

Increasing pupil physical activity: a comprehensive professional development effort

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Summary

Study aim: To determine if pupil physical activity and Body Mass Index classifications maintained or improved after a one-year professional development program involving both classroom and physical education teachers. Guskey's model of teacher change guided this study.

Material and methods: Indigenous children from ten schools (N = 320) in grades 3-12 from one community participated in this year-long comprehensive school change effort. Classroom (n = 31) and physical education teachers (n = 7) participated in this study as intervention (n = 27) or comparison (n = 11) teachers. Intervention teachers participated in a year-long professional development program to increase physical activity and healthy behaviour knowledge of pupils.

Results: ANOVA results for pupil physical activity (measured using pedometry) indicated that both groups of pupils (intervention and comparison) became significantly more active over time. The intervention groups' behaviour was less stable ($\alpha = 0.71$) over time versus the comparison group ($\alpha = 0.86$), suggesting positive behaviour changes. No significant Body Mass Index changes were found.

Conclusions: Although the intervention resulted in physical activity increases for both intervention and comparison pupils at the schools, change takes time and these initial findings show progress in increasing physical activity behaviours at school in an understudied and disadvantaged population of indigenous USA youth.

Key words: Children – Health – Physical activity – Intervention

Introduction

The negative pattern of reduced physical activity and increased dietary consumption has led to the current childhood overweight crisis [20]. This national trend of youth's decreased physical activity and increased body mass have been seen in Poland [8], USA [9], Australia [11], England [7], Canada [17] and most other developed countries. The negative health effects related to inactivity (i.e., obesity, diabetes) have been more severe for minority populations, especially for indigenous youth [16]. When compared to an age and gender-matched reference population 5 to 10 years of age, indigenous children were heavier and had a higher percentage of body fat [16]. Diabetes in the indigenous tribe of Pima Indian children is growing at about 2% per year with nearly half of the adult population over the age of 35 having Type II diabetes [4].

One intervention strategy for working with schools on public health issues is to implement ongoing, embedded comprehensive professional development sessions with classroom teachers and physical education teachers focused on helping teachers change behaviours.

Guskey's Model of Teacher Change [6] is a theory about how teacher change happens in schools. It begins with staff development, which leads to changes in teachers classroom practices, which, in turn, leads to changes in pupil learning outcomes and finally to the creation of new teacher belief systems. This model is guided by three principles. First, teacher change takes time and is not easy. Second, it is necessary for teachers to see positive changes in pupil learning in order to buy into program effectiveness. Finally, support and follow-up are needed for teachers in the process of change.

The current paper grounded in Guskey's Model of Teacher Change focuses on pupil physical activity and body composition outcomes of this teacher change project (interviews are presented elsewhere [3]). The purpose of this study was to determine if pupil physical activity and Body Mass Index (BMI) classifications maintained or improved after a year long, professional development program involving both classroom and physical education instructors teaching healthy and active content (physical activity and nutrition). It was hypothesized that: (a) pupils would increase their physical activity levels at

school and (b) pupils would maintain or decrease their BMI as a result of their teachers' lessons changes as an outcome from participation in ongoing healthy and active professional development experiences over one year.

Material and Methods

Guskey's model of teacher change and corresponding principles [6] were used to frame the current study. Based on Guskey's first principle, teachers were given time to implement changes in their teaching. For example, both classroom and physical education teachers participated in five workshops spread across the academic year (about 35 hours) to help them prepare to teach ten healthy behaviour lesson ideas (i.e., physical activity and nutrition content knowledge) and daily physical activity breaks, while Physical Education teachers were also trained to teach the Dynamic Physical Education curricular model. Wei et al. [22] reported that 30-100 hours of teacher training spread over six to 12 months resulted in significant positive effects on pupil outcomes. Based on Guskey's second principle, intervention teachers were able to observe and assess pupil changes taking place (i.e., pedometers were used to track physical activity). Finally, addressing Guskey's third principle, teachers were provided with extensive support. Mentor teacher support was provided to both classroom and physical education teacher participants on a monthly basis. Furthermore, administrative support was present at the school level.

