I was applying academic rigor to the methodology and the analysis of the data so that it would stand up to public scrutiny. Clayton et al. (2008) noted that practitioner-research is often undertaken over and above regular demands of work; therefore, it will be restricted to a minority of enthusiasts and converts. Armour and Yelling (2007) stressed that professional development should be developed so that it reduces rather than increases such pressures. In addition, Clayton et al. (2008) issued a warning that establishing practitioner-research as a systematic form of CPD for teachers may be difficult, as governments insist on quantifiable measures of improvement and tend to distrust qualitative research, which AR is grounded in. AR should be a core skill introduced in teacher education courses as it provides teachers with a skill for evaluating their performance and assists teachers in introducing incremental enhancements into their daily practices. But I also think it should be used as part of a broader CPD long-term strategy that combines outside providers, a community of practice to work as a group to provide

CPD. As in other studies, the PE teachers in this study placed a high value on learning collaboratively with and from each other in informal networks or communities (Armour & Yelling, 2007). This is an area that is worth pursuing among a group of like-minded people, especially in the absence of externally provided CPD.

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PEDAGOGY

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

Andreas Fröberg and Anders Raustorp

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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PEDAGOGY

An Interdivision Mentoring Program: Doctoral Students as Mentors for Preservice Teachers

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Abstract

A recent surge in scholarship related to doctoral education in physical education teacher education has raised questions about the effectiveness of doctoral programs in preparing students to fill the role of teacher educator. Given that most doctoral program graduates seek positions as teacher educators, they are responsible for educating the next generation of preservice physical educators and need to be adequately prepared for the role. Inviting doctoral students to serve as mentors for small groups of preservice teachers during methods courses and early field experiences taught by experienced faculty members represent one way doctoral students can practice the role of teacher educator in a supervised environment. Further, in these arrangements, preservice teachers get attention and feedback beyond what is possible when a single instructor teaches the course. This paper provides practical guidance for implementing a mentoring program, including potential benefits and challenges, and gives recommendations for research and practice.

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There is a rich tradition of research related to doctoral student socialization in higher education (e.g., Gardner, 2008a, 2010b; Golde & Walker, 2006). While Lawson (1991) advocated similar research in physical education teacher education (PETE) over 25 years ago, only recently have scholars begun examining the socialization experiences of PETE doctoral (D-PETE) students (Casey & Fletcher, 2012; Lee & Curtner-Smith, 2011; Richards, Eberline, & Templin, 2016; Richards, McLoughlin, Gaudreault, & Shiver, in press). Building upon the work of Lee and Curtner-Smith (2011), Russell, Gaudreault, and Richards (2016) developed a model of D-PETE socialization that expands upon occupational socialization theory (OST). The model recognizes five phases of socialization beginning with acculturation and culminating in socialization through the faculty role.

Understanding the ways in which D-PETE students are socialized into faculty roles is critical to the viability of the physical education (PE) profession. As scholars, they study teaching and learning, and as teacher educators, they prepare the next generation of physical educators and provide professional development to inservice teachers. For this reason, both in the extant literature (Golde & Walker, 2006) and in PETE (Lawson, 2016; Russell et al., 2016), faculty members have been referred to as stewards of their respective disciplines. The notion of stewardship encompasses both a set of technical skills required to advance the discipline, and principles, which relates to a moral compass and caring disposition that embraces the importance of making those advancements. We, therefore, conceptualize D-PETE preparation and socialization as a process through which prospective faculty members are prepared for disciplinary stewardship, and this stewardship must encompass the multiple roles that faculty members play related to research, teaching, and service (Richards & Levesque-Bristol, 2016).

While some attention has been given to the ways individuals learn to be teacher educators (Casey & Fletcher, 2012; T. Fletcher & Casey, 2014), comparatively little has been directed toward conceptualizing how the process of learning to be a teacher educator can be made more intentional. Prior teaching experiences as an inservice professional may be viewed as important to an individual's identity as a teacher educator (M. Woods, Goc Karp, & Judd, 2011), but not everyone who pursues D-PETE education is an effective inservice teacher and some practices learned to be effective with children do not transfer to college students (Casey & Fletcher, 2012). We propose that D-PETE students should be exposed to formal opportunities to experience and practice the role of teacher educator while receiving support and feedback.

This conceptual manuscript provides an overview of how D-PETE students can better prepare for their future roles as teacher educators through engagement in a mentoring program whereby they serve as mentors for preservice teachers in methods courses and early field experiences. We draw upon the literature related to mentoring in educational contexts to examine an interdivision mentoring program in which D-PETE students serve as mentors to preservice teachers completing methods courses and early field experiences. These arrangements, we argue, create a mutually beneficial relationship in which the D-PETE students practice the role of teacher educator in a supportive environment, while the preservice service teachers get additional attention and feedback. Our arguments are grounded in OST (Richards & Gaudreault, 2017; Templin & Schempp, 1989), focusing primarily on doctoral education, which has been referred to as secondary professional socialization (Lee & Curtner-Smith, 2011).

Occupational Socialization Theory

Lawson (1986) defined occupational socialization into the PE profession as "all kinds of socialization that initially influence persons to enter the field of PE and later are responsible for their perceptions and actions as teacher educators and teachers" (p. 107). Those with this perspective embrace a dialectical approach to understanding socialization by acknowledging that individuals have the ability to covertly or overtly resist the influences of those who wish to socialize them (Schempp & Graber, 1992). Traditionally, OST has been used for examining the ways individuals are recruited into, prepared for, and socialized through careers as inservice physical educators. These processes are typically viewed through the three phases of acculturation, professional socialization, and organizational socialization (Richards, Templin, & Graber, 2014). Lawson (1991), however, noted that OST could be extended to examining the experiences of PETE faculty, and Lee and Curtner-Smith (2011) proposed secondary professional socialization as the process of D-PETE education for faculty roles.

Initial Socialization Into Physical Education

While our arguments are most concerned with secondary professional socialization as it relates to preparation for the teaching facet of the faculty role, this process cannot be understood without attention to antecedent socialization that initially draws individuals into PE and eventually D-PETE programs (Russell et al., 2016). During *acculturation*, individuals are recruited into PE based on their experiences in PE and youth sport as children during what Lortie (1975) referred to as the apprenticeship of observation. This anticipatory socialization leads to the development of subjective theories related to the purpose and goals of PE that become rather stable and difficult to change (Grotjahn, 1991). In countries such as the United States where physical educators often serve as coaches, acculturation also leads to the development of role orientations that lay on a spectrum ranging from preference for teaching PE to preference for coaching extracurricular sport (Richards & Templin, 2012).

Individuals advance to *professional socialization* when they make the decision to purpose a career in PE and enter a PETE program (Curtner-Smith, Hastie, & Kinchin, 2008). Preservice teachers are taught the knowledge, skills, and dispositions PETE faculty members believe to be important to teaching PE. When recruits' subjective theories do not align with those espoused by faculty members, however, they are likely to resist formal teacher education (Richards et al., 2014). This may be particularly true of students with a coaching orientation who entered into the teaching field as a contingency to coaching (Curtner-Smith, 1997).

When individuals move into their first teaching position, they begin *organizational socialization*. This phase of socialization emphasizes the role played by the sociopolitical environment present in a school setting, which has a significant impact on physical educators' careers through experiences such as isolation (Richards et al., 2014) and marginalization (Kougioumtzis, Patriksson, & Stråhlman, 2011). Many beginning teachers work in environments that encourage a custodial orientation emphasizing traditional teaching methods, which perpetuates the status quo rather than challenging it (Richards, Templin, & Gaudreault, 2013). Over time, this can lead to the "washout effect" in which beginning teachers abandon teaching strategies learned during PETE in favor of those that prevail in their school context (Blankenship & Coleman, 2009).

Secondary Professional Socialization

While some individuals remain physical educators in schools for long careers (e.g., A. Woods & Lynn, 2014), some transition out of teaching to pursue careers as PETE faculty members. It should also be noted that not all recruits teach in school environments before pursuing doctoral education as some move directly from professional socialization into D-PETE programs (Richards, McLoughlin, et al., in press). Regardless of the specific path taken, when individuals begin formal D-PETE education, they enter *secondary professional socialization* (Lee & Curtner-Smith, 2011). Golde (1998) defined the doctoral student socialization process as one "in which a newcomer is made a member of a community – in the case of doctoral students, the community of an academic department in a particular discipline" (p. 56). In much the same way that professional socialization seeks to prepare preservice teachers with the knowledge, skills, and dispositions necessary to teach, secondary professional socialization can be conceptualized as a series of formal and informal learning experiences intended to prepare doctoral students for careers in academia (Tierney & Rhoads, 1994).

An important part of the doctoral student socialization process is learning what it means to be a faculty member—both within their specific discipline and academia more generally (Reich & Reich, 2006). This culture includes explicitly communicated expectations as well as unwritten rules that must be learned through interactions with others (Golde, 1998). As such, relationships are particularly important to successful socialization experiences (Austin & McDaniels, 2006). Without strong relationships, doctoral education can be an isolating experience (Baker & Pifer, 2011). Faculty members play an important role in secondary professional socialization by providing a variety of support and guidance through the doctoral education process (Gardner, 2010b; Nettles & Millett, 2006). Doctoral students' orientations toward teaching and research, for example, are highly influenced by those of faculty mentors, and they are more likely to focus on research if they are encouraged to do so (Weidman & Stein, 2003). Beyond the advisor, individuals often seek guidance from other faculty members and their peers, as well as family members and friends outside of academia (Gardner, 2010a). Students within the same program often engage in informal peer mentoring, as veteran students serve an important role in inducting newcomers to a program (Grant-Vallone & Ensher, 2000).

Research specifically related to the socialization of D-PETE students is limited; however, emerging evidence highlights the potency of the experience. Lee and Curtner-Smith (2011) comment specifically on the strength of secondary professional socialization, particularly in relation to initial teacher education, and note the importance of influential faculty mentors and undergraduate teaching opportunities. Related to the teaching aspect of the faculty role, there appears to be an implicit assumption that prior socialization and experience teaching K–12 PE will transfer to working with preservice teachers (Murray & Male, 2005), which may help to explain why more emphasis is placed on research than teaching in D-PETE programs. However, in considering their own socialization experiences, Casey and Fletcher (2012) describe differences between teaching PE and teaching at the higher education level and emphasize the need to "unlearn" practices that work with school-age children but not college students.

The changing landscape of PE, which now emphasizes health-related fitness activities, may also be problematic for some D-PETE students learning to teach at the college level (M. Parker, Sutherland, Sinclair, & Ward, 2011). This may be particularly the case for individuals who worked as inservice physical educators for long periods before returning to pursue a doctoral degree (Richards, McLoughlin, et al., in press). For these reasons, it is important that D-PETE students be given formalized opportunities to practice the role of teacher educator in authentic settings, preferably under the supervision of experienced PETE faculty members (Dodds, 2005)

In interpreting the secondary professional socialization process, it is important that we note that prior socialization plays an important role in framing one's induction into the faculty role (Austin, 2002; Russell et al., 2016). Individuals who initially enter PE because they want to coach and who maintain that coaching orientation through initial teacher education may espouse more conservative orientations when entering D-PETE than those whose acculturation results in a teaching orientation strengthened through PETE (Lee & Curtner-Smith, 2011). Further, although often presented in a temporal sequence, the phases of socialization are not linear (Russell et al., 2016).

While most individuals experience initial acculturation as children through their own PE and sport experiences, the remaining phases may not be experienced in lock-step fashion, and D-PETE recruits may skip phases. Not all D-PETE recruits, for example, experience initial teacher education, and not all are licensed teachers. Further, some recruits experience initial teacher education, but forgo teaching in school settings to move directly into D-PETE (Richards, McLoughlin, et al., in press). Others still spend decades teaching PE in school settings before deciding to pursue a second career as a PETE faculty member. In short, recruits come into D-PETE programming with a variety of background experiences, which must be considered when interpreting their readiness for different elements of D-PETE. In an effort to better meet the needs of D-PETE students in their journeys toward becoming teacher educators, we now turn to the mentoring literature, which provides insights into how prospective PETE faculty members can practice the role of teacher educator in a supportive environment.

Overview of Mentoring

The term *mentor* describes a relationship between two individuals in which the mentor has expertise gained through experience and education relative to the protégé, or individual being mentored (Allen, Eby, Peteet, Lentz, & Lima, 2004). Traditionally, mentor and protégé relationships were informal, and the two parties were left to serendipitously find one another (Kram, 1985). However, as organizations realized the potential for mentoring relationships to positively impact both mentor and protégé, more formal arrangements were developed (Ehrich & Hansford, 1999; Ehrich, Hansford, & Tennent, 2004). Mentoring now serves an important informal and/or formal socialization function as one of the ways the norms and culture of a profession broadly and an organization more specifically are transmitted to the next generation.

Key characteristics of mentoring include significant assistance offered to the protégé in a warm and nurturing environment by a skilled mentor, and continuous reflection, which is an important part of professional growth involved in the process (Jones, Harris, & Miles, 2009; Long, 1997). It is best conceptualized as a reciprocal process in which both mentor and protégé benefit from the relationship by exploring and sharing their own thinking through cooperation and community connectedness (Awaya et al., 2003). Long (1997) indicates that the functions of a mentoring relationships should at least include "(1) emotional and psychological support, (2) direct assistance with career and professional development, and (3) role modeling which is focused on achievement of skills and knowledge within the organizational context" (p. 116). These elements, it has been argued, help to focus the relationship on further developing the practice of both the mentor and protégé (Awaya et al., 2003; Long, 1997).

The match between mentors and protégés has been described as one of the most important elements of a mentoring relationship (C. Campbell, 2007), and the literature outlines numerous strategies for pairing mentors and mentees. For example, Bernier, Larose, and Soucy (2005) emphasize the importance of pairing mentors and mentees based on the relational styles of both groups. Mentors hold styles that range from valuing dependency to valuing self-reliance, whereas mentees range from attachment to self-reliance. While relational styles are better thought of in terms of continuums rather than dichotomies, pairing mentors and mentees with differing styles was more effective than pairing those with similar approaches (Bernier et al., 2005). Regardless of the approach, evidence indicates that intentional matching could optimize program success (C. Campbell, 2007; Jones et al., 2009).

Mentoring in Higher Education

While mentoring relationships originated in the business sector, they can be readily transferred into other settings, such as nursing and collegiate education (Jacobi, 1991; Jones et al., 2009). On-campus programs for mentoring undergraduate students include faculty–student mentoring (C. Campbell, 2007) and peer mentoring (Sanchez, Baur, & Paronto, 2006). Faculty mentoring programs have become increasingly popular on college campuses. Peer mentoring programs range in scope and purpose from those run informally, to those that go through extensive matching protocols and provide personal, significant, and lengthy mentoring relationships between faculty and students (C. Campbell, 2007).

Faculty/undergraduate-student mentoring relationships have been found to increase study skills, motivation, academic adjustment, and personal adjustment, and to reinforce the message that faculty care about student success (Jacobi, 1991). T. Campbell and Campbell (1997) found that students who received mentoring had a higher GPA, more units completed per semester, and a lower dropout rate than students who did not participate in the mentoring program. These programs also help students develop greater confidence in their research skill (Kardash, 2000). Faculty members report enjoying the opportunity to mentor, and note that it helps them to create greater synergies between teaching and scholarship (Elgren & Hensel, 2006).

Peer mentoring refers to a relationship in which an older or more advanced students (e.g., upperclass student) mentors a younger or beginning student (e.g., underclass student; Sanchez et al., 2006). Similar to faculty mentors, peer mentors provide protégés with career guidance that aids in learning and provide encouragement and social support (Holland, Major, & Orvis, 2011). However, students are often more comfortable approaching someone who is similar in age for mentoring needs, and the mentors are able to draw up on more recent and relatable experiences (P. Parker, Hall, & Kram, 2008). A peer approach also removes the status difference between faculty and students, increasing the likelihood that protégés will trust and invest in their mentors (Hall & Jaugietis, 2011). One approach to peer mentoring that is common in university settings is to pair first-year students with upperclass students to reduce the trauma related to transitioning into university life (Hall & Jaugietis, 2011). This arrangement has been found to increase college students' satisfaction, commitment, and retention to graduation (Sanchez et al., 2006). In addition to the support provided to protégés, peer mentoring programs have been found to benefit the mentors by enhancing leadership, communication, and organization skills (Hall & Jaugietis, 2011).

An extension of student peer-mentoring programs is graduate students mentoring undergraduates. While many universities advertise opportunities for graduate students to mentor undergraduates outside of traditional teaching assistant roles, evidence related to these interdivision student-mentoring programs is limited. It has been suggested that graduate-level and postdoctoral students may also be able to serve as mentors to undergraduate students engaging in early scholarship (Dooley, Mahon, & Oshiro, 2004). The National Academy of the Sciences (1995) supports such an arrangement. Dooley et al. (2004) provided such opportunities by pairing undergraduate students with graduate student mentors in the context of a research partnership. The positive outcomes of such graduate–undergraduate mentoring partnerships included learning to work collaboratively, gaining a better understanding of field research, and completing the research projects. While mentoring students through research opportunities is important, it is also important that graduate students in teacher education are provided opportunities to practice the role of teacher educator and mentor preservice teachers through the development of teaching skills and competencies (Casey & Fletcher, 2012). To date, however, no such mentoring arrangements have been articulated in the literature. Toward this end, we outline an interdivision mentoring program that provides doctoral students opportunities to practice the role of teacher educator by mentoring preservice teachers.

Serving as a Mentor Through Doctoral Education

Scholars agree that doctoral students need opportunities to practice the role of teacher educator so to develop skills necessary for becoming effective PETE faculty members (Casey & Fletcher, 2012). However, concerns related to early career PETE faculty members' teaching preparedness are abundant (e.g., Boyce, Lund, & O'Neil, 2015; van der Mars, 2011; M. Woods et al., 2011). Some scholars have specifically noted that preparation for the teacher education role is generally lacking (Ward, 2016) and inconsistent across institutions (M. Parker et al., 2011). We recognize these concerns and agree that D-PETE programs have a responsibility to prepare graduates for future teaching responsibilities. In this vein, we advance mentoring relationships that pair aspiring teacher educators with preservice teachers as one way to further develop the teacher educator role. We draw from our experiences with such a program and note the success we have experienced and challenges faced.

Mentoring Program Overview

At the University of Alabama, we developed an interdivision mentoring program with the goal of fostering authentic opportunities for D-PETE students to engage with preservice PE teachers. Grounded in best practices suggested through the literature related to initial PETE (Curtner-Smith & Sofo, 2004; Richards et al., 2014), preservice teachers are enrolled in a secondary methods course and a corresponding field experience in which they learn about and then implement models-based pedagogies (e.g., Lund & Tannehill, 2010; Metzler, 2011) with children in local schools' PE classes (see Richards, Lynch, & Sinelnikov, in press). The doctoral students enroll in a credit-bearing course focused on teaching PETE (see Table 1). As part of this course, D-PETE students learn about best practices in PETE education and serve as mentors for small groups of PETE students throughout the methods course and field experience. The same PETE faculty member teaches both the undergraduate and doctoral-level course, which provides consistency across the experience. While we have developed a formal D-PETE course related to the experience, doctoral student participation could also be facilitated through teaching assistantships, or doctoral students who want more PETE teaching experience could be recruited on a voluntary basis. In our program, for example, some doctoral students repeat the experience on a voluntary basis to gain more higher education teaching experience.

Regardless of the recruitment method for D-PETE students, Figure 1 illustrates the relationships that we seek to develop among the PETE faculty member, D-PETE students, and preservice teachers in the mentoring program. The PETE faculty develops the content for both the undergraduate- and doctoral-level course and develops and monitors the mentoring relationships. The D-PETE students learn about best practices in PETE through seminar-style discussions at the beginning of the semester, and are then paired with small groups of PETE students (a ratio of 1 D-PETE student to 3–4 preservice teachers works best in our experience) with whom they work throughout the semester. In line with the mentoring literature (Bernier et al., 2005; C. Campbell, 2007), mentors and protégés are paired intentionally based on the instructor's perceptions of the relational styles of both groups and responses on the value orientations inventory (Chen, Ennis, & Loftus, 1997). Our goal is to connect D-PETE students with preservice teachers they will relate well to and who have similar value orientations.

Table 1
Overview of Teaching Physical Education in Higher Education Courses

Week	Content covered	Mentoring responsibilities
1	Introduction to the goals and purposes of PETE with a focus on the connection between methods courses and field experiences.	Methods course begins for the preservice teachers.
2	Discussion of constructivist PETE and helping PSTs question subjective theories (e.g., Betourne & Richards, 2015; Richards et al., 2013).	Doctoral students introduced in the methods course for the first time.
3	OST readings on developing effective field experiences (e.g., Curtner-Smith & Sofo, 2004; Stran & Curtner-Smith, 2009).	Doctoral students give presentations related to PE teaching styles (Mosston & Ashworth, 2008).
4	Discussion related to developing and coordinating field-based learning experiences, including the selection of placement sites and coordinating with cooperating teachers.	Doctoral students lead group discussions related to models-based practice (e.g., Metzler, 2011).
5	Develop mentoring teams based on perceived working relationships and VOI scores of mentors and protégés (Ennis & Chen, 1993).	PSTs are introduced to their doctoral student mentors and talk in small groups.
6	Overview of how to evaluate PSTs' lesson plans using a rubric. This includes a grade norming session (Holmes & Oakleaf, 2013).	Final preparations for the field experience; PSTs have time to meet with their mentors.
7–8	Brief prior to and debrief following field experiences. Focus on challenges in the field experience and mentoring. Specific discussion about effective teaching and observational strategies.	Observe and provide feedback at field placement, evaluate PSTs' lesson plans.
9	Brief prior to and debrief following early field experiences. Includes conversations about challenges in the field experience and mentoring. Specific discussion about evaluating lesson plans.	Observe and provide feedback at field placement, evaluate PSTs' lesson plans. Lesson planning workshop for PSTs who need extra help.
10–11	Brief prior to and debrief following early field experiences. Includes conversations about challenges in the field experience and mentoring.	Observe and provide feedback at field placement, evaluate PSTs' lesson plans.
12	A second grade norming meeting (Holmes & Oakleaf, 2013) to check on doctoral students' consistency in applying the evaluation rubric.	Observe and provide feedback at field placement, evaluate PSTs' lesson plans.
13–15	Meet to debrief and discuss the field experience. Includes conversations about challenges in the field experience and mentoring relationship.	Observe and provide feedback at field placement, evaluate PSTs' lesson plans.
16	Final meeting to debrief doctoral students' experiences in the mentoring role, and to connect the experience to the role of teacher educator.	Final meeting to debrief the field experience. Doctoral students meet with mentoring groups.

Note. PETE = physical education teacher education; PE = physical education; OST = occupational socialization theory, PST = preservice teachers; VOI = value orientations inventory.

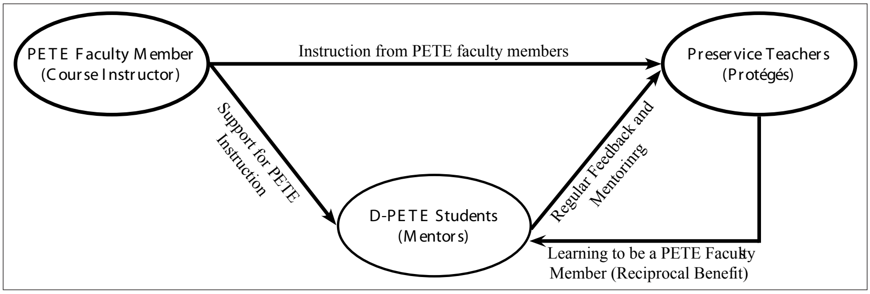

Figure 1. Model illustrating the structure of a mentoring program in which the faculty member structures and provides instruction to preservice teachers related to course content. The faculty member also provides instruction to D-PETE students related to higher education pedagogy and working with preservice teachers. The D-PETE students then provide regular mentoring and feedback to preservice teachers throughout the course and associated field experience. By engaging in the mentoring process, D-PETE students reap reciprocal benefits as they learn more about being a PETE faculty member.

In their role as mentors, the D-PETE students attend every meeting of the methods course and early field experience. They work primarily with their group of protégés through tasks such as facilitating group discussions about teaching, observing and providing feedback on teaching, and evaluating and grading course assignments. During the field experience, for example, the mentors typically hold pre- and post-teaching discussion with their protégés to prepare them for and subsequently debrief the day's activities. We also provide the D-PETE students with opportunities to teach the entire class in a lecture setting during the methods course prior to the field experience. The primary contact for the preservice teachers becomes the D-PETE student rather than the course instructor, and they only approach the instructor directly should they experience challenges in working with their mentors. In facilitating the mentoring relationship, the course instructor must strike a balance between direct and indirect approaches to working with the D-PETE students. If too much guidance is given relative to the methods for mentoring preservice teachers, D-PETE students may not have an opportunity to learn on their own and experience the challenges of teacher education. If too little guidance is provided, the D-PETE students may stray from effective practices and the preservice teachers' learning may suffer.

