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Training teachers to implement physical activity: Applying social cognitive theory

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Abstract

Objective: To evaluate the impact of three types of social cognitive theory (SCT)-based elementary school classroom physical activity (PA) training on teachers' implementation rates, attitudes, knowledge and behaviour.

Design: Key stakeholder focus groups informed development of phase II which took the form of a randomised controlled trial of three different intensities of teacher training to conduct classroom-based PA sessions.

Setting: The study was conducted over one school year (2016–2017), across four elementary schools in the USA.

Methods: Researchers delivered professional development to teachers, focusing on effective methods for PA use in the classroom through three formats: webinar, in-person training and in-person with personalised assistance. Training content was built on SCT constructs. This study examined the impact of the PA training on SCT construct outcomes among elementary school classroom teachers ($n = 41$). Study outcome measures included reciprocal determinism, behavioural capability, outcome expectations and self-efficacy. Over the 12-week period following the training, teachers completed surveys to measure SCT construct outcomes.

Results: Results of the intervention demonstrated an increase in teacher self-efficacy and knowledge ($p < .01$ and $p < .01$). There was a significant increase of teachers who started using PA in the classroom who indicated no use at baseline (from 21% to 6% not using).

Conclusion: The use of SCT to provide a teacher training is an effective method to increase classroom PA, while improving teacher self-efficacy and knowledge concerning PA implementation.

Keywords

Classroom, physical activity, social cognitive theory, teachers, training

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Introduction

National physical activity (PA) recommendations in the USA call for young people to participate in at least 60 minutes of PA every day (Centers for Disease Control and Prevention [CDC], 2017; Office of Disease Prevention and Health Promotion [ODPHP], 2018). However, only 21% of young people meet these activity level guidelines, contributing to the overweight and obesity epidemic affecting one-third of US youth (National Physical Activity Plan Alliance [NPAPA], 2016; Ogden et al., 2015; Troiano et al., 2008). Young people are spending more time engaging in sedentary behaviours like screen time and decreased time participating in outside recreation (Bassett et al., 2015).

School is an opportune setting to engage students in PA to meet national recommendations, given children spend the majority of their waking hours there (Institute of Medicine, 2012). The US CDC encourages school districts to develop a Comprehensive School Physical Activity Programme (CSPAP) to provide varying opportunities for students to be physically active. PA within schools takes on a variety of forms, including physical education (PE) classes, PA before and after school, PA during school PA for school staff, and PA for family and community members (CDC, 2015). Research suggests that school-based health interventions such as CSPAP are an effective means to educate and reduce sedentary time among students, leading experts to recommend that schools provide multiple opportunities for students to be active (Bassett et al., 2015; Hughey et al., 2014). The CSPAP framework is currently used across the USA to develop policies, programmes and financial support for PA opportunities in school districts, but there remains a need to determine best practices for incorporating evidence-based frameworks like CSPAP and PA interventions into real-world settings (Sobol-Goldberg et al., 2013).

One innovative strategy to increase PA during school is through classroom-based PA integrated into the academic lesson or during transitions between lessons. Some examples of this include fitness exercises like jumping jacks while practising mathematics or reviewing spelling words, or utilising dance-based videos to involve students in activity between academic subjects. These short (5–20 minutes) and sporadic activity sessions can contribute to students' achieving the recommended 60 minutes of PA per day and have had a demonstrated positive impact on the learning environment (Norris et al., 2015). For example, several studies support findings that classroom PA increases cognitive functioning, mathematics scores and time-on-task among students (Donnelly et al., 2016; Howie et al., 2015; Mahar, 2011; Moore et al., 2013). Experts agree that even though PA sessions can take away time from academic instruction, student achievement shows improvement or remains the same (Norris et al., 2015).

