The Physical Educator Vol. 75 • pp. 498–514 • 2018
https://doi.org/10.18666/TPE-2018-V75-I3-8086

PHYSICAL ACTIVITY

Effects of a Classroom Walking Program on Physical Activity Accrual and On-Task Behavior

Peter Stoepker, Brian Dauenhauer, Tiffany McCall

Abstract

The Walking Classroom (TWC) program provides a structured classroom physical activity (PA) break that incorporates academic content. The purpose of the study was to (a) explore differences in PA accrual on TWC school days versus non-TWC school days, (b) examine on-task behavior before and after TWC, and (c) better understand student and teacher experiences with the program. A mixed methods case study design was used as a method of examining the experiences of one fourth grade classroom and one classroom teacher in the western United States. Twelve weeks of pedometer steps were collected for the entire school day. Student on-task behavior was systematically observed for 10 weeks with 5-s interval recordings approximately 30-min before and after the implementation of TWC. Repeated measures ANCOVA (n = 22) revealed no significant differences between TWC days (M = 7,726 steps) and non-TWC days (M = 7,934 steps). Significant increases were observed in student on-task behavior following TWC breaks (+7.5%, t = -6.782, p < .001, Cohen's d = .944). Three major themes emerged from the qualitative data: (a) students had fun learning while exercising, (b) technology challenges hindered TWC

Peter Stoepker is a graduate research assistant, UNC Active Schools Lab, University of Northern Colorado. Brian Dauenhauer is an assistant professor, School of Sport and Exercise Science, University of Northern Colorado. Tiffany McCall is a fourth grade classroom teacher in Colorado. Please send author correspondence to Peter.Stoepker@unco.edu

implementation, and (c) social interaction was desired during TWC breaks. Although findings indicated that TWC days were no different than non-TWC days in terms of PA accrual, teacher logs suggested that an additional recess was provided on non-TWC days, thus washing out any potential PA effect. The students and teacher had positive impressions of TWC overall, but offered suggestions for how TWC could be improved.

Since 1980, childhood obesity rates have tripled, with rates of obesity among 6- to 11-year-olds more than doubling from 7% to 17.5% and rates of obesity among teens quadrupling from 5% to 20.5% (Centers for Disease Control and Prevention [CDC], 2014). Schools have been identified as primary sites for promoting physical activity (PA), because children and adolescents spend most their time in school (Mahar et al., 2006). Yet, because of budget constraints and pressures on increasing academic achievement scores, opportunities for students to be physically active in schools have been declining (Mahar et al., 2006).

Public health authorities recommend that schools provide PA opportunities to help children meet the 60 min/day PA guideline (CDC, 2010). Many schools provide insufficient PA opportunities, with students in some elementary schools receiving as little as 15 to 20 min of moderate to vigorous PA during school (Carlson et al., 2015). A sedentary lifestyle influences not only physical health, but also cognitive and brain health (Chaddock, Pontifex, Hillman, & Kramer, 2011). When not exposed to enough activity throughout the school day, students are more likely to be off-task and fidgety (Howie, Schatz, & Pate, 2015).

A whole- school approach, such as the Comprehensive School Physical Activity Program (CSPAP) model, is recognized as a way for children to accumulate daily PA (Carson et. al., 2014). A component of a CSPAP that few studies have examined is the effectiveness of the integration of PA during the school day (Howie, Beets, & Pate, 2014). Classroom PA breaks are a potential solution for increasing PA levels, because they have been shown to contribute meaningful amounts of PA and improve student on-task behavior and academic skills and decrease classroom behavior issues (CDC, 2010; Erwin, Fedewa, & Ahn, 2012; Katz et al., 2010). With the increase of PA in

venues other than physical education classes, additional opportunities such as classroom PA breaks need to be developed and evaluated (Donnelly & Lambourne, 2011).