Perceived Benefits of the Mentoring Relationships

We conceptualize the mentoring relationship as mutually beneficial to all parties involved (Awaya et al., 2003; Long, 1997). The D-PETE students benefit from the opportunity to practice the role of teacher educator in a safe environment under the tutelage of an experienced teacher educator. They learn vicariously by watching the instructor model best practices in PETE, and receive regular feedback related to their more active performance in the mentoring role. They learn about and how to teach using appropriate practices in PE and PETE, including models-based practice (Lund & Tannehill, 2010; Metzler, 2011), which may not have been a component of their initial teacher education (Lee & Curtner-Smith, 2011). The authenticity of the experience is enhanced by mentoring preservice teachers in school-based field experiences, which helps D-PETE students understand the social complexities of facilitating appropriate teacher education (Casey & Fletcher, 2012). They have the opportunity, for example, to observe and participate in the processes required to set up and run field experiences (e.g., requesting placements, negotiating access, working with cooperating teachers).

As an additional benefit, the PETE faculty member receives assistance with the design and conduct of the course and with the assessment and grading of preservice teacher work. From a utilitarian perspective, this reduced the load placed on the instructor, which can be particularly valuable in settings where faculty struggle to balance responsibilities associated with teaching, research, and service (Richards & Levesque-Bristol, 2016). Having doctoral students assist with PETE courses could also enhance accountability and fidelity to appropriate instructional practices because the student-to-teacher ratio is reduced and supervision can be enhanced. The presence of D-PETE students can also facilitate physical and emotional safety during field experiences—for the preservice teachers and the children with whom they work—because there are more supervisors in the setting.

Finally, the preservice teachers receive additional, targeted feedback and attention beyond what a single instructor can give, from a mentor who gets to know them—including their instructional strengths and weaknesses—well throughout the semester. This feedback can also be delivered in a more personalized and immediate manner through postlesson debriefing sessions in the small mentoring groups. Ideally, the preservice teachers develop an intimate working relationship with their mentors, which can inspire openness and trust beyond that which is possible with a single course instructor. This is especially true in cases when the protégés are closer in age and peer-status to their mentors than the course instructor, and can therefore draw on more recent and relevant experiences (Hall & Jaugietis, 2011; P. Parker et al., 2008). Supervision from the D-PETE students also releases the course instructor to focus attention on the preservice teachers who are in particular need of assistance and focused feedback.

Noted Challenges in the Mentoring Relationship

While we believe that mentoring relationships can benefit all those involved, they are not without potential challenges. One of the most significant issues that we have encountered relates to mismatches in mentor–protégé relational style or personality. Per recommendations in the mentoring literature, we do our best to match mentors and protégés intentionally so that mentors work with protégés that have compatible relational styles (C. Campbell, 2007). However, not all relationships work out as intended, and issues can intensify due to the D-PETE students' lack of experience mitigating relational issues in the classroom. Most relational issues can be resolved when the instructor acts as a mediator. When the mediating process becomes unproductive, however, the pairing may be altered and another D-PETE student or course instructor may serve as a mentor.

Other challenges, albeit less severe, but inherent in the D-PETE mentoring model, include matters relative to communication, feedback, and grading. The presence of mentors—who essentially serve as mediators in the relationship between the course instructor and preservice teachers—can lead to communication issues. Sometimes information provided by the instructor to the D-PETE students can be interpreted differently when explained by different mentors to their individual protégés or misinterpreted altogether. Inconsistency can also become a challenge with respect to feedback and grading (Gopinath, 2004). Mentors may approach the grading process with more or less rigor and provide feedback with different levels of effectiveness. To combat these challenges, we have developed a common grading rubric for all assignments and hold a grade norming meeting at the beginning of the semester and again halfway through the field experience to encourage uniformity (Holmes & Oakleaf, 2013).

Generally, we have found that the involvement of D-PETE mentors reduces some of the course instructor's instructional and evaluative responsibilities and frees the instructor to address "the big picture" and provide more individual feedback to graduate and undergraduate students. However, at times we have found that the instructor replaces those alleviated responsibilities with additional time working with the doctoral students in their journey of learning PETE faculty instructional role. One of the confounding factors for the instructor in assisting D-PETE students in their learning of PETE faculty instruction roles is that students enter D-PETE with vastly different levels of comfort and experience with teaching PE and PETE based on their prior socialization experiences (Lee & Curtner-Smith, 2011). Furthermore, some students enter D-PETE with numerous years of teaching experience, while others come in with virtually no time spent in school settings (Russell et al., 2016). In some cases, D-PETE students even come into programs without having attended a preservice teacher education program.

Since not all D-PETE students have the same socialization experiences, some will be better prepared to serve in the mentoring role than others. As such, the course instructor needs to become familiar with each doctoral student's background and adjust his or her instructions, feedback, pairings, responsibilities, and levels of accountability accordingly (Gardner, 2008b). Students who have experience with college-level teaching during a master's program, for example, can often handle more freedom than those teaching at the college level for the first time. If appropriate adjustments are not made, the experience of the D-PETE mentor and the associated group of protégés could suffer (S. Fletcher & Mullen, 2012).

Discussion

Drawing from the OST literature, this paper provides an overview of how D-PETE students can be prepared for disciplinary stewardship (Golde & Walker, 2006; Lawson, 2016) expressly related to their function as future teacher educators. We specifically overviewed a mentoring program in which D-PETE students practice the role of teacher educator (Casey & Fletcher, 2012) by working with small groups of preservice teachers under the supervision of a PETE faculty member.

Mentoring programs such as the one described herein have the potential to address the concern that D-PETE students are not getting enough targeted education on how to become a teacher educator (Boyce et al., 2015; Ward, 2016). Further, enhancing preparation in the teaching facet of the faculty role and continuing to teach D-PETE students how to be effective researchers may better prepare them for the realities of academic life, including how to balance the roles associated with being a teacher educator and researcher (Richards & Levesque-Bristol, 2016). Such a well-rounded doctoral education reinforces Golde and Walker's (2006) and Lawson's (2016) recommendations that emphasize doctoral education as preparation for disciplinary stewardship. Students in D-PETE programs are future teacher educators, and in many ways, the future of the PE profession depends on their preparation for taking over research and teacher education responsibilities.

We have found that OST presents a theoretical lens and a conceptual framework for understanding the preparation of D-PETE students for a variety of academic roles, including teacher educator (Richards & Ressler, 2016; Russell et al., 2016). From a theoretical perspective, studying the occupational socialization of D-PETE students could advance the knowledgevbase related to this group, including best practices for doctoral preparation. As a conceptual framework, OST presents a model for understanding physical educator teachers' and teacher educators' experiences and perspectives, which can be used in structuring more effective D-PETE programs. It is important for doctoral faculty members, for example, to remember that D-PETE students come into programs with diverse background experiences related to their prior socialization (Lee & Curtner-Smith, 2011). Some have abundant prior teaching experience, whereas others have not taught in schools at all. This may leave some D-PETE students feeling more comfortable and prepared with PE content and the experience of practicing the role of PETE instructor than others (Casey & Fletcher, 2012).

One practical limitation of the model presented is that it was developed and field-tested in an institution that has a robust D-PETE program. In our situation, larger D-PETE program numbers allow for reduced mentor–protégé ratios in the program. Recently, for example, we had six doctoral students and 15 preservice teachers, which made for a 2.5:1 protégé-to-mentor ratio. Such arrangements may not be possible in institutions that have smaller doctoral programs or larger undergraduate programs. Nevertheless, a modified version of the mentoring program could be implemented in any D-PETE program. Rather than conceptualizing D-PETE students as mentors for small groups of preservice teacher protégés, the program could reconceptualize these students as co-instructors, if only one or two engaged in the experience. Similarly, universities without D-PETE programs could engage master's students as mentors to capitalize on the benefits of the mentoring program for PETE faculty and preservice teachers.

It should also be acknowledged that D-PETE programs are not monolithic entities. Rather, they are influenced in large part by individual program faculty members and contextual norms (Ward, 2016; Ward et al., 2011). As a result, the enactment of D-PETE in different settings will vary, as will the need for additional concentrated education in the role of teacher educator. Some settings already provide a variety of opportunities for D-PETE students to teach PETE courses, providing feedback and support through that process. Others, however, may benefit from considering the role of teacher education in their larger program structure. This may be particularly true of programs that admit students who do not have prior teaching experience, or those who did not experience initial PETE (Russell et al., 2016). The need for targeted teacher education interventions such as the one advocated in this article is, therefore, related to the prior socialization experiences of the D-PETE students.

Scholars should investigate the efficacy of mentoring relationships, while another line of research seeking to address D-PETE students' teaching preparedness and the effect of mentoring could prove fruitful. Investigations could use OST as a theoretical lens to account for the influence of D-PETE students' prior socializing experiences. This research should also consider the perspectives of D-PETE students who embark upon the journey of becoming teacher educators.

In addition to other approaches, self-study (LaBoskey, 2004) could give D-PETE students voice and agency while they explore their own learning to become teacher educators. Such research may help them develop their own practices while resulting in publishable research that carries recommendations for the larger community of aspiring teacher educators (Richards & Ressler, 2016).

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PEDAGOGY

Comparison of the Command and Inclusion Styles of Physical Education Lessons to Teach Volleyball in Middle School

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Abstract

This experimental study compared the impact of the command style and inclusion style of physical education lessons on teaching basic volleyball skills to 6th graders during the 2014–2015 academic year. The 100 students in the research group were divided into three groups: control (n = 32), command style (n = 34), and inclusion style (n = 34). A Physical Education and Sport Attitude Scale (PESAS) developed by Demirhan and Altay (2001) and a Volleyball Psychomotor Skills Test (VPST) developed by the researcher were administered to all students in the research group as pretests and posttests. After the pretest scores were recorded, all students participated in volleyball lessons for 2 hr/week over 8 weeks; curriculum units included finger passing, forearm passing, and underhand service. According to the findings, when the PESAS posttest scores were compared, the inclusion style group's skills improvement was greater than that of the command style group and the control group ($p > 0.05$). When the VPST posttests were analyzed, the inclusion style group's finger passing, forearm passing, and underhand service skills scores were statistically higher than those of the command style group and the control group ($p < 0.05$). In summary, students'

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basic volleyball skills and physical education attitude improved more through the inclusion style than through the command style or the traditional teaching methods of the control group.

In learning activities, the most important responsibility no doubt belongs to the teachers. Teachers should convey the skills they want to transfer to students in the most suitable way. Physical education courses provide socialization, health improvement, and skills in sport, too. When the teaching methods encourage active participation, students learn better and faster, enjoy the activities, and show more interest in the course.

The main aim of a physical education teaching program is to contribute to individuals' physical, kinesthetic, emotional, and social progress, and to promote participation in physical activity throughout life. For this aim to be actualized, students should be gradually introduced to new physical activities and should be made aware of their improvement. For this reason, it has been suggested that a constructivist approach that accounts for diverse learning styles should be employed in developing activities (Koçak & Hürmeriç, 2006).

From preschool through middle school, participating in sport and physical education plays an important role in improving the physical, emotional, social, and mental characteristics of students. It is hoped that teachers' support and advisory role helps students to improve movement competence, which helps them to acquire active and healthy lifestyles. At the same time, physical education and sport should also help students improve their thinking, social, and self-management skills. Trying various new types of physical activities and improving movement skills is a priority.

For students in fifth to seventh grade, physical and mental development through physical activity is even more important than developing competitive sports skills, which can be worked on from eighth grade onwards (MEB, 2006). The scientific literature suggests that students in this age group need at least 1 hr/day of physical activity to keep up their health. For this reason, it is important that students develop habits of regular and willing participation in physical activities. From around 11 years old, students should begin to develop specialized movement skills, while developing the main sport-related movement skills between ages of 12 and 14.

The teaching methods used in this study differ from those currently prevalent in physical education. They were developed by Mosston and Ashworth (2001) and include teacher-centered and student-centered approaches. The full spectrum of presentation methods is made up of the command style, practice style, reciprocal style, and self-check methods; the spectrum of invention methods is made up of the inclusion, guided discovery, divergent, individual, learner-initiated, and self-teaching styles (MEB, 2013). This study focuses on the command and inclusion styles. The command style focuses on the relationship between a stimulus provided by the teacher and the instant and direct reaction of the student. All decisions about place, stance, start time, speed and rhythm, stop time, time and distance are taken by the teacher, and the student's movements follow accordingly. The inclusion style is characterized by the student's access to the teaching process and active learning. At the preparation stage of the course, the teacher is active and then during the practice and conclusion stages, the student is active. Considering individual differences, student participation is customized according to level of preparedness so that a positive learning environment is created and success achieved with as many students as possible (Demirhan & Altay, 2001).

Other teaching methods can be described as traditional teaching methods' Some of these methods, which are about cognition, and which may be preferred for some teaching–learning activities, include computed teaching, discussions, panels, opposing panel, symposiums, forums, cluster studies, circle discussions, brain storming, showing projections, case study examination, workshops, seminars, educational plays, flash cards, Q&A, group or team play, field trips, homework, and interviews (MEB, 2006).

The traditional learning method in physical education courses is the expression method. In the expression method, teacher makes all decisions. In the practice part of the course, the students show what they can do and then the teacher provides necessary feedback and corrections as the students practice their skills (Güllü & Korucu, 2005). A lot of students are inclined to seek help from friends to solve problems they encounter during practice, but in a traditional learning environment this is unwelcome by the teacher. Traditional teaching methods encourage competition between students for the teacher's approval; this competition creates an inhibited rather than supportive learning environment (Salam & Naddaf, 2004). Nowadays different teaching methods have begun to be practiced in physical education courses, and their effectiveness is being tested.

Volleyball is one of the most popular sports in the world, and it includes actions that are extremely rapid and dynamic. For children, the skills of the volleyball include finger and forearm passes and underhand service. The aim of this sport is to send the ball to the other side of the net (Aracı, 2006).

In this study, the command and inclusion styles were tested alongside traditional teaching methods with the aim of evaluating their effectiveness for learning volleyball skills such as the finger pass, forearm pass, and underhand service, and with regard to cognitive, emotional, and movement development.

Method

Participants and Research Setting

The research group was formed from 100 students at the Sivas Center Group middle school during the 2014–2015 year. The control group received physical education lessons according to traditional teaching methods, while the experimental group was subdivided into two groups, one receiving lessons according to the command style and the other according to the inclusion style. The lessons were conducted for 2 hr/week for 8 weeks. Daily lesson plans for the command and inclusion styles were prepared by the researcher and executed by a physical education teacher (teachers trained to use the teaching styles). The effects of the different methods on movement and emotional development were studied at teaching groups.

Procedure

For this study, a pretest–posttest control group experimental model was used. The research was conducted at a state school connected to the Ministry of National Education, whose formal permissions were taken in the 2014–2015 academic year. The goal was to provide a natural course atmosphere, so participants were selected from among students already enrolled in physical education courses (based on volleyball skills and past experiences of playing volleyball). Two groups were formed with unbiased assignment; one of these was the experimental group and the other was the control group. Pretest measurements were taken before the experiment and posttests afterwards for each group. The students were recruited into the research project so that a broader aim of maximizing educational effectiveness could be fulfilled.

Measures

Demographic data and scale data. Children's demographic information (age, gender, class, etc.) was obtained using a demographic information sheet completed by students, with assistance from research assistants and teachers.

The Physical Education and Sports Attitude Scale (PESAS), which includes 12 positive and 12 negative items, measured emotional aspects of the research. It is formulated based on a 5-point Likert scale with the responses *strongly agree*, *agree*, *undecided*, *disagree*, and *strongly disagree*. Positive items of the PESAS were scored from 5 to 1 beginning with *strongly agree*; negative items of scale were scored from 5 to 1 beginning with *strongly disagree*. The lowest possible score was 24 and the highest was 120. When the scores were averaged, the lowest was 1 and highest was 5. The Cronbach's alpha reliability index was calculated as .93; the criterion validity index was calculated as .83.

Physchomotor tests. During the research, with the aim of measuring skills, a Volleyball Psychomotor Skills Test (VPST), developed by the researcher with consultation from volleyball experts, was administered. While the VPST was being developed, the main volleyball skills for sixth graders were determined; these were making finger and forearm passes toward squares drawn on a wall and serving underhanded toward zones marked at the back of the opposite side of the court. On the advice of the experts, each student was given six tries to make finger and forearm passes and three tries at underhand service. The VPST pretest and posttest were recorded on video and evaluated with reference to other volleyball skills videos, arriving at an equivalent average score.

Data Analysis

Statistical analysis of the results was performed with the SPSS pocket program version 22.00. Descriptive statistical methods and a chi-square test of the data show a normal distribution. Paired samples, a *t* test, a one-way ANOVA, and Tukey's honest significance test were also applied, and the meaningfulness level was taken as 0.05.

Results

The frequency and means of the sociodemographic characteristics of the students in the control and experimental groups are given in this part of the study. In addition, other statistical assessments for the PESAS and VPST scores are presented in the tables. See Table 1 for a comparison of the pretest and posttest total values of the PESAS.

Table 1
Comparison of Pretest and Posttest Total Values of the PESAS

Group		*M*	*SD*	Result
Control	Total PESAS Pretest	69.18	9.32	$t = 0.61$
	Total PESAS Posttest	70.50	7.77	$p = 0.542$
Command Style	Total PESAS Pretest	69.11	8.84	$t = 0.56$
	Total PESAS Posttest	70.38	8.67	$p = 0.575$
Inclusion Style	Total PESAS Pretest	67.00	4.96	$t = 13.02$
	Total PESAS Posttest	84.38	6.67	$p = 0.001$*

*$p < 0.05$.

When the pretest and posttest scores of the control and experimental groups' PESAS were compared, significant differences were found for the inclusion style group ($p < 0.05$). See Table 2.

Table 2
Comparison of the Control and Experimental Groups' PESAS Pretest and Posttest Scores

Group	*M*	*SD*	Result
PESAS Pretest			
Control (1)	69.18	9.32	$F = 0.82$
Command Style (2)	69.11	8.84	$p = 0.448$
Inclusion Style (3)	67.00	4.96	
Total	68.42	7.90	
PESAS Posttest			
Control (1)	70.50	7.77	
Command Style (2)	70.38	8.67	$F = 36.28$
Inclusion Style (3)	84.38	6.67	$p = 0.001$*
Total	75.18	10.14	3 > 1.2*

*$p < 0.05$.

When the posttest scores of the groups' PESAS were compared, significant differences were found between groups ($p < 0.05$). See Table 3.

Table 3
Comparison by the First Expert of the VPST Pretest and Posttest Scores for the Group's Finger Pass, Forearm Pass, and Underhand Service Skills

Group	First expert - Skills	*M*	*SD*	Result
Control	Finger pass pretest	3.71	1.95	$t = 0.24$
	Finger pass posttest	3.81	1.97	$p = 0.805$
	Forearm pass pretest	2.62	1.38	$t = 0.92$
	Forearm pass posttest	2.84	1.34	$p = 0.362$
	Underhand serve pretest	4.25	1.88	$t = 2.58$
	Underhand serve posttest	3.37	1.60	$p = 0.015$*
Command Style	Finger pass pretest	4.11	2.01	$t = 0.40$
	Finger pass posttest	4.29	1.86	$p = 0.689$
	Forearm pass pretest	3.02	1.24	
	Forearm pass posttest	3.02	1.54	
	Underhand serve pretest	4.26	1.81	$t = 2.29$
	Underhand serve posttest	3.38	1.55	$p = 0.028$*
Inclusion Style	Finger pass pretest	4.55	1.58	$t = 2.25$
	Finger pass posttest	5.35	1.99	$p = 0.035$*
	Forearm pass pretest	3.58	1.30	$t = 3.01$
	Forearm pass posttest	4.61	1.84	$p = 0.005$*
	Underhand serve pretest	3.52	1.41	$t = 6.59$
	Underhand serve posttest	5.23	1.34	$p = 0.001$*

*$p < 0.05$.

When the first expert's VPST pretest and posttest scores for the finger pass and forearm pass skills were compared to those of the control group, the differences were not significant ($p > 0.05$), but a significant difference was found for underhand service ($p < 0.05$).

When the VPST pretest and posttest scores of the command style group were compared for the finger pass and underhand service skills, a significant difference was found ($p < 0.05$). The mean scores of the forearm pass skills remained unchanged.

When the VPST pretest and posttest scores of the inclusion style group were compared for the finger pass, forearm pass, and underhand service skills, a significant difference was found ($p < 0.05$). See Table 4.

Table 4
Comparison by the Second Expert of the VPST Pretest and Posttest Scores for the Group's Finger Pass, Forearm Pass, and Underhand Service Skills

Group	Second expert - Skills	*M*	*SD*	Result
Control	Finger pass pretest	3.18	1.63	$t = 0.96$
	Finger pass posttest	3.43	1.45	$p = 0.340$
	Forearm pass pretest	2.78	1.31	$t = 1.35$
	Forearm pass posttest	3.06	1.13	$p = 0.184$
	Underhand serve pretest	3.93	1.66	$t = 2.41$
	Underhand serve posttest	3.28	1.52	$p = 0.022$*
Command Style	Finger pass pretest	3.70	1.85	$t = 0.08$
	Finger pass posttest	3.67	1.68	$p = 0.937$
	Forearm pass pretest	3.08	1.23	$t = 0.40$
	Forearm pass posttest	3.00	1.18	$p = 0.687$
	Underhand serve pretest	4.20	1.77	$t = 2.25$
	Underhand serve posttest	3.58	1.41	$p = 0.035$*
Inclusion Style	Finger pass pretest	4.00	1.47	$t = 4.40$
	Finger pass posttest	5.23	1.67	$p = 0.001$*
	Forearm pass pretest	3.58	1.15	$t = 4.49$
	Forearm pass posttest	4.97	1.69	$p = 0.001$*
	Underhand serve pretest	3.64	1.36	$t = 5.45$
	Underhand serve posttest	5.08	1.48	$p = 0.001$*

*$p < 0.05$.

When the second expert's VPST pretest and posttest scores for the finger pass and forearm pass skills were compared to those of the control group, the differences were not significant ($p > 0.05$), but a significant difference was found ($p < 0.05$) for underhand service skills.

When the VPST pretest and posttest scores of the command style group were compared for the finger pass and forearm pass skills, the differences were not significant ($p > 0.05$), but a significant difference was found for underhand service skills ($p < 0.05$).

When the VPST pretest and posttest scores of the inclusion style group were compared for the finger pass, forearm pass, and underhand service skills, significant differences were found ($p < 0.05$). See Table 5.

Table 5

Comparison by the Third Expert of VPST Pretest and Posttest Scores for the Group's Finger Pass, Forearm Pass, and Underhand Service Skills

Group	**Third expert - Skills**	***M***	***SD***	**Result**
Control	Finger pass posttest	3.46	1.62	$t = 0.52$
	Finger pass posttest	3.59	1.49	$p = 0.601$
	Forearm pass posttest	2.96	1.28	$t = 0.97$
	Forearm pass posttest	3.15	1.27	$p = 0.338$
	Underhand serve posttest	3.81	1.55	$t = 1.45$
	Underhand serve posttest	3.40	1.36	$p = 0.157$
Command Style	Finger pass posttest	3.82	1.81	
	Finger pass posttest	3.82	1.24	
	Forearm pass posttest	3.17	1.08	$t = 0.84$
	Forearm pass posttest	3.35	1.32	$p = 0.404$
	Underhand serve posttest	3.61	1.30	$t = 1.95$
	Underhand serve posttest	3.08	1.21	$p = 0.059$
Inclusion Style	Finger pass posttest	3.85	1.32	$t = 5.23$
	Finger pass posttest	5.05	1.47	$p = 0.001$*
	Forearm pass posttest	3.58	1.25	$t = 4.77$
	Forearm pass posttest	5.00	1.57	$p = 0.001$*
	Underhand serve posttest	3.41	1.13	$t = 5.93$
	Underhand serve posttest	5.08	1.67	$p = 0.001$*

*$p < 0.05$.

When the third expert's VPST pretest and posttest scores for finger pass, forearm pass, and underhand service skills were compared to those of the control group, the differences were not significant ($p > 0.05$).

When the VPST pretest and posttest scores of the command style group were compared for the forearm pass and underhand service skills, the differences were not significant ($p > 0.05$). The mean skills for the finger pass pretest and posttest remained unchanged.

When the VPST pretest and posttest scores of the inclusion style group were compared for the finger pass, forearm pass, and underhand service skills, significant differences were found ($p < 0.05$). See Table 6.

