Evaluating the effect of SWITCH PE on physical activity and sedentary behavior in and out of physical education classes

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Evaluating the effect of SWITCH PE on physical activity and sedentary behavior in and out of physical education classes

by

Yoon Ho Nam

A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

Major: Kinesiology

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Iowa State University
Ames, Iowa
2015

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ABSTRACT

Physical education (PE) is a key channel to influencing youth physical activity (PA) and sedentary behavior (SB) but it has proven difficult to improve the quality of PE lessons. SWITCH PE is a concept-based PE curriculum that helps shape healthy behaviors in relation to the energy-balanced lifestyle. The purposes of this study are to evaluate (a) whether a SWITCH PE can provide recommended amounts of PA in PE and (b) whether SWITCH PE can impact children’s daily PA and SB levels. Data were collected from fourth and fifth grade students at four elementary schools in Iowa (with two schools in the experimental group and two in the control group; n = 475). Children’s in-class PA during PE were monitored via Actigraph GT3X+w accelerometer. Their overall PA and SB were pre- and post-measured using the Youth Activity Profile (YAP). Descriptive statistics and two-way (time and group) repeated measure analyses of variance were conducted to address the research questions. The SWITCH PE lessons yielded similar distributions of SB, light PA (LPA), and moderate-to-vigorous PA (MVPA) as regular PE lessons. The SWITCH PE lessons did not meet the absolute standard for in-class PA (i.e., MVPA for 50% of the PE time) but neither did the regular PE lessons. There was no statistical difference in PA levels at home by time or group (p>.05) between youth in SWITCH PE or traditional PE classes. There was a significant group difference in PA at school (Pre: F1, 926=6.36, p<0.01; Post: F1, 926=9.42, p<0.01, η² = .017) but this difference was driven by the significantly lower scores at one SWITCH PE school (i.e., School 1). The time effect for PA at school was not significant. The levels of SB at both SWITCH PE and regular PE schools decreased over time. However, only the SWITCH PE schools demonstrated significant decrease from baseline (F1, 928=7.33;
p<0.01, \eta^2 = .006). In conclusion, SWITCH PE provided similar amounts of MVPA as regular PE but levels did not meet recommendations for MVPA time in PE (i.e. 50% of the class time). SWITCH PE did not significantly impact students’ behavior outside of school but the education on lifestyle behaviors may have long term benefits. The SWITCH PE program is an innovative addition to the SWITCH program but further work is needed to improve the lessons.
INTRODUCTION

Childhood obesity prevention is one of the public health priorities in modern societies (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). A variety of strategies have been tested in intervention based research to promote children’s behaviors associated with obesity prevention (Steinbeck, 2001). Some school-based obesity prevention programs have proven to be effective in initiating a healthy lifestyle in youth but many are costly and lack sustainability over time (Kriemler et al., 2011). Family-based intervention can also induce positive influences on improving healthy behaviors in children by establishing healthy home environments and facilitating parent-child interactions (Davison & Birch, 2001). Although it is beneficial to promote health education and obesity prevention behaviors in school or family atmospheres, experts in the field have pointed out the importance of integrating these two environmental settings to bring upon optimal intervention outcomes (Kriemler et al., 2011).

SWITCH is an obesity prevention program developed for use in school and at home. The SWITCH program focuses on promoting healthy “Do (PA), View (screen time), and Chew (fruits and vegetables)” behaviors among youth. The original SWITCH program used schools to reach family and involve parents to supervise and interact with their children in the above behaviors (Eisenmann et al., 2008). The strategy employed on the coordinating framework with the support of school-based programs without causing considerable burdens on school personnel. Parents were designated as the most important component of the SWITCH program due to their prominent influence on children’s daily behavioral choices throughout their lives (Ritchie, Welk, Styne, Gerstein, & Crawford, 2005). Due to this nature, parents were given more responsibility than school personnel in the original SWITCH program to impact youth behaviors. Nevertheless, schools still played an important role and were involved in the program to reach the “Do, View,
and Chew” (Welk, Chen, Nam, & Weber, 2015). Specifically, student and parent participants were recruited through schools by trained local program coordinators. The local program coordinators interacted with the participants to give them informational reminders and program materials, collect SWITCH Trackers (a logging booklet completed by parents and turned in weekly), and distribute incentives for program engagement.

The SWITCH program emphasizes self-monitoring and goal setting to help promote healthy “Do, View, and Chew” behaviors in youth (Eisenmann et al., 2008). Children or their parents are asked to complete a self-tracking booklet, called Tracker Charts, on a weekly basis to track their interaction with the program. The tracking record is linked to an incentive scheme, where the participants can earn incentives (based on the accumulated points) through the school for their participation. The SWITCH program has been demonstrated providing positive health-enhancing effects in children’s behaviors (Gentile et al., 2009). Specifically, compared to the children in the control group, those who partook in the SWITCH program engaged less time spent in screen time and consumed more fruits and vegetables at the post and 6 month follow up assessment. (Gentile et al., 2009).

The original SWITCH program involved a coordinated partnership with schools to reach and engage parents but specific materials were not available to directly impact nutrition education and PE in schools. Recent pilot work shows that school’s level of engagement had a significant impact on the degree of parental involvement and child participation (Welk et al., 2015). Thus, it is possible that the effectiveness of SWITCH could be enhanced if materials were available to allow schools to teach and reinforce messages received at home. The SWITCH team is currently working to build school modules (i.e., the enhanced SWITCH program) to promote school engagement and to enlarge the impact of the program. By incorporating supplemental school
modules (i.e., SWITCH PE, SWITCH Classroom, and SWITCH Lunchroom), it is expected that the enhanced SWITCH would show strengthened efficacy on the “Do, View, and Chew” behaviors.