The Walking Classroom (TWC) organization created an innovative program that provides a structured PA break while incorporating academic content. Students take a brisk 20-min walk as a class while listening to a kid-friendly podcast that comes preloaded on a Walk Kit (audio device; see Figure 1). The curricular materials align directly with fourth and fifth grade Common Core Standards and contain more than 100 preloaded podcasts at each grade level. Anecdotally, teachers report after implementing TWC that students retain information better, demonstrate improved behavior and engagement in the classroom, and show increased performance on standardized exams (The Walking Classroom Institute, 2016). However, no known studies have determined the amount of PA that the program can provide and how participation may affect classroom behavior. Therefore, the purpose of this study was threefold: (a) to explore the differences in PA accrual on the days TWC was implemented to non-TWC days, (b) to determine if the program affected student on-task behavior, and (c) to develop a deeper understanding of student and teacher experiences with the program.

Figure 1. Audio kit device.

Method

Prior to data collection, the university institutional review board and the school in which the project was implemented granted approval for this study. The parents of the students gave written consent, and the students verbally affirmed assent. An entire fourth grade classroom (N = 28) had the opportunity to participate in the study, 96% of the students and their parents agreed, 23 students participated in the focus groups, and 22 were included in the final statistical analysis.

School Environment and Participant Characteristics

The school selected for this study was located in the western United States. It included approximately 670 students in kindergarten to fifth grade. Sixty-one percent of the student population was eligible for free or reduced lunch. The campus was surrounded by open space, along with a paved walking loop that worked well with the implementation of TWC. The school was selected because it received access to a classroom set of TWC as part of the district's student wellness program. This was the first time the students and teacher had used the program. The school, teacher, and research team had no relationship with TWC.

The school physical education teacher and the classroom teacher collected demographic information. The school physical education teacher collected height, weight, and laps completed on the Progressive Aerobic Cardiovascular Endurance Run (PACER) during PE classes using FitnessGram testing protocols (The Cooper Institute, 2010). The classroom teacher provided ethnicity, gender, and age information, with permission from the school principal. Student VO_2 max was calculated using the Quadratic Model (Mahar, Guerier, Hanna, & Kemble, 2011) and BMI was calculated using the CDC BMI calculator for children and teens (CDC, 2016). Ten boys and 12 girls (aged 9 to 11) from one fourth grade classroom participated in this study. According to VO_2 max and BMI results, most students were in a healthy zone. Most students were Latino and Caucasian (see Table 1 for complete demographic characteristics).

The classroom teacher was female with 16 years of teaching experience. She held a bachelor's degree in interdisciplinary studies with an emphasis in elementary education and a master's degree in educational leadership with a principal license. The classroom teacher had a strong background in PA, studying ballet throughout her life. Her students had many opportunities throughout the school day to be active, including PA breaks, sitting on exercise balls instead of chairs, and extra recess periods.

Table 1
Student Demographic Characteristics

Participant characteristic	Girls	Boys	Total
Total (*n*)	12	10	22
Age (years)	10.2 (.17)	10.3 (.34)	22
VO_2 max (ml/kg/min)	38.4 (2.93)	42.7 (3.74)	22
BMI (kg/m^2)	18.3 (2.06)	16.5 (2.03)	22
BMI Percentile (age/gender normed)	56.8% (.23)	28.7% (.266)	22
Ethnicity			
Caucasian	3	5	8
Latino	8	4	12
Other	1	1	2

Note. Values presented as means (standard deviations).

Research Design

This study used a mixed methods design with quantitative data on PA and student on-task behavior and with qualitative data on participant experiences. This study used pedometers to measure PA accrual and systematic observation to record student on-task behavior. A deeper understanding of TWC was developed through a teacher interview and student focus groups. The classroom teacher kept weekly logs throughout the study to record any contextual factors that could influence PA accrual and TWC implementation.

Measures

Pedometers. FitStepPro pedometers (Gopher Sport) measured total steps during the school day. Pedometer reliability is moderate to high in children 5 years or older; thus, pedometers are deemed

an appropriate measure of PA in elementary-aged children (Clemes & Biddle, 2013). Pedometers were checked for accuracy with the 100-step walk test (Vincent & Sidman, 2003), and all values were found to be within ±5% of observed steps.

Students were asked to clip the pedometers onto their hip at the beginning of the school day and wear them until the end of the school day (~8:20–3:45). Prior to dismissal, students uploaded their pedometer data using an accompanying USB uploader device. Prior to the study, a 1-week practice data collection occurred that ensured proper procedures were followed and that accounted for potential participant reactivity. PA data were collected at the end of each school day on TWC days (Tuesday and Thursday) and non-TWC days (Wednesday and Friday). Steps were repeatedly measured for 12 weeks during the spring semester.