Table 6

Comparison Between Each Group of the VPST Pretest and Posttest Scores for the Finger Pass, Forearm Pass, and Underhand Service Skills

Volleyball skill	Group	*M*	*SD*	Result
Finger Pass Pretest	Control (1)	3.45	1.64	$F = 1.48$
	Command Style (2)	3.88	1.79	$p = 0.232$
	Inclusion Style (3)	4.13	1.36	
Forearm Pass Pretest	Control (1)	2.79	1.14	$F = 4.24$
	Command Style (2)	3.09	1.09	$p = 0.017$*
	Inclusion Style (3)	3.58	1.12	3 > 1*
Underhand Serve Pretest	Control (1)	4.00	1.55	$F = 1.33$
	Command Style (2)	4.02	1.47	$p = 0.268$
	Inclusion Style (3)	3.52	1.18	
Finger Pass Posttest	Control (1)	3.61	1.56	$F = 9.60$
	Command Style (2)	3.93	1.52	$p = .000$*
	Inclusion Style (3)	5.21	1.65	3 > 1.2*
Forearm Pass Posttest	Control (1)	3.02	1.11	$F = 20.52$
	Command Style (2)	3.12	1.20	$p = .000$*
	Inclusion Style (3)	4.86	1.59	3 > 1.2*
Underhand Serve Posttest	Control (1)	3.35	1.38	$F = 19.57$
	Command Style (2)	3.35	1.27	$p = .000$*
	Inclusion Style (3)	5.13	1.39	3 > 1.2*

*$p < 0.05$.

According to Table 6, when the finger pass pretest mean scores of the three groups were compared, significant differences were not found ($p > 0.05$). When the finger pass posttest mean scores were compared, the inclusion style group's mean scores were higher than those of the command style and control groups ($p < 0.05$).

When the forearm pass pretest mean scores of the groups were compared, the inclusion style group's mean scores were higher than those of the control group ($p < 0.05$). Also, the inclusion style group's forearm pass posttest mean scores were higher than those of the command style and control groups ($p < 0.05$).

When the underhand service skill pretest mean scores were compared, no significant differences were found between the three groups ($p > 0.05$). The inclusion style group's underhand service skill posttest mean scores were significantly higher than those of the command style and control groups ($p < 0.05$).

Discussion

Like similar research, this study found that the inclusion style was more effective than the command style or traditional teaching methods. Physical education attitudes among students in the inclusion style group increased. This situation can be explained by the fact that the students realize the activities they are interested in and determine the difficulty level.

Doydu, Çelen, and Çoknaz (2013) examined the attitudes of students toward physical education and sports, and determined there is no difference between students who received training via a Sports Education model and those trained through a traditional teaching approach. Bahadır (2011) compared the practice and cooperative learning methods and found that in terms of attitude, both methods equally increased the attitudes and interest of students toward physical education. Güllü & Korucu (2005) reported positive interest and attitudes toward physical education among middle school students. Koçak and Hürmeriç (2006) found that middle school students have positive attitudes toward physical education and sports. Erkmen, Tekin, and Taşğın (2006) stated that students at private primary schools have positive attitudes toward physical education. Balyan, Yerlikaya, and Kiremitçi (2012) found that the attitudes of middle school students toward physical education were not affected by different sporting activities. Byra, Sanchez, and Wallhead (2014) found that personal preferences and time spent on different sporting activities were significantly higher among those taught via the inclusion style rather than the command or practice styles.

When the VPST pretest and posttest scores of each group were averaged and compared by the experts consulted, meaningful improvement was shown in underhand service skills among the command style group, whose chosen method was repeated drills.

All three experts who evaluated students' pretest and post-test in this study indicated more meaningful improvement in finger pass, forearm pass, and underhand service skills among the inclusion style group relative to other methods. The reason for this is thought to be because the teacher gives the students options based on their interests and level of ability. Salam and Naddaf (2004) in a study on the effects of the individual control method determined that the performance level command and practice methods were more effective than the individual control method in long- and short-application tests.

Alhayek (2004) compared the practice and reciprocal methods of physical education for the case of basic basketball skills and found that the jump shot and dribbling skill tests of those in the practice method group showed greater proportional improvement than those in the reciprocal method group. Chatoupis (2005) compared the efficacy of the practice and inclusion styles among fifth grade students and determined that the students in the inclusion style groups showed greater athletic improvement. This outcome shows a parallelism with our study. According to the each of the three volleyball experts consulted, the students taught with the inclusion style developed volleyball skills at a more meaningful level than those in the command style and control groups. Chatoupis (2008) compared the physical fitness values of fifth grade students taught with the practice and inclusion styles and concluded that both methods elicited more meaningful development than those in the control group. Sunay, Gündüz, and Dolaşır (2004) compared the effects of the command style and the guided discovery method for teaching volleyball technique and found no meaningful differences between them. Griffey (1983) observed that students exposed to the practice style showed greater improvement in the forearm pass than those exposed to the command style. Goldberger and Gerney (1986) determined that the inclusion style was effective for skills development in students. This result was also valid for our research. After 8 weeks of education, students' basic volleyball skills showed the greatest improvement with the inclusion style. Beckett (1991) also found that the inclusion style was more effective than the practice method at skills development in his study with college students.

Zeng, Leung, Liu, and Bian (2009) compared the effectiveness of the practice, reciprocal, and inclusion styles on the basic volleyball skills development of female college students and found the inclusion style to be the most effective. Karavelioğlu (2012) researched the effect of the cooperative learning method and command style on the football skills development of sportsmen and found the traditional method to be more effective for the development of technical skills such as dribbling, while the cooperative learning method was more effective for skills such as the goal pass and canon ricochet.

Conclusion

The results of this study correspond to those of others designed to compare the effect of various teaching models on psychomotor skills. Much other research on the effect of teaching methods on volleyball skills focuses on the positive effects of student-centric, active learning approaches. Similarly, in our study, the basic volleyball skills of students in the inclusion style group developed at a meaningful level. The most important advantage of the inclusion style was that students determined for themselves the course content and difficulty level from a range of options provided by the teacher. As a result, the number of students who actively participated in physical education exercises was very high. It can be said that these advantages increase student motivation and perpetuate an interest to volleyball.

The students in the inclusion style group of this study showed improvement in their finger pass, forearm pass, and underhand service volleyball skills. The research conclusion is that the most effective method to teach basic volleyball skills to sixth grade students is the inclusion style.

In conclusion, findings of this study add to literature on the roles of styles, compared with traditional physical education, in contributing to children's basic volleyball skills. Especially, inclusion style influenced children's finger pass, forearm pass, and underhand service skills into the higher levels, as seen at follow-up among children.

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PHYSICAL ACTIVITY

Exploring Secondary Science Teachers' Use of Classroom Physical Activity

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Abstract

This study explored the use of classroom physical activity (PA) in secondary science classrooms. To accomplish this, semistructured interviews were conducted with secondary science teachers (n = 11). Interviews were based on the constructs of the social-ecological model. Most teachers reported using classroom PA in some form—in-class breaks, outdoor activities, and curriculum support. Teachers used classroom PA to improve academic and behavioral outcomes of students. They had varied perceptions regarding collegial support of classroom PA, but mostly felt supported by administrators. Teachers reported being unaware of their district's and the state department of education's beliefs about classroom PA. Overall, factors that negatively influenced classroom PA use tended to be within the interpersonal, organization, and policy levels of the social-ecological model, while factors that positively influenced classroom PA use tended to be within the individual level.

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Participation in physical activity (PA) offers several benefits for adolescents. Regular PA helps build and maintain healthy bones and muscles, reduces the risk of obesity and several chronic diseases (e.g., diabetes, cardiovascular disease), and promotes psychological well-being (Centers for Disease Control and Prevention [CDC], 2010; U.S. Department of Health and Human Services [USDHHS], 2008). Further, adolescents who participate in higher levels of PA tend do better in a number of school-related metrics, such as homework completion, class attendance, self-reported grades, positive academic attitudes, higher academic aspirations, and school completion rates (Darling, 2005; Darling, Caldwell, & Smith, 2005; Fredricks & Eccles, 2006; Harrison & Narayan, 2003). Despite these benefits, PA levels appear to decline as children become adolescents (CDC, 2014). For example, children aged 6 to 11 in the United States average 88 min/day of moderate to vigorous PA compared to only 33.3 and 25.5 min/day for youth aged 12 to 15 and 16 to 19, respectively (Belcher et al., 2010). Efforts are needed to lessen this decline and to ensure that adolescents attain sufficient levels of PA.

The school environment offers a potential opportunity for increasing PA in this age group, as adolescents in the United States spend, on average, 6.64 hr/day for 180 days/year in school (National Center for Education Statistics, 2008). In elementary schools (kindergarten to sixth grade) in the United States, students have opportunities to be active during physical education and recess. However, these opportunities typically decrease or are eliminated as students progress into secondary school (i.e., middle school, high school; Pellegrini, Huberty, & Jones, 1995). For instance, only 3% of high schools provide physical education 3 days/week compared to 13.7% of elementary schools (CDC, 2007b). Further, only 17% of students (ninth to 12th grade) report to be physically active 60 min/day and 30% report to attend daily physical education class (CDC, 2007b). Clearly, efforts for improving PA in adolescents during school are needed.

Although a strong body of observational research supports the need for PA in adolescents, limited data exist on how to increase PA in secondary schools (Belcher et al., 2010; Darling, 2005; Darling et al., 2005; Harrison & Narayan, 2003; Whitt-Glover et al., 2009). Few interventions involving high school students have successfully increased PA (Felton et al., 2005; Knox et al., 2012). Felton et al. (2005) found that a comprehensive school PA intervention targeting high school females led to significant improvements in moderate to vigorous and vigorous PA levels 1 year postintervention. Additionally, Knox et al. (2012) implemented PA into seventh to ninth grade mathematics and English classrooms, finding improvements in waist circumference, systolic blood pressure, triglycerides, and high density lipoprotein cholesterol in the intervention group after 18 weeks of intervention. These success stories lay the groundwork within the literature; however, more research needs to explore how PA can be increased in schools.

The Comprehensive School Physical Activity Program [CSPAP]—a framework designed by the Society of Health and Physical Educators (SHAPE America) to increase PA in schools (CDC, 2013)—outlines methods of increasing PA in kindergarten to 12th grade students. The CSPAP is "a multi-component approach by which school districts and schools use all opportunities for students to be physically active, meet the nationally-recommended 60 minutes of PA each day, and develop the knowledge, skills, and confidence to be physically active for a lifetime" (CDC, 2013, p. 12). The CSPAP framework is not limited to change at the individual level, but was created to change the entire school culture through a systematic format. Classroom PA is one method for increasing adolescents' PA suggested by the CSPAP framework (CDC, 2013). Classroom PA involves integrating PA into the content of lessons and/or classroom breaks through provision of activities as a break within a lesson or during a transition between subjects (CDC, 2013). Classroom PA can be easily adapted to various styles of teaching and allows for flexibility in implementation. Activities can be unplanned or strategically integrated into specific areas within a curriculum.

Classroom PA may be a beneficial addition to classrooms for several reasons. First, classroom PA has been linked to improvements in cognitive function (e.g., attention, memory), academic behaviors (e.g., homework completion, time on task), and academic achievement (e.g., standardized test scores, grades), as well as increased overall PA (Donnelly & Lambourne, 2011; Mahar et al., 2006; Rasberry et al., 2011). Second, PA accumulated in short bouts throughout a day improves health-related outcomes (e.g., body composition, blood pressure) as much or more than a single continuous PA bout (Ando et al., 2013; Padilla, Wallace, & Park, 2005; Stone, Rowlands, Middlebrooke, Jawis, & Eston, 2009). Third, PA is a relatively simple teaching strategy that does not require a plethora of resources or extensive training to be successfully implemented. For example, in a study examining the impact of classroom PA on BMI, teachers were able to be trained at one 6-hr in-service session prior to the school year (Donnelly et al., 2009). Yet most research on classroom PA has been completed in elementary school settings. For instance, a recent review of PE integration into classrooms—a form of classroom PA—found that 19 of 21 studies targeted elementary school settings (Marttinen, McLoughlin, Fredrick & Novak, 2017).

While classroom PA has been found to be an effective method for increasing PA, research of classroom PA in secondary classrooms is limited (Knox et al., 2012). Primarily, efforts have focused on teachers' perceptions of classroom PA in secondary classrooms and these studies were conducted in schools that serve Native American or Indigenous populations in the United States (Cothran, Kulinna, & Garn, 2010; McMullen, Kulinna, & Cothran, 2014). For example, Cothran et al. (2010) conducted a study in which 11 of the 23 participants were secondary school teachers and concluded that teachers were more likely to use classroom PA if they were concerned with the wellness of their students and if they had a history of a high level of wellness themselves. Teachers in the same study encountered barriers to classroom PA related to challenges with scheduling and emphasis on academic assessments. McMullen et al. (2014) explored teachers' perceptions of classroom PA breaks and determined features of preferred activity breaks. Eight of the 11 participants in this study were secondary school teachers. Teachers reported classroom control was an important aspect of classroom PA implementation and preferred activities that were related to class content, easy to implement, and enjoyed by the students. The focus on schools that serve Native American and Indigenous populations in these studies creates challenges with generalizing the results to other secondary schools. Thus, research should continue to explore classroom PA in secondary schools with differing populations to improve understanding in this area.

For an increase in classroom PA opportunities in secondary schools, best practices from teachers who use classroom PA strategies must be understood. Several studies have explored the use of classroom PA by elementary and middle school teachers to hone classroom PA strategies (Dinkel, Schaffer, Snyder, & Lee, 2017; Kibbe et al., 2011; Mahar et al., 2006). However, some differences in secondary classrooms may influence classroom PA. For instance, secondary teachers typically teach in discipline-specific subject areas, meaning they may have fewer opportunities to use PA in transitions between subjects or they may teach a subject that is not as conducive with PA as others. Similarly, secondary teachers may feel they do not have time to implement classroom PA, because they only see a group of students for a portion of the day (e.g., 45 min, 1 hr), whereas elementary teachers spend the majority of the day with the same group of students. Because of this, the nuances of classroom PA within secondary classrooms and specific subject areas must be understood.

Science classrooms may be an ideal setting for increasing understanding of PA in secondary classrooms, yet research in this area has been limited and conflicting. One study found middle school science teachers and students reported positive effects on enjoyment, learning, and behavior after implementing a PA-specific science curriculum, citing an ideal overlap between science curriculum and PA (Finn & McInnis, 2014). However, another study found elementary and middle school teachers reported being the least comfortable integrating classroom PA into science in comparison to other subjects (Dinkel, Lee, & Schaffer, 2017). Because of conflicting results and the lack of high school teachers involved in these studies, additional examination of classroom PA in secondary science classrooms is needed.

This study explored the use of classroom PA in secondary science classrooms. To accomplish this, it examined science teachers' use of classroom PA and barriers to implementing classroom PA. Because of the lack of research on classroom PA in secondary settings, the researchers used a qualitative approach to explore the topic thoroughly and develop an understanding that guides subsequent research efforts.

Theoretical Framework

The study design was based on the constructs of the social-ecological model (Stokols, 1996). The social-ecological model provides a framework for understanding the influence of several social and environmental factors on the utilization of classroom PA by secondary science teachers. The model comprises five levels (individual, interpersonal, organization, community, policy) that contain several factors that may influence the use of classroom PA (American College Health Association, 2016). The individual level includes personal knowledge, self-efficacy, and beliefs. The interpersonal level includes relationships with friends, peers, and coworkers. The organization level includes place of employment and involvement in groups. The community level includes local recreation facilities and interactions with community organizations. The policy level includes school/district policies and state legislation (Stokols, 1996).

Method

Researchers conducted semistructured interviews with secondary science teachers to explore the use of PA in their classrooms. Interviews focused on teachers' use of classroom PA and/or their willingness to incorporate classroom PA. This was approved by a university institutional review board.

Eleven secondary science teachers from a Midwestern metropolitan area in the United States participated in this study. The majority of participants (n = 8) were high school teachers (ninth to 12th grade), female (n = 9), and Caucasian (n = 10). The average age of the teachers was 35.63 years (range: 22–55 years). Teachers had on average over 7 years (range: 1–19 years) of teaching experience and almost all held a master's degree (n = 10). When asked about their typical PA levels, most teachers reported attaining at least 30 min of PA on 6 of the past 7 days. Teachers represented seven schools and two school districts.

Participants

A purposive sample of participants was initially recruited through (1) a partnership program that connects researchers and local prekindergarten (PK) to 12th-grade teachers, or (2) a teacher education meeting for local secondary science teachers. During recruitment efforts, research personnel provided a brief description of the study and teachers were asked to provide their e-mail address if interested in participating. An e-mail was sent to potential participants with a brief description of the procedures. Teachers were encouraged to respond to verify their interest, ask for clarification or further information, and schedule an interview. After the initial interviews, snowball sampling was used and participants were asked to provide the e-mail addresses of colleagues they thought might be interested in participating. A similar e-mail to the aforementioned recruitment e-mail was sent to the suggested colleagues, and the same protocol was followed for scheduling interviews.

Instrument

An interview based on constructs of the social-ecological model sought to determine the use of classroom PA. For participants to have the same concept of classroom PA, interviews were initiated with the definition that classroom PA includes integrating any type of PA, at any level of intensity within general education classrooms during normal classroom time (Webster et al., 2013). The researcher posed dichotomous yes/no questions to guide the interviewee to a corresponding set of follow-up probes. Table 1 provides examples of interview questions. The interview guide was a modified version of an interview guide for examining the use (e.g., teachers' perceptions, factors influencing implementation) of classroom PA in elementary school teachers (Dinkel, Lee, & Schaffer, 2017).

Data Collection

A semistructured interview was conducted with each of the 11 participants. Interviews lasted 30 to 75 min and occurred either in-person or over the telephone. Interviews took place in a quiet, private environment and were recorded with an audio recorder. At the completion of the interview, participants were given or mailed a $10 gift card.

Two research personnel were involved in data collection. Research personnel were trained in qualitative data collection methods and had previously gathered qualitative data (e.g., focus groups, semistructured interviews). Half of interviews were conducted by one of the research personnel, and the other half were conducted by the other research personnel.

Table 1
The Social-Ecological Model and Example Interview Questions

Level	Example interview questions
Individual	Do you currently integrate PA into your classes? Why/why not?
	How confident do you feel using PA in your classroom? Please explain.
	How do you typically use PA in your classroom?
Interpersonal	Thinking about other teachers within your grade level at your school, how do you think their opinions on classroom PA compare to yours? Why?
	How often would you ideally like to collaborate with other teachers to discuss classroom PA? Why?
Organization	Please tell me about the wellness environment at your school.
	What are your district's beliefs about utilizing PA in the classroom and promoting PA in general?
Community	How could community organizations support the use of classroom PA?
Policy	Does your school/district have a wellness policy about classroom PA? Please explain.
	What guidelines or policies are you aware of for providing classroom PA?

Data Analysis

After the interviews were completed, research personnel transcribed the interviews verbatim using an Olympus AS-2000 transcription kit (Center Valley, PA). Interviews were uploaded in NVivo 10 (QSR International, 2012) and analyzed through a directed content analysis approach (Baxter, 1991; Hsieh & Shannon, 2005). First, the themes for the codebook were designed based on the social-ecological model's framework (Bradley, Curry, & Devers, 2007; Crabtree & Miller, 1999). Next, two trained researchers read the transcripts and independently developed codes within each theme to create an initial draft of the codebook. The drafts were compared and discrepancies were discussed (Borkan, 1999). Consistencies were then synthesized and codes formed (Moustakas, 1994). Data were validated through the process of peer debriefing—discussion of discrepancies in coding with a third researcher until consensus is reached (Lincoln & Guba, 1985). The third researcher reviewed the codebook and any major discrepancies to form the final codebook. Once the final codebook was completed, the first two researchers revisited the transcriptions and coded the content. Coded content was compared and discrepancies were discussed. Major discrepancies were discussed with a third researcher until consensus was reached. Data were further validated via member checking (Creswell, 1998).

Results

Results are presented within the constructs of the social-ecological model—individual, interpersonal, organization, community, and policy. Trends in responses illustrate key findings and are followed by one or more quotes that support these findings.

Individual

All but one participant (n = 10) reported utilizing classroom PA. Participants primarily utilized classroom PA in the form of in-class PA breaks (n = 5), outdoor activities (n = 6), and curriculum support (n = 8). Several participants reported implementing classroom PA daily (n = 4), while other participants typically implemented between 1 and 3 days/week (n = 4), or reported infrequent implementation (n = 2). Those implementing PA daily cited behavioral improvements as their primary reason (n = 3) for doing so. For example, a middle school teacher mentioned, "It keeps boredom down, um, it keeps participation up . . . makes them look forward to what they're doing next." Participants who implemented 1 to 3 days said it depended on their curriculum (n = 4). A middle school teacher explained the frequency of her use, "Just because . . . it doesn't always fit in the schedule. Um, sometimes I can't always tie it in every single class period."

Mondays (n = 5) and/or Fridays (n = 4) were seen as the most effective days for implementing classroom PA. Mondays were seen as ideal because of student fatigue (n = 3). A middle school teacher mentioned, "Mondays are usually really good because [students are] really sleepy so it helps them wake up." Fridays were cited as ideal for behavioral reasons (n = 3). A high school horticulture teacher stated, "Fridays are very important because they get really anxious to be out by that point."

Several participants ($n = 5$) reported classroom PA was most effective at the beginning of the day. A high school biology teacher said, "First period, um, you know I'm working with teenagers and they're still groggy and, you know, uh, the non-morning people and it does sort of help to get them going." However, a number of participants also saw value in utilizing PA at the end of the day ($n = 5$) or after lunch ($n = 4$).

Some participants noted their students responded positively to classroom PA ($n = 5$). As a high school teacher stated, "They're pretty good. They appreciate it. Um, most of them are pretty engaged when we get up and do something." Participants also reported improvements in their students' academic performance ($n = 6$) and/or behavior ($n = 6$). A high school horticulture teacher stated,

> It just helps with behavioral management. For one, ya know, the students get really antsy after having to sit throughout the entire day. Um, it's good for engagement, ya know, and it's just more fun to learn that way. I feel like it's just, ya know, sometimes it's easier to retain things when you have physical activities associated with it.

When discussing how classroom PA was implemented, participants most frequently reported integrating PA into the curriculum ($n = 8$). For example, a high school biology teacher mentioned, "Just part of teaching science, the lab, the activities." Other common implementation methods included outdoor activities ($n = 6$) and/or taking in-class breaks for PA ($n = 4$). As far as outdoor activities, a middle school teacher said,

> We'll go outside and look at the different parts of the environment and that helps them with, "Oh this is living and nonliving." It's not necessarily like purposeful movement but its general movement. Um, I do measurement outside, because you need space to measure things. So they're moving around measuring things.

Referring to in-class PA breaks, a high school biology teacher noted, "I occasionally do brain break stuff . . . that is completely unrelated to the content if I need to wake them up or if we have a really long section of notes."

Participants utilizing classroom PA reported learning about the strategy while in college (*n* = 6). One of the high school teachers stated, "From day one, like even in undergrad, like my teaching science topics class focused on activity in the classroom." Participants also reported learning about classroom PA during professional development (*n* = 4). For example, a middle school teacher mentioned, "I went to a conference, like a professional development workshop, where we had to get up and move around, we had to interact."

Over half of participants reported that they were very confident in implementing classroom PA (*n* = 7), while others reported that their confidence could be improved (*n* = 5). A high school biology teacher stated, "Very confident. Don't have a problem with it." Conversely, another high school teacher said,

> You know, when it comes to my anatomy classes it's a little bit different story; it's harder because that is just—it's such a different type of curriculum, um, and it's a lot of memorization of content, which it makes it a little bit more uncomfortable trying to incorporate PA into a class like that.

Although utilization of classroom PA was common, almost all participants felt they could incorporate more PA into their classroom (*n* = 9). Several participants noted this could be done through more curriculum integration (*n* = 8). For example, a middle school teacher mentioned, "We talk about bones and muscles and how they work together. So that's another way we could incorporate movement." Additionally, a high school biology teacher said, "I think [in] the calorie lab you could insert physical [activity], . . . when they talk about nutrition and calories we can insert more PA specific curriculum related there."

Many participants identified at least one barrier that limited the amount of PA they used (*n* = 8). One of the more frequent barriers noted was large class sizes/lack of space (*n* = 5). A high school biology teacher noted, "Definitely space. There's 32 students in most of my classes, in a room that should probably hold 24, so, it's an issue." Half of participants mentioned changing the classroom environment (*n* = 6) to overcome structural limitations in the classroom environment. A high school biology teacher stated:

> I can move my tables around so, um, different table arrangements can help with stuff like that. Um, whether ya know we put them together in like a 4, like prearranged in a group or rows makes a difference so I think that the arrangement of tables can over—you can do things to overcome large classes.

Resistance from students (n = 3) was also found to be a significant barrier. One participant noted, "They don't want to do it. Some of them don't want to do it. Um, that's [being active] doing too much. We hear that a lot—anything is doing too much for some kids." Additionally, participants (n = 3) mentioned challenges with classroom management as a barrier. A middle school teacher commented,

> Even if you go over expectations beforehand, there's always somebody who's going to cross that line and being able to pull them back without, um, shutting the whole thing down can be really difficult at times. Um, if the classroom management is not strong, getting kids up and moving around and learn while they're doing it is really hard to do.