The “SWITCH PE” was developed by the SWITCH research team to meet the need of incorporating school PE into SWITCH program. It is a curriculum unit designed to specifically increase children’s energy balance knowledge and behaviors (e.g., PA, diet, and SB). The unit has been validated by an expert panel and is current being field-tested in schools. The present study will evaluate the effect of SWITCH PE on PA and SB in and out of PE classes. The study will specifically examine the following two research questions:

Research Question # 1 (RQ#1). Does SWITCH PE offer sufficient PA? The Healthy People 2010 proposed that school PE should confer upon students with 50% of the class time on MVPA (U.S Department of Health and Human Services, 2000). This level of in-class PA during PE has been reinforced elsewhere, because one primary aim of PE is to make children physically active both in and out of PE class (SHAPE America, 2014). Thus, the SWITCH PE lessons have been designed to actively engage students in interesting movement tasks. It is hypothesized that SWITCH PE lessons would meet the recommended level of in-class PA (i.e., 50% of class time on MVPA).

Research Question # 2 (RQ#2). Can SWITCH PE enhance children’s overall PA and reduce SB? The SWITCH PE lessons were carefully designed to teach students energy balance knowledge in order to make good decisions for engaging healthy “Do, View, and Chew” behaviors. However, behavior change is uneasy and may require concerted efforts from ecological perspectives. Therefore, it is hypothesized that children would show a marginal but significant increase in PA level and or decrease in SB as a result of experiencing the SWITCH PE unit.
LITERATURE REVIEW

Childhood Obesity

Prevalence

Overweight and obesity is one of the most serious pandemics when considering risk factors for mortality. (Flegal, Carroll, Kit, & Ogden, 2012). Currently, the U.S. is facing the obesity epidemic, as more than 50% of the American adult population are considered overweight or obese (Flegal et al., 2012). The rate of obesity in U.S. adults has been static over the recent years (Flegal et al., 2012; Flegal, Carroll, Ogden, & Curtin, 2010). However, childhood obesity has been shown to dramatically and continually increase over the past 3 decades (Ogden, Carroll, Kit, & Flegal, 2014). To be specific, 6% of children and adolescents were considered obese in 1980, compared to 20% in 2012 (Ogden et al., 2014). It is crucial to prevent and curb childhood obesity strategically and comprehensively. Research shows that having a normal weight during childhood is correlated with having a healthy weight in the adulthood (Wang & Lobstein, 2006). Obesity in children produces negative health impacts in childhood and adulthood. A previous study reported that weight gain in infancy could lead to childhood obesity (Reilly et al., 2005). Therefore, public health priorities should focus on preventing excessive weight gain as early in life as possible in an effort to lower the high rate of childhood and adult obesity.

Risks Associated with Obesity

Childhood obesity is related to chronic health indicators such as coronary artery disease, hypertension, type 2 diabetes, psychosocial problems (Caprio et al., 2008; Choudhary, Donnelly, Racadio, & Strife, 2007; Daniels et al., 2005). High body mass index (BMI) explains about 30% of coronary heart disease and ischemic strokes and 60% of hypertensive diseases (World Health Organization, 2013). However, it is not clearly substantiated if childhood obesity can lead to
cardiovascular diseases during adulthood (Lauer & Clarke, 1989; Lloyd, Langley-Evans, & McMullen, 2010; Wright, Parker, Lamont, & Craft, 2001). Ayer et al. asserted that the scarcity of evidence regarding the association between childhood obesity and cardiovascular diseases is attributable to methodological concerns in relation to not reporting puberty cohort and inconsistent recounted biomarkers (Ayer & Steinbeck, 2010). It is important to clearly define obesity since magnitudes of relationships between obesity and health outcomes can vary depending on the criteria or measures used for obesity (Wright et al., 2001).

**Prevalence of PA and SB**

*PA*

One of the leading causes for obesity is physical inactivity (Crawford & Ball, 2002; Hill & Melanson, 1999). Inactive children are inclined to be inactive adolescents, as reported in a 5-year study (Janz, Dawson, & Mahoney, 2000), and according to Gordon-Larsen et al., physically inactive adolescents turned out to be inactive adults over time base upon a nationally representative sample (Gordon-Larsen, Nelson, & Popkin, 2004). Evidently, these issues seem to be stepping stones to an inactive lifestyle and needs to be fixed. There appears to be a decline in youth PA. A study by Kimm et al. (2002) reported that adolescents’ daily PA level was attenuated about 20%, measured via self-reported questionnaire and accelerometry. 12 to 17 year old participant’s PA decreased, measured via survey and pedometry (Duncan, Duncan, Strycker, & Chaumeton, 2007). Further, another study that followed up 806 adolescents (11-15 years old) for five years also showed that girls’ proportion of time spent in MVPA significantly lowered from baseline (Nelson & Gordon-Larsen, 2006). Furthermore, it has been stated that vigorous PA was greatly reduced. 401 8 to 13-year-old children’s vigorous PA decreased at a higher rate than their MVPA, measured via accelerometry (Sherar, Esliger, Baxter-Jones, & Tremblay, 2007).
Thus, there seems to be a need to examine youth PA by intensity to better understand their behavioral pattern (i.e., LPA, MVPA, or SB).

**SB**

In modern societies, children are increasingly living in a sedentary pattern of lifestyle. Excessive screen-based behavior (i.e., watching TV, playing video games, and surfing internet) is associated with deleterious health consequences eliciting obesity (Livingstone, Robson, Wallace, & McKinley, 2003). The recommendation from American Academy of Pediatrics (2001) is that children should be involved in less than 2 hours per day in screen-based behaviors. However, a review study by Pate et al. (2001) reported that children, on average, spent 3.5-8.1 hours per day being sedentary. Moreover, substantial disparities in sedentary time have been observed by different levels of socio-demographic variables. A study by Lowry et al., (2013) showed that non-White children spent considerably more sedentary time compared with White children. The same study showed similar patterns of disparities for prevalence of PA. For example, boys and/or younger children spent more time being physically active in comparison with girls and/or older children (Lowry, 2013).

**PA and SB in PE setting**

According to the recent recommendation, children ought to accumulate 60 minutes or more MVPA per day to be physically active (Carlson, Fulton, Schoenborn, & Loustalot, 2010). School PE is the pronounced avenue to helping children to meet this recommendation. It is documented that PE is the critical component of influencing daily PA and SB (Alderman, Benham-Deal, Beighle, Erwin, & Olson, 2012; Meyer et al., 2013).