Systematic Observation of On-Task Behavior. Student on-task behavior was measured with systematic observation (see Figure 2). The protocols for measuring on-task behavior were adapted from Goh (2014). A student was considered on-task (T) if he or she was working on an assigned task, discussing work with a partner, looking at the teacher, moving in response to teacher directive, or asking questions. A student was marked off-task (F) if he or she was bouncing out of control on an exercise ball, fidgeting, excessively moving or talking without teacher directive, had his or her head on the desk, or was staring out the window. A student was coded missing (X) if he or she was absent, out of the room, or away from his or her desk.

Interobserver reliability among members of the research team was established prior to formal data collection (92% agreement), and periodic checks were conducted on one third of observations as a method of accounting for observer drift, with each reliability score being greater than 80%. The observers listened to an audio recording via headphones that had a beep every 5 s. At the signal, the observer noted the type of behavior the student was exhibiting. The observer was present approximately 30 min before and after TWC. With 360 observations per 30 min, each student was observed approximately 12 times during each observation period, resulting in 6,529 individual observations during the study.

On-Task Behavior Observation

Observer: _____ Date: _____ Start Time: _____ Stop Time: _____ Pre Post

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

On Task **(T)**: Working on assigned task, discussing work with a partner, looking at the teacher, moving in response to teacher directive, asking questions.

Off Task **(F)**: Bouncing out of control, fidgety, excessive movement or talking without teacher directive, tapping arm/leg, head on desk, staring out the window.

Student not in desk **(X)**: Absent, out of the room, away from desk as a result of teacher directive.

Observation Notes

- One primary observer and a secondary observer coming in for ≥ 20% of observations for reliability checks.
- Approximately 30-min observation before and 30-min observation after Walking Classroom.
- The numbers on the top of the table represent student number.
- The sequence will start at Student 1 and go to Student 30 then start back over at Student 1.
- Each observer will observe individual students for 5 seconds before moving on to another student, until all students in the class are observed.
- The researchers will repeat this sequence for the entire observation period.
- Each observer will listen to an MP3 file via headphones that signal every fifth second. At the signal, the observer will note the appropriate behavior code (BT, BF, T, F, X) and begin observing the next student.
- With 360 observations per 30-min period, each student will be observed approximately 12 times.

Figure 2. Observation form to code on-task behavior.

Teacher log. The classroom teacher completed a teacher log at the end of each data collection day. The purpose of the log was to monitor pedometer activities and to keep track of extenuating circumstances that may have affected PA levels. In addition to keeping track of whether TWC was implemented each day and what times the pedometers were put on and taken off, the teacher recorded how many minutes the students spent in physical education, at recess, or in other classroom-based PA breaks.

Qualitative data collection. At the end of the spring semester, four student focus groups (n = 23) and one teacher interview were conducted. The purpose of the interviews was to see how the students and the teacher felt about TWC. The teacher interview was related to five topics: (a) overall experience with TWC, (b) ease of use, (c) perceived student changes in PA, (d) safety, and (e) enjoyment. Student focus groups were related to three topics: (a) overall experience, (b) changes in PA, and (c) enjoyment. The teacher interview was completed at the end of a school day, and the four focus groups were conducted during students' lunchtime. For all questions in the focus group interviews and the teacher interview, detail-oriented, elaboration, clarification, and contrast probes were used as a method of eliciting additional information from participants (Patton, 2002; Rubin & Rubin, 2005).

Data Analysis

Quantitative. Prior to analysis, data were screened for missing values, outliers, and violations of statistical assumptions. Students with excessive missing data due to absences (n = 5) were removed from the data set, resulting in an n of 22 for quantitative analyses. Outliers in pedometer steps were defined as > 14,000 steps in 1 school day and were subsequently treated as missing data. To maintain sample size in a repeated measures design, the research team imputed missing values using the mean of nearby points (i.e., the observation immediately before and immediately after), as described by Meyers, Gamst, and Guarino (2013). Means and standard deviations for the 12 weeks of PA data and 10 weeks of observational data were computed. Skewness and kurtosis values were beyond a desirable range (-1.781 to 3.04) for the on-task behavior variable; therefore, the research team conducted a square transformation to moderate this

violation. The transformation resulted in an acceptable distribution of values (Shapiro-Wilks, $p \geq .001$; Meyers et al., 2013).