To overcome barriers, some teachers identified the need to increase their knowledge of classroom PA (n = 3). A high school biology teacher mentioned, "Well more literature, obviously would always be good. Um, I know that, uh, we need more stuff [research on classroom PA research] for science." When asked what more they would like to learn about classroom PA, participants most frequently reported that they would like to learn new or specific ideas for implementing classroom PA (n = 8). A high school teacher was interested in learning "ways to get students engaged physically in the morning." Similarly, participants (n = 8) reported they would attend professional development about classroom PA to gain more classroom PA knowledge (n = 8). For example, a middle school teacher stated, "I've always done everything that I could to learn more, so yeah [I would attend]."

Interpersonal

When discussing other teachers within their subject area and grade level, most participants reported their colleagues' use of classroom PA varied or none of their colleagues used classroom PA

($n = 9$). A high school chemistry teacher stated, "Um, within my specific subject [colleagues] are set in their ways a little bit, but I think they value, um, work completion and things that they can track, over getting the kids really actively involved." All but one participant saw years of teaching experience as an indicator of classroom PA use ($n = 10$), with more experienced teachers being less likely to implement. A high school teacher stated,

> I feel like, and I don't know if its necessarily that years of teaching experience, they just get apathetic about these things, I think that it's just nowadays, you know, how they teach us in college is just so different. And what I learned is probably much different than someone who's been there for 20 years and I, ya know, when I was in college they really stressed things like that. So I think that's why it's a lot easier for me to incorporate it or think about it when I'm trying to teach.

Some participants reported that they discuss classroom PA with their colleagues ($n = 5$). Typically, these discussions were infrequent and as part of a broader conversation regarding curricular topics. For example, describing these discussions, a high school biology teacher said, "Um, only when we are talking about human anatomy labs or labs that relate to PA."

In regard to other teachers at their schools, participants were asked how the physical educators promote PA. Several participants reported they were unaware of any efforts or their efforts were minimal ($n = 5$). For example, a middle school teacher responded, "Um, recently not much. They used to do walking clubs and then of course sports, um, but in the recent years nothing really other than what they do in their own physical education classes." Additionally, a high school chemistry teacher mentioned, "Um, I'm not really that sure. I mean they really don't. But I also—we are on complete different sides of the building."

Organization

Several participants reported, on a scale from 1 to 5 (1 = *low*, 5 = *high*), that their school was rated as a 4 or 5 in terms of readiness to increase classroom PA ($n = 5$). Each participant attributed that score to having an open-minded and supportive administration. For instance, a middle school teacher replied, "I would say around a four. I think our administration is very open minded about these newer, not even newer, but you know the revamping of classroom strategies and things."

When describing their school's wellness environment, participants most commonly mentioned activities related to staff wellness (*n* = 7). A high school biology teacher remarked,

> So for staff wellness it is very much promoted, like they promote, um, they do like quarterly little giveaway things where they'll focus on [a] wellness topic and then they'll give you a water bottle or a whatever—if you take a health survey at the end of every school year you get a $25 gift card . . . so I think as a staff, um, the opportunity is there to participate in some wellness stuff, um, I don't know how much it filters down to kids.

Five participants reported having a wellness team that provided leadership for school wellness activities. A high school teacher stated, "We have a committee for health and wellness and . . . they send out ideas. Like on Wednesdays wear tennis shoes to promote a healthy back and taking care of our feet because teachers stand on their feet all the time." The wellness priorities of the schools were most frequently related to healthy nutrition and PA promotion (*n* = 5) or the priorities were unknown (*n* = 5). Among the participants recognizing wellness priorities in their schools, a high school biology teacher mentioned, "PA and nutrition—I mean like from the emails I get like the programs are always either nutrition based or like record how much you walk a day." Conversely, a high school teacher stated, "I don't think there are any. I don't think there is a wellness team. There's definitely not a wellness team. There's a school nurse and she sometimes agrees to weigh everybody in, like that's what we have."

The majority of participants reported that the administration at their school is supportive of classroom PA (*n* = 8). For instance, a high school horticulture teacher said,

> I would say that they're really supportive of it. Our assistant principal actually used to be a physical education teacher so I'm sure she's really supportive of it. Um, they're always really

> big into finding, like, the new research out there and what can best serve students and then, you know, teaching us right at the beginning of the year; how can we incorporate this into our classroom styles.

In contrast, most participants did not know their district's ($n = 6$) and/or the state department of education's ($n = 10$) stance on classroom PA. When discussing the district, a high school teacher stated, "I don't know that they have any beliefs. If they do, they haven't conveyed those to me." All of the participants that thought they knew their district's beliefs ($n = 5$) reported they were similar to their schools' beliefs and supportive of classroom PA. A middle school teacher mentioned, "I think the district is also for promoting it, as well. I think they can see the benefits behind it." In terms of the state department of education, a middle school teacher remarked, "The only thing I really know about state is the state's standards and state testing. I don't really hear much about PA and different kinesthetic activities at the state level."

Community

Almost all participants reported that it would be helpful to receive support from a community organization ($n = 10$). Participants often discussed how community organizations could collaborate with or support schools by providing partnerships and resources ($n = 7$) and/or lead activities at schools ($n = 4$). In reference to providing resources, a high school biology teacher stated,

> I really like the idea of those exercise balls as the chair for students, um, what I have heard at conferences is that once the initial kind of bouncing . . . [ends], it seems to be well-received by the students as well. But there's a huge cost there that, ya know, most school districts aren't gonna be able to do that on top of their normal budget.

Policy

All but one participant ($n = 10$) reported their school did not have a wellness policy that included classroom PA or they were not aware of one. When asked how they would create a wellness policy for their school, most participants mentioned mandating frequency of PA in class (*n* = 10). A middle school teacher mentioned, "That the kids get up out of their seat at least once a lesson. Moving around; move their entire body somewhere." Participants felt a policy like this would be most effective if it came from the school or teachers within the school (*n* = 7) rather than the district (*n* = 3) or the state department of education (*n* = 1). A high school chemistry teacher noted, ". . . teacher driven would get more teachers on board. Starting from the bottom up is a lot better. Coming from the top down you're going to get a lot of resistance from teachers." Additionally, a high school chemistry teacher said,

> Other teachers. Teachers hate being dictated to. We really do. But if you've got a teacher that is willing to, you know, um, kind of humble themselves and learn from administrators and learn from other people and then say "Hey, this is what I'm doing in my classroom, please come and watch." Um, teachers are really, they are, they're much better at, you know, at picking up on stuff that their colleagues are doing rather than being dictated [to].

Discussion

This study explored secondary science teachers' use of classroom PA. Secondary science teachers primarily utilized classroom PA in the form of in-class PA breaks, outdoor activities, and curriculum support. Factors that negatively influenced classroom PA use tended to be within the interpersonal, organization, and policy levels of the social-ecological model, while factors that positively influenced classroom PA use tended to be within the individual level. These findings suggest that understanding factors within specific social-ecological model levels may be important for reducing barriers and building on positive influences of classroom PA.

Throughout the interviews, several factors were discussed that may be detrimental to the implementation of classroom PA. These factors were within the interpersonal, organization (e.g., school characteristics, formal rules and regulations), and policy (e.g., local policy, state policy) levels of the social-ecological model. Within the interpersonal level, teachers had mixed perceptions of support for classroom PA from their colleagues (e.g., mixed use in colleagues, lack of collaboration). This was especially prevalent when they discussed more experienced teachers. Colleagues' attitudes toward classroom PA have been shown to influence teachers' willingness to implement classroom PA in their own classrooms (Goh et al., 2013). Consistent with previous research, within the organization level teachers reported large classes/lack of space as an environmental barrier to implementing classroom PA (Cothran et al., 2010; Dinkel, Lee, & Schaffer, 2017; Evenson, Ballard, Lee, & Ammerman, 2009; McMullen et al., 2014). Within the policy level, most teachers were unaware of any wellness policy related to classroom PA at their schools. Teachers were also unaware of their district's and the state department of education's beliefs about PA. When teachers are unaware of policies and beliefs about classroom PA, this could be viewed as lack of support and, consequently, limit the implementation of classroom PA (Dinkel, Schaffer, et al., 2017; Webster et al., 2013).

Conversely, several factors were discussed that may positively influence the use of classroom PA. Four of these factors were within the individual level of the social-ecological model (e.g., knowledge, attitudes, beliefs), while one was within the interpersonal level (e.g., social networks, family, friends). First, all teachers were able to identify benefits of classroom PA. The ability to identify and understand the benefits of classroom PA has been shown to increase teachers' likelihood of implementing classroom PA (Cothran et al., 2010; Martin & Murtagh, 2015). For instance, Martin and Murtagh (2015) concluded that teachers' perceptions of classroom PA were associated with levels of PA in their students, in that positive perceptions equated to higher levels of PA. Second, most teachers mentioned they were confident in their ability to implement classroom PA. Confidence in implementing classroom PA is likely a result of positive attitudes and past experiences with classroom PA (Cothran et al., 2010; Faulkner & Reeves, 2000; McKenzie, LaMaster, Sallis, & Marshalls, 1999). Third, the majority of teachers reported being physically active on most of the previous 7 days. Teachers' perceptions of personal wellness and history of PA have been associated with attitudes toward classroom PA (Faulkner, Reeves, & Chedzoy, 2004). Faulkner and Reeves (2000) found that teachers with positive perceptions of their own sport competence also had the most positive attitudes toward implementing classroom PA. Fourth, within the interpersonal level of the social-ecological model, support from administration appeared to influence classroom PA implementation positively. Administrative support has been associated with increased use of classroom PA (Centeio, Erwin, & Castelli, 2014; Goudeau, Baker, & Garn, 2014; Howie, Newman-Norlund, & Pate, 2014; Naylor, Macdonald, Zebedee, Reed, & McKay, 2006; Stylianou, Kulinna, & Naiman, 2015). Centeio et al. (2014) concluded that "having a supportive administration gave teachers the efficacy and backing they needed to carry out implementation and provide more opportunities for students to be physically active" (p. 503).

Implications

Findings from this study have research and practical implications. From a research perspective, future efforts need to explore the utilization of PA in secondary science classrooms using larger, more diverse samples—including teachers who do not utilize classroom PA—to gain broader knowledge of the use of classroom PA. Additionally, it may be helpful for research to target specific grades and subjects. For instance, a teacher in this study was very confident implementing PA into a horticulture class, but lacked confidence with anatomy and physiology. Future research efforts could also include a PA measure (e.g., pedometer, accelerometer) to examine the relationship between teachers' perceptions of classroom PA and the amount of classroom PA students obtain.

Future research efforts may also aim to reduce barriers and/or assist teachers in overcoming barriers to implementing classroom PA. Based on this study, the interpersonal, organization, and policy levels of the social-ecological model may serve as good target areas for this. For instance, increasing support from colleagues (e.g., mentoring, collaborating), schools/districts (e.g., providing equipment, offering professional development opportunities), and policy makers (e.g., developing standards, providing resources for classroom PA) have been shown to increase implementation of classroom PA in elementary classrooms (Cothran et al., 2010; Webster et al., 2013). Similar strategies need to be tested in secondary classrooms so that their efficacy can be determined.

It is noteworthy that findings of this study largely align with research involving elementary school teachers (Dinkel, Lee, &

Schaffer, 2017; Evenson et al., 2009; Goh et al., 2013; Martin & Murtagh, 2015). Thus, it may that research findings from elementary classrooms can inform efforts and research in secondary classrooms.

One promising route forward is the integration of PE into classrooms. A review by Marttinen et al. (2017) suggests the utilization of PE teachers to integrate PA into the curriculum of other disciplines. Although most studies examined integration with mathematics, science classrooms might be ideal because of the overlap with PA and physiology (Marttinen et al., 2017). Further, O'Hara et al. (2011) suggest that wearable activity trackers allow students to be active, measure activity, and interact with the data outputs. It is important to note that the above studies included a combination of elementary and secondary school settings. Differences between elementary and secondary classrooms, such as longer class times, focus on individual disciplines, and teachers should consider overlap between content and PA responses (e.g., biology and cardiovascular response, physiology and cellular respiration) when beginning to integrate PA into classrooms. Future research may explore these factors in more depth.

As far as practical implications, these findings may be applicable to the future practices of teachers, administrators, and policy makers. A notable trend in teachers' responses involved willingness of teachers to learn more about classroom PA. Thus, classroom PA professional development workshops may improve classroom PA utilization in teachers. Participants in this study mentioned they would like to learn from other teachers, see classroom PA modeled, and hear success stories from other teachers, thus teacher-led workshops may be beneficial. Further, collaborative efforts with PE teachers could be another effective way of providing education within these parameters. From an administrative perspective, administrators can continue to make efforts to increase and/or clarify support of classroom PA such as communicating with teachers to emphasize the use of classroom PA and/or fostering discussions of classroom PA among teachers to increase their sense of social support. Per the findings relating teachers own wellness to increased classroom PA implementation, efforts that promote teacher PA participation are recommended (Dinkel, Schaffer, et al., 2017; Faulkner & Reeves, 2000).

All of the aforementioned factors are similar to recommendations provided by CSPAP (CDC, 2013). Considering most participants felt their schools were ready to increase classroom PA implementation, it may be beneficial for these schools to initiate the CSPAP training program. In the case of schools that are not as ready, SHAPE America (n.d.) offers a Physical Activity Leader professional development that develops and supports teachers who serve as PA champions within their school. This may allow teachers who use classroom PA to catalyze school-wide implementation. It is also essential that schools create and effectively communicate wellness policies related to classroom PA. Policy makers within the school, district, and state department of education could create wellness policies that include classroom PA, to increase teachers' perception of support from the policy level (Webster et al., 2013).

Limitations and Strengths

This study was not without limitations. The generalizability may be limited by the small sample size and use of a single data collection method. Future studies may include a larger sample and a multifaceted approach to data collection that might include direct observation of PA or document analysis. The use of snowball sampling in recruitment may have limited this study. Snowball sampling increased the efficiency of recruiting participants; however, it may have homogenized the sample as participants might have referred like-minded coworkers. To limit this, the researchers recruited teachers from various grade levels to increase diversity of the sample. Another limitation might have been responses that were influenced by participants' social desirability. It is possible that teachers provided their perceptions of a desirable response rather than an accurate response to appease the interviewer. To limit this, the researchers encouraged teachers to respond genuinely and instructed interviewers to remain as unbiased as possible.

Most of the findings from this study are consistent with findings from similar studies. This study substantiates previous research and expands the knowledge base, particularly related to secondary students. For this study, alignment with previous research helps address methodological issues that might limit generalizability, such as a small sample size. Additionally, these findings support research that was conducted within specific populations (i.e., Native American, Indigenous populations). This adds weight and relevance to the present findings that expand beyond what was previously known. In terms of previous research, the consistency found with these findings increases the validity of previous findings of studies conducted in different populations.

Conclusions

The findings from this study increase understanding of secondary science teachers' use of classroom PA. Although teachers identified several barriers to implementing classroom PA, it appears that teachers use classroom PA when they understand the benefits of classroom PA, are confident in implementing classroom PA, participate in PA themselves, and feel their administration supports classroom PA. In contrast, teachers may limit use of classroom PA when they feel unsupported by colleagues in their use of classroom PA, have large classes/limited space, and lack awareness on policies related to classroom PA. Future efforts may consider these factors when aiming to improve secondary teachers' use of classroom PA.

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PHYSICAL ACTIVITY

Active Families at Home: The Development of a Let's Wiggle With 5-2-1-0 App

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Abstract

Parents play a pivotal role in increasing children's physical activity levels and reducing time spent in sedentary activities. Positive role modeling of physical activity behaviors influences the amount of screen time use and engagement in at-home physical activity. This study aimed to determine the effectiveness and perceived usability of a physical activity app designed for children aged 3 to 5. Parents/guardians of preschool-age children were interviewed on the desired content of a physical activity app targeted at children. Following a review of the free physical activity app, participants were asked questions about the content, imagery, resources, and overall user friendliness. Parents suggested that the app be frequently updated with new videos and that more colorful icons that better represent the physical activity videos be added. In addition, they desired access to printable resources such as curriculum cards and coloring pages. Participants identified that the app was easy to follow and they would recommend the app to a friend. The majority of recommendations included improving the presentation of the app so that it looks more appealing and needing the app to be more preschool-age friendly. For the app to remain a resource for physical activity and not a source for sedentary activity, recommendations for more interactive games on the app were not included in the final version.

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Preventing childhood obesity is an important component for addressing the larger scale obesity epidemic (Pandita et al., 2016). Over the past 3 decades, childhood overweight and childhood obesity has tripled in the United States (Fryar, Carroll, & Ogden, 2014). Despite decreases in obesity among children aged 2 to 5, prevalence among preschool-age children remains high (Ogden et al., 2016). Children who are overweight and obese are developing health problems, such as diabetes and heart disease, previously only seen in adults (Pandita et al., 2016). Physical activity participation can help prevent these chronic disease associated with overweight and obesity. Preschool-age children who are active have less adiposity, improved motor skills, better psychosocial health (Timmons et al., 2012), and higher cognitive development (Carson, Rahman, & Wiebe, 2017). Despite these benefits, most children between 2 and 5 years old do not meet physical activity guidelines of 15 min of activity per hour (Pate et al., 2015).

Parents are important resources for demonstrating physical activity and for setting rules about how much access their children have to screen time (Spurrier, Magarey, Golley, Curnow, & Sawyer, 2008; Zecevic, Tremblay, Lovsin, & Michel, 2010). In addition, parental physical activity levels and availability of media in the home are predictors of sedentary time and physical activity in preschool-age children (Cislak, Safron, Pratt, Gaspar, & Luszczynska, 2012; O'Dwyer, Fairclough, Knowles, & Stratton, 2012; Pugliese & Tinsley, 2007; Zecevic et al., 2010). Children spend a significant amount of time in home environments, and parental role modeling of physical activity and parental control is associated with children demonstrating high-energy expenditure (Woon et al., 2014) and reduction in screen time use (Loprinzi, Cardinal, Kane, Lee, & Beets, 2014), respectively. Thus, childhood obesity prevention strategies that reach and educate parents on how to be active role models are paramount.

The World Health Organization (2012) recommends community-based interventions for population-based childhood obesity prevention strategies. Community-based obesity prevention programs already target increasing physical activity and reducing screen time use. One of which, Let's Go! 5-2-1-0, was developed by a health department in Maine to promote healthy messages in four key areas: "eat five or more fruits and vegetables each day"; "limit daily recreational screen time to two hours or less"; "engage in one or more hours of physical activity per day"; and "consume zero sugary drinks, drink water or low fat milk" (Rogers et al., 2013). Therefore, identifying ways to effectively educate parents about obesity prevention messages and strategies is important.

Previous research suggests that successful parent education strategies include providing weekly newsletters with incentives (De Lepeleere, De Smet, Verloigne, Cardon, & De Bourdeaudhuij, 2103; Fitzgibbon et al., 2006), providing alternatives to screen time sedentary behavior (De Lepeleere et al., 2013), and allowing children to choose activities (Davis et al., 1999; De Lepeleere et al., 2013; Jones, Price, Okely, & Lockyer, 2009). In addition, parents need inexpensive suggestions and fun programs that are easy to implement with their children in their home (Dwyer, Needham, Simpson, & Heeney, 2008).

For an inexpensive resource for physical activity information to be provided, an app was developed for parents/guardians to promote the 5-2-1-0 message and encourage at-home engagement in nonsedentary activities. This study determined the effectiveness of a physical activity app for parents of preschool children aged 3 to 5 to use in home-based settings.

Method

App Development

The research team met with app developers to determine the overall needs for the app. Storyboards for 20 video vignettes were developed by the research team in accordance with physical activity curriculum cards for *Let's Wiggle With 5-2-1-0* message that had been developed for childcare centers in a previous study (Vinci, Whitt-Glover, Wirth, Kraus, & Venezia, 2016). Each activity includes an instructional component provided by a charismatic adult wearing 5-2-1-0 attire followed by pre-k children demonstrating the physical activities. The backdrop for the filming also carried the 5-2-1-0 message, and the three children included in the videos wore 5-2-1-0 t-shirts. Parental consent was obtained prior to their participation in the videos. The 20 videos were filmed in a 3-hr period with appropriate break time for the child participants. Following the completion of the videos, the research team met with the app developers to make recommendations about sound and animation additions to each video. Six videos were created for the initial app development.

Design and Sample

To assess the quality of a physical activity app, the research team used a 12-item demographic questionnaire and a 12-item semistructured interview (see Table 1) to ask questions about the app content. The interview questions were open ended and included seven questions specific to the parent and child user-friendliness. In addition, five questions were asked about the content of the physical activity video vignettes. Prior to the study, the demographic questionnaire and interview questions were approved by the institutional review board. Demographic items included age, gender, marital status, education, race/ethnicity, employment, number of children living at home, and adult/child screen time/physical activity hours.

Table 1
Interview Questions for Parents About the App Presentation and App Videos

App Feedback Questions
1. Would your children be able to use the app without you?
2. How easy is it to use?
3. Would you recommend this app to a friend?
4. If you could change one thing about this app, what would it be?
5. What do you like best about the app?
6. What do you like least about the app?
7. How can we improve our app?
Video Feedback Questions
8. Do the videos provide clear instruction?
9. Would your child be able to follow along with the activities?
10. PROBE: Are the activities too long? Too short?
11. Would your child participate in these activities along with the video?
12. PROBE: Would they simply watch the video?
13. Do you feel you could participate in these activities with your children?
14. Is there anything else you can think of that would help us improve the quality of our app?

A study recruitment flyer was developed and distributed to childcare center directors who had established relationships with the research team. Parents/guardians who responded to the flyer were identified by center directors and were then contacted by a member of the research team. In addition, some participants directly contacted the research team to set up an interview. Participants were also recruited from a home-school physical education program at the research institution conducting the study. The interviews were conducted at a time and place most convenient for the subject. These interviews took place from July to September 2016 and were conducted until the research team achieved data saturation.

Following consent, participants were asked to complete the 12-item demographic questionnaire and were allowed to access the Let's Wiggle With 5-2-1-0 app for 10 min prior to the semistructured interview, with instructions to click on the pages and videos. Following the 10-min period, an approximately 20-min interview was conducted and participants were given a $10 Walmart gift card for their time.

Statistical Analysis

The interviews were audiotaped using two Olympus digital voice recorders (WS-400S) that were placed between the participant and research team. In addition, field notes were recorded by two members of the research team. The audiotapes were uploaded to the computer and transcribed using Express Scribe Professional NCH software. The audiotapes were used as a supplement to the answers provided in the field notes.

The transcription data were analyzed through a conventional content analysis of coding categories directly from the transcripts (Hsieh & Shannon, 2005). A primary coder and a secondary coder coded the interview transcripts. Coders first read through the transcripts to analyze the transcript as a whole. Data were coded through first cycle (single word) and second cycle (longer sentences) coding processes (Saldana, 2009). The primary and secondary coder met to discuss key coding terms and combine codes or eliminate redundant codes. They then used the codes to identify emerging themes (Morse & Field, 1995).

Results

Demographics

Eight parents participated in the pilot study. All participants were female and were married. Seven were aged 30 to 39 years old, and one participant was 40 to 49 years old. Six participants were Caucasian/White and two were Asian American/Pacific Islander. Five identified as stay-at-home parents, and three were employed full time. Seven reported watching 3 hr or less of screen time each day and six identified being active at least 4 days/week.

Themes

Following thematic analysis, eight themes emerged that were agreed upon by the primary and secondary coder. Themes were specific to the app overall, the videos vignettes included on the app, and suggestions for improvement. Verbatim quotes were pulled that best support the identified themes and are included in the text.

App is easy to use. The majority of participants indicated that the app was easy to use and that their children would be able to use the app with minimal assistance.

> It wasn't overwhelming to use with all these features and all these aspects. It was click on the little activity card and it went straight there. Very basic, which for me was a benefit because it got right to what I needed it to get to.

They identified the video icons being easy to navigate and something that the children watch again and again on their own. "You have it set up where they just have to tap the icon for the one [video] that they want." Participants noted that some of the educational materials targeted to adults would be beyond a 3- to 5-year-olds reading level. "They could use the videos without me, but I mean, my five year old isn't quite at this reading level. So this would be something that I would have to assist her with."

Improvements needed to overall presentation and videos. The majority of changes that were recommended involved overall formatting of the app. The curriculum provided for parents led to suggestions for icons on the main screen for children content and adult content. "The links that take you to stuff that's more geared toward parents should be somewhere separate than what the kids are getting access to." In addition, participants made suggestions with regard to the videos, including increasing the length and improving the video presentation. One participants said, "The videos themselves could be slightly longer." Another noted,

> I think I would have liked to see her face [instructor on video] a little bit more, like when you had them on the floor with the beach scene. Like pan into their faces when she is asking them questions.

One participant expressed concern about the filming format of the video. The videos were filmed with the children moving toward the camera so that a face-to-face demonstration could be provided; however, it was suggested that moving across the screen might deter children from moving toward the screen.