However, only a few studies have examined about the contribution of PE to overall PA (Dale, Corbin, & Dale, 2000; Mallam, Metcalf, Kirkby, Voss, & Wilkin, 2003). Some studies
found that rarely have children spent more than 50% of the total PE time in MVPA, although offering abundant MVPA time in class is an indicator of the quality of PE program (Chen, Kim, & Gao, 2014; Sallis et al., 2012). Other research showed that PE can influence PA time outside of school hours (Mallam et al., 2003). The knowledge, skills, and dispositions learned in PE may equip children and adolescents to engage in PA outside of school (SHAPE America, 2014).

SB is considered as a “separate construct” irrespective of PA; hence there is a non-joint relationship between PA and SB (Pate, Mitchell, Byun, & Dowda, 2011; Tremblay et al., 2011). Few studies have examined the relationship between PE and SB. One study did find an association between overall sedentary time and sedentary time in PE, highlighting the importance of minimizing students’ sitting behaviors in PE (Chen et al., 2014). More research needs to be done to inform the relationship between PE and SB.

**Interventions for Obesity Prevention**

Summaries of some studies on the topic of obesity prevention interventions are provided below along with programs that have targeted multiple settings.

**School**

School is the most strategic place to target childhood obesity because children spent a great amount of time at school. Prior research and reports from health-related organizations concluded that school is the most appropriate place for controlling obesity for children and that school PE is the most effective program to promote youth PA (Centers for Disease Control and Prevention [CDC], 2003; Story, Kaphingst, & French, 2006). School-based strategies often involve an intervention directed to alter various types of behaviors in children. Some intervention programs using multi-components and multi-level approaches have proven effective to reduce obesity in children (Kriemler et al., 2011). In a recent systematic review study, for example,
Bassett et al evaluated the effectiveness of intervention studies carried out in schools in promoting youth PA (Bassett et al., 2013). They found out that school-based intervention programs in general were effective, and the highest effectiveness was observed with mandatory PE (23 minutes), classroom activity breaks (19 minutes), and active commuting to school (16 minutes). CDC also has introduced effective strategies to address the needs of preventing obesity (CDC, n.d.). These strategies were widely disseminated in many school settings and shown to be operational to combat the obesity epidemic (Kothandan, 2014). The Educating the Student Body report put forth by the Institute of Medicine proposed the “Whole-of-School” approach stressing the necessity to promote PA in multiple school segments and programs (Institute of Medicine, 2013). PE, health education, and parent engagement, and diet control play a pivotal role in collectively promoting PA and health (CDC, 2003). Salmon et al described PA, activity breaks, and family strategies were the key segments to enhance children’s PA level in school environment (Salmon, Booth, Phongsavan, Murphy, & Timperio, 2007).

**Family (Parents)**

Family based programming is another common target for obesity prevention programs. Evidence indicates that interventions targeting both PA and diet behaviors and having parental and familial involvement are effective and need to be encouraged (Katz, O'Connell, Njike, Yeh, & Nawaz, 2008). Although children spend most of their wake time in school, they spend a significant amount of time at home with their family. Family environment is significantly critical in reaching children to be physically active and eat healthy. Research shows that parental obesity is associated with childhood obesity more due to environment than heredity influences (Ritchie et al., 2005). Welk et al found that kids with high parental influences were associated with higher PA level (Welk, Wood, & Morss, 2003). Family influences a child’s social development and habits in
nutrition and PA (Ritchie et al., 2005). Therefore, parents must be involved in the obesity prevention actions by encouraging and shaping children’s healthy eating and exercising habits. However, family-based intervention was not implemented with ease compared to other interventions (Davison et al., 2011). Parents are reported to assume responsibilities to supervise, interact, and/or promote many kinds of activities with their kids, and a strong commitment in parenting is required (Ritchie et al., 2005).

The goal of the original SWITCH program was to actively engage children and adults to the program and help them to construct an encouraging setting for healthy behaviors. Families are essential to developing a healthy environment for children to make changes in their levels of nutrition and PA, as well as screen time (Gentile et al., 2009).

**Overview of the SWITCH Program**

SWITCH is a multi-level obesity prevention study to switch what children “Do, View and Chew” (Eisenmann et al., 2008). It was first designed and then implemented in 2005 to 2006 school year in two communities of Minnesota and Iowa (Gentile et al., 2009). Over the years, SWITCH, as a sustained program, has been implemented yearly by the Cedar Rapids community school district (Gentile et al., 2009). Recently, the Iowa State University research team has been further refining the program in the attempt to broaden its impact in more schools and homes.

**SWITCH PE**

The SWITCH program incorporates PE lessons in which children learn energy balance knowledge and behavior through active tasks. It is a validated curriculum unit designed to be easily incorporated into any elementary school PE program so this will facilitate incorporation in to the targeted SWITCH schools. The unit challenges students to think how to sustain a healthy lifestyle with regard to increase PA, cutback screen time, and consume 5 or more serving of
fruits and vegetables.

The SWITCH PE unit enables students to “think as they move” by following the 11 lesson plans. The unit is focusing on imparting cognitive learning (i.e., knowledge), psychomotor (i.e., PA and motor skills), and affective (i.e., value and responsibility) domains to children as well as satisfying the National Association for Sport and Physical education (NASPE) standards (SHAPE America, 2014). The SWITCH PE is consisted of 4 modules of activities/lessons: Energy out, Energy in, Energy balance, and Body composition. This infrastructure is implementing on the basis of living in an energy balanced life.

**Pilot Study Related to SWITCH**

This thesis study is a continuation of my research involvement as a SWITCH team member. I have contributed to the SWITCH project as a research assistant taking roles such as program manager, data collector, data analyst, and report/manuscript writer. Since 2013, I have been actively involved in the following pilot study.