Pearson product-moment correlation coefficients were calculated for demographic characteristics (VO_2 max, BMI) and PA variables (TWC-PA and Non-TWC-PA). Repeated measures analysis of covariance (ANCOVA) tested differences in PA between TWC and non-TWC days, determined changes in PA over time, and explored potential interaction effects. A paired sample *t* test tested differences in on-task behavior before and after TWC sessions. Significance for all statistical analyses was set a priori at $p < .05$, and effect sizes were calculated for significant findings with Cohen's *d*. Analyses were conducted through SPSS version 23.

Qualitative. Audio recordings from the student focus groups and teacher interview were transcribed into a word processing document using Dragon NaturallySpeaking (Nuance), and transcripts were uploaded into NVivo 10 for qualitative analysis. Two research team members independently coded the data and identified broad themes in a process of open and axial coding (Strauss & Corbin, 1998). Results from each researcher's analysis were then compared through a process of peer debriefing, and consistent themes were identified. Once identified, the themes were sent to the classroom teacher for member checking, which ensured credibility (Lincoln & Guba, 1985).

Results

Quantitative

Students averaged 7,726 steps (*SD* = 1,488) on TWC days, compared to 7,934 steps (*SD* = 1,407) on non-TWC days. Positive, moderate correlations were observed between PA and VO_2 max on TWC ($r = .594$, $p = .004$) and non-TWC days ($r = .646$, $p = .001$); thus, VO_2 max was included as a covariate in the repeated measures analysis. Results of the repeated measures ANCOVA revealed no significant interaction effects among the variables and no differences in PA between TWC and non-TWC days, $F(1, 20) = .000$, $p = .996$. Results from systematic observation data revealed on-task behavior increased from 85.9% to 93.4% following TWC implementation,

which was found to be a statistically significant increase, $t(21) = -6.782$, $p < .001$, with a large effect size (Cohen's $d = .944$; Cohen, 1998).

Qualitative

Three major themes emerged from the qualitative data: (a) students had fun learning while exercising, (b) technology challenges hindered TWC implementation, and (c) social interaction was desired during TWC breaks.

Students had fun learning while exercising. The students were asked about their overall enjoyment with the program, and they frequently stated that they had fun learning while exercising. One student mentioned, "You get to go outside and enjoy the day and also learn something." Another student said, "If they are telling you something about nature and you are outside walking you learn more about what is around you and you probably are enjoying it more." A student stated, "I also like TWC because it gave you exercise plus learning, and I love exercise and it helps me learn and I like to learn new things."

Technology hindered TWC implementation. Throughout the semester, the students, as well as the classroom teacher, seemed to run into numerous technology issues. The biggest problem seemed to be the battery life of the audio players. The classroom teacher stated,

The battery life seemed to run out very fast and did not give any warning. The podcast would shut off and it makes things challenging when the whole thing shuts down when you are halfway through the lesson. Then you have six kids are at three minutes, one kid is at four minutes and then students start complaining that their podcast is dead and have to start all over again.

Students agreed with the classroom teacher. One student stated,

> The one thing I didn't like about TWC is [the audio player] would shut off while we were walking and one day when I was walking, I would turn it on, then it would turn off, then turn on, then turn off.

Another student added, "The biggest issue is the batteries and it would shut off on me." Overall, the students and teacher perceived

that if the technology was improved, the experience would be more enjoyable.

Social interaction was desired during TWC breaks. The students and the teacher agreed that they wished they could have interacted more with each other during the program. A student noted, "I wish we were able to stop and ask questions to different students about the lessons." Another student added,

> I liked TWC, but I didn't like that I was not able to talk to my friends, because I like to learn new things and I want to tell them about it, but I wasn't able to during the walking.