> I think on the video where the kids are doing the jumping they move toward the camera so you can't see their movement. They should be moving across the video from left to right instead of toward the viewer. So if they are jumping like a bunny you can't really see that. Because they move close to you so all you see are their arms in bunny position, but you can't see their feet. So it's hard to mimic a movement that you can't visualize. And it will also make the kid jump toward the screen which you probably don't want. You want them to jump across the room.

Enjoyed children, activities, and instructor in video. Overall, participants highlighted the choice of the instructor and children who were used for the videos. "I think the colors are great and the little kids that you guys got are adorable. And they are different ages and sizes which is kind of nice to see." "I like that there's a girl in there [the video] too." "The kids are really cute." There were multiple comments pertaining to the effectiveness of the video instructor's teaching skills and enthusiasm. "The instructor was very interesting, and exciting, and engaging." "I like the energy of the girl. She's very engaging to kids that age." "The person speaking does a really good job of being interactive and entertaining." Participants also valued incorporation of activities that tie to learning. "I like the activities that she gives to combine exercise with learning." "I think [the videos are] really attractive to kids." "I liked the videos very much. I thought they were endearing."

Provide printables. Several of the participants indicated that they wanted to use the activities outside of the electronic presentation and felt they would have greater opportunities to use them if they could print them. "Being able to easily print the activity cards would be great." "Printables are always great, they're always a benefit and they are always a big reason why we will continue to use a different app. If we continue the activity outside of it just being electronics."

Adult encouragement needed to ensure video participation. Participants felt that while children could and would participate with the videos, parents/guardians needed to be involved with the app rather than simply having the children use the app by themselves. "They wouldn't do it [participate] by themselves." The participants discussed that activity could differ from child to child and felt if the parent/guardian encouraged physical activity with the app that would ensure the children would move along with the videos. "I think that a parent involvement would definitely need to happen." However, a few parents indicated that the children would eventually engage in the physical activities being presented. "Maybe not at first because he would be watching it to see what happened, but then he would, especially the jumping one." "I think they would watch it [first], then they would do it."

More videos, push notifications, and challenges. Several comments centered on ensuring the app would be used by children and suggested motivational components such as challenges and rewards.

> Maybe you could do a challenge, just off the top of my head. "Can you do five?" "Can you jump like a frog 10 times?" "Oh that's great." Something very coachy, you know those exercises coaches: "Can you do one more?"

All participants agreed the app needed to be updated frequently to be kept fresh. "Adding, like you know, every three weeks adding a video or a new activity card so it keeps the app new and refreshed and encourages people to come back to get more ideas for activities."

Increase the visibility of the 5-2-1-0 message. Several participants wanted more information on the 5-2-1-0 message. Specifically, they wanted to know about the breakdown of each of the daily recommendations. "Is that like 5 fruits and vegetables a day and zero soda? I was trying to figure that out. Is that explained somewhere on there?" Suggestions were also made about providing information about the organization providing the app. "I think there could be more to the 'about us' screen."

Add interactive games. A few parents suggested adding more interactive components to the app such as video games that could continue to hold the child's attention. "Something interactive that they could play on there would probably be good."

Discussion

In accordance with the identified themes, the research team met with app developers to make changes to the app based on the parent feedback in three key areas: video/activity cards, app presentation, and 5-2-1-0 information.

Video/Activity Card Availability

With respect to the suggestion of keeping the app fresh, the video allotment was limited to five videos with the corresponding activity cards. Ten activity cards were included with projections to add two additional videos and 10 additional cards every few weeks within the app updates. A Flickr account was created for activity cards to be accessed and printed. In addition, 5-2-1-0 color printables were developed and added to the Flickr account.

App Presentation

The icons on the main page of the app were changed to be more eye appealing, and the video icon was changed so that it included children playing, which increased the likelihood that children would click on the icon. The video icons were changed from colorful boxes to pictures that represented the activity, such as a rocket ship icon for the activity Blast Off (see Figure 1).

Original Revised

Figure 1. Original and revised formats for the video icons.

5-2-1-0 Information

Information regarding the 5-2-1-0 campaign was added with an informational poster that describes the program and the mission statement of the program. An icon for upcoming events was added so that information about local physical activity training opportunities in the community can be provided. A "Wiggle Media" icon was added to link the app to Flickr, Facebook, Twitter, Instagram, and the Let's Wiggle With 5-2-1-0 website.

Conclusions, Limitations, and Future Research

The results from the interviews were overwhelmingly in favor of the app and participants positively reacted to the app. The app was reported to be easy to follow and appealing. All participants felt that they would recommend the app to a friend, would participate in the videos with their children, and would use the app as an educational tool for ideas. The majority of recommendations focused on the presentation of the app, the visual appeal of the icons, and making changes that make the app easier for young children to navigate. Participants were mixed on the duration length of the videos, but all found the instructor on the videos to be highly captivating and engaging.

A major takeaway from the interviews for the research team was the app being used by parents as a resource for ideas. The initial goal was to create an app that allows children to participate along with a video with limited assistance. After the app was created and pilot tested, it became clear to the research team that the app would best be utilized as an educational tool for parents to promote home-based physical activity with their children.

This study had several limitations. Recruitment of this population was difficult given limited time available to meet with the research team. In addition, the majority of participants were stay-at-home parents and were highly active, and the sample was not diverse. Finally, the app development software purchased restricted the research team on formatting, video delivery, and updateability of the app.

Moving forward, additional videos and activity cards will be added. Push notifications will be sent out each week, which will encourage users to check in with the app, check for updates, and remain active. An informational card that promotes the app will be developed and distributed to childcare centers and parent community events. Future research is needed on the the effectiveness of the app on influencing parent and child physical activity engagement.

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PHYSICAL ACTIVITY

Infusing Physical Activity Leadership Training in PETE Programs Through University–School Partnerships: Principals' and Graduate Students' Experiences

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Abstract

With the emerging trend of physical education teacher education (PETE) programs incorporating Comprehensive School Physical Activity Program (CSPAP) training to prepare preservice teachers and future teacher educators to be competent Physical Activity Leaders (PAL), little is known about the feasibility of such programs. Therefore, this study examined graduate students' (future teacher educators) and principals' experiences implementing CSPAPs through a university–school partnership model. Six graduate students served as PALs in elementary schools. Focus group discussions at 6 months and interviews at 1 year were conducted with the PALs, while 4 principals participated in individual interviews at the end of Year 1. The audio-recorded data were transcribed verbatim and analyzed inductively. Both PALs and principals experienced challenges in implementing

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other components of CSPAPs beyond physical education mainly due to time constraints. Collaboration and rapport building with school staff would aid in the implementation of CSPAPs. Continual feedback and supervision could improve the graduate students' skills in performing their roles as PALs in schools. As PETE programs across the United States are finding ways to prepare students to be competent PALs, this study provides valuable information for challenges and future considerations for CSPAP infusion in PETE programs.

Many children do not meet physical activity (PA) guidelines. To increase the number of children who meet these guidelines, the Society of Health and Physical Educators (SHAPE America, 2015) and the Centers for Disease Control and Prevention (2013) recommend a Comprehensive School Physical Activity Program (CSPAP), which includes five components: physical education (PE), PA during the school day, PA before/after school, staff involvement, and family engagement (Erwin, Beighle, Carson, & Castelli, 2013). PE teachers are often called upon to serve as Physical Activity Leaders (PAL) to champion CSPAPs and grow the support base needed for diffusing and maximizing PA promotion efforts (Carson, Castelli, Beighle, & Erwin, 2014). Because of the changing roles of PE teachers as PALs, professional development workshops that equip PE teachers (as well as other school professionals) with the knowledge and skills necessary to implement CSPAPs are provided (Carson et al., 2014). Karp, Scruggs, Brown, and Kelder (2014) suggest that physical education teacher education (PETE) programs are in an important position to educate undergraduate and graduate preservice PE teachers in coordinator and leaderships skills related to the implementation of CSPAPs in schools. PETE faculty across the United States are beginning to reimage and restructure undergraduate and graduate programs through social marketing, advocacy training, and theory-based program planning to assist teachers to develop skills to implement CSPAPs (Castelli, Carson, & Kulinna, 2017). In view of changing trends in PETE programs, Brusseau (2017) advocates for doctoral programs to also include CSPAP training through in-class learning and out-of-class practical experiences (i.e., CSPAP implementation and/or research experiences) to enhance graduate students' knowledge in supporting the implementation of CSPAPs in PETE programs in the future. Yet, with this emerging trend of

PETE programs infusing CSPAPs into teacher and teacher educator training, little is known about the feasibility or effectiveness of different strategies PETE programs use to prepare future PALs (Karp et al., 2014).

Conceptual Framework

As an extension to the CSPAP conceptual framework, Webster, Beets, Weaver, Vazou, and Russ (2015) propose the use of a conceptual model for achieving effective and sustainable CSPAPs. The model focuses on internal–external partnerships via three strategies: community-based participatory research (CBPR), communities of practice (CoP), and service-learning (SL). Depicted with a moving wheel to signify program continuance, the framework denotes an external support system made up of university faculty, professional networks, and/or service providers who support an internal support system made up of PE teachers, classroom teachers, and/or school administrators in implementing sustainable CSPAPs. The wheel also includes three spokes that represent CBPR, CoP, and SL, which bridge the external and internal resources, helping them overcome barriers to implementing CSPAPs. CBPR relies on internal and external partners (i.e., school professionals and university researchers, respectively) working collaboratively to identify specific PA needs, design and implement PA programs, measure program outcomes, and set realistic goals for program improvement/maintenance. CoPs can involve face-to-face or Web-based learning tools that increase the networking capacity of school professionals and increase the availability of ideas and resources related to CSPAP implementation. Finally, SL relies on the external support system to implement CSPAP in schools. For example, preservice PE and classroom teachers can organize, lead, and/or support before, during, and after school PA opportunities (Webster et al., 2015).

Despite the potential benefits of this internal–external partnership approach to CSPAP implementation, little research has investigated the feasibility, effectiveness, or sustainability of efforts that align with such an approach. Most studies have focused on the use of an internal approach of schools leveraging internal resources to implement CSPAPs. Doolittle and Rukavina (2014) examined an urban school's implementation of a CSPAP and found that administrators felt the primary purposes of the program were to enhance students' well-being and school achievement, and to foster a positive school community, rather than to increase wellness and fitness. In another study, Centeio, Erwin, and Castelli (2014) reported that PE teachers trained as PALs used resources to implement CSPAPs differently depending on school context, and administrative support was important to program success. Other research indicated that principals had positive perceptions regarding school-based PA programs and felt such programs benefit students physically, mentally, and academically (Parks, Solmon, & Lee, 2007).

In tandem with Webster et al.'s (2015) conceptual model and the increasing focus on the role of PETE programs in preparing future educators for CSPAPs, the present study investigated an initiative in which graduate assistants from a university PETE program provided external support to local schools with the aim of implementing CSPAPs. As CSPAP preparation takes hold within PETE programs, research needs to examine the extent to which university support can become a viable strategy to leverage CSPAP implementation efforts. In particular, the perspectives and experiences of key individuals within the internal and external support systems, who partner to increase CSPAP implementation capacity, must be considered for the merits and challenges of such partnerships to be better understood. This study qualitatively examined the experiences of PETE graduate students and school principals in the first year of participation in a partnership implementing CSPAPs.

Method

Participants and Setting

A university in a Southwestern city in the U.S. collaborated with a school district to implement CSPAPs in six elementary schools for 3 years. Five of the six schools are Title 1 (i.e., low-income) public schools where the majority of the students qualify for free or reduced lunch. Six graduate students (four females and two males, ages 28 to 31; one master's student and five doctoral students) from the university were contracted (30 hr/week) as PALs at each of the six schools. Five of the six graduate students' responsibilities included implementing PE because five schools did not have PE teachers. All graduate students were also responsible for implementing other components of a CSPAP. Four principals (all female) who collaborated with the university to implement the CSPAPs also participated in the study. They had 4 to 9 years of experience working as principals in elementary schools. We examined PALs' and principals' experiences of participating in the initiative. This study adds to the literature by examining principals' experiences of participation in a collaborated CSPAP project with a university.

Professional Learning

A 2-hr professional learning workshop was provided for the PALs prior to the start of their contract in the schools. The PALs who were responsible for teaching PE had prior experience working as PE teachers in schools. Therefore, the focus of the professional learning was to equip the PALs to implement other CSPAP components. The research team, who had experience in PA programming in schools, conducted the workshop. They provided information about the health benefits of and the rationale for PA, followed by hands-on experiences conducting and participating in selected PA activities. Resources were provided for the PALs to implement PA programs, such as classroom and recess activities during the school day. The group brainstormed ideas to implement staff involvement, and family and community engagement programs in the schools. Throughout the yearlong contract, the PALs also communicated among themselves about PA opportunities that could be feasibly implemented in the schools. For program fidelity, the PALs reported and provided feedback to the research team periodically on the progress of CSPAP implementation in their respective schools.

Data Collection and Study Procedures

The school district and principals gave approval for the research team to conduct the research. Informed consent forms with the PALs and principals were obtained in accordance with the university institutional review board. Data collection methods included (a) focus group discussion and semistructured interviews with the PALs and (b) semistructured interviews with the principals.

The PALs participated in a focus group discussion at 6 months into their contract. A follow-up individual semistructured interview was conducted with them at 1 year of the program implementation. Four female principals who collaborated with the university to implement CSPAP also participated in an individual semistructured interview at the end of Year 1. The focus group discussion lasted approximately 1 hr, while each interview lasted approximately 30 min. The focus group discussion and interviews used a semistructured format with open-ended questions to facilitate follow-up questions to any of the open responses that were relevant to the study (Fontana & Frey, 2005). Main questions included "How did the implementation of the program go?" and "How easy was it to implement the CSPAP?" These were followed by probe questions (e.g., "What difficulties did you encounter in implementing the CSPAP?") to elicit rich response from the participants.

Data Analysis and Trustworthiness

The audio-recorded data were transcribed verbatim after completion of the focus group discussion and interviews. The transcripts were inductively analyzed for emergent themes (Kvale, 1996). The first author carried out initial data analysis through open-coding methodology, followed by focused coding to establish frequent or significant initial codes, and then built categories around these codes (Emerson, Fretz, & Shaw, 2011). Through these codes, themes that were pertinent to the study were generated. During open coding, the first author carefully read and reread the data and noted words or phrases that identify specific analytic dimensions and categories in the transcripts. Examples of open codes from the transcripts were "scheduling is a difficulty," "build rapport," and "time teaching PE." During focused coding, the authors identified the most frequent and significant codes and built categories around them. Following which, they selected core themes by categorizing the codes. Priority was given to themes for which a substantial amount of codes had been identified or what seems significant to the participants (Emerson et al., 2011). After a set of core themes were identified, the transcripts were sorted on the basis of these themes and subthemes were generated.

Trustworthiness and credibility were established through peer debriefing and triangulation (Marshall & Rossman, 2011). Credibility of analysis was enhanced through peer debriefing of the generated themes to reach an agreement on the themes. Furthermore, the research team discussed the study protocols prior to the start of the project to facilitate peer debriefing. Data were collected from multiple sources (i.e., focus group discussion and interviews with PALs and principals) as a way of enhancing triangulation. Data were also analyzed through comparison of the results of this study with those of previous literature.

Results

Results of the study generated several themes. This section describes these themes and supports them with quotations gathered from the transcribed interviews and focus group discussions. We organized the themes as principals' and PALs' experiences to richly highlight the perspectives of each group. To maintain participants' anonymity, we used pseudonyms.

Principals' Experiences

Benefits of program. The principals consistently mentioned that having the PALs teach PE positively affected students' engagement in PA, compared with having paraprofessionals teach PE. For instance, Doreen said,

> What a difference it makes to be able to have a certified teacher instructing PE . . . meaning no disrespect to anybody else, but having a mum off the street come in and try to teach PE is a joke. It's awful. For someone who tends not to have classroom management and teaching PE.

Dorothy agreed,

> She [PAL] is so great and so dedicated and has taken this program to places that it's never been, because we were able to have a program that was not skills based and she was able to teach kids skills and rules and make their activity so much fun and meaningful.

She continued,

> When I first arrive, we hired a lady who was just a college student and she didn't really know anything about teaching PE, we just kind of tried to send her to trainings to help her. The second lady is a mum who just stepped in to finish it because the first lady left in the middle of the year. But, neither one had much training in how to do anything.

Furthermore, the principals commented that children focused and behaved better when they participated in PA. Doreen commented, "The kids are really truly well behaved. They come out of that PE class, dripping in sweat, just dripping, but smiling and happy and they got good PE. And that is kind of unheard of."

Constraints. Scheduling of the PALs' time in the schools was challenging. The principals unanimously agreed that it was challenging for PALs to conduct other components of CSPAP (i.e., leading classroom and structured recess activities), because of time conflicts with the PE schedule. Jean commented, "Scheduling is a difficulty because I think most of the schools had only actually 20 hours of what we have to schedule with. So, you can't do things effectively because of time." Dorothy added,

> We had hoped to be able to schedule [PAL] to be able to go into classrooms and help teachers with the PA and that just didn't happen. She was really great at telling the teachers different things but we didn't get her in the classroom doing them.

Furthermore, because of the limited contracted hours, PALs were not able to effectively implement the staff involvement and family/community engagement components of a CSPAP. Doreen described,

> When you only have 30 hours, you know, the doctoral students have other things to do, too, they can't live in school for goodness sake, so there needs to be reality in there, too. So, the community outreach didn't really happen.

Dorothy concurred,

> I think it's hard for college students to come here and make a very meager amount of money and, you know, work basically, 30 hours a week between the 20 here and 10 for the university, and survive. That's hard in this economy. So, we need to figure a way to make it so that it's beneficial for the students, so that the student doesn't get so financially strapped, cause it's hard enough to be in college.

Finally, Jenny mentioned that university and school schedules did not align: "One other problem is we're year-round. So, like right now,

[PAL] was done end of May (like traditional), so all through June, we have to have a substitute in there."

Suggestions for improvements. Suggestions provided by the principals for successful CSPAP implementation included strengthening communication between the university and the schools, having PALs build rapport with other teachers, and having other university personnel (e.g., other graduate students or student teachers) help with the implementation. For instance, Doreen said,

> I think there needs to be a lot clarification between our district and the university. As far as expectations, and what we can expect, and what it should look like, that's going to be improved. But, that's all work in progress . . . but they need to improve their communication.

Dorothy added, "We just need to sit down with the university before school starts, the specialist with our principals, and talk about what the expectations are and what we need to have to make it successful." In regard to building rapport with other teachers, Doreen also mentioned,

> It kind of takes time to develop rapport with teachers. They are not going to let you come in and really, they are not going to invite you in because they've got things to do. But, she [PAL] managed to build enough of a relationship with a couple of teachers that she would go in and teach little brain breaks with 2nd grades.

Jean, who already had a PE teacher in her school, suggested that collaboration with other staff would improve the CSPAP implementation:

> I got them [PE teacher and PAL] together earlier on and told them to work together. I hoped that they would collaborate, that when we have some spare time, the university person would go into the PE classes and help her with ideas and organization and tell her the things he would like the kids to learn to be able to play at the playground.

Jenny discussed also getting support from other university students. She said, "Also, the university, you know, they should be able to get more student teachers in PE helping and maybe more graduate students that just need a few hours that could come and help do some training and work in classes."

PALs' Experiences

Conflicting roles. The PALs consistently mentioned that they saw themselves primarily as PE teachers, rather than as PALs in their schools, because they spent most of their time teaching PE. Conflicting PE schedules with other PA opportunities, such as recess and classroom instruction times, made it challenging for the PALs to be physically present to promote PA at school beyond PE. Jasmine mentioned, "I think it depends on how many hours you teach PE, that if that's all you're doing then you can't be outside doing recess and you can't be doing before and after-school activities" (focus group). Another challenge was that the PALs were also graduate students who had to take classes in the evening. Maureen shared her experience:

> We have classes after school but they don't give us enough time. We have to drive so far and in bad weather. It's extremely tough and so then we don't have time to do an after-school activity and then make it back to class or the university" (focus group).

Support from stakeholders. Initially, it was not easy garnering support for implementing the CSPAPs from school staff. Dawn described her experience, speaking to the classroom teachers:

> I have several that, after I talked about stuff I'm doing, not several but at least two, that hardly even talked to me, [would] completely avoid me because they don't want anything to do with adding something else to their classroom. (focus group)

She continued,

> I've talked to the recess aides. I've told them some of the stuff that we're going to do. I tell them about the games that I teach the kids because I teach them recess games so that they can go out and do these different recess games and I've talked to them several times and they don't want anything to do with new stuff . . . I don't have the support at my school. (focus group)

Alice shared her similar experience:

> Initially, there was a little bit of resistance, at least in my experience at [the school]. There was a little bit of resistance from the administration and from the teachers to have someone come in and implement a whole bunch of those things all at once. (interview)

The PALs unanimously agreed that support from the administration is the key to successful implementation of a CSPAP. For instance, Dawn commented,

> I think you definitely have to have your administration on board to encourage the teachers and staff to do it as well, because just having [the PAL] come in and say, 'This is what we should do and this is how we are going to do it' – they're already overwhelmed with everything else they have to do. Then, unless they have administration and that kind of support, that's not going to work very well. (focus group)

Support for Kevin came from clear expectations provided from his administration: "The principal sometimes talked with me about the goals of the recess activities in the school. She really hoped that all the activities will be organized and the children will have fun and play together" (interview). During the follow-up interview, Dawn shared her experience of promoting her program through supportive teachers:

> There's at least two that would help me talk, one that's very motivated . . . She's very involved and active too. She's been trying out a lot more in her class. And she's very willing to be vocal about how much it's helped.

Alice commented that student support is also important for the success of the program:

> The students are the biggest thing that, early on, many of the students were still learning who I am as a teacher and stuff. As time goes on, they start to make more comments about wanting to wear the pedometers or wanting to know how

> many more push-ups they need to do now, or wanting to come in after school and play a game or whatever. (interview)

Building rapport and collaboration with the community. The PALs felt that it was important to build rapport with all the staff at the beginning, as they were new to the job. Dawn said,

> It's just getting to know people. Like you can't really go in and just say, 'Hey, you need to do this,' without knowing the people, because they don't trust you. They don't know what you're there for. The first year, the first few months was just, 'Who are these people and how would they feel and what are they willing to do? How can I show them that this is a good thing that is important for the kids.' It's really slow. I think, so far, for me, it's just been about trying to develop relationships in order to have them want to do this. (focus group)

Kevin concurred,

> Try to get the teachers and the faculties on board as quickly as you can just because if you have the faculty and the teachers on board, you don't feel like you're doing this on your own, that you'll have a larger support foundation to influence the kids. (interview)

The PALs felt that they could not implement CSPAP all by themselves. Dawn commented,

> You can't just go in and make it happen because you need the teachers, you need the recess aides, you need the before and after-school program, you need the community, you need PTA. There's so many aspects of it, you need so many people on board.

The PALs shared some successful experiences collaborating with the school community. For instance, Dawn described her experience collaborating with the Parent Teacher Association (PTA): "I've teamed up with the PTA, anytime the PTA does something. They did a family fiesta night and I taught the kids a dance and we did it with their parents at the fiesta" (focus group). Jasmine also described her experience using a school event to reach out to the staff:

> They had nurses come in [the Wellness Fair] that take your blood pressure and stuff like that and then we did a 'Take Ten' [classroom PA] training. They had a nutritionist come in and show recipes and stuff like that. Then the teachers could choose to come. They have like drawings for prizes if the teachers came. (focus group)

Dawn shared: "I'm talking with the Wellness director at the school and we're going to try and do something different for all of the staff starting in January" (focus group). During her follow-up interview, Dawn felt more successful at collaborating with the community to implement programs for the staff: "I was able to do more with the staff this time around. We did a healthy fitness challenge with the staff and I was able to hand out five discounted gym memberships from Anytime Fitness."

Professional development. The PALs felt that continual training and mentoring would help them in their roles as PALs more effectively. Alice mentioned,

> In the first semester that we went out to this school was probably the semester that we needed the most guidance. What I found was that in order for teachers to continue to learn, that the mentoring has to be continuous. You can't teach a teacher something new and then expect them to go just implement it, but they have to be observed and the feedback given, those sort of things. (interview)

The PALs also felt that continual support and feedback from the university is needed, as Alice continued, "In order for this CSPAP program to be really successful, there needs to be support coming from the university. I mean that people from university need to come out and see what's happening and give feedback" (interview). Kevin also commented that training had to be specific toward their roles in implementing a CSPAP:

> With the district training, when I met with all the other PE teachers and met with the team, I didn't think that was very useful personally. The reason I didn't like the training was just because one, we were just kind of going over a few PE games. It's like what games are acceptable, what games are

> not acceptable . . . and all of that is kind of like, for me, a no-brainer. (interview)

Nonetheless, forming a community of practice among the PALs helped them learn new ideas to implement in the program, as Jasmine mentioned, "We'll share with each other what we are doing" (focus group). She reiterated during her follow-up interview, "I think that just working with the other graduate students, using their ideas would help."