The SWITCH pilot study was conducted as a formative evaluation of a refined online version of SWITCH that could be disseminated in a more cost-effective way (Welk et al., 2015). This study specifically tested whether the online or paper version of the SWITCH program were equally effective. Ten schools were paired by matching socio-economic status and randomly allocated to online or print version of SWITCH. One indicator of engagement was the rate of return of the SWITCH Tracker charts. The overall return rate was (34.1%±13.0%) but there was evidence of a general decline over time from Week 1 to Week 16 interventions (See Figure 1). The overall SWITCH tracker return rate was found to be lower in in the online group (27.4%±10.9) than in the print schools (42.5%±11%) suggesting that it was more difficult for parents to submit the SWITCH trackers.
While differences in tracker rates were noted, there were no substantial changes in behavior recorded or in parent/child interactions (see Table 2). These results indicated that the online and print versions of SWITCH program were equally effective in engaging parents/children with the program activities. Due to its reduced intervention cost, the online SWITCH program showed good prospect for long term sustainability.

Another result of this pilot study was that school engagement was found to moderate the behavioral outcomes. Figure 2 shows that variability in school engagement was significantly related to school enrollment size and SWITCH tracker return rate. Two experienced SWITCH coordinators were involved in evaluating the teacher/school engagement. As shown in Figure 2, higher teacher/school engagement was associated with higher student enrollment size and higher tracker return rate. In other words, variability in school engagement played a significant role in intervening school enrollment size and SWITCH tracker return rate.

This pilot study demonstrated the potential of a web-based school obesity prevention program but demonstrated a need to more directly involve school personnel in the programming. PE provides a primary avenue to increase PA and lower sedentary time in children so there is potential for enhancing the SWITCH program through PE. To address this, the present study evaluated a conceptual PE curricula designed to specifically complement the SWITCH program (i.e., SWITCH PE). The specific goal was to evaluate the efficacy of providing MVPA opportunities in class and impacting children’s overall PA and SB outside of class.
METHODS

Study Design, Setting and Participants

This study was part of a funded larger project emphasized on developing and evaluating the SWITCH PE. The larger project evaluated variables including but were not limited to children’s in-class PA, in-class situational motivation, energy balance knowledge, overall PA level, and SB. This study followed the same research design but utilized fewer variables to address the specific research questions. The study involved intact fourth and fifth grade classes from four schools (~three classes in each grade level per school). Two schools participated in the experimental group receiving SWITCH PE (n = 259 students), while two schools participated in the control group receiving standard PE (n = 216). The sample included 221 girls and 250 boys, and four had missing data. The experimental group received the SWITCH PE lessons while the regular group received the regular PE lessons. Students in both group were monitored for their in-class PA in every other PE class (RQ#1). They were pre- and post-measured for their overall PA level and SB levels (RQ#2). The study was approved by the Iowa State University Institutional Review Board in the “exempt” category (see Appendix B for the approval document), since the project was part of normal school-based programming and because de-identified data were collected and analyzed.

Instruments

GT3X+w

Individual participant’s MVPA level was recorded through GT3X+w accelerometers (Pensacola, FL) during the SWITCH PE lesson. The Actigraph GT3X+w monitor is capable of tracking data on the participant’s setting with the involvement of surrounding light sensor. It is an unobtrusive triaxial accelerometer-based PA monitor that is able to capture the subject’s
intensity and volume of the activity (Flynn et al., 2014). All participants wore the monitor during each SWITCH PE class.

**Youth Activity Profile (YAP)**

The levels of PA and SB in and outside of school were assessed with the use of validated Youth Activity Profile (YAP) (Saint-Maurice, 2013). This self-report tool was designed to evaluate PA and SB patterns for children. The YAP were uploaded and distributed to participants online using a website (http://www.youthactivityprofile.org/). See Appendix A for the specific YAP items.

**Data Collection**

Data collectors were trained by the research team to follow a standardized protocol. The protocol detailed on how to collect in-class PA data and YAP data. These are described in the following paragraphs.

To collect in-class PA data, the data collector arrived at the school 15 minutes early in an effort to prepare the materials needed in each SWITCH PE lesson and coordinate gym with PE teachers to provide guidance and assistance to participants. The data collector and the PE teacher ensured that children wore the GT3X+w accelerometers and pedometers (for instructional purpose) during the targeted PE classes. Each accelerometer was strapped with an elastic band worn on their waist. The accelerometer was set to 10 seconds epoch before data collection using the ActiLife Version 6.0 software (Actigraph, Pensacola, FL). Each accelerometer was fully charged with battery and numbered for students to sign-in and–out. Accelerometers were distributed to all students at present to record their in-class PA. Data were collected between February and May, 2015 during both SWITCH PE and regular PE lessons using a systematic data collection plan. Limited by shortage of personnel, only one half (i.e., odd numbers) of the SWITCH PE lessons
were tracked using accelerometers in one school, while the other half (i.e., even numbers) were tracked in the other school, to control for school effect. A similar scheduling was made with regular PE schools. Table 3 shows the pre-determined schedule of lessons (SWITCH PE and regular PE) and field observations. A fidelity checklist was utilized in SWITCH PE schools to document deviations of practice from the lesson plans. Standardized observation protocols were conducted in regular PE schools to record what activities were instructed in PE classroom and how they were taught.

YAP data were collected on two occasions: before and after the implementation of SWITCH PE. For each data collection, data collectors arrived at each school’s media center 20 minutes early. At the media center, data collectors turned on all the school computers, downloaded the web links, and loaded the instrument to each computer monitor. They guided students to complete the YAP assessment with the help of the PE teachers. The survey prompted the students to provide demographic information such as grade, classroom teacher’s name, classroom ID, and gender in addition to 15 YAP items. The survey took about 10 minutes to complete.

**Data Reduction**

To reduce the in-class PA data, Freedson’s equations for 10-11 year old population were employed to convert raw activity counts into time of activities by intensity (Freedson, Pober, & Janz, 2005). Because MVPA for youth have been defined as 3METS+ or 4MVPA+ by different research studies, both cut points were adopted, comparatively, to quantify students’ in-class PA. Stata 13.1 was used for importing and converting Actigraph raw data into minutes of MVPA, LPA, and SB time. Since all students wore an Actigraph accelerometer monitor, individual data files were coded by time of data collection, class, PE lesson number for reduction. Minutes of PA per intensity were aggregated by class and prepared for subsequent data analysis.
To reduce the YAP data, the pre- and post-measurements data were downloaded from the website and saved to a data processing computer in .csv format. The 15 items of YAP were aggregated into three outcome variables: PA at school, PA at home, and SB. The pre-test and post-test data were merged into the single Excel spreadsheet. Mean scores on the 3 YAP subscales were computed with scores ranging from 0-5 as continuous variables.