The classroom teacher stated,

> When they were walking, I wish they could have been able to pause and talk to their neighbor about it. It is a long time for kids without interaction . . . I would love to see more interactive content somehow. I think moving makes them better, but I believe that social interactions will increase their comprehension even better.

Discussion

The purpose of this study was to examine differences in PA accrual on TWC and non-TWC days, explore differences in on-task behavior pre- and post-TWC, and to gain a better understanding of student and teacher experiences with the program. Results indicated no significant differences in PA accrual on TWC versus non-TWC days, an increase in on-task behavior following TWC implementation, and overall positive impressions of the program, with some reasonable suggestions for program improvement. Results contribute to a growing body of knowledge on the effectiveness of classroom PA integration strategies.

TWC and PA

When comparing TWC days to non-TWC days, the research team found no significant differences in student PA accrual. However, teacher logs indicated that on non-TWC days, an extra 20-min recess was typically provided. Therefore, for PA accrual,

it can be concluded that TWC provided as much PA as an extra 20-min recess. Students accrued an average of 7,726 steps/school day, which is consistent with findings from other PA intervention studies. Mahar et al. (2006) found that two 10-min classroom-based PA interventions per week increased overall PA accrual in fourth grade students and contributed an average of 6,063 steps/school day. Erwin, Beighle, Morgan, and Noland (2011) found similar results; step accrual was higher for students who received an additional PA break during the day than for students in the control group. With the addition of a 20-min PA intervention in this study, students accumulated approximately 63% of their daily recommended steps (12,000 to 16,000 steps/day for boys; 10,000 to 13,000 steps/day for girls; Tudor-Locke et al., 2011) during school hours. A typical school day lasts approximately 7.5 hr, and this percentage has been shown to be a substantial amount of PA during the school day, because students are active over half the day. When children meet the requirements of PA during the school day, PA has the potential to provide multiple health benefits such as healthier bones and muscles, improved cardiovascular health, and reduced risk for developing chronic disease (CDC, 2010).

TWC and On-Task Behavior

On-task behavior increased by 7.5% following TWC implementation. This finding is consistent with findings in other studies that have shown increases in on-task behavior post–PA intervention. Howie et al. (2014) found that after a 10-min intervention, student on-task behavior increased by 10%. Carlson et al. (2015) and Webster, Wadsworth, and Robinson (2015) also found that the implementation of a PA break positively affected student on-task behavior. Off-task behavior is perceived to be problematic in a school setting because of the potential to limit learning opportunities, which could negatively affect student academic performance (Godwin et al., 2016). Results from this study suggest that TWC positively affects student on-task behavior, which could help increase student academic performance.

TWC and Enjoyment

Research suggests that children are more likely to participate in PA when they perceive it to be enjoyable, and enjoyment is positively related to the desire to continue PA participation (Coulter &

Woods, 2011; Gao, Zhang, & Podlog, 2013). Students enjoyed TWC and reported the TWC program was fun to use. However, students and the classroom teacher mentioned that they would have enjoyed TWC more if they were able to interact with their peers during the intervention. Engagement with peers, mentors, and teachers is critical for student achievement and overall development (Brand & Kasarda, 2014). Thus, TWC could be improved through the integration of more opportunities for student interaction during the lessons.

The use of technology is not without limitations, and understanding how teachers and students view the implementation of technology is important in that technology may affect future participation in PA (Partridge, King, & Bian, 2011; Welk, Corbin, & Dale, 2000). When first exposed to the use of technology, students are curious and looking forward to using it; however, as they begin to run into technological problems, curiosity turns into frustration and alters the student experience (Pokay & Tayeh, 1997). The implementation of TWC included similar challenges, and the results indicated that technology issues hindered the student experience with TWC. TWC program and hardware developers should consider addressing this issue moving forward to maximize the user experience.

Limitations

The results of this study must be interpreted with caution. The sample size was relatively small, and only one school was represented in the study. All the students were on a similar schedule and experienced the same school environment, which may or may not be the same as other schools. The classroom teacher strongly advocated for PA and provided additional opportunities for PA beyond TWC, which makes comparisons complicated. Future research needs to determine the effect of TWC on diverse populations and explore its effects on student knowledge and academic performance.