Participants

Youth. Children and youth participants were 320 indigenous boys ($n = 136$) and girls ($n = 184$) at the primary ($n = 200$) and secondary ($n = 120$) levels, ranging from seven to twenty years of age (mean age 10.30 ± 3.06) from a single indigenous community in the USA. Participants in the intervention group ($n=234$) and comparison group ($n = 86$) were from ten schools: five were primary, three were middle, and two were high school, governed by Tribal Administrators, the Catholic Church, or the State Department of Education (two public schools). The project was approved by Tribe Administrators and the University IRB committee. Parents/guardians also provided consent and pupils assented to participate.

Teachers and recruitment. Thirty-one classroom teachers and seven physical education teachers (11 male and 27 female) from the ten schools who taught pupils in grades 3-12 participated in this project. Teachers were invited to participate in either the intervention ($n = 27$) or comparison ($n = 11$) group and only interested teachers participated. There were one to two intervention and comparison teacher participants at each school as per Tribal Administrators' requirements. Teachers in the interven-

tion group had between one and 27 years of teaching experience (mean 9.40 ± 7.67) and teachers in the comparison group had between two and 27 years of teaching experience (mean 12.75 ± 11.02). Physical Education teachers met with classes two to five days/week depending on the school.

Overview and school district needs

Participation in this year-long teacher change initiative required intervention teachers to attend five after-school workshops (spread across the year) that were either focused on infusing physical activity and healthy behaviour knowledge into the curriculum or on the Dynamic Physical Education curriculum (a multi-activity K-12 Physical Education curricular model [5,14]). Teacher input was sought at workshops. Brainstorming time was also provided with other teachers who taught at similar grade levels. Teachers were given classroom sets of pedometers (all intervention teachers), physical activity equipment appropriate for the classroom, e.g., poly spots for the floor, soft balls, dice with words (classroom teachers), physical education class equipment, i.e., Dynamic Physical Education school equipment sets (see gophersport.com, physical education teachers), and a small stipend (participation incentive). For the comparison teachers, pre/post pupil data were collected and the teachers did not participate in any other aspects of the project.

Two experienced mentor teachers (external to the school district) who had taught indigenous pupils in Physical Education and in classroom settings were assigned to all intervention teachers. They visited the intervention teachers' classrooms/gymnasiums at an agreed upon date/time each month. Teachers also submitted monthly electronic reflections to their mentor teachers. Teachers in the intervention group were required to teach a minimum of ten lesson ideas (e.g., establishing a baseline for physical activity using pedometers) that integrated physical activity and healthy behaviour knowledge with academic content (please refer to Table 1). The lesson ideas were very general in order for teachers to modify the lessons as needed as well as to fit the content into their regular curriculum in logical places.

To complement and supplement the physical activity based lesson ideas that were being taught, classroom teachers also provided daily activity breaks for pupils (3-10 minutes). Primary classroom teachers were provided with the Activity and Healthy Schools® [15] classroom physical activity break cards (e.g., cards with physical activity break instructions see www.gophersport.com) that they used for lessons to teach physical activity breaks in the classroom). All teachers were also provided with over 40 classroom activity breaks that integrated content from various subjects (e.g., writing, math).

Table 1. Lesson objectives

State Standards Met	Title	Objective
Physical Education Standard 5 Technology Standard 3	Recording Pedometer Data	Pupils will demonstrate their understanding of pedometers by recording their daily accumulated step count and if required, their daily activity time.
Mathematics Standards 3 & 6	Establishing a Baseline	Pupils will learn how to establish a baseline by using teacher-designed data. When pupils can successfully establish a baseline with teacher designed data, they are now ready to work with their own data.
Self-Regulation Standard 1 Mathematics Standard 3	Goal Setting	Pupils will learn how to establish their own personal goals for increasing their activity level.
Language Arts Standard 1	Establish a Activity Word Wall	Pupils and teachers working together will establish a word wall of activity words they have learned while working with their new pedometers. This wall will be added to throughout the school year.
Mathematics Standard 1	Walking versus Jogging	Pupils will determine how walking and jogging differ in accumulating steps and activity time with their pedometer.
Physical Education Standard 3	Fitness Concepts	Pupils will understand why each of the five components of health related fitness are essential to improving the length and quality of their own life.
Mathematics Standards 2 & 8	Incorporating Math and Graphing Skills	Pupils will reinforce their math critical thinking skills and computation skills by using pedometer data to solve math problems.
Arts Standard 1 Language Arts Standard 2	Incorporating Wri- ting Activities	Pupils will reinforce their writing skills by incorporating their pedometer information into their writing.
Science Standard 12 Life Skills Standard 4	The Scientific Process	Pupils will demonstrate their understanding of the scientific process by completing a walking and jogging activity.
Geography Standard 2 Mathematics Standard 4	Integrating Social Studies	Pupils will use their social study skills and pedometer step count to determine the distance and/or time it will take them to travel from point to point.