**Data Analysis**

To address the RQ#1, descriptive statistics were conducted to report the quantity of MVPA, LPA, and SB time in SWITCH PE classes as well as in regular PE classes. The goal for each SWITCH PE lesson was to provide students with a minimum 50% of the class time on MVPA, so the average MVPA time from SWITCH PE was compared against this absolute criterion as well as against PA time from regular PE. Statistics such as mean and standard deviations of the MVPA time and percentage were reported by group (i.e., SWITCH PE vs. regular PE) and school (i.e., Schools 1, 2, 3, and 4). To address the RQ#2, separate two-way repeated measure analyses of variance (ANOVA) were conducted using MVPA, LPA and SB as dependent variables, time and group as independent variables. Both main and interaction effects were tested in the analyses with effect size reported ($\eta^2$). The analyses were operated in Stata 13.1 and a 95% confidence interval was set up for the inferential analyses ($\alpha = .05$).
RESULTS

Students’ In-Class PA

The SWITCH PE lessons included PAs such as locomotor movement, modified sport games, and fitness games while regular PE lessons included a number of teacher selected activities such as hockey, jump rope, bowling, running/dynamic walking and jogging/dodgeball. Figure 3a and Figure 3b show the comparison of average in-class PA and SB between SWITCH PE and regular PE schools using 4METs+ and 3 METS+ as the cut point, respectively. Figure 3a shows SWITCH PE schools had 7.33 minutes of MVPA, whereas regular PE schools accrued 8.16 minutes of MVPA. SWITCH PE schools accumulated 8.14 minutes of LPA; while regular PE schools accrued 9.35 minutes of LPA time. As shown in Figure 3b, regular PE schools also generated slightly higher level of MVPA and LPA in comparison to SWITCH PE schools when 3METS+ was adopted as the cut point for MVPA. Specifically, on average, SWITCH PE schools accrued 9.80 minutes of MVPA; while regular PE schools accrued 11.09 minutes of MVPA. SWITCH PE schools accumulated 5.66 minutes of LPA; whereas regular PE schools accumulated 6.41 minutes of LPA. Concerning SB time in PE, SWITCH PE schools reported 12.52 minutes of the proportion of non-active learning time. Meanwhile, regular PE schools captured 10.97 minutes of the SB time in class.

To locate the actual differences between schools, results were further broken down by school (i.e., Schools 1, 2, 3, and 4) and time (i.e., pre and post). Figure 4a and Figure 4b display the in-class PA level by school and time. School 1 and School 2 represent the two schools that implemented the SWITCH PE; while School 3 and School 4 represent the two regular schools. Shown in Figure 4a where 4METS+ was adopted as the cut point for MVPA, School 3 had an average 8.32 minutes of MVPA and School 4 showed 8.02 minutes of MVPA, whereas School 1
had 7.33 minutes of MVPA and School 2 showed 7.32 minutes of MVPA. The above results indicate that the four schools were relatively comparable for MVPA time accumulation. In terms of LPA, School 3 had the highest LPA with 9.61 minutes per PE class; while School 2 showed the lowest level of LPA. Figure 4b shows the comparable activity level by school using 3 METs+ as cut point for MVPA. Schools 3 and 4 had 11.19 and 11.00 minutes of MVPA; while school 1 and 2 demonstrated 9.92 and 9.62 minutes of MVPA during the PE class. In terms of LPA, School 3 demonstrated 7.20 minutes of LPA, which is the highest among the four schools. Concerning SB behavior time in PE, School 1 showed the highest level (13.01 minutes) followed by School 4 (12.14 minutes), School 2 (11.77 minutes), and School 3 (19.08 minutes).

Further descriptive analyses were conducted to compare in-class PA levels in SWITCH PE lessons and the average regular PE lessons. Figure 5a shows that regular PE schools accrued 8.17 minutes of MVPA using 4 METs+ as the cut point. It is noticeable that some SWITCH PE lessons (i.e., lessons 3, 4, 11, and combined lesson 1 and 3) were more active than regular PE lessons or commensurate (i.e., lessons 6, 7, 8, and 10). SWITCH PE lessons also showed similar LPA as regular PE. Regular PE showed 9.39 minutes of LPA; while a number of SWITCH PE lessons showed similar amount of LPA. Interestingly, some of the SWITCH PE lessons (e.g., >15 minutes SB time for lessons 5, 9, and combined lesson 2 and 4) were sedentary and did not demonstrate high level of MVPA. Lesson 2 produced the least MVPA, Lesson 9 was the most sedentary, and Lesson 24 (i.e., combined lesson 2 and 4) had the most LPA. Figure 5b shows the parallel results but used 3 METs+ as the cut point for MVPA. The results were similar to those based on the 4 METs+ cut point.
Daily PA and SB

To evaluate the effect of SWITCH PE on students’ daily PA and SB, we compared their PA at school, at home, and SB by group (SWITCH PE group vs. regular PE group) and time (pre vs. post). Figure 6 shows daily PA level at school by group and time. Descriptive results showed that both SWITCH PE schools and regular PE schools maintained their PA at school over time. No significant time difference was detected. However, the group effect was significant. Regular PE showed significantly higher level of PA at school than SWITCH PE at both pre and post measurement (Pre: $F_{1, 926} = 6.36, p<0.01$; Post: $F_{1, 926} = 9.42, p<0.01$, $\eta^2 = .017$). No interaction effect was detected ($p> .05$).

Figure 7 shows the daily PA at school by school and time. School 1 had significantly lower PA at school than the other three schools at both pre- and post-measurements ($F=16.72, p<.01$, $\eta^2 = .052$). The students in all but one schools (i.e., 2, 3, and 4) slightly increased their PA at school, but the increases were not statistically significant ($p>.05$). No interaction effect was detected ($p>.05$).