Discussion

This study qualitatively examined the experiences of PETE graduate assistants, contracted as PALs, and school principals in implementing CSPAPs. The CSPAP implementation approach examined in this study drew upon Webster et al.'s (2015) conceptual framework, which emphasizes the need for bridging resources within the internal (school-based) and external (e.g., university-based) support systems for increased program implementation capacity. This study broadens our understanding of the feasibility of one partnership approach consistent with Webster et al.'s model, wherein doctoral PETE preparation was centrally situated within an effort to provide external support to local elementary schools for CSPAP implementation.

In past research, principals were found to have limited understanding of the goals of PE and its curriculum (George & Curtner-Smith, 2017). However, the principals in the present study unanimously agreed that the elementary students benefited from PE lessons taught by the PALs, who were experienced PE teachers. They felt that the students were more engaged in PE and more physically active than before when individuals without PE certification taught PE. This finding supports the idea that the university can provide meaningful resources to increase the effectiveness of a CSPAP (Webster et al., 2015). Yet the PALs spent the majority of contracted time focusing on PE, and both PALs and principals felt that this placed constraints on implementing other CSPAP components. Future considerations could include having two PALs in one school to support each other and allocate time efficiently to successfully teach PE and implement other CSPAP components.

Another barrier experienced by the PALs in the study was the conflict between their roles as PALs in schools with their roles as graduate students at the university. Many of them returned to the university for late afternoon and evening classes after their work as PALs in the schools. As such, many PALs were unable to implement before and after school PA programs. PETE doctoral programs usually require extensive coursework for degree completion, and it may be unrealistic for such programs to remove certain requirements to increase the amount of time doctoral students spend in schools as PALs. Online doctoral programs could offer more flexibility as to when students can implement different CSPAP components. In such cases, students may already be employed as teachers at the school. Alternatively, PALs might be able to collaborate with after school staff and offer training for them to provide PA that students learn and enjoy in PE. After school staff might also collaborate with other school staff to lead PA clubs or intramural programs once or twice a week for an hour, which would require little time investment while providing multiple benefits for students (Beighle & Moore, 2012).

Both PALs and principals discussed the importance of building rapport with the school staff to collaborate on CSPAP projects and activities. Of the five components, the PALs responded to implementing family and community involvement PA programs as most challenging. The data indicate that one reason for this could be that the PALs were new to the school and were still building rapport with the staff. Strategies that could increase family and community involvement include (a) using technology to increase communication with family members through social media (i.e., Twitter, Facebook) to inform them of PA programs in the schools, (b) creating active events such as "homework" that promotes children and their family members to be active together, and (c) establishing partnerships and sharing expertise where PA and nutrition professionals (e.g., yoga instructor, dietician) provide enrichment classes to the parents and children (Cipriani, Richardson, & Roberts, 2012). Some PALs experienced success collaborating with the PTA and the Wellness director to implement CSPAP activities in this study. The PALs all agreed that support from stakeholders (i.e., administration, teachers, and students) is the key to the successful implementation of a CSPAP. Collaboration with school staff could increase their engagement in

PA, which has been found to positively affect youth PA in previous research (Dinkel, Huberty, Beets, & Tibbits, 2014).

In collaborating with the university, the principals suggested having earlier and more frequent communication with the university on the progress on the CSPAP project implementation by the PALs. Also, the PALs remarked on the importance of continual professional training that equips them to be competent PALs in the schools. Ongoing mentoring through initial professional learning and follow-up on implementation has been found to be effective in PA programs in elementary schools in other studies (Miller et al., 2016; Miller, Christensen, Eather, & Lubans, 2015). The graduate students suggested that frequent observations and constant feedback could help them improve on their roles as PALs. Perhaps a structured supervision system, such as that often used in student teaching internships, could be incorporated for supervising PALs. In student teaching, a triad model is commonly used, both a cooperating teacher at the school and a university supervisor assess and evaluate the student teacher (Metzler, 1990). Future studies can also consider including systematic supervision (i.e., structured observations and formalized feedback) of the PALs by principals in the schools and university supervisors. Furthermore, the PALs in this study indicated some success in sharing ideas with each other at the beginning of the implementation. In the university–school model proposed by Webster et al. (2015), a support system through face-to-face or Web-based learning tools can provide a platform for the PALs to continually and sustainably share ideas and resources for CSPAP implementation. Classroom teachers' confidence in implementing classroom PA in schools increased over time as they gained more experience in one study (Goh, Hannon, Webster, & Podlog, 2017). Through continuous mentoring and experience, the graduate students' confidence in implementing CSPAPs and serving as PALs might also increase over time.

Conclusions

As more PETE programs include professional developments to prepare preservice teachers to be competent PALs in schools in the future, it is important that training is given to future teacher educators who will have influence on their preservice teachers. This study examined the experiences of graduate students' (future teacher educators) and principals' experiences in implementing CSPAPs in elementary schools. Through interviews and focus group discussions, results revealed that it is challenging for the graduate students (who served as PALs in this study) to successfully implement other components of CSPAPs beyond teaching PE due to the constraints of time and lack of rapport with school staff from being new to the school. Seeking collaborations within schools (i.e., other teachers and parents) eventually helped in the implementation of CSPAPs in the second half of the year. Continual feedback and systematic supervision could also enhance their roles as they serve as PALs in schools.

This is one of the first studies to examine the feasibility of a university–school partnership approach to implementing CSPAPs. The perspectives of the graduate student PALs and the school principals shed light on important considerations for furture efforts aimed at harnessing school–university ties to build organizational capacity for CSPAP implementation and sustainability. This study demonstrates that graduate education in PETE offers a potential avenue for establishing and developing partnerships with schools to implement CSPAPs, but there are likely to be both successes and challenges involved with the early stages of program generation and delivery. The key issues identified in this study point to the need for university personnel (teacher educators and graduate students) to carefully consider relationship building with school professionals, role conflict (PAL vs. graduate student), and scheduling and resources to be able to implement more CSPAP components than just PE. Overall, the results of this study provide valuable information for PETE programs to incorporate PAL training to prepare future preservice teachers and future teacher educators.

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PHYSICAL ACTIVITY

Perceptions of Physical Activity Tracking Devices: A Survey Analysis

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Abstract

Most adults fail to meet recommended physical activity (PA) guidelines. PA tracking technologies may help increase activity because they facilitate self-monitoring and self-regulation. In response to recent calls for testing the effectiveness of these technologies, this study surveyed opinions of Fitbit users within a university setting. Participants ($N = 371$, $M_{age} = 31.3$, $SD = 14.4$) responded to an online survey that gauged perceived usefulness and adoption of Fitbit. Analyses revealed that 97.3% of the respondents used Fitbit to track PA, while others did it to track heart rate or to compete against others. The majority of respondents (80.9%) reported increased PA levels as a result of Fitbit use, and 63.5% reported Fitbit had a very positive impact on their health. Most respondents (88.1%) also reported they liked using Fitbit. With regard to continued use, a portion of respondents (67.7%) reported intentions for continued use to increase PA in the future. Respondents' reported satisfaction with Fitbit use was significantly associated with the perceived usefulness of Fitbit's mobile application, perceived impact of Fitbit on health, and intentions for future use ($p < .001$). Qualitative analysis revealed three major themes: (1) criticism related to use,

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(2) positive comments related to use, and (3) comments related to mobile application. Results suggest that novel advances, such as Fitbit, could hold unique potentials to improve PA behaviors.

Despite the well-known health benefits of physical activity, over half of the adults in the United States fail to meet the recommended 150 min/week of moderate- to vigorous-intensity physical activity (Bassuk & Manson, 2005; Centers for Disease Control and Prevention, 1996, 2008; Dunlop et al., 2015; Moreau et al., 2001; Owens, Matthews, Raikkonen, & Kuller, 2003; Pleis & Lucas, 2009; Troiano et al., 2008; Vagetti et al., 2014; Vallance et al., 2011). The most commonly cited barriers to physical activity include lack of time, lack of motivation, and perceived adverse effects associated with physical activity (Netz, Zeev, Arnon, & Tenenbaum, 2008). One public health priority is to develop and test the effectiveness of low-cost interventions targeted toward increasing physical activity levels (Wang et al., 2015). Over the years, interventions to increase physical activity have included approaches ranging from individual- to group-based, phone- and/or Web-based, and counseling to coaching modalities (Irwin et al., 2009; Jakicic, Marcus, Lang, & Janney, 2008; Pierce et al., 2007; Rock et al., 2010). Recently, there has been growing interest in wearable physical activity tracking devices that help individuals self-monitor and increase physical activity behaviors (Lee, Kim, & Welk, 2014; Patel, Asch, & Volpp, 2015; Wang et al., 2015).

Commercially available wearable physical activity tracking devices offer a practical tool for improved self-monitoring of physical activity (Wang et al., 2015). These trackers gather objective measures of physical activity levels, upload the collected physical activity data onto a personal website or mobile application account, and provide real-time and daily summary data for detailed feedback on users' physical activity performance. Additionally, they allow users to set goals and obtain real-time feedback on progress toward meeting these goals. From a behavioral standpoint, these products facilitate self-monitoring and self-regulation, which frequently assist health behavior change (Michie, Abraham, Whittington, McAteer, & Gupta, 2009; Michie et al., 2011).

Despite the growing popularity of these devices, researchers have noted that most mobile health applications draw too little from principles of behavioral economics and theories of health behavior

(Conroy, Yang, & Maher, 2014; Loewenstein, Asch, & Volpp, 2013). Therefore, the potential of these devices and their mobile applications to address the major challenge of long-term behavior change remains unknown. Furthermore, over half of individuals who purchase a wearable device discontinue its use, and one third of them do so within the first six months (Ledger & McCaffrey, 2014). For long-term behavior change, consumer research has emphasized that these technologies should meet the psychological principles of (a) habit formation to enhance wellness, (b) social motivation to connect in a community and goal sharing and competitions toward the achievement of these goals, and (c) goal reinforcement to lead to positive momentum for progress (Boyd & Ellison, 2007; Fogg, Cuellar, & Danielson, 2009; Ledger & McCaffrey, 2014; Lieberman, 2013; Seger & Spiering, 2011).

Consequently, researchers have noted a paucity of published literature on the usability of these devices and their potential to get users to increase their physical activity (Cadmus-Bertram, Marcus, Patterson, Parker, & Morey, 2015; Feehan, Clayton, Carruthers, & Li, 2014; Wang et al., 2015; Wanless et al., 2014). Researchers also contended that potential health benefits are contingent upon the design of interventions and engagement strategies rather than the technological features of the device (Patel et al., 2015). Ultimately, it was suggested that the monitoring of physical activity data does not always lead to behavior change. Hence, more research is needed so that we can better understand the effectiveness of these devices for true behavior change (Krebs & Duncan, 2015; Lazar, Koehler, Tanenbaum, & Nguyen, 2015; Wang et al., 2015).

Of interest to this study, Fitbit activity trackers make up the majority of physical activity trackers purchased by consumers (Agomuoh, 2014). Given the lack of data into users' opinions and attitudes on perceived usefulness and intentional adoption of these technologies (Ledger & McCaffrey, 2014; Shin, Cheon, & Jarrahi, 2015), this study surveyed the attitudes, beliefs, preferences, and physical activity levels of Fitbit users in a university setting in the United States.

Method

Study Design and Sample

A survey of 451 Fitbit users affiliated with a university in the Midwestern United States was conducted. Potential respondents were recruited via a university-wide recruitment e-mail, which requested Fitbit users complete the survey between July 2015 and August 2015. After clicking on a Qualtrics (Qualtrics Labs, Provo, UT) survey link, respondents were screened for the following eligibility criteria: aged 18 to 80 years and owned a Fitbit activity monitor. Individuals who met these criteria completed an online informed consent document. Respondents were provided all questions at once via two successive web pages. Respondents were permitted to review and change previous answers. As an incentive, respondents were entered into a random drawing for one $20 gift card to a major local retailer. The researchers' university institutional review board approved all study procedures.

Survey Items

The survey consisted of 15 items (Figure 1). All items were presented to each respondent in the same order. The survey took approximately 10 min for the participants to complete.

Data Processing and Analysis

Data analysis was completed with SPSS 21 (IBM Corp., Armonk, NY). It consisted of three groups of respondents: main group (every respondent), physical activity subgroup (respondents who provided access to step count data from their Fitbit device), and qualitative subgroup (respondents who completed Item 15, additional thoughts and comments about Fitbit). Descriptive statistics were calculated for the data of all groups. Frequencies were computed on select attitudes and opinions by means of Likert scales (1 = *really dislike* to 5 = *really like*; 1 = *less often* to 3 = *more often*; 1 = *much less active* to 5 = *much more active*; 1= *very negatively* to 5 = *very positively*; 1 = *less often* to 3 = *more often*; Figure 1).

1. Please select one that applies: I am a
   a. University student
   b. University staff
   c. University faculty
   d. Other
2. Please select one that applies: I am
   a. Male
   b. Female
   c. Prefer not to reply
3. My current age is ___ years.
4. Did you purchase your Fitbit physical activity monitor through the University's wellness program?
   a. Yes
   b. No
5. In months, how long have you owned your Fitbit device?
   a. < 1 month
   b. 1–2 months
   c. 3–4 months
   d. 5–6 months
   e. 7–9 months
   f. 10–12 months
   g. 13–18 months
   h. 19–24 months
   i. > 24 months
6. Please select one that applies: What model of Fitbit do you own?
   a. Flex
   b. One
   c. Zip
   d. Ultra
   e. Surge
   f. Charge
7. Why do you use your Fitbit? (select all that apply)
   a. To track your physical activity levels
   b. To track your nutrition
   c. To track your sleep
   d. For fashion
   e. Other (Please type additional usage answer(s) in blank)
8. How do you feel about your Fitbit?
   a. Really dislike
   b. Dislike
   c. Neutral
   d. Like
   e. Really like
9. Do you use the Fitbit app for smartphones?
   a. Yes
   b. No
10. If answering yes to question 9, how do you feel about the app? (Only available if yes was selected on #9)
   a. Really dislike
   b. Dislike
   c. Neutral
   d. Like
   e. Really like
11. How has your Fitbit influenced your activity levels?
   a. Much less active
   b. Less active
   c. Same amount of physical activity
   d. More active
   e. Much more active
12. How has your Fitbit affected your overall health?
   a. Very negatively
   b. Negatively
   c. No change in health
   d. Positively
   e. Very positively
13. In comparison to your current usage, how often do you plan to use your Fitbit in the future?
   a. Less often
   b. Same amount
   c. More often
14. In comparison to your current amount of exercising, how often do you plan to exercise in the next 6 months?
   a. Less often
   b. Same amount
   c. More often
15. Do you have any additional thoughts or comments about your experience with your Fitbit that you would like to share? (Blank space provided)

If you would like to be included in the drawing for one of three $20 Meijer gift cards, please provide an email address at which we may contact your if you win. (Blank space provided)

Are you a member of the University's wellness group on the Fitbit website? Being a member of this group allows you to see how your physical activity level ranks with others within the group. If interested in joining, simply go to fitbit.com, log in, click on the "Community" tab at the top of the site and then proceed to the "Activity Groups" page. From there, you can search for and join the group.

Additionally, for the purposes of obtaining a greater understanding of how opinions regarding Fitbit trackers may influence physical activity levels, we would greatly appreciate your voluntary willingness to share your username. (Blank space provided)

Figure 1. Survey distributed via Qualtrics.

For the physical activity subgroup, average weekly step counts were calculated for participants. Daily step totals were tracked and recorded from September 2015 through November 2015. For a week of data to be considered valid and included in the analysis, the respondent needed at least 4 days of 1,000+ steps. Additionally, respondents needed at least 5 weeks of valid data for their step data to be included for analysis. Based on these data, respondents were split into one of two groups based on established suggestions: the "more active" group (average steps/day ≥ 10,000) and the "less active" group (average steps/day < 10,000; Tudor-Locke & Bassett, 2004).

Likelihood ratio chi-square analyses were performed to test for potential associations between variables ($p < .05$). For the respondents completing the qualitative item (Question 15; qualitative subgroup), an inductive thematic analytical approach was used (Fereday & Muir-Cochrane, 2006).

Results

A final sample of 371 respondents were included in the data analysis. The data were divided into the three aforementioned groups (i.e., main group, physical activity subgroup, qualitative subgroup).

Main Group Analysis

Demographics and Fitbit ownership. Table 1 provides information related to demographics and Fitbit ownership. For the main group, respondents' mean age was 31.3 years (*SD* = 14.4) and ranged from 18 to 72 years. The majority of respondents were female (> 80%) and students (> 60%). Of the Fitbit models owned, the Fitbit Flex was owned by over 55% of the respondents. Length of ownership was most commonly reported to be 3 to 4 months (18.2% of respondents). Regarding the Fitbit mobile application, most respondents (> 85%) reported having used the application, and most users of the app regarded it positively (> 92%).

Opinions, future plans, and usage of Fitbit. Nearly all respondents (> 97%) reported using their Fitbit to track physical activity. Few (< 7%) reported using it for tracking heart rate and time of day or competing against others. The majority of respondents reported liking their Fitbit to some degree (> 88%). Most respondents reported that their Fitbit positively affected their health (73.6%) and physical activity levels (83.1%). Finally, although most respondents

(> 60%) planned to use their Fitbit the same amount in the future, most (> 65%) revealed planning to exercise more often in coming months (see Table 1).

Table 1
Demographic Characteristics and Opinions of the Main Group (n = 371), Physical Activity Subgroup (n = 32), and Qualitative Subgroup (n = 112)

Item	Characteristic/ opinion rating	Main group *n* (%)	Physical activity subgroup *n* (%)	Qualitative subgroup *n* (%)
Sex	Female	301 (81.1)	23 (71.9)	93 (83.0)
	Male	70 (18.8)	9 (28.1)	19 (17.0)
Role	Student	241 (65.0)	14 (43.8)	61 (54.5)
	Staff	75 (20.2)	14 (43.8)	29 (25.9)
	Faculty	44 (11.9)	4 (12.5)	17 (15.2)
	Other (undisclosed)	11 (3.0)	–	5 (4.5)
Fitbit Model Owned	Flex	207 (55.8)	17 (53.1)	60 (53.6)
	Charge	102 (27.5)	9 (28.1)	35 (31.3)
	One	34 (9.2)	2 (6.3)	11 (9.8)
	Zip	16 (4.3)	2 (6.3)	3 (2.7)
	Surge	11 (3.0)	2 (6.3)	2 (2.7)
	Ultra	1 (0.3)	-	-
Use of Fitbit Mobile Application[a]	Yes	332 (89.5)	29 (90.6)	101 (90.2)
Appreciation of Fitbit Mobile Application[b]	Dislike	4 (1.2)	–	3 (3.0)
	Neutral	20 (6.1)	–	5 (5.0)
	Like	168 (51.7)	18 (62.1)	50 (49.5)
	Really Like	133 (40.9)	11 (37.9)	43 (42.6)

Table 1 (cont.)

Item	Characteristic/ opinion rating	Main group *n* (%)	Physical activity subgroup *n* (%)	Qualitative subgroup *n* (%)
Reasons for Owning Fitbit[a, c]	Track Physical Activity	361 (97.3)	31 (96.9)	109 (97.3)
	Track Sleep	178 (48.0)	17 (53.1)	60 (53.6)
	Track Nutrition	71 (19.1)	7 (21.9)	19 (17.0)
	For Fashion	10 (2.7)	1 (3.1)	1 (0.9)
	Other (e.g. heart rate, time)	24 (6.5)	1 (3.1)	9 (8.0)
Feel About Fitbit[a]	Dislike	10 (2.7)	–	7 (6.3)
	Neutral	34 (9.2)	2 (6.5)	11 (9.9)
	Like	134 (36.2)	9 (29.0)	25 (22.5)
	Really Like	193 (51.9)	20 (64.5)	68 (61.3)
How Has Fitbit Affected Health[a]	Negatively	1 (0.3)	-	-
	No Change in Health	96 (26.5)	8 (25.0)	29 (25.9)
	Positively	35 (9.7)	5 (15.6)	14 (12.5)
	Very Positively	230 (63.5)	19 (59.4)	69 (61.6)
Future Fitbit Usage[a]	Less Often	20 (5.5)	–	9 (8.0)
	Same Amount	228 (63.0)	23 (71.9)	73 (65.2)
	More Often	114 (31.5)	9 (28.1)	30 (26.8)
Future Plan to Exercise[a]	Less Often	2 (0.6)	–	1 (0.9)
	Same Amount	115 (31.8)	11 (34.4)	30 (26.8)
	More Often	245 (67.7)	21 (65.6)	81 (72.3)

[a]Only respondents who answered each item were included in the analyses. [b]Only respondents who answered Yes to "Use of Fitbit Mobile Application" were provided access to this question. [c]Respondents were permitted to select multiple reasons.

Likelihood ratio chi-square tests. Significant associations ($p < .05$) with at least moderate strength (Cramer's V ≥ .30) were highlighted (Table 2; Cohen, 1977). For the main group, the strongest associations emerged between how respondents felt about their Fitbit and other variables. Feelings about Fitbit strongly associated with feelings about the mobile application, perceptions of influence on health and physical activity, and anticipation for future use (all $p < .001$; see Table 2).

Physical Activity Subgroup Analysis

Demographics and Fitbit ownership. The subgroup respondents' mean age and age range were similar to that of the main group. The proportion of females was slightly less in this subgroup (~72%), while the majority of respondents were either students or staff (~44% each). Fitbit model owned, length of ownership, and feelings regarding the Fitbit application were also consistent with that of the main group (see Table 1).

Opinions, future plans, and usage of Fitbit. The responses of the subgroup were similar to the main group's regarding using the Fitbit mainly to track physical activity (> 96%), in maintaining a positive regard for their Fitbit (> 93%), in perceiving that their Fitbit positively affects their health (75.0%) and physical activity levels (74.6%), as well as expected future use (same amount: > 70%) and increased exercise plans (100%).

Step count comparison *t* tests. Regarding step averages, 16 (50.0%) of the respondents averaged meeting the daily recommended step count of ≥ 10,000 steps/day. Independent samples *t* tests revealed no significant difference in age, sex, or role of those who met and did not meet the recommendation of 10,000 steps/day. Paired samples *t* tests comparing users' Week 1 step count averages to Week 4 ($p = .29$) and then to Week 9 ($p = .95$) step count averages showed no significant differences, regardless of if respondents planned to exercise more in the future.

Likelihood ratio chi-square tests. For the physical activity subgroup, dissimilar from the main group, feelings about Fitbit did not strongly associate with most variables, except for sex (p = .03) and future exercise plans (p < .001). Unique to this subgroup, strong associations existed between multiple variables and future exercise plans. Specifically, in addition to sex and feelings about their Fitbit, future exercise plans strongly associated with perceived influence on activity (p = .01), effect on health (p = .006), and future desired use of their Fitbit (p = .002; Table 2).

Qualitative Subgroup Analysis

Demographics and Fitbit ownership. For this subgroup, all demographic and Fitbit ownership variables were similar to that observed in the main group (see Table 1).

Opinions, future plans, and usage of Fitbit. The responses of the qualitative subgroup were similar to those of the main group and physical activity subgroup regarding their opinions (> 80% like device and > 90% of those who use app like it), future exercise plans (> 98% plan to exercise more), and usage of their Fitbit (> 65% plan to use it the same amount).

Likelihood ratio chi-square tests. For the qualitative subgroup, consistent with the main group, feelings about Fitbit strongly associated with feelings about the mobile application, perceived influence on health and physical activity, as well as future use plans (all p < .001). Unique to this subgroup, strong associations existed also between the perceived influence their Fitbit had on activity and health (p < .001), as well as future use desires (p = .001; Table 2). Analyses were also conducted comparing comment type with each of the previously tested variables. For these analyses, respondents who provided both positive and negative comments were removed from analyses and comparisons with only positive or negative comments (n = 99) were made. Strong associations existed between the type of comment respondents made and the way they felt about their Fitbit (p < .001), the Fitbit mobile application (p = .001), as well as how they perceived the Fitbit to affect their health and activity levels (both p < .001; Table 2).