Conclusion

This study explored the effects of an integrated classroom PA program on PA accrual and on-task behavior. Although results showed that TWC had no positive effect on student PA accrual, it did increase student on-task behavior. This increase in on-task behavior could limit classroom management issues and affect overall student performance. The teacher and students enjoyed using TWC

and perceived it as a tool that they would like to use again. Limited social interaction time and technological difficulties diminished the users' experience with the program, and program developers could consider ways to improve these factors. Findings suggest that integrated classroom PA programs such as TWC have the potential to contribute meaningful amounts of daily PA and positively affect classroom behavior. More research needs to explore the effect of such programs across a variety of student and school populations and on additional academic outcomes.

References

Brand, B., & Kasarda, M. (2014). The influence of social interactions on female students' retention in two engineering programs. *Insights on Learning Disabilities*, *11*(1), 33–45.

Carlson, J. A., Engelberg, J. K., Cain, K. L., Conway, T. L., Mignano, A. M., Bonilla, E. A., & Sallis, J. F. (2015). Implementing classroom physical activity breaks: Associations with student physical activity and classroom behavior. *Preventive Medicine*, *81*, 67–72. https://doi.org/10.1016/j.ypmed.2015.08.006

Carson, R. L., Castelli, D. M., Pulling Kuhn, A. C., Moore, J. B., Beets, M. W., Beighle, A., & Glowacki, E. M. (2014). Impact of trained champions of comprehensive school physical activity programs on school physical activity offerings, youth physical activity, and sedentary behaviors. *Preventive Medicine*, *69*, S12–S19. https://doi.org/10.1016/j.ypmed.2014.08.025

Centers for Disease Control and Prevention. (2010). School health guidelines to promote healthy eating and physical activity. *MMWR Recommendations and Reports, 60*(RR05), 1–71.

Centers for Disease Control and Prevention. (2014). Questionnaires, datasets, and related documentation. Retrieved December 2, 2016, from https://wwwn.cdc.gov/nchs/nhanes/search/nhanes13_14.aspx

Centers for Disease Control and Prevention. (2016). BMI Percentile Calculator for Child and Teen. Retrieved from https://nccd.cdc.gov/dnpabmi/calculator.aspx

Chaddock, L., Pontifex, M. B., Hillman, C. H., & Kramer, A. F. (2011). A review of the relation of aerobic fitness and physical activity to brain structure and function in children. *Journal of the International Neuropsychological Society*, *17*, 975–985. https://doi.org/10.1017/S1355617711000567

Clemes, S. A., & Biddle, S. J. H. (2013). The use of pedometers for monitoring physical activity in children and adolescents: Measurement considerations. *Journal of Physical Activity and Health*, *10*, 249–262. https://doi.org/10.1123/jpah.10.2.249

Cohen, J. (1998). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

The Cooper Institute. (2010). *FitnessGram reference guide*. Retrieved from http://www.cooperinstitute.org/reference-guide

Coulter, M., & Woods, C. B. (2011). An exploration of children's perceptions and enjoyment of school-based physical activity and physical education. *Journal of Physical Activity and Health*, *8*, 645–654. https://doi.org/10.1123/jpah.8.5.645

Donnelly, J. E., & Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine*, *52*(Suppl. 1), S36–S42. https://doi.org/10.1016/j.ypmed.2011.01.021

Erwin, H. E., Beighle, A., Morgan, C. F., & Noland, M. (2011). Effect of a low-cost, teacher-directed classroom intervention on elementary students' physical activity. *Journal of School Health*, *81*, 455–461. https://doi.org/10.1111/j.1746-1561.2011.00614.x

Erwin, H., Fedewa, A., & Ahn, S. (2012). Student academic performance outcomes of a classroom physical activity intervention: A pilot study. *International Electronic Journal of Elementary Education*, *5*, 109–124.