Figure 8 shows the daily PA at home by group and time. Both SWITCH PE and Regular PE schools demonstrated higher average scores for PA at Home at post-test in comparison to their baseline scores. However, inferential statistical analyses did not find any significant main or interaction effects ($p >.05$).

Figure 9 shows students’ daily PA at home by school and time. All schools demonstrated a slight increase in PA at home over time. School 2 showed the highest PA at home than the other schools at pre and post measurement. However, no significant difference was observed for the time and group main effects ($p > .05$).
Figure 10 shows the daily SB by group and time. SB at both SWITCH PE and Regular PE schools decreased over time. However, only the SWITCH PE schools demonstrated significant decrease from baseline ($F_{1, 928}=7.33; p<0.01$, $\eta^2 = .006$). Thus, SWITCH PE significantly reduced students’ daily sedentary activity. There was no significant interaction effect between time and group ($p>0.05$).

Figure 11 shows the students’ daily SB level by school and time. The results indicated that all but one school (i.e., School 3) showed a decrease in SB by time. However, only the decrease in SB at School 1 (decreased by .22) was statistically significant ($F_{1, 924}=6.37; p<0.01$, $\eta^2 = .019$).

**DISCUSSION**

**In-class PA**

The first research purpose of this study was to evaluate the level of in-class PA for SWITCH PE lessons. Actigraph GT3X+w monitors were worn by students in SWITCH PE and in regular PE classes. The level of MVPA in SWITCH PE was compared with that in regular PE; and then MVPA in both groups were compared with the absolute standard of 50% class time on MVPA (Sallis et al., 2012). The SWITCH PE unit encompasses 11 lessons that were validated by the expert panels and pilot tested at a home-school PE program in the same state. The results showed a variation in the level of PA among the SWITCH PE lessons. The amount of MVPA was similar between SWITCH PE and regular PE schools, though slightly favoring the regular PE schools. However, neither regular PE schools nor SWITCH PE schools had PE classes more active for 50% of the PE time. These findings indicate that both SWITCH PE lessons need to be revisited or reformed to further enhance students’ MVPA time in class. Indeed, SWITCH PE has its curricular and instructional priority to promote students’ cognitive learning about energy
balance knowledge; while not compromising students’ in-class PA. SWITCH PE is a curricular creation on the framework of concept-based PE. Concept-based PE such as the *Science, PE, and Me* curriculum has been found to enhance elementary school students’ fitness knowledge (Sun, Chen, Zhu, & Ennis, 2012) without limiting students’ in-class PA level. The evaluation result from the present study confirmed the efficacy of SWITCH PE as a concrete example of concept-based PE. That is, students’ knowledge gain as result of receiving the SWITCH PE unit was considerable (results are reported elsewhere in the larger study). Although the amount of in-class PA in SWITCH PE lessons was commensurate with that in regular PE lessons, there is much room to make SWITCH PE lessons more physically active. For example, observation of the teaching process in SWITCH PE schools demonstrated that the teachers spent more time on explaining the concepts or managing student behaviors, especially in the beginning of the unit. This was not surprising given the fact that neither the teachers nor the students had previously experienced the concept-based PE curriculum. It took them longer for the teacher to convey SWITCH PE lessons to the students, as the result. In addition, lesson-by-lesson analysis of the in-class PA for SWITCH PE showed varying MVPA time within the unit, with some lessons (e.g., lessons 2, 5 and 9) showing less MVPA time than others. SWITCH PE revision effort should specifically target on these less active lessons in the future.

The finding that students’ activity time in regular PE did not meet the recommended standard (i.e., 50% class time on MVPA) was not surprising. PE is a school subject with a “muddled mission” (McKenzie & Lounsbery, 2009) where students are expected to accomplish multiple objectives and standards (SHAPE America, 2014). Systemic evidence has shown that PE programs nationwide has consistently failed to provide students MVPA time for half of the class time (Sallis et al., 2012). This conclusion was supported by the evaluation result from the
present study in which we examined two regular PE programs within the same school district. This finding suggests the challenge and difficulty to offer students MVPA for 50% of the class time in traditional PE. The expectations on PE offering of this amount of MVPA time is, perhaps, unrealistic. Public health experts and school leaders may need to move away from this viewpoint and strategize to supplement students with PA opportunities elsewhere so that they could meet the recommended 60 minutes of MVPA per day. In fact, numerous possibilities exist for improving students’ PA outside of PE classes. The popular national initiatives such as the “whole-of-school approach” and Comprehensive School Physical Activity Program (CSPAP) as a multi-faceted coordinated approach have been gradually adopted by school administrators, teachers, and staff (Hills, Dengel, & Lubans, 2015). Research on these concepts and programs are burgeoning. Systematic research has shown that PE is one of the major, but not the sole, source of PA for student (Bassett et al., 2013). Students should be encouraged to be active during various time segments of each day: transportation to/from school, PE, recess/lunch, recess, classroom-based PA, and after-school programs (Bassett et al., 2013).

**Overall PA and SB**

The second research purpose of this study was to determine whether the SWITCH PE lessons can impact children’s overall PA and SB. The self-reported YAP was utilized to evaluate student’s PA at school, PA at home, and SB. The hypothesis of the study was that SWITCH PE would bring upon a marginal effect on changing student’s engagement in daily PA and SB. The results from the evaluation demonstrated that students’ level of PA at school did not show significant time by group (school) interaction effects. Specifically, the mean scores of PA at school for both SWITCH PE schools and regular schools remained unchanged over time (pre vs. post), although an increasing trend was shown in several schools (Schools 2, 3, and 4). This
finding indicates the difficulty of youth PA promotion at school. In particular, as mentioned above, solely relying on school PE is inadequate to significantly increase students’ PA at school. Previous research has shown that students display higher daily time spent in MVPA on PE days than days without PE (Chen et al., 2014) as well as higher daily time spent in LPA but lower time spent in SB on PE days (Sigmund, Sigmundová, Hamrik, & Gecková, 2014). Given the limited instructional time, PE alone may be insufficient to address youth physical inactivity at school. The finding from this study further suggests that what students have learned from PE (e.g., energy balance knowledge) may or may not directly, at least in the short-term, be translated to students’ PA behavior. Other school segments should work together with PE teachers to promote energy balance education and build an ecological model such as CSPAP for PA promotion at school (Institute of Medicine, 2013).