Table 2
Chi-Square Likelihood Test Results for Main Group, Physical Activity Subgroup, and Qualitative Data Subgroup

Variable	Sex	Length owned	Model	Feel about Fitbit	Use app	Feel about app[a]	Influence activity	Affect health	Future use	Future exercise
Sex		.44 (.15)	.56 (.11)	**.04** **(.16)**	.88 (.01)	**.04** **(.16)**	**.03** **(.17)**	.33 (.11)	.66 (.05)	**.02** **(.15)**
Length Owned	**.02** **(.67)** *.52* *(.23)*		**< .001** **(.22)**	.13 (.17)	.48 (.13)	.16 (.17)	.29 (.16)	.66 (.15)	**.004** **(.21)**	.52 (.15)
Model	.10 (.46) *.06* *(.28)*	.49 (.55) *.06* *(.32)*		**.01** **(.16)**	**.03** **(.21)**	.403 (.11)	.13 (.21)	**.02** **(.23)**	.07 (.14)	.08 (.15)
Feel About Fitbit	**.03** **(.49)** *.26* *(.17)*	.75 (.45) *.06* *(.32)*	.33 (.36) *.20* *(.19)*		**< .001** **(.23)**	**< .001** **(.36)**	**< .001** **(.31)**	**< .001** **(.30)**	**< .001** **(.33)**	**.01** **(.15)**
Use App	.15 (.20) *.32* *(.10)*	.26 (.66) *.25* *(.25)*	**.002** **(.90)** *.56* *(.14)*	.33 (.27) *.31* *(.17)*		[b]	**.001** **(.22)**	.06 (.15)	.33 (.08)	**.05** **(.14)**
Feel About App[a]	**.03** **(.37)** *.61* *(.12)*	**02** **(.68)** *.46* *(.26)*	.14 (.40) *.36* *(.20)*	.06 (.40) ***<.001*** ***(.39)***	[b]		**.002** **(.16)**	**.001** **(.18)**	**.001** **(.27)**	.40 (.10)
Influence Activity	.78 (.13) *.65* *(.09)*	.32 (.52) *.55* *(.24)*	.57 (.28) *.78* *(.15)*	.07 (.35) ***<.001*** ***(.40)***	.30 (.21) *.27* *(.16)*	**.05** **(.38)** ***.01*** ***(.26)***		**< .001** **(.69)**	**.001** **(.24)**	**.04** **(.14)**
Affect Health	.25 (.31) *.87* *(.05)*	.76 (.40) *.75* *(.26)*	.07 (.50) *.12* *(.26)*	.10 (.35) ***<.001*** ***(.36)***	.58 (.14) *.69* *(.08)*	.84 (.11) ***.004*** ***(.29)***	**.004** **(.53)** ***<.001*** ***(.54)***		**< .001** **(.22)**	.21 (.10)
Future Use	.16 (.24) *.41* *(.12)*	.43 (.43) *.18* *(.28)*	.46 (.29) *.10* *(.23)*	.13 (.33) ***<.001*** ***(.44)***	.84 (.04) *.52* *(.11)*	.98 (.01) ***.005*** ***(.33)***	.06 (.37) ***.001*** ***(.32)***	**.02** **(.42)** ***.001*** ***(.31)***		**< .001** **(.25)**
Future Exercise	**.02** **(.43)** *.22* *(.17)*	.23 (.52) *.38* *(.28)*	.25 (.36) ***.01*** ***(.29)***	**< .001** **(.79)** *.54* *(.15)*	.97 (.01) *.73* *(.07)*	.14 (.27) *.94* *(.08)*	**.01** **(.48)** *.17* *(.17)*	**.006** **(.53)** *.49* *(.11)*	**.002** **(.45)** *.06* *(.20)*	
Step Goal	.24 (.21)	.21 (.51)	.99 (.07)	.24 (.26)	.54 (.11)	.31 (.19)	.82 (.11)	.88 (.09)	.69 (.07)	.71 (.07)
Pos./Neg. Comment	*.19* *(.14)*	*.06* *(.35)*	*.54* *(.15)*	***<.001*** ***(.54)***	*.09* *(.17)*	***.001*** ***(.40)***	***<.001*** ***(.46)***	***<.001*** ***(.40)***	*.13* *(.21)*	*.23* *(.17)*

Note. Main group (top right), physical activity subgroup (bottom left, regular font), and qualitative subgroup (bottom left, italicized font). *P* values with Cramer's V results included in parentheses. Significant results ($p < .05$) bolded. Variable analyses included for those who met or did not meet 10,000-step/day goal (gray boxes, regular font) and positive/negative comments (grey boxes, italicized font).

[a]Only respondents who answered Yes to "Use of Fitbit Mobile Application" were provided access to this question. [b]Variables are constants (not independent).

Thematic content analysis

A thematic content analysis revealed three major themes, along with two subthemes for each major theme.

Complaints and suggestions regarding Fitbit use and device technology. One major theme included complaints and suggestions regarding participants' experiences with their Fitbit device. Two subthemes that developed were general complaints about the Fitbit device and technology-related critics and suggestions. These are presented in this section.

Subtheme 1: Participants indicated general complaints about the device. Participants indicated difficulties related to Fitbit use. Some of these pertained to challenges associated with use. These participants stated difficulties related to the overuse of Fitbit, its potential to be tedious and hard to charge, and finally how its regular use can increase one's stress levels.

> "I feel that, depending on one's lifestyle, using a Fitbit device can be tedious to use daily."

> "Wish mine warned me when it was dying . . . vibrate or something like that to indicate I need to charge it."

> "Using the Fitbit has made me obsessive, at times, about my level of physical activity. It has caused emotional distress when I don't reach the goals set by the Fitbit, as I feel upset about my failure."

> "Wearing the Fitbit would occasionally increase my stress level. I tended to feel guilty if I was working or doing homework and my Fitbit would indicate that I had not been active enough that day. I also think I would feel more tired if I woke up and saw on my Fitbit tracker app that my sleep had been restless. I think knowing that I had slept restlessly made me more aware of my exhaustion."

Others similarly discussed how wearing a Fibit device can be challenging within different settings. Throughout the participants' statements, it was evident that not all participants conceived Fitbit suitable for specific lifestyles and/or professions.

"Fitbit too sensitive for a working man."

"I can't track my steps at a restaurant because of health code and getting the Fitbit wet when helping with dishes."

"It is not ideal for athletes."

Subtheme 2: Participants indicated criticism and suggestions to improve the Fitbit technology. Throughout their responses, some of the participants reported technical difficulties associated with Fitbit use. A few of these also suggested potential strategies to improve upon these.

"Small technical issues become annoying."

"I also wish it included heart rate information."

"It would be much better if Fitbits were waterproof."

"I wish there was a better way to track sleep. I wear my Fitbit one in my bra so it is difficult to wear it when I sleep to track."

"I wish the battery lasted longer."

"Sometimes it doesn't hold a charge."

"So, needs improvement to rotate in iPhone or iPad. Need to be able to download date to Excel."

Supportive statements in relation to Fitbit experience. A second major theme created was supportive statements in relation to participants' Fitbit experience. Subthemes that were generated corresponded to supportive statements for general use and supportive statements with regard to device-related features.

Subtheme 1: Participants indicated supportive statements for general use. Participants indicated their satisfaction related to Fitbit use in general. Some of these directly related to the participants' positive feelings and opinions about Fitbit.

"I really enjoy Fitbit."

> "I'm still in the 'slightly obsessed with my Fitbit' stage."

> "I like it overall."

> "I love my Fitbit."

> "I couldn't be happier with the product."

> "I absolutely love mine and feel lost without it on me."

Others indicated satisfaction from specific causes. As such, some emphasized the motivational gains associated with regular self-monitoring, while others reported enjoying its feedback and accountability aspects.

> "It is very useful and has made me more conscious of how active I really am."

> "I like the feedback and accountability."

> "I liked it a lot more than I anticipated! It motivates me to exercise."

> "I definitely recommend a Fitbit! It's a great way to track steps, heart rate, sleep, and etc. Makes me work harder to reach my goal."

> "I really enjoy having data that will enable me to track activity."

Subtheme 2: Participants indicated support for device-related features. Throughout their supportive comments, rather than relating to their Fitbit experience in general some of the participants discussed their positive opinions related to the Fitbit device and its properties. These participants reported their contentment about specific features and accompanying motivational gains.

> "I will continue to wear it because I like the sleep tracking feature."

> “Fitbit has a been a great way for me to have a functional watch, but to also know the level I am at in fitness with heart rate and steps.”

> “Fitbit is highly ‘addictive’ and provides motivational feedback including comparison to friends.”

> “Activity level monitoring has been very motivating.”

Statements with regard to Fitbit mobile app. The final and third major theme pertained to the Fitbit mobile application. Subthemes included complaints and supportive statements regarding the application.

Subtheme 1: Participants indicated complaints with regards to the app. Some of the participants indicated difficulties related to Fitbit mobile app use. They discussed an unease to use the app in general, mostly due to freezing, malfunction, and/or lack of synchronization and connection issues.

> “The app frequently freezes and has to be shut down.”

> “Malfunctioned after having it for only four months and it hasn’t functioned correctly with the app since.”

> “My flex would no longer connect to the app.”

> “Loved my Fitbit until it stopped syncing with my app. Now it’s not as useful. Disappointing.”

Others elaborated on app-related issues pertaining to specific Fitbit features. As such, app features including nutrition tracking, goal setting, and sleep monitoring seemed to pose challenges to some of the respondents.

> “I find the food tracking difficult if you use your own recipes.”

> “It doesn’t give you any goals to lose the weight based upon your nutrition.”

"The app changed dramatically making the sleep monitoring more challenging."

Subtheme 2: Participants indicated support with regard to the app. As opposed to the participants who reported issues related to app use geared toward specific features, others reported satisfaction with the app and its features. Some of these participants commented on their positive experience with select features, self-monitoring guidance, and overall happiness with the app's design and structure.

"Like the way you can track nutrition."

"I like that the app gives badges based on meeting certain milestones such as a total distance walked or a new record for steps walked in a single day."

"Very well-designed device and app."

Discussion

Based upon the present results, tracking physical activity, sleep, and nutrition behaviors were the most common reasons for using the Fitbit mobile application. The majority of users liked their Fitbit and associated Fitbit with higher activity and positive health effects; hence, they reported intentions for continued use in the future. Persons with more positive attitudes toward the product (i.e., liking or very much liking it) also tended to perceive it more beneficial for health and had greater intentions for continued use in the future.

Of the individuals with step count averages, half met the daily recommended step count of ≥ 10,000 steps/day. However, in this subgroup, females tended to report increased positive attitudes toward Fitbit. They also tended to perceive it as more beneficial and had greater intentions for continued use in the future. Physical nuisance in the form of skin irritation and misfit (of the product) into one's lifestyle was a concern among respondents. Respondents also indicated that tracking and monitoring reminded them of failure to meet goals and hence led to disappointment and guilt. Others requested additional watch features, higher quality wristband, improved sleep and nutritional tracking, enhanced synchronization, and fewer episodes of freezing. Among those with positive comments, satisfaction with the product and its mobile application, as well as the belief in its perceived effect on increased activity and health, was high. In contrast to those with criticizing comments, among those with positive comments, enjoyment of the monitoring features for physical activity, sleep, and nutrition, as well as appreciation of peer challenging, was also present.

Given limited previous work that investigated attitudes, beliefs, preferences, and physical activity levels among Fitbit users, this study offers a unique contribution (Ledger & McCaffrey, 2014; Shin et al., 2015). While not survey based, previous studies reveal that physical activity tracking devices, such as pedometers, can help individuals increase physical activity through increased monitoring and self-regulation (Lee et al., 2014; Michie et al., 2009; Michie et al., 2011; Patel et al., 2015; Wang et al., 2015; Wanless et al., 2014). Some researchers also suggested that significant changes in physical activity behavior occur when self-monitoring is combined with either goal setting and/or performance feedback (Michie et al., 2009). The data in this study also indicated that respondents reporting higher perceived impact of Fitbit on their activity behaviors were more likely to value the tracking and monitoring properties of the product. In contrast to the previous findings, however, the results indicated that some respondents discontinued use of their Fitbit because they felt discouraged by its tracking and monitoring.

Consistent with extant consumer research (Ledger & McCaffrey, 2014), the results of this study suggested that respondents who reported their Fitbit helped increase physical activity levels also enjoyed the social connection and competition allowed by the product. Consistent with previous findings (Boyd & Ellison, 2007; Fogg et al., 2009; Lieberman, 2013), these results indicated that features of goal setting, goal sharing, and goal reinforcement produced feelings of discouragement and guilt in some individuals and caused them to discontinue use.

In terms of the most common reasons for Fitbit mobile application use, the findings of this study confirmed other studies indicating that self-monitoring of physical activity presents unique benefits for behavior change, which is arguably its most common use (Michie et al., 2009; Michie et al., 2011). While this study did not ask specific questions to measure whether the mobile application supports behavioral economics and theories of health, the data indicated a high regard for the mobile application, with some respondents noting they commonly used their application; found it helpful for self-monitoring and self-regulating physical activity, sleeping, and nutritional behaviors; and wanted to increase and optimize its features (Conroy et al., 2014; Loewenstein et al., 2013).

The data in this study indicated that some participants perceived competition as confrontational. Competition features may need to further consider users' motivation to prevent frustration (Middelweerd et al., 2015). A 3-month follow-up of the physical activity subgroup indicated that many respondents' desire to increase physical activity did not translate into real changes, as determined by no change in average daily step counts. Therefore, while this small subgroup relied on their Fitbit to maintain physical activity, Fitbit did not appear to help them increase physical activity despite their stated intention to increase physical activity. To that end, the state of evidence for wearable technologies and applications including Fitbit to increase physical activity is somewhat lacking (Middelweerd, Mollee, van der Wal, Brug, & TeVelde, 2014). This finding may be attributed to a critically limited use of possible behavior change techniques by these technologies (Conroy et al., 2014; Direito et al., 2014; Middelweerd et al., 2014).

For true promotion of change, a foundational requirement could be further aligning these products with theories of health behavior change (Foster et al., 2013; Michie et al., 2009; Noar, Harrington, Van Stee, & Aldrich, 2011; Webb, Joseph, Yardley, & Michie, 2010). Beyond self-monitoring, generic feedback on performance and goal settings may likely be required (Golley, Hendrie, Slater, & Corsini, 2011; Hermsen, Frost, Renes, & Kerkhof, 2016; Michie et al., 2009; Webb et al., 2010). For instance, inclusion of role models, positive self-talk scripts, prompted barrier identifications and possible strategies to overcome these, and the delivery of more individually tailored feedback could enhance the effectiveness of Fitbit and thus further disrupt inactivity and allow long-term behavior change (Hermsen et al., 2016; Kaptein & van Halteren, 2013; Middelweerd et al., 2015; Noar, Benac, & Harris, 2007; Noar et al., 2011).

In contrast to many online surveys, this survey was designed to examine psychological determinants of adoption with the actual step counts among Fitbit users. To the extent that there is a need to investigate both the subjective opinions of the adopter and the objective data provided by these wearable technologies, these all-inclusive methods of data collection are important (Kim & Shin, 2015; Paul et al., 2015). Also, this survey evaluated key information, especially in regard to reasons for use and disuse of Fitbit, and analyzed demographic and attitude-based correlates of Fitbit and Fitbit mobile application use. Nevertheless, although this study analyzed the step counts of a small subgroup of the total sample, responses to survey items were based on self-report, and the survey included only persons from a college in the Midwestern United States. In addition, although the step counts were observed at various points in time, the survey responses are cross-sectional in nature. While the cross-sectional data can allow attitudes, beliefs, and preferences to be examined at one point in time, these patterns likely may vary over time.

Based upon the open-ended responses, some participants indicated a desire for tracking and monitoring features not to be as prominent. Consumers may find being reminded of goals and viewing information about achievement of their goals burdensome and invasive. These responses also indicated a strong desire in the ability of mobile applications to track and synchronize more efficiently and without frequent freezing. Current findings showed that these technologies could be improved regarding their features and the number of behavioral strategies for increasing activity. Based upon previous recommendations (Middelweerd et al., 2015), Fitbit can further motivate users with a coaching-like function that integrates a personalized and customized behavior change system. While refining these technologies, researchers and practitioners should consider the potential utility and the obstacles these emerging tools may face when reaching broader populations and disrupting deep-rooted habitual patterns.

Application of Findings for Future Research in Physical Education

National guidelines indicate that adults should obtain at least 150 min/week of moderate- to vigorous-intensity physical activity (Centers for Disease Control and Prevention, 2015). Policy and legislative changes pertaining to physical education classes have been suggested among effective approaches for promoting physical activity (Story, Nanney, & Schwartz, 2009.) Researchers have also suggested that increasing physical education and activity within schools and after school (Wanless et al., 2014) may have the greatest impact on improving physical activity behaviors into adulthood. Therefore, physical education professionals who can use technology appropriately play an important role in helping students become physically educated individuals (National Association for Sport and Physical Education, 2009). Accordingly, early use of personal self-monitoring devices such as Fitbit may help instill long-standing physical activity habits in youth. Researchers have already recommended use of self-monitoring devices for integrating high levels of activity in physical education. Specifically, some have suggested that within physical education settings, personal gadgets can help students meet learning objectives such as the number of steps to achieve by the end of the class (Lynch et al., 2017).

This study offered an initial overview of adults' perceptions and opinions toward physical activity tracking devices. Drawing upon the need for increasing activity in the general population, physical activity leaders who work in the university or adult settings can consider this technology-based intervention to increase physical activity. To the extent that self-monitoring and behavior change are closely associated (Carels et al., 2005; Gleeson-Kreig, 2006), using Fitbit may allow increases in physical activity levels in college students and adults, and this is important to consider. This said, sustained physical activity increase requires adequate behavioral intention and attitude for behavior change (Kim, 2014). Consequently, physical activity leaders can benefit from using these technologies in conjunction with other behavioral and motivational approaches for optimizing self-efficacy and self-regulation (Shieh, Weaver, Hanna, Newsome, & Mogos, 2015). Some of these strategies include goal setting, feedback and rewards, social support, and assisting individuals in identifying common obstacles and barriers to activity (Sullivan & Lachman, 2016). On a final note then, future work should prioritize that these technologies are supported by evidence-based behavior change advances that are specifically geared toward targeted populations.

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PHYSICAL FITNESS

Examining the Relationship Between High School Physical Education and Fitness Outcomes in College Students

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Abstract

The decline in physical activity (PA) from youth to young adulthood is evident, though limited research has addressed whether specific factors of K–12 physical education (PE) have any influence on outcomes during college years. This study examined the relationship between college students' physical fitness and PA behavior and their high school PE experiences. College student volunteers (n = 537) completed a fitness assessment examining aerobic endurance, muscular endurance, body composition, and blood glucose and lipids. A survey examined current PA and PE experience in high school (number of semesters, enjoyment, requirements). Analyses were conducted separately for males and females. Pearson correlations examined relationships between fitness, behavioral, and PE outcomes. Differences in behavioral and fitness outcomes were compared with t tests. The final sample was 56.6% male (n = 298) and 43.4% female (n = 227). For males, analyses revealed that PE enjoyment was significantly related to VO_2 max , curl-ups, and vigorous physical activity. Number of semesters of PE in high school was negatively associated with triglycerides and

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total cholesterol and positively associated with moderate physical activity. Those who took PE when it was not required were more vigorously active than those who did not. Males who had a waiver for PE had a lower body fat percentage, performed more curl-ups, and were more vigorously and moderately active compared with those who had no waiver. Number of semesters of PE in high school was negatively associated with triglycerides and total cholesterol. PE enjoyment was positively associated with VO_2 max and push-ups. For females, those who took PE when it wasn't required had a higher VO_2 max and vigorous physical activity compared with those who did not. Females with a waiver for PE class had higher triglycerides and total cholesterol compared with those who did not. Females in a coed PE class had a higher BMI and VO_2 max compared with those in a combination class. Effective PE programs that encourage participation and educate students on the benefits of physical activity have the capability to establish lifelong healthy and active habits that translate to the college years, and likely beyond. The main findings of this study have the potential to influence the policies regarding PE requirements for school-aged students in all states, such as possibly increasing PE requirements for all grades and discovering certain aspects of PE that could make it more enjoyable for a larger number of students.

Physical education (PE) in schools is a cornerstone in the development of early physical activity (PA) habits, gross motor and movement skills, and personal and social character development in children and teenagers (Roslow Research Group, 2009). In the past 15 years, PE programs in K–12 schools have placed a greater emphasis on introducing students to activities that encourage lifelong fitness habits by providing children with a wide array of exercise methods and educational techniques that focus on the importance of PA and how they can continue to take the skills and activities learned in K–12 PE and pursue them for a lifetime (Kohl & Cook, 2013). Although PE can positively impact fitness and health outcomes, research suggests that the decline in regular moderate to vigorous and vigorous physical activity participation for males and females begins as early as high school and translates into the college years (Trost, Pate, et al., 2002). Specifically, research suggests that physical activity declines in college at a steady rate from the first semester to the seventh semester (Small, Bailey-Davis, Morgan, & Maggs, 2013), and sedentary behavior is becoming increasingly more common.

While the clear decline in PA from the youth years to young adulthood, and the resulting negative physical impact, is evident, limited research has addressed whether specific factors of K–12 PE, such as length of participation or level of PE enjoyment, have any influence on frequency, type, and intensity of PA or on physical fitness outcomes during the college years. It is also unclear whether gender differences exist for these outcomes. This study examined the relationship between college students' physical fitness and PA behavior and their high school PE experiences. The results of this study could influence future programming and policies for K–12 PE programs.

Method

Participants and Recruitment

Participants were college student volunteers (n = 537) enrolled in for-credit physical activity and nutrition classes that required a fitness assessment as a part of their course requirements at a university with an approximate enrollment of 44,000 between September 2015 and April 2016. These classes were a part of a student general education requirement. Upon completing the fitness assessment, students were invited to complete a survey and provided written consent to use their data. This study was approved by the institutional review board at ***Pennsylvania State University***.

Fitness Outcomes

Aerobic fitness. All subjects completed the YMCA cycle ergometer protocol, which included of four 3-min stages of submaximal exercise (American College of Sports Medicine, 2013). Heart rate was recorded each minute with an ePulse2 Heart Rate Monitor Armband (Impact Sports Technologies, San Diego, CA). An estimate of maximal oxygen consumption (VO_2 max) was calculated via direct heart rate plotting.

Muscular endurance. Assessments included two tests: a 1-min maximum repetition push-up test and a modified curl-up test. Women performed modified push-ups, as per established protocols. Modified curl-ups are performed under a 40-bpm cadence (max number possible to perform is 75 repetitions; American College of Sports Medicine, 2013).

Body composition. Height, weight, waist girth, body mass index (BMI), and body fat percentage via bioelectrical impedance (Omron BF306, Omron Global, Lake Forest, IL) were used for assessing body composition and weight.

Blood lipids. Participants were asked to fast overnight. Total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), and triglycerides (measured or calculated) were measured with a commercially available analyzer (Cholestech LDX, Alere, Waltham, MA). Forty microliters of blood were collected via finger stick and injected into a Cholestech LDX lipid profile cassette.

Self-Report Measures

Following the objective fitness measurements, subjects were asked to complete a brief survey. An identifying code number linked the participant's fitness outcomes with their survey responses.

Demographics. Students self-reported their age, sex, and race/ethnicity.

Behavioral outcomes. The Global Physical Activity Questionnaire (GPAQ) assessed moderate and vigorous leisure, occupational, and transportation-related physical activity (Armstrong & Bull, 2006). Minutes a week of moderate and vigorous physical activity were used in analyses.

Physical education variables. Several variables were used for examining PE experience in high school.

Number of semesters of PE in high school. Participants were asked to report the number of times they took PE in each year from ninth through 12th grade. The total number of times they took PE was summed.

PE requirement. Participants were asked to report (yes/no) if they ever took PE when it was not required.

PE class. Participants were asked to report if their PE classes were always coed, always single sex, or a combination of both.

PE waiver. Respondents were asked to indicate (yes/no) if they ever had a waiver or exemption from PE so they did not have to take a PE course.

PE enjoyment. Participants were asked to indicate on a 5-point Likert scale how much they agreed (1 = *strongly disagree* to 5 = *strongly* *agree*) with the statement "Overall I enjoyed my physical education experience in 9-12th grade."

High school physical activities. Participants were asked to indicate (yes/no) if they took part in any physical activities in high school (high school varsity team, high school junior varsity team, school-sponsored sports/activity, sports/activity team outside of high school, or a sport/activity not a part of a team). The number of activities was summed (range 0–5) and was dichotomized into no participation in physical activities/participation in one or more activities.

Statistical Analysis

Basic descriptive statistics described the sample. All analyses were conducted separately for males and females. Pearson correlations examined the relationships between the fitness, behavioral, and PE outcomes. Independent *t* tests compared the differences between participation in any high school physical activities, taking PE when it was not required, and having a waiver for PE. A one-way analysis of variance (ANOVA) examined differences in fitness and behavioral outcomes by PE class type with a Tukey post hoc test. Significance levels were set at $p < .05$, and all analyses were run using SPSS 22.0 (IBM, Armonk, NY).

Results

The final sample was 56.6% male (n = 298) and 43.4% female (n = 227). Table 1 shows the demographic characteristics of the sample. Males were significantly older (21.52 ± 2.04 vs. 21.07 ± 1.04 years), were more vigorously active (192.21 ± 161.39 vs. 142.25 ± 135.12 min), had a higher fitness level (35.74 ± 6.53 vs. 34.25 ± 6.44 ml/kg/min), had a lower body fat percentage (15.20 ± 5.03 vs. 26.13 ± 4.64%), had a higher BMI (24.85 ± 3.61 vs. 23.94 ± 4.64 kg/m^2), could perform more push-ups (33.56 ± 14.77 vs. 26.36 ± 10.21), and had lower total cholesterol (152.36 ± 32.13 vs. 166.42 ± 31.88 mg/dL) and HDL (49.03 ± 14.98 vs. 64.79 ± 15.79 mg/dL) than females ($p < .05$).