Unfortunately, teachers cite lack of time, classroom space, knowledge and skills needed as barriers to implementing classroom PA (Turner and Chaloupka, 2016; Webster et al., 2017) and lower socioeconomic schools have lower implementation rates due to competing needs such as urgent student needs or limited financial support, citing a need for more support for teachers to utilise classroom PA in these disadvantaged schools (Turner and Chaloupka, 2016). To address these common barriers, researchers have identified technical assistance and training as an opportunity to help teachers with PA session implementation including in-person training, one-on-one support and web-based resources (Erwin et al., 2011; Hughey et al., 2014; Lonsdale et al., 2016; Lynch, 2015; Resaland et al., 2016). Studies show that these inexpensive methods of teacher training are viable and effective at facilitating teacher implementation of classroom PA (Erwin et al., 2011; Hoke et al., 2017). However, to our knowledge, there is no research that has examined the most effective type of teacher support or training to increase classroom PA outcomes. Overall, research suggests that theory should guide frameworks for effective training (Bartholomew and Jowers, 2011; Glanz and Bishop, 2010; Kay and Kibble, 2016), and social cognitive theory (SCT) in particular has

demonstrated positive health behaviour change outcomes (Aleksejuniene et al., 2016; Eather et al., 2013; Stacey et al., 2015). Developed by Albert Bandura, SCT is shaped by the idea that an individual behaves as a result of their observation and experiences of the consequences of a behaviour (Bandura, 1977). Personal, environmental and behavioural factors act as reciprocal components affecting overall behaviour. Key constructs include outcome expectations, self-efficacy, self-regulation, behavioural capability and observational learning (Table 1) (University of Pennsylvania, n.d.). Therefore, training should use these components to impact behaviour and build both content knowledge and personal change (Bandura, 1977; Kay and Kibble, 2016). To our knowledge however, the effect of a SCT-rooted teacher PA training on classroom PA has not previously been examined.

To explore these points, we conducted a pilot study to investigate the outcomes of classroom-based PA training among elementary school teachers at a low socioeconomic status school district. The aims of the study were to (1) determine if varying intensities (web-based, in-person, and in-person with technical assistance) of teacher training resulted in differences of classroom PA implementation duration and frequency and (2) examine teacher perceptions of classroom PA implementation based on SCT constructs, including attitudes, knowledge and behaviour.

Methods

This two-phase study took place over one school year (July 2016–June 2017). A formative qualitative research phase (phase I) aimed to obtain feedback on the feasibility of a randomised controlled trial (RCT) comparing three different intensities of classroom-based PA training for teachers (phase II). Phase I took place during the first half of the school year. Phase II included a RCT to explore the effect of three different intensities of classroom-based PA teacher training. The primary outcome measure was teacher implementation of PA as evaluated through time duration of sessions and frequency of sessions per week. Secondary outcome measures included the SCT outcomes self-efficacy and knowledge. The Pennsylvania State University Institutional Review Board reviewed and approved the study.

Phase I – formative research

The study team conducted a focus group with school personnel (teachers, principals, school nurses and counsellors; $n=10$) of an elementary school in an urban, Central Pennsylvania school district within a low socioeconomic community (100% free/reduced lunch). Discussion topics included knowledge of how to incorporate PA, perceived barriers and facilitators, and various techniques to refocus students following an activity break. Overall, themes from the focus group showed that teachers were supportive of the idea of PA use in the classroom setting, but were concerned about barriers that might prevent consistent implementation. These included a lack of time, difficulty with transitioning students from PA to instructional time, space and noise level. Themes that emerged from the focus group informed the study design, training and data collection procedures for phase II. As a result, during the training (phase II), researchers spent significant time addressing strategies to overcome barriers and reinforced the benefits of classroom PA. Researchers also included questions in the survey to better understand teacher barriers to implementation. Additional materials provided to teachers also addressed these topics.

Phase II – RCT

The phase II RCT examined the feasibility and effectiveness of teacher training on implementation of classroom activity. Researchers recruited five elementary schools from the same Central

Table 1. Social cognitive theory constructs aligned with intervention strategy.