Data from YAP further captured students’ PA at home and SB which were compared between group and time. First, the study showed that the mean time spent in PA at home in both SWITCH PE and regular PE schools presented an improving trend, but not favoring either of the two groups. The increase over time was not statistically significant. These findings indicate that SWITCH PE lessons failed to impact the children’s overall daily PA at home. In contrast, there was some evidence of significant changes in terms of sedentary activity compared to regular PE schools but this was significant in only one SWITCH PE school. This finding suggests that the SWITCH PE may help make youth more aware of the need to curb SB; however, more work is needed to verify these findings.

The finding has important public health implications in light of SB epidemic. Previous research has shown that children spent 3.5-8.1 hours being sedentary (Pate et al., 2011). SB is associated with increased risks of morbidity and mortality (Lynch & Owen, 2015). For example,
several epidemiology studies found that SB and PA both independently and jointly impact obesity (Ekelund et al., 2012). Other studies also directly examined the association between PE and SB. For example, Chen et al. (2014) found that the time spent in SB during PE could be used to estimate time spent in SB for the whole day. Sigmund et al. (2014) demonstrated that engaging in active time play (e.g., taking part in PE lessons) noticeably weakened the total daily time spent in SB in the normal weight and overweight 9 to 11-year-old participants. The present study echoes the importance of SWITCH PE in curbing SB. The SWITCH PE curriculum teaches students important concepts about energy balance via active movement forms, which might have informed them to sit less.

**Limitations**

Several limitations need to be addressed. First, the researchers partially mis-tracked the PE schedules in one of the two SWITCH PE schools for the accelerometer data, which led to uneven sample size (ranging from 24 to 144 students per lesson) for the SWITCH PE lessons. This might have compromised the data quality by either over- or under-representing certain SWITCH PE lessons. Second, the overarching SWITCH program was activated concurrently with the SWITCH PE evaluation at the four participating schools. As the school coordinators, the PE teachers were engaged in both programs, which might have introduced bias into their PE classes. But only a minority of students from each school enrolled in the general SWITCH program receiving systematic intervention on adopting healthy related to PA, diet, and screen time.

**Conclusions**

This evaluation study has arrived at two major conclusions: (a) the SWITCH PE lessons were as physically active as regular PE, although neither the two types of PE offered MVPA for
50% of the class time. (b) The SWITCH PE did not significantly enhance students’ PA at school or at home, but there is evidence that it may help to reduce SB. The evaluation suggests the need to revisit or reform some of the SWITCH PE lessons to enhance their in-class MVPA time. The findings reinforces former systemic evidence that perhaps solely relying on PE itself to accrue MVPA time is not enough to meet the 60 minutes of MVPA at school. To this end, school teachers, staff, and parents need to work together and bring a synergistic effort to increase children’s level of MVPA (i.e., before school/afterschool, staff involvement, family and community engagement, PA during school, and PE). Popular national initiatives such as “Whole-of-School” approach or CSPAP should be selected and implemented in schools for youth PA promotion. Meanwhile, this evaluation further demonstrate that concept-based PE such as SWITCH PE is powerful in instilling students with essential healthy-living knowledge that informs them to make sound decisions for healthy behaviors. The current version of SWITCH PE provides promise for enhancing students’ knowledge about energy balance and healthy lifestyles but additional work is needed to increase engagement in MVPA during the lessons. With some further revision, SWITCH PE can help to enhance student learning, promote PA, and complement the broader SWITCH school obesity program.
REFERENCES


Institute of Medicine. (2013). Educating the student body taking physical activity and physical education to school. Washington DC.


American Journal of Lifestyle Medicine.


### List of Tables

*Table 1.* Suggested scope and sequence for teaching SWITCH PE Unit

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Module</th>
<th>Concepts</th>
<th>“Think as They Move” Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy Out</td>
<td>Physical activity; intensity; steps measurement</td>
<td>“Count my steps” Students learn how to use the pedometers to measure the steps in various physical activities</td>
</tr>
<tr>
<td>2</td>
<td>Energy Out</td>
<td>Physical activity; intensity; target heart rate zone</td>
<td>“Target Heart Rate Range” Students learn how to take these pulse timely and accurately in movement tasks. They learn the desirable target heart rate range respective to their age group</td>
</tr>
<tr>
<td>3</td>
<td>Energy Out</td>
<td>Energy out; physical activity intensity</td>
<td>“Energize My Steps” Students apply the utility of the pedometer and connect steps with energy expenditure in various movement tasks.</td>
</tr>
<tr>
<td>4</td>
<td>Energy In</td>
<td>Food groups; energy in</td>
<td>“Choose My CHEWS” Students learn to differentiate five food groups by accurately retrieving food items via physical activity</td>
</tr>
<tr>
<td>5</td>
<td>Energy In</td>
<td>Food groups; energy in; balanced meal; empty calories</td>
<td>“Snack Attack” Students learn to make a balanced meal with food items from all five groups using various movement forms. They also learn the concept of “empty calories”</td>
</tr>
<tr>
<td>6</td>
<td>Energy In/Balance</td>
<td>Energy in/balance; physical activity</td>
<td>“Energy Beanbags” Students gain an understanding about energy balance by throwing beanbags to colored hula hoops representing the five food groups</td>
</tr>
</tbody>
</table>
Table 1 continued.