In addition to the ten lessons, physical education teachers were taught lessons and management techniques to adopt the Dynamic Physical Education curricular model [5,14]. The Physical Education teachers also provided support for the classroom teachers who were at the same school. Fidelity by Physical Education teachers to the Dynamic Physical Education curricular model was assessed by the mentor teachers during their monthly observations/meetings as well as by mentor teachers who read/corresponded with teachers regarding their reflections.

Instruments

The current study used pedometers to track pupils' physical activity patterns at school. Pedometers measure

vertical oscillations of body movement from the hip, thus providing a total count of accumulated ambulatory movement of steps taken [19]. All pupil participants in the current project wore a Walk4Life 2505 pedometer shown to provide valid and reliable estimates of youth physical activity and steps [1].

Data collection procedures

Pedometer preparations. Guidelines [21] were followed in pedometer preparations and data collection procedures using sealed pedometers. Pupil participants in this project were informed that their physical activity was being measured. Prior to data collection, pupils practiced wearing pedometers in several physical education classes

and/or in their classrooms (varied by school) to diminish potential novelty and reactivity effects. Refresher lessons were also provided the week prior to data collection.

Pedometer protocol. Pupils were instructed to wear pedometers at all times at school and not to tamper with them. Pupils who tampered (e.g., shook) with pedometers lost the privilege of participation (1-2 pupils per school). All pupils wore pedometers (Walk4Life 2505) for four consecutive school days in both September and May in order to give a representative sample of school based physical activity. Four days have been shown to be adequate time in order to accurately measure children's physical activity patterns [18]. At the end of each day, research team members recorded steps for each pupil, reset the pedometers to zero, and resealed them for the following day. The team members were present at the schools all day to ensure that pupils were accurately wearing pedometers.

BMI data. Demographic information (i.e., age) was collected from the parents or schools. BMI measurements, body mass (kg) and height (cm) were directly measured without shoes using a calibrated digital scale (Seca 882 Digital BMI Scale) and stadiometer (Seca 214 Portable Stadiometer). These measurements were taken during non-pedometer data collection days at each school pre and post intervention by members of the research team.

Data analyses

Data analyses began with *t*-tests investigating potential pre-test differences between the intervention and comparison groups for physical activity and BMI. Since groups were not significantly different at pre-test, Analysis of Variance (ANOVA) tests were performed to investigate pre/post group changes in physical activity and BMI by group (intervention versus comparison). ANOVA was also run to investigate possible gender and grade level differences in physical activity. Due to multiple ANOVA analyses, Bonferroni adjustments were made ($k=4$). Internal consistency reliability analyses were conducted to investigate the stability of physical activity behaviours; that is, high (e.g., >0.80) internal consistency reliability suggests little behaviour change. Finally, descriptive statistics were also run on the variables. The level of $p \leq 0.05$ was considered significant.

Results

ANOVA results investigating physical activity changes showed both groups (intervention and comparison) became significantly more active over time ($F_{1, 319} = 20.10$, $p < 0.001$, partial $\eta^2 = 0.06$). There was no significant group main effect ($F_{1, 319} = 3.10$, $p = 0.079$). Mean change scores were (622 steps/day) and (474 steps/day) for the

intervention and comparison groups, respectively. For BMI, both groups had a slight increase in their BMI with no significant group main effect ($F_{1, 307} = 1.01$, $p = 0.36$). At post-test, BMI results showed 66.7% (girls) and 69.4% (boys) in the "at risk for overweight" and "overweight" categories using the Centres for Disease Control (USA) classifications [10]. Although BMI was lower for primary (25.16 ± 6.68) than secondary pupils (27.93 ± 7.97) it was not statistically significantly different. There were no gender differences in physical activity patterns ($F_{1, 319} = 1.73$, $p = 0.189$). There were, however, grade level differences in physical activity patterns ($F_{1, 319} = 5.56$, $p < 0.001$; partial $\eta^2 = 0.14$). Grade level differences were due to large change scores or deltas for sixth (3884.4) and seventh grade pupils (2480.5).