Gao, Z., Zhang, P., & Podlog, L. W. (2014). Examining elementary school children's level of enjoyment of traditional tag games vs. interactive dance games. *Psychology, Health, and Medicine*, *19*, 605–613. https://doi.org/10.1080/13548506.2013.845304

Godwin, K. E., Almeda, M. V., Seltman, H., Kai, S., Skerbetz, M. D., Baker, R. S., & Fisher, A. V. (2016). Off-task behavior in elementary school children. *Learning and Instruction*, *44*, 128–143. https://doi.org/10.1016/j.learninstruc.2016.04.003

Goh, T. L. (2014). *Effects of a movement integration program on elementary school children's physical activity, fitness levels, and on-task behavior and teachers' implementation experiences* (Doctoral dissertation). Retrieved from ProQuest database. (3619725)

Howie, E. K., Beets, M. W., & Pate, R. R. (2014). Acute classroom exercise breaks improve on-task behavior in 4th and 5th grade students: A dose–response. *Mental Health and Physical Activity*, *7*(2), 65–71. https://doi.org/10.1016/j.mhpa.2014.05.002

Howie, E. K., Schatz, J., & Pate, R. R. (2015). Acute effects of classroom exercise breaks on executive function and math performance: A dose–response study. *Research Quarterly for Exercise and Sport*, *86*, 217–224. https://doi.org/10.1080/02701367.2015.1039892

Katz, D. L., Cushman, D., Reynolds, J., Nijke, V., Treu, J. A., Walker, J., Smith, E., & Katz, C. (2010). Putting physical activity where it fits in the school day: Preliminary results of the ABC (Activity Bursts in the Classroom) for fitness program. *Preventing Chronic Disease, 7*(4), 1–10.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage. https://doi.org/10.1016/0147-1767(85)90062-8

Mahar, M. T., Guerieri, A. M., Hanna, M. S., & Kemble, C. D. (2011). Estimation of aerobic fitness from 20-m multistage shuttle run test performance. *American Journal of Preventive Medicine*, *41*(4, Suppl. 2), S117–S123. https://doi.org/10.1016/j.amepre.2011.07.008

Mahar, M. T., Murphy, S. K., Rowe, D. A., Golden, J., Shields, A. T., & Raedeke, T. D. (2006). Effects of a classroom-based program on physical activity and on-task behavior. *Medicine & Science in Sports & Exercise*, *38*, 2086–2094. https://doi.org/10.1249/01.mss.0000235359.16685.a3

Meyers, L. S., Gamst, G., & Guarino, A. J. (2013). *Applied multivariate research: Design and interpretation* (2nd ed.). Thousand Oaks, CA: Sage.

Partridge, J. A., King, K. M., & Bian, W. (2011). Perceptions of heart rate monitor use in high school physical education classes. *Physical Educator*, *68*, 30–43.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Pokay, P. A., & Tayeh, C. (1997). Integrating technology in a geometry classroom: Issues for teaching. *Computers in the Schools*, *13*(1–2), 117–123. https://doi.org/10.1300/J025v13n01_13

Rubin, H. J., & Rubin, I. (2005). *Qualitative interviewing: The art of hearing data* (2nd ed.). Thousand Oaks, CA: Sage. https://doi.org/10.4135/9781452226651

Strauss, A., & Corbin, J. (1998). *Basic of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Thousand Oaks, CA: Sage.

Tudor-Locke, C., Craig, C. L., Beets, M. W., Belton, S., Cardon, G. M., Duncan, S., & Blair, S. N. (2011). How many steps/day are enough? for children and adolescents. *International Journal of Behavioral Nutrition and Physical Activity*, *8*(1), 1–14. https://doi.org/10.1186/1479-5868-8-78

Vincent, S. D., & Sidman, C. L. (2003). Determining measurement error in digital pedometers. *Measurement in Physical Education and Exercise Science*, *7*(1), 19–24. https://doi.org/10.1207/S15327841MPEE0701_2

The Walking Classroom. (2016). The Walking Classroom program. Retrieved from http://www.thewalkingclassroom.org/

Webster, E. K., Wadsworth, D. D., & Robinson, L. E. (2015). Preschoolers' time on-task and physical activity during a classroom activity break. *Pediatric Exercise Science*, *27*(1), 160–167. https://doi.org/10.1123/pes.2014-0006

Welk, G. J., Corbin, C. B., & Dale, D. (2000). Measurement issues in the assessment of physical activity in children. *Research Quarterly for Exercise and Sport, 71*(2), 59–73. https://doi.org/10.1080/02701367.2000.11082788