Construct	Definition	Intervention technique used	Outcome measure evaluated via survey
Behaviour Capability	Teacher's understanding of the importance and appropriate methods to incorporate PA into the classroom	Providing knowledge-based and skill-based trainings to teachers through resource sharing, discussion and participation on classroom-based PA	1. I feel knowledgeable about physical activity break strategies and techniques for use in my classroom.
Outcome Expectations	Teacher's belief that implementing classroom PA will produce positive outcomes (i.e. student behaviour, time on task, academic scores)	Present research findings showing that classroom PA is associated with positive student outcomes (i.e. improved attention, behaviour, academic scores)	1. How feasible is it to implement physical activity breaks in your classroom? 2. I can incorporate physical activity breaks into my classroom without having major student disruption. 3. In your opinion, how do physical activity breaks affect the following items (student behaviour, student engagement during lessons, test scores, amount of time for academic instruction)? 4. How would you rate student behaviour during physical activity break times?
Self-efficacy	Teacher's confidence in their ability to successfully implement classroom PA	Teacher discussion on strategies to overcome perceived barriers (i.e. noise, time)	1. How confident are you in your ability to implement physical activity breaks in your classroom? 2. I can successfully encourage student participation in physical activity breaks.
Self-regulation	Teacher's control of oneself via self-monitoring techniques through planning to implement classroom PA	Teacher discussion on effective strategies to incorporate PA into academic content	1. I feel motivated to incorporate physical activity breaks into my classroom.
Reciprocal Determinism	The interaction between the teacher, implementing PA in the classroom, and the school and classroom environment that either supports or rejects classroom PA	Present information on PA utility; discussion on shaping the environment to support classroom PA	1. I feel as though I have enough time to incorporate physical activity breaks into my classroom. 2. My classroom is set up in a way that is conducive to implementing physical activity breaks with my students. 3. My school administration supports the use of physical activity breaks in the classroom. 4. There is time in the school day available for incorporating physical activity breaks.

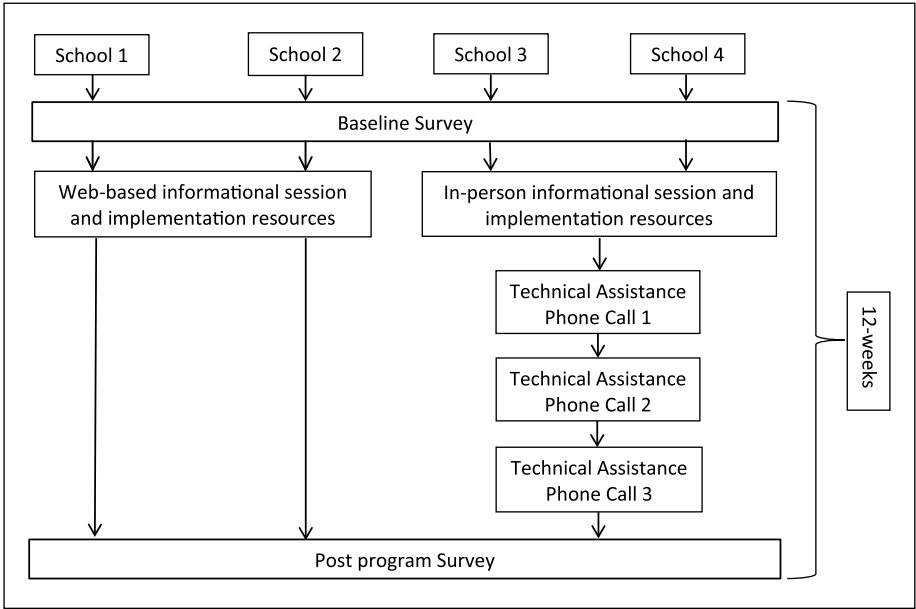Source: University of Pennsylvania (n.d.).

Figure 1. Study design.

Pennsylvania school district that participated in phase I. Of the five schools contacted, administrators from four schools agreed to participate in the intervention. The four schools were randomised to one of three intensities of the intervention (tiers). The low tier included a web-based training ($n=2$), the moderate tier included an in-person training ($n=1$) and the high tier included an in-person training with additional personalised assistance across the implementation timeline (Figure 1). Researchers used this study design to determine the presence of a training dose-response. Teacher eligibility criteria included all part-time and full-time elementary school teachers who were over the age of 18 ($n=41$).