Table 1
Demographic Characteristics of the Sample and Comparisons Between Males and Females

	Males (*n* = 298)		Females (*n* = 227)		
Demographic variable	***n*** **(%)**	***M*** **(*SD*)**	***n*** **(%)**	***M*** **(*SD*)**	***t*** **or** χ^2
Age (years)		21.52 (2.04)		21.07 (1.04)	3.03**
Race/Ethnicity					5.32
Non-Hispanic White	216 (72.7)		177 (78.3)		
Non-Hispanic Black	7 (2.3)		7 (3.1)		
Hispanic	18 (6.0)		14 (6.2)		
Asian American/Pacific Islander	47 (15.8)		26 (11.5)		
Other	9 (3.0)		2 (0.8)		
Behavioral outcomes					
Moderate physical activity minutes/week		154.78 (142.97)		158.84 (129.69)	0.33
Vigorous physical activity minutes/week		192.21 (161.39)		142.25 (135.12)	3.74***
Fitness Outcomes					
VO_2 max (ml/kg/min)		35.74 (6.53)		34.25 (6.44)	2.53*
% Body Fat		15.20 (5.03)		26.13 (5.53)	23.06***
Body Mass Index (kg/m2)		24.85 (3.61)		23.94 (4.64)	2.49*
Curl-ups (per minute)		28.59 (20.79)		31.22 (23.06)	1.34
Push-ups (per minute)		33.56 (14.77)		26.36 (10.21)	6.14***
Total cholesterol (mg/dL)		152.36 (32.13)		166.42 (31.88)	4.15***
HDL (mg/dL)		49.03 (14.98)		64.79 (15.79)	9.69***
LDL (mg/dL)		80.86 (32.09)		79.52 (28.17)	0.41
Triglycerides (mg/dL)		94.15 (63.52)		106.44 (62.79)	1.84
Physical education outcomes					
Total semesters of PE in high school		6.52 (3.52)		6.95 (4.20)	1.23
Participation in one or more high school PA	131 (43.9)			117 (51.7)	1.05
PE enjoyment		4.12 (0.96)		3.85 (1.00)	2.98**
% taking PE when it wasn't required	97 (39.2)		60 (33.5)		1.5
Type of PE class					3.99
Single sex only	20 (6.4)		30 (13.6)		
Coed only	240 (77.0)		154 (70.0)		
Combination	50 (16.1)		36 (16.3)		

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Outcomes for Males

Correlational analyses (Table 2) revealed that PE enjoyment was significantly related to VO_2 max (*r* = 0.19, *p* = .04), curl-ups (*r* = 0.17, *p* = .03), and vigorous physical activity (*r* = 0.16, *p* = .02). Number of semesters of PE in high school was negatively associated with triglycerides (*r* = -0.23, *p* = .01) and total cholesterol (*r* = -0.18, *p* = .02) and positively associated with moderate physical activity (*r* = .014, *p* = .02).

Table 3 shows a comparison of fitness and behavioral outcomes by PE variables. Among males, those who participated in any high school physical activities had a lower body fat percentage (*t* = 2.58, *p* = .01), higher VO_2 max (*t* = 3.60, $p < .001$), lower triglycerides (*t* = 2.29, *p* = .04), and greater moderate physical activity (*t* = 1.93, *p* = .05) compared with those who did not participate in any high school physical activities. Those who took PE when it was not required were more vigorously active (*t* = 2.38, *p* = .02) than those who did not. Males who had a waiver for PE had a lower body fat percentage (*t* = 2.33, *p* = .02), performed more curl-ups (*t* = 3.12, *p* = .001), and were more vigorously (*t* = 2.08, *p* = .04) and moderately (*t* = 2.41, *p* = .02) active compared with those who had no waiver. Males in combination-type classes performed more curl-ups (*F* = 5.93, *p* = .003) than those who were in single sex (*p* = .01) or coed classes (*p* = .002). Also, males in combination-type classes were more vigorously active (*F* = 5.16, *p* = .003) than those in coed classes (*p* = .006).

Outcomes for Females

Table 4 shows Pearson correlation analyses for females. Number of semesters of PE in high school was negatively associated with triglycerides (*r* = -0.23, *p* = .004) and total cholesterol (*r* = -0.18, *p* = .02). PE enjoyment was positively associated with VO_2 max (*r* = 0.15, *p* = .04) and push-ups (*r* = 0.13, *p* = .03).

Table 2

Pearson Correlations Between Fitness, Behavioral, and PE Outcomes for Males (n = 297)

Academic outcomes	Body fat	BMI	VO_2 max	Curl-ups	Push-ups	Triglycerides	Total cholesterol	LDL	HDL	VPA min/week	MPA min/week
Number of semesters of PE in high school	0.01	0.11	0.01	0.04	0.04	-0.23**	-0.18*	-0.07	-0.12	0.06	0.14*
PE Enjoyment	-0.04	-0.02	0.19*	0.17*	0.14*	-0.09	-0.02	0.03	0.06	0.16*	0.02

Note. BMI = body mass index; VPA = vigorous physical activity; MPA = moderate physical activity.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3
Comparison of Fitness and Behavioral Outcomes by Physical Education Variables for Males (n = 297)

		Physical education variables												
Fitness outcomes		**Participated in any HS PA (n = 166)**	**No participation in HS PA (n = 131)**	***t***	**Took PE when it was not required (n = 97)**	**Did not take PE when it wasn't required (n = 149)**	***t***	**Had a waiver for PE (n = 36)**	**No waiver for PE (n = 261)**	***t***	**Class type: Single sex (n = 20)**	**Class type: Coed (n = 240)**	**Class type: Combination (n = 50)**	***F***
Body Fat	*M*	14.34	15.87	2.58**	14.74	15.13	0.59	13.02	16.35	2.33*	18.4	16.06	15.31	1.27
	SD	5.1	4.9		4.67	5.14		3.78	5.01		5.64	5.12	3.92	
BMI	*M*	24.72	24.96	0.54	24.99	24.56	0.87	23.82	25.24	1.41	27.43	24.83	25.44	2.52
	SD	3.83	3.43		3.58	3.72		2.82	3.54		4.55	3.52	2.706	
$V0_2$ max	*M*	37.29	34.54	3.60***	36.41	35.65	0.87	32.85	34.58	0.98	33.88	34.63	34.07	0.13
	SD	6.72	6.14		6.8	6.34		7.74	5.94		3.35	6.41	5.73	
Curl-Ups	*M*	29.27	28.06	0.49	28.51	28.14	0.26	45.08	26.62	3.12**	$17.78_{a,b}$	28.55_{a}	34.96_{b}	5.93**
	SD	20.64	20.95		20.47	20.87		22.72	20.08		7.68	19.57	26.04	
Push-Ups	*M*	33.69	33.45	0.14	35.27	32.75	1.28	40.15	33.75	1.58	25.67_{a}	33.37	39.84_{a}	3.93*
	SD	15.36	14.4		16.19	13.79		15.36	13.72		19.21	12.81	16.64	
Triglycerides	*M*	82.79	103.74	2.29*	89.48	87.24	0.65	104.38	105.24	0.03	74.86	99.89	139.08	2.03
	SD	45.43	74.38		53.72	58.92		48.27	79.25		49.84	71.23	105.32	
Total Cholesterol	*M*	148.33	155.73	1.59	151.92	153.49	0.28	166	154.87	0.85	148	156.99	159.57	0.25
	SD	28.44	34.69		31.63	28.42		33.79	35.53		29.68	37.66	24.94	
LDL	*M*	78.48	82.86	0.91	80.47	81.86	0.56	95.75	82.21	1.06	79.14	84.03	85.31	0.08
	SD	31.47	34.09		32.15	34.09		28.34	34.81		43.84	34.32	28.33	
HDL	*M*	47.95	49.92	0.9	49.32	48.57	0.25	51.88	48.69	0.59	42.57	50.45	50	0.86
	SD	14.39	15.46		17.12	13.27		12.94	14.58		8.94	15.64	14.68	
VPA min/week	*M*	192.11	163.54	0.01	225.44	175.07	2.38*	286.61	189.6	2.08*	166.1	180.04_{a}	287.8_{a}	5.16**
	SD	192.28	160.22		181.57	148.33		221.69	153.51		191.66	134.87	222.18	
MPA min/week	*M*	172.78	140.65	1.93*	154.78	156.45	0.11	219	186.94	2.41*	186.8	143.59	115.32	1.12
	SD	153.39	133.01		141.33	152.49		132.11	116.56		223.27	123.78	114.47	

Note. Subscript letters indicate a difference between categories. BMI = body mass index; VPA = vigorous physical activity; MPA = moderate physical activity; HS PA = high school physical activities; PE = physical education.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 4

Pearson Correlations Between Fitness, Behavioral, and PE Outcomes for Females (n=227)

Academic outcomes	Body fat	BMI	VO_2 max	Curl-ups	Push-ups	Triglycerides	Total cholesterol	LDL	HDL	VPA min/week	MPA min/week
Number of semesters of PE in high school	0.14	0.11	0.01	0.04	0.04	−0.23**	−0.18*	−0.07	−0.15	0.06	−0.11
PE Enjoyment	−0.04	−0.02	0.15*	0.11	0.13*	−0.10	−0.02	0.03	−0.06	0.06	−0.02

Note. BMI = body mass index; VPA = vigorous physical activity; MPA = moderate physical activity.
*$p < .05$. **$p < .01$. ***$p < .001$.

For females, Table 5 shows a comparison of fitness and behavioral outcomes by PE variables. Those who participated in any high school physical activities had higher triglycerides ($t = 2.65$, $p = .009$) and lower HDL ($t = 2.30$, $p = .02$) than those who did not participate in any activities. Females who took PE when it was not required had a higher VO_2 max ($t = 1.99$, $p = .04$) and vigorous physical activity ($t = 2.00$, $p = .03$) compared with those who did not. Those with a waiver for PE class had higher triglycerides (t = 1.98, p = .02) and total cholesterol ($t = 1.93$, $p = .04$) compared with those who did not. Females in a coed PE class had a higher BMI ($F = 3.27$, $p = .02$) and VO_2 max ($F = 3.45$, $p = .01$) compared with those in a combination class ($p = .02$, $p = .01$, respectively).

Discussion

The findings of this study indicate that an individual's PE experience in high school relates to a number of factors during the college years, such as aerobic fitness, muscular endurance, body composition, and blood lipid composition outcomes. The most significant findings from this study relate to the total length of PE participation throughout high school, students who chose to take PE when it was not required, and level of PE enjoyment in high school. Physical activity patterns, as well as overall physical health and fitness outcomes, were found to significantly relate to PE outcomes, suggesting a potential for long-term health impacts. While many outcomes apply to males and females, a few significant differences between genders were also present in the findings.

One of the most important findings of this study dealt with the relationship between number of semesters of PE taken in high school and health-related fitness for this population. A strong negative association was noted between the total number of semesters of PE that were taken in high school and triglyceride levels and total cholesterol for males and females. These data indicate a possible relationship between prior PE participation with physical health components, whereas the relationship with PA patterns was inconsistent. These findings were consistent with previous research in this area, which included the amount of PE participation in high school with young adult weight. Menschik, Ahmed, Alexander, and Blum (2008) concluded not only that increased participation in physical activities as an adolescent was strongly related to a decrease in the

Table 5

Comparison of Fitness and Behavioral Outcomes by Physical Education Variables for Females (n = 227)

		Physical education variables												
Fitness outcomes		**Participated in any HS PA (*n* = 110)**	**No participation in HS PA (*n* = 117)**	***t***	**Took PE when it was not required (*n* = 60)**	**Did not take PE when it wasn't required (*n* = 119)**	***t***	**Had a waiver for PE (*n* = 30)**	**No waiver for PE (*n* = 197)**	***t***	**Class type: Single sex (*n* = 30)**	**Class type: Coed (*n* = 154)**	**Class type: Combination (*n* = 36)**	***F***
Body Fat	*M*	25.8	26.45	0.85	26.2	26.1	0.11	25.28	26.55	0.99	25.15	27.09	24.64	1.64
	SD	5.41	5.65		6.24	5.36		4.2	5.88		3.12	5.91	6.15	
BMI	*M*	24.24	23.64	0.95	23.94	24.05	0.14	22.64	23.9	0.66	22.74	24.30$_a$	21.94$_a$	3.27*
	SD	5.38	3.67		3.87	5.35		2.88	3.86		2.43	3.99	3.39	
$V0_2$ max	*M*	34.45	34.05	0.45	33.73	34.79	0.99	34.33	33.79	0.23	33.2	33.02$_a$	37.70$_a$	3.45*
	SD	6.15	6.75		5.9	6.92		5.93	6.93		4.61	6.56	8.14	
Curl-Ups	*M*	30.84	31.59	0.29	28.96	32.21	0.86	35.2	30.09	0.66	19.71	33.83	29.41	2.28
	SD	22.41	23.76		23.94	22.91		22.06	23.19		12.55	25.26	18.01	
Push-Ups	*M*	26.14	26.58	0.93	25.93	26.29	0.23	25.5	26.94	0.43	24.14	27.86	25.71	1
	SD	10.41	10.06		10.77	9.25		10.12	9.99		9.59	9.62	11.04	
Triglycerides	*M*	113.62	92.51	2.65**	104.23	107.7	0.34	122.14	90.71	1.99*	97.6	88.85	106.73	0.88
	SD	58.64	41.97		39.06	61.08		92.01	33.53		46.08	31.51	76.57	
Total Cholesterol	*M*	167.56	165.23	0.47	165.89	168.92	0.5	184.57	164.19	1.93*	159.4	169.51	157.36	1.23
	SD	34.94	28.49		29.71	33.83		39.08	26.66		27.17	26.95	33.48	
LDL	*M*	82.14	79.75	0.58	83.25	79.49	0.79	90.14	79.58	1.2	75.5	82.89	73.91	1.08
	SD	29.96	21.91		26.33	25.19		23.47	21.9		20.96	22.11	21.09	
HDL	*M*	62.08	67.62	2.30*	61.91	66.51	1.52	70	67.18	0.46	64.6	69.69	62.27	1.31
	SD	15.65	15.53		16.31	16.3		15.63	15.41		9.01	16.38	15.51	
VPA min/week	*M*	146.08	138.72	0.4	153.1	106.07	2.00*	143.17	139.74	0.09	134.07	146.98	113.89	0.51
	SD	144.67	126.19		106.37	123.71		101.66	131.23		138.07	121.07	141.3	
MPA min/week	*M*	157.87	159.76	0.18	154.37	168.5	0.72	127.17	169.27	1.13	197.33	158.72	149.72	0.77
	SD	142.23	117.3		124.2	122.92		119.04	121.18		190.33	107.24	92.85	

Note. Subscript letters indicate a difference between categories. BMI = body mass index; VPA = vigorous physical activity; MPA = moderate physical activity; HS PA = high school physical activities; PE = physical education.

*$p < .05$. **$p < .01$. ***$p < .001$.

prevalence of overweight young adults, but also that increasing the number of days that adolescents participated in PE decreased their chances of being overweight as an adult by up to 28%. This finding was not surprising given that the amount of PE was also significantly related to blood lipid levels; a dose–response relationship was present in which increased participation in PE could lead to overall better health as a young adult, which could include both healthy cholesterol levels and weight.

It is interesting that students who took PE in high school when it was not required by their school district or state policy (as an elective) performed more PA at a vigorous level in college compared to those who chose not participate in PE unless it was a requirement. A number of possible factors could explain these outcomes, one being a greater sense of enjoyment of PE. Children who enjoy PE classes likely possess greater perceptions of self-efficacy in a physically active environment, causing them to actively choose to take PE classes. A related study found a positive relationship with PE and the resulting amount of MVPA on days that PE was taken by the school-aged children (Chen, Kim, & Gao, 2014). Regardless of whether the source of increased PA in college was due to high perceptions of enjoyment or self-efficacy, only six states currently require their high school students to perform a specific number of minutes of PE per week and only 46% of students nationally attend PE class at least once per week on average while in high school (Society of Health and Physical Educators, 2016). As outlined in the National Physical Activity Plan, a comprehensive school physical activity plan addresses PE policy in terms of frequency and quality, and this study suggests that there is an impact beyond K–12 (National Physical Activity Plan Alliance, 2016). In addition to these findings, it is also important to note that sedentary lifestyles and obesity continue to rise among adolescents and young adults, with 32% of all adolescents currently being considered overweight or obese (Society of Health and Physical Educators, 2016). PE programs during the adolescent years have the opportunity to instill lifelong activity patterns in individuals, as well as provide knowledge about the benefits of PA overall. If PE was made a requirement in more schools, and if PE programs were made more enjoyable and increased enthusiasm for PE classes, this situation could cultivate more active lifestyles in the future and encourage more vigorous levels of PA.

While partaking in PE when it was not a requirement proved to be a relevant outcome in this study, this finding can be related to students' levels of perceived enjoyment of their PE experiences in high school. It is noteworthy that level of PE enjoyment related significantly to different physical fitness components in males and females. Perceived level of PE enjoyment in high school positively related to VO_2 max in males and females. It also positively related to different strength assessments, including number of push-ups for females and number of sit-ups for males. Overall, these results suggest that students who report greater PE enjoyment in high school typically tend to perform at a higher level of physical fitness than those students who do not enjoy PE, and are also more likely to partake in additional PE, even when it is not required. This could lead to increased vigorous PA in the future, in addition to achievement of higher levels of physical fitness in general. These results are not surprising, given that PA enjoyment is a strong correlate of participation in nearly every population (Trost, Owen, Bauman, Sallis, & Brown, 2002). This study suggests that creating enjoyable PE experiences can result in positive long-term outcomes; therein further study on the aspects that make PE enjoyable are warranted.

Although this study had a number of significant findings about how PE experiences relate to PA patterns and fitness levels at the college level, it has some limitations. To obtain information related to PE experiences in high school, the researchers used retrospective self-report surveys. While this was the most feasible method for this study, the accuracy of responses could not be ensured with recall or social desirability bias. Additionally, the sample that volunteered for the study, though representative of the current study body, was not diverse in terms of race/ethnicity, with greater than 70% of the sample reporting they were non-Hispanic White. The strength of the correlations was also moderately weak, limiting the researchers' ability to interpret the real-world implications of the findings. Last, the sample was drawn from volunteers, which could create additional bias. Further studies in this area may opt to use longitudinal study designs or objective forms of measurement (e.g., pedometers or accelerometers) to address some of these methodological limitations.

Despite these limitations, this study offered insight into how physical activity and different physical fitness components in college relate to students' PE experiences in high school. Effective PE programs that encourage participation and educate students on the benefits of PA have the capability to establish lifelong healthy and active habits that translate to the college years, and likely beyond. The main findings of this study could influence the policies regarding PE requirements for school-aged students in all states, such as possibly increasing PE requirements for all grades and discovering certain aspects of PE that could make it more enjoyable for a larger number of students. Strategies to improve enjoyment could include the inclusion of lifestyle-based activities to promote lifelong participation, opportunities for discovery of lesser known sports or activities, or allowing students to have greater choice and input on activities included in the curriculum. Based on the results of this study, further investigation of the potential of PE to impact population health and alter the incidence rates of inactivity-related chronic disease is warranted.

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YOU AND THE LAW

School Compliance to a Physical Education Lawsuit Settlement

David Kahan and Thomas L. McKenzie

The elementary school years are a particularly crucial time for children to engage in quality physical education (PE). Increasing the proportion of elementary schools that require daily PE is a Healthy People 2020 objective (PA 4.1; Office of Disease Prevention and Health Promotion, n.d.). Concerns over deficiencies in the quantity and quality of PE in California, especially in elementary schools, have been voiced for decades (San Diego State University [SDSU], 2007). For example, 48% of California elementary schools have been found to not comply with the state PE time requirements of 200 PE min/10 days (California Education Code § 51210.7) and direct observation of lessons showed teachers were providing PE an average of only 30 min/week (SDSU, 2007). California schools at that time were monitored for compliance to PE requirements only every 4 years, and schools meeting academic goals could be exempted from PE monitoring. Meanwhile, the consequences for being out of compliance were minimal, as the school had only to submit a written plan for improvement (SDSU, 2007).

This situation began to change in 2010 when a California appellate court ruled in favor of a plaintiff who sought the enforcement of the state PE time requirements for his third-grade son who was receiving less PE (i.e., 80 fewer min/10 days) than the amount stipulated by law (*Doe v. Albany Unified School District,* 2010). Specifically, the

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court ruled that "(1) state law imposes a mandatory duty on school districts to provide minimum physical education requirements, and (2) parents can sue public schools to seek enforcement of the state law" (*Doe v. Albany Unified School District,* 2010).

Subsequently, a follow-up class action lawsuit (*Cal 200 et al. v. San Francisco Unified School District et al.*, 2014) was successfully litigated against 37 school districts that were selected, in part, based on information the plaintiffs obtained through statewide e-mails that requested teachers report how much PE they offered (Adams, 2015). Among settlement stipulations, the court ruled that for 3 years—through the 2017–2018 academic year—the 37 school districts were required to collect, maintain, and report the documentation of the PE minutes that schools provided. Specifically, teachers were to document their PE in writing by showing the days, times, and duration of their scheduled PE lessons, and this information was to be posted in the classroom or on the school website. Subsequently, teachers were also to complete monthly certification forms for instructional minutes, and in instances of making a schedule change that resulted in lost PE minutes, they were to identify when the compensated time was or would be provided. Additionally, the school administrator (or designee) was to create a school site schedule that indicated the day and time of PE for each class of students within the school. Combined, these stipulations required documentation that afforded an opportunity for evaluating how schools scheduled PE time pursuant to the settlement agreement and in accordance with state law.

We examined the websites of 860 elementary schools (Grades 1 to 6)—proportionately randomly sampled from 1,208 schools within the 37 school districts—between March and June 2018, a time that corresponded to the final semester that schools were required to collect and disseminate PE minute data pursuant to the settlement agreement. We searched for PE schedules (master schedules by school or grade level or for individual classes) and assessed websites for any additional verbiage about the frequency and duration of PE when a schedule was not posted.

Overall, 92 schools (10.7%) posted PE schedules on their website and an additional 14 schools provided weekly PE lesson frequency (n = 9, 1.0%) or lesson duration (n = 5, 0.6%) without providing a specific schedule. In particular, only 1.6% of the targeted schools in Los Angeles Unified School District (LAUSD), the second largest school district in the United States, posted a PE schedule. A majority of schedules (n = 47, 51.1%) were current (i.e., Fall 2017 or Spring 2018), with schedules representing previous academic years 2016–2017 (n = 14), 2015–2016 (n = 9), 2014–2015 (n = 3), and 2013–2014 (n = 1). Eighteen schools (19.6%) did not identify a specific semester or school year on their posted schedules.

For the 101 schools posting lesson frequency, PE was scheduled an average of 3.5 ± 1.3 days/week, and for the 97 schools posting lesson length, the average lesson was scheduled for 31.2 ± 11.4 min. The overall scheduled PE volume/dosage for the 92 schools that provided it was 99.0 ± 23.0 min/week (range, 23.0–140.0 min/week). Most schools (68.6%) identified scheduling a PE volume that met the statutory requirements equal to 100 min/week. Yet even after their districts had lost in court, 29 schools posted a PE schedule that was below the state mandated minutes, with 9 schools scheduling PE for ≤ 50 min/week. Further, no school indicated having a PE schedule that met the national professional recommendation of 150 min/week (Shape America, n.d.).

National surveillance data found that 3.1 min of a typical elementary PE lesson was lost to changing clothes and administrative tasks and children were inactive during this time (Centers for Disease Control and Prevention, 2015). Based on the notion that "short" lessons were likely scheduled to reach prescribed PE minute thresholds rather than to provide quality PE instruction, we calculated the frequency of classes ≤ 10 min in duration. Three short lesson lengths were common: 10 min (n = 318 lessons, 29.1%), 5 min (n = 43, 4.0%), and 2 min (n = 5, 0.5%). Seventeen schools (18.5%) posted schedules with at least one lesson ≤ 10 min, and five of these indicated most of their lessons were scheduled for ≤ 10 min in duration. Such short lessons, even if managed efficiently, would unlikely produce desirable outcomes in student physical activity accrual, physical fitness, and motor skill development.

Nearly all schools across the United States now have websites that serve as "public windows" for providing up-to-date information on school goals and programs. A follow-up study in these same school districts and schools could determine long-term compliance to state statutory PE laws in the absence of litigation. Parents, physical educators, and community stakeholders interested in schools providing quality PE should examine their state's education codes for language mandating PE minutes and determine whether they are being provided in accordance with state law. If not—and if informal negotiations with school and district administrators do not resolve a PE time deficiency—there is legal precedent for utilizing litigation to ensure PE is provided as specified by law.

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The Physical Educator

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