Looking at an indicator of behavioural stability, the intervention groups' behaviour was less stable ($\alpha = 0.71$) over time versus the comparison group ($\alpha = 0.86$). This indicates that more change was occurring in the intervention group. In other words, the intervention group was comparatively less stable in behaviour over time, which is characterized by a less predictable shifting in rank order between time points. Interpreting the stability finding alongside an increased mean steps/day in the intervention group suggests that the observed instability was the result of a positive change in physical activity behaviour. This measure has also been used to show stability/lack of stability in physical activity patterns for adults [19].

Discussion

Results lend support to the generally favourable changes in pupils' physical activity patterns as a result of a year-long teacher change intervention in an indigenous community, with intervention pupils showing less stability in their physical activity patterns after the intervention. Utilizing the ratio of 100 steps is equivalent to one minute of physical activity [13], the indigenous pupils in the current sample averaged 53 (intervention) and 45 (comparison) minutes of physical activity per day at school. At post test, these pupils were coming close to accumulating the minimum recommendation of 60 minutes of daily physical activity for youth [20]. It is important to keep in mind, however, that pedometers do not measure the intensity of the physical activity performed; thus it is not known if the pupils met the intensity part of the recommendation for moderate-to-vigorous physical activity, which is a limitation of the current study.

In alignment with Guskey's second principle [6] teachers were able to see pupils' physical activity increasing, which might have persuaded them to integrate physical activities into their classrooms even more the following

year. Supporting interview data are reported elsewhere [3] which are in alignment with Guskey's first principle that teachers who were able to buy into the program were able to see the program in "support of their work" rather than as additional work. Finally, in accordance with Guskey's third principle, the teachers in this project were provided support at all levels including: (a) teachers may have also had colleagues at their own school involved in the intervention, and (b) an external support team of mentor teachers and researchers were available to them.

In the current study, it was also hypothesized that pupils' BMI levels would be maintained or decrease for the intervention group. This investigation did not show a significant influence on pupils' body mass. It is important to address both increased physical activity patterns and improved eating behaviours in order to affect body mass. Nutrition content was taught along with physical activity knowledge by classroom teachers in the current study. The comprehensive Pathways Obesity Prevention Program project assessed both eating behaviours and physical activity behaviours. Researchers reported that pupils had a reduction in dietary fat intake but no significant reduction in percentage body fat [2]. In the present study, the relatively modest changes in physical activity were clearly not enough to influence pupils' entering body mass status. It is important to note, however, that both before and after the investigation over 65% of the pupils were classified as "overweight" or "at risk for being overweight". This was valuable baseline data for the community and other researchers.

As clearly stated by Guskey [6], p. 9, we should "recognize that change is a gradual and difficult process for teachers. Learning to be proficient at something new and finding meaning in a new way of doing things requires both time and effort..." This teacher change effort with pedometer lessons/activity breaks taught by all teachers and the Dynamic Physical Education curricular model taught by physical education teachers may take years to be fully understood as the first year of an investigation is almost always a challenging one for all involved partners with few large scale successes immediately apparent.

The results of this study are significant for several reasons. First, school based interventions are a logical and cost effective means of changing children's health behaviours, but educators know little about how to implement or assess such programs. The unique collaboration between physical education and classroom teachers in an indigenous community to build a healthy behaviour culture in their schools is a promising but little understood option that needs more investigation. Second, indigenous people around the world have significantly higher health risks than other ethnic background groups, which may

make creating a healthy and active school culture more critical for indigenous communities. Finally, this investigation also provides insights into both a specific at-risk group as well as more generally the influence of context and its impact on change. Future work is needed with indigenous youth focusing on both in and out of school physical activity contexts in short and long term physical activity and nutrition interventions. For example, the Coordinated Approach to Child Health project (CATCH), had success in increasing physical activity in Physical Education programs, increasing physical activity during the school day and improving youth eating patterns with more than half of the teachers still consistently using the curriculum at a five year follow up study [12].

In conclusion, although the results of this study were modest gains in physical activity and no significant BMI changes, the study still provides important information. Any physical activity change is a positive one as physical activity behaviours are hard to change and the need for change in this community was great. Given the limited scope of the intervention, it is exciting to see that change did occur. It is also important to note that the data collected provided benchmark data on an understudied population.

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