Study interventions

The web-based training (low tier) consisted of one 30-minute recorded webinar hosted by a study team member with certification as a Health Education Specialist, and covered topics based in SCT constructs, including the benefits of classroom PA examples and guidelines of implementing activity sessions, solutions to common barriers and the study protocol. These participants also received resources to help plan activity sessions, including specific classroom PA examples and online web-links.

The in-person training included similar content covered in the recorded webinar but was structured to provide a more in-depth and engaging learning environment through topic discussion and movement. Participants in the moderate and high tiers participated in a 1-hour, in-person training led by the study team. The session started with introductions and study information, followed by the researched-benefits of classroom PA (i.e. time-on-task, behaviour and academic improvement) to increase teacher's outcome expectations. Content delivery was based on SCT constructs. Examples of PA breaks and active learning scenarios were provided, and teachers contributed their knowledge and experience of using similar activities with colleagues to increase behaviour

capability and self-regulation. Researchers led the teachers through an activity break and breathing exercise to further reinforce the fact that activity breaks can be simple and effective at refocusing students. The session ended with a discussion of how to overcome common barriers to implementation such as time, behaviour and noise. Researchers facilitated discussion and provided solutions including utilising mindfulness and breathing activities after an activity break to calm students, and also suggested that teachers model the activity to encourage participation. To reinforce learning, researchers provided handouts with resources to help plan activities and guidelines for implementing the activity sessions, including scheduling suggestions, overcoming barriers and supporting other classroom teachers. The structure of the training aimed to increase the behavioural capacity, self-efficacy, self-regulation and reciprocal determinism through engaging participants in the learning process through discussion and movement.

In addition to the in-person training session and resources, the high tier received proactive technical assistance, including monthly telephone conversations with study personnel to assist with implementation strategy. Teachers in the high tier also received monthly emails to reinforce topics covered during the in-person training session. Topics included overcoming barriers to implementation, free online resources and messages that reinforced the benefits of classroom PA.

Outcome measures

Data were collected using electronic surveys. Researchers collected intervention data through a self-report baseline survey administered before the training and a post-intervention survey administered at the end of the school year. Researchers administered additional monthly surveys following the training session at weeks 3, 7 and 11 during the second half of the school year to evaluate frequency of teacher implementation and self-efficacy of implementation. Each survey included the following definition of a PA break to facilitate consistent outcome reporting among participants: 'A physical activity break is defined as: a session of movement during regular classroom time excluding recess and physical education class. Sessions should range from 5 to 20 minutes and integrate strengthening or aerobic activity'. Participants were asked to reflect on the past month to answer questions about PA implementation habits in their classroom in an average week.

To our knowledge, there is no pre-established tool for measuring PA session frequency in the classroom. We therefore used SCT to develop a unique evidence-based tool. Study outcome measures were adapted SCT constructs, which included reciprocal determinism, behavioural capability, outcome expectations and self-efficacy by teacher self-report using a Likert-type scale (Table 1). Reciprocal determinism can be described as influencing multiple environmental and personal factors to change behaviour. Teachers evaluated the effect of PA sessions on student behaviour, student engagement during lessons and time available on a scale of 1 (strong decline) to 5 (strong improvement).

Additional questions evaluated teachers' perspectives on administrator support, classroom set-up and knowledge on a scale of 1 (strongly disagree) to 5 (strongly agree) and 1 (least knowledgeable) to 5 (most knowledgeable). Behaviour capability was evaluated by teacher knowledge of PA session methods and self-efficacy was evaluated through confidence in their ability to successfully implement PA sessions and successfully encourage student participation. PA session impact on test scores, student behaviour during sessions, student engagement during lessons, and amount of time for academic instruction and implementation feasibility each contributed to the evaluation of outcome expectations. We additionally measured PA break length and frequency as outcomes measures. Finally, reciprocal determinism was evaluated through various aspects of environmental support for the intervention, including adequate time for implementation, appropriate classroom setup and administrator support.

Data analysis

All variables were summarised prior to analysis using descriptive statistics. The distribution of continuous variables was assessed using box plots, histograms and normal probability plots in order to determine what data analysis was appropriate. The Wilcoxon Signed Rank test was used to compare skewed and Likert-type scale outcome variables, including the pre-intervention and post-intervention responses. Comparisons of these same outcome variables were made by intervention level (low, moderate, high) at post-intervention using a Kruskal–Wallis test with Wilcoxon Rank Sum tests for pairwise group comparisons to determine if there was any significance between intervention level. The *p* values from the three pairwise group comparisons (low, moderate, high) were adjusted for multiple comparisons using the Bonferroni correction in order to correct the Type I error rate for multiple testing. The Likert-type scale outcome variables based on agreement were then recoded as binary variables with strongly disagree, disagree and neutral in one group and agree and strongly agree in another group. Categorical variables were developed for simplicity in teacher completion of surveys, but for identifying degree of change with the sample, researchers dichotomised the answer selections. To measure length of time of PA sessions per week, participants selected a categorical option among the following options: no breaks, 1–5 minutes, 5–10 minutes or 10+ minutes. These answers were then translated into median values (0, 3, 7.5 and 10, respectively) to determine degree of change among baseline and post-intervention responses. A Wilcoxon Signed Rank test was then applied to determine change among this variable. McNemar's test was applied to these recoded outcome variables to test for differences in the pre-intervention and post-intervention proportions with agreement. Bowker's test of symmetry tested for pre-intervention and post-intervention differences in proportions of the three categories for length of sessions. All analyses were performed with SAS version 9.4 (SAS Institute, Cary, NC).

Results

Forty-one teachers participated in phase II of this study and there was a high survey response rate (~90%). There was an overall significant increase in PA implementation time from 4.1 to 5.4 minutes ($p = .02$) from baseline to post-intervention; however, no significant change was found between intervention tiers ($p = 1.0$). There was a significant increase of teachers who started using PA in the classroom who reported not using classroom PA at baseline (from 21% to 6% not using). Overall, the percentage of teachers implementing longer PA sessions increased from the beginning of the study to the end, though not significantly ($p = .41$). However, we did find an overall decrease in 1- to 5-minute PA sessions (from 62% to 46%), and an increase in 5- to 10-minute PA sessions (from 19% to 39%). Longer PA sessions (i.e. greater than 10 minutes) decreased slightly, from 19% to 15%. Overall, 41% of teachers increased the duration of their PA sessions, and 18% decreased their duration as compared to baseline. Furthermore, teachers who reported not including PA sessions decreased from 21% to 6% at post-intervention. Among the group of teachers who indicated not using PA sessions at baseline, average post-intervention duration was 7.5 minutes of activity. Overall, teachers held 6.7 PA sessions per week before the intervention, which increased to 9.4 at post-intervention ($p = .20$) (Figure 2). No statistically significant differences were found between intervention tiers for feasibility measures, including duration and frequency of sessions.

The intervention resulted in statistically significant improvements in the following SCT constructs: teacher self-efficacy, outcome expectations and reciprocal determinism (Table 2). The percentage of teachers who reported feeling confident (self-efficacy) in their ability to implement PA sessions increased from 57% to 86% ($p = .002$). Researchers examined change between average reported self-efficacy and found no statistical significance between tiers at post-intervention.
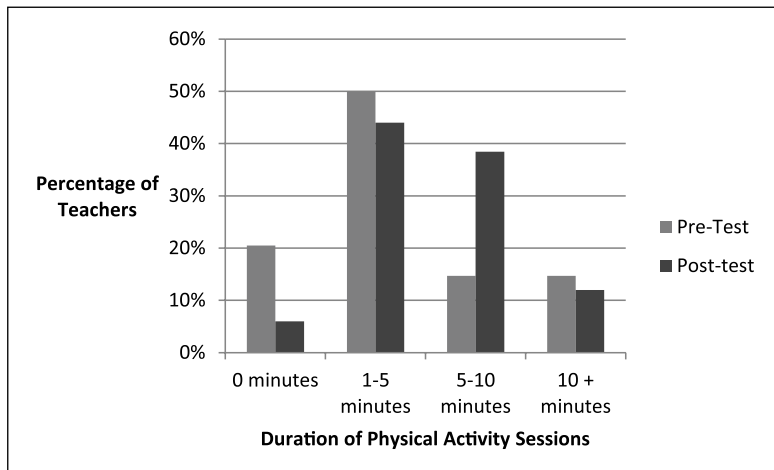
Figure 2. Duration of reported physical activity sessions before training and following the 12-week period.

Table 2. Percent change in social cognitive theory construct from baseline to post-intervention.

Indicator	Baseline (%)	Post (%)	p
Teacher self-efficacy[a]	57.1	85.7	<.01
Reciprocal determinism[b]			
Classroom setup	85.3	61.8	.04
Adequate time	91.2	55.9	<.01
Administrator support	80.0	91.3	.29
Outcome expectations			
Student engagement[c]	73.5	82.4	.51
Student behaviour[c]	73.5	82.4	<.01
Feasibility[d]	69.0	93.1	<.01

[a]Percent of teachers who indicated confident or very confident.
[b]Percent of teachers who indicated agree or strongly agree.
[c]Percent of teachers who indicated improvement or strong improvement.
[d]Percent of teachers who indicated easy or very easy.

The low tier reported an average of 4.0, moderate, 3.95 and high 4.20 (very confident=5, not at all confident=1) and after calculating change between each tier, there was no statistical significance ($p=1.00$). Perceived feasibility of PA session implementation increased significantly from pre- to post-intervention from 69% to 93% ($p<.001$). Student behaviour ratings increased significantly at post-intervention from 74% to 82% ($p=.005$). Furthermore, a higher percentage of teachers indicated improvement in student engagement during lessons from baseline (74%) to post-intervention (82%).

A lower percentage of teachers reported that their classroom was set up appropriately (85% vs 62%, $p=.04$) and that there was adequate time during the school day to implement PA sessions (91% vs 56%, $p=.002$) from baseline to post-intervention. Furthermore, a greater percentage of teachers reported that their administration supports the use of PA sessions at post-intervention (91%) compared to baseline (80%).

In terms of SCT construct variables, there was a statistically significant difference in teachers who felt that they were knowledgeable between the low (4.8) and moderate (4.0, $p = .05$) tiers at post-intervention and overall from baseline (30%) to post (80%) ($p = .002$). In addition, there was a statistically significant difference in teachers who agreed that there was adequate time for incorporating PA sessions between the low (4.6) and moderate (3.9) tiers at post ($p = .02$); however, there was no statistical significance for this measure between the low and high ($p = .23$) or moderate and high ($p = .65$).

Discussion

The purpose of this study was twofold: first, to determine if varying intensities of teacher trainings on classroom PA increase implementation duration and frequency, and second, to examine the efficacy of SCT-based outcomes on teacher attitudes, knowledge and behaviour. Although we did not identify a statistically significant change in PA session frequency or duration from the baseline to post-intervention among intervention tiers, the average number of PA sessions increased from 6.7 to 9.4 per week, demonstrating a 50% increase. Furthermore, the overall average time spent using classroom PA increased from baseline to post-intervention and the number of teachers who had never used PA in the classroom decreased from 21% (baseline) to 6% (post). Among teachers who reported no use of classroom PA at baseline, the majority of participants indicated activity levels at an average of 7.5 minutes at post. Overall, this finding contributes to the increase in sessions less than 10-minutes and indicates that the intervention contributed to overall longer PA sessions and an increase in number of teachers who utilise classroom PA. In addition, 41% of participants increased the duration of their activity sessions throughout the 12-week intervention period. Similar studies suggest that teacher trainings plus technical assistance (high tier) related to PA in the school setting is effective at improving student activity levels (Erwin et al., 2011; Hughey et al., 2014).

Secondary outcomes of the study focused on teachers' SCT belief constructs. Teachers in all tiers experienced improved self-efficacy and an increase in knowledge following the training and 12-week intervention period. In addition, varying the training tier format did not result in differences among participant SCT outcomes, which may indicate that content of training is more important for behaviour change than format and intensity of trainings.

Literature consistently supports the benefit of addressing and evaluating self-efficacy, as it is associated with sustained behaviour change (Bandura, 1977; Boulton, 2014). In general, teachers who lack confidence in implementing PA into the classroom are less likely to do so; however, when components that affect self-efficacy are addressed, there is a general improvement in overall learning and behaviour change (Bartholomew and Jowers, 2011; Dinkel et al., 2017). In this study, researchers allowed time for teacher discussion regarding overcoming barriers during the in-person trainings which has been previously used to impact behaviour change and is likely to improve self-efficacy (Webster et al., 2017). Teachers also reported an increase in student engagement from baseline (74%) to post (82%), which may have further reinforced teachers' self-efficacy and behaviour change.

Perceived administrator support within the schools was relatively high at baseline (80%), which may have contributed to implementation rates. Administrator support is influential in affecting teachers' perceptions and implementation of classroom activity specifically when it comes to teacher trainings and student priorities (Dinkel et al., 2017; Erwin et al., 2011; Stylianou et al., 2015). It is important to note that researchers obtained permission from administrators from participating schools to implement the intervention, indicating administrator support for PA in the classroom setting (Donnelly et al., 2016; Rasberry et al., 2011).

The major barrier to implementing PA sessions at baseline was time, reported by 55% of teachers. This finding is consistent with focus group themes where teachers mentioned barriers such as 'Time. It seems like we're always so rushed'. Other studies have found that common barriers for teacher PA implementation include lack of time, student participation, available resources and classroom management (Howie et al., 2014; Webster et al., 2017). Researchers addressed these barriers during the teacher training and offered suggestions for overcoming them. Specifically, researchers strongly encouraged the integration of PA into instructional academic time, such as practising mathematics facts or spelling words while doing fitness exercises such as jumping jacks. Furthermore, researchers encouraged persistence with implementing, as students may engage better after several attempts. In addition, the training included discussions about classroom management techniques, like using cues to control the class. Study findings demonstrated that many of these barriers still existed following the training, though at a lesser rate. Emphasis on overcoming barriers to implementing PA in the classroom should always be included in teacher training around PA implementation to facilitate conversation and solutions.

Although the format of intervention style (in-person vs web-based) does not necessarily predict stronger SCT construct outcomes, researchers had a more difficult time recruiting participants for the web-based version of the study. This suggests that training which administrators are more supportive of or that teachers prefer (i.e. in-person training) may be more effective.

Limitations

This study has several limitations. First, participants self-reported PA implementation frequency and duration, which may result in biases. However, questionnaires asked for participants to reflect on the past month overall, providing specific time-based guidance to report. Second, researchers developed a unique survey tool for measuring feasibility due to the lack of an existing validated tool, creating an opportunity to further replicate and test the tool. Because this was a pilot study, the results are naturally limited by the sample size ($n=41$). A larger sample size may generate increased significance and strengthen the literature in this area (Hughey et al., 2014). Despite the small sample, significant changes in SCT outcomes were identified, showing promise for future studies powered for significant outcomes.

Strengths

Our study has a number of strengths. With the opportunity to conduct formative research through focus groups, researchers tailored the intervention training specifically to the needs of teachers and focused on overcoming barriers through facilitated teacher discussion. In addition, we randomised schools to remove the influence of unmeasured differences and achieved high response rates on surveys (90%). This is the first study known to the authors that examines the effectiveness of SCT-based training, creating an opportunity to expand this work and ultimately create impactful training for teachers.

Conclusion

PA training based in SCT improved teacher self-efficacy, knowledge and reciprocal determinism in implementing classroom PA. The findings of this study contribute to our understanding of how best to prepare teachers to implement PA while suggesting that SCT-based training may be an effective model to predict sustained implementation. We found that the one-time training was effective at predicting increased knowledge and self-efficacy; however research calls for more sustained and

consistent professional development offerings focusing on classroom PA (Stylianou et al., 2015). Regular and ongoing teacher training should address personal, social and environmental constructs that work to change behaviour and knowledge around successful classroom PA implementation.

Funding

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