<table>
<thead>
<tr>
<th></th>
<th>Energy Balance</th>
<th>Energy in; energy balance</th>
<th>“Bowl to Balance”</th>
<th>Students knock down 60% of the bowling pins from different distances using the appropriate throwing technique. They compare the amount of energy expenditure demanded to counter fruits/vegetables vs. energy dense foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Energy Balance</td>
<td>Energy in; energy balance; fruits and vegetables</td>
<td>“Capture the Fruits and Veggies”</td>
<td>Students learn the importance of consuming fruits and vegetables by playing a game similar to “Capture the flag”</td>
</tr>
<tr>
<td>9</td>
<td>Energy Balance</td>
<td>Food groups; physical activity; energy balance</td>
<td>“Eat to Move”</td>
<td>Students consciously move using a variety of physical activities in the effort to balance the energy they intook from selected food items.</td>
</tr>
<tr>
<td>10</td>
<td>Energy Balance</td>
<td>Fat; energy balance</td>
<td>“Healthy Fat and Unhealthy Fat”</td>
<td>Students play a soccer game called “keep unhealthy fat away” and a throw and catch game called “catching on to healthy fat” to differentiate healthy and unhealthy fat choices</td>
</tr>
<tr>
<td>11</td>
<td>Body Composition</td>
<td>Body composition; fat tissues; lean tissues; healthy diet; exercise</td>
<td>“Fat Cell Tag and Ultimate CHEW”</td>
<td>Students play a tag game to learn body compositions such as fat cells, lean tissue. They further plan a “ultimate” game to reinforce the importance of fruits and vegetables</td>
</tr>
</tbody>
</table>
Table 2. Descriptive results for key impact and outcome measures

<table>
<thead>
<tr>
<th>Outcome Variables</th>
<th>Overall</th>
<th>Print SWITCH</th>
<th>Online SWITCH</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N  M  SD</td>
<td>n  M  SD</td>
<td>n  M  SD</td>
<td></td>
</tr>
<tr>
<td><strong>Impact Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall interactions</td>
<td>90  2.94  .79</td>
<td>49  2.97  .80</td>
<td>41  2.90  .80</td>
<td>.09</td>
</tr>
<tr>
<td>Interactions w/Do</td>
<td>90  2.96  .90</td>
<td>49  2.98  .92</td>
<td>41  2.93  .88</td>
<td>.06</td>
</tr>
<tr>
<td>Interactions w/View</td>
<td>88  2.81  .87</td>
<td>48  2.81  .91</td>
<td>40  2.80  .82</td>
<td>.01</td>
</tr>
<tr>
<td>Interaction w/Chew</td>
<td>90  3.03  .92</td>
<td>49  3.10  .90</td>
<td>41  2.95  .95</td>
<td>.16</td>
</tr>
<tr>
<td><strong>Outcome Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall behaviors</td>
<td>90  3.69  .49</td>
<td>49  3.75  .47</td>
<td>41  3.61  .51</td>
<td>.29</td>
</tr>
<tr>
<td>Do behavior</td>
<td>89  3.73  .70</td>
<td>48  3.84  .64</td>
<td>41  3.60  .74</td>
<td>.35</td>
</tr>
<tr>
<td>View behavior</td>
<td>89  3.69  .65</td>
<td>49  3.65  .62</td>
<td>40  3.73  .70</td>
<td>-.12</td>
</tr>
<tr>
<td>Chew behavior</td>
<td>90  3.64  .59</td>
<td>49  3.75  .64</td>
<td>41  3.52  .51</td>
<td>.40</td>
</tr>
</tbody>
</table>
Table 3. The Observation Schedule in SWITCH PE and Regular PE schools

<table>
<thead>
<tr>
<th>Lesson</th>
<th>SWITCH PE</th>
<th>Regular PE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>School 1</td>
<td>School 2</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>3</td>
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<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
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<td>X</td>
</tr>
<tr>
<td>11</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
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Figure 5a
Figure 5b

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Figure 11. Mean scores in SB among four schools by time (pre vs. post)
**APPENDIX A. YOUTH ACTIVITY PROFILE**

The Youth Activity Profile will ask you about the time you spend being active (both in school and out of school) and the time you spend being sedentary (sitting). Physical activities are things that involve a lot of walking, running or moving around. It includes biking and dancing as well as sports or outdoor play that involves a lot of moving around. Sedentary (sitting) activities are things such as watching TV, or playing video games, computer games, or hand-held games that you do in your free time. It does NOT include the time you spend sitting while eating or while doing homework. Most questions will ask you only to think about the last 7 days but a few questions will ask about what you typically do (on a normal week). There are no right or wrong answers so provide honest answers.

1. How many days did you walk or bike to school? *(If you can't remember, try to estimate)*
   a. 0 days (never)  
   b. 1 day  
   c. 2 days  
   d. 3 days  
   e. 4-5 days (most every day)

2. During physical education, how often were you running and moving as part of the planned games or activities? *(If you didn't have PE, choose "I didn't have physical education")*
   a. I didn't have physical education  
   b. Almost none of the time  
   c. A little bit of the time  
   d. A moderate amount of time  
   e. A lot of the time  
   f. Almost all of the time

3. During recess, how often were you playing sports, walking, running, or playing active games? *(If you didn't have a break at school, choose "I didn't have recess")*
   a. I didn't have recess  
   b. Almost none of the time  
   c. A little bit of the time  
   d. A moderate amount of time  
   e. A lot of the time  
   f. Almost all of the time

4. During lunch break, how often were you moving around, walking or playing? *(If you didn't have a break at school, choose "I didn't have lunch breaks")*
   a. I didn't have lunch breaks  
   b. Almost none of the time  
   c. A little bit of the time  
   d. A moderate amount of time  
   e. A lot of the time  
   f. Almost all of the time

5. How many days did you walk or bike from school? *(If you can't remember, try to estimate)*
   a. 0 days (never)  
   b. 1 day  
   c. 2 days  
   d. 3 days  
   e. 4-5 days (most every day)

6. How many days before school (6:00-8:00 am) did you do some form of PA for at least 10 minutes? *(This includes activity at home NOT walking or biking to school)*
   a. 0 days  
   b. 1 day  
   c. 2 days  
   d. 3 days  
   e. 4 to 5 days
7. How many days **after school (between 3:00 - 6:00 pm)** did you do some form of PA for at least 10 minutes? (This can include playing with your friends/family, team practices or classes involving PA but **NOT walking or biking home from school**)
   a. 0 days   b. 1 day   c. 2 days   d. 3 days   e. 4 to 5 days

8. How many **school evenings (6:00 - 10:00 pm)** did you do some form of PA for at least 10 minutes? (This can include playing with your friends/family, team practices or classes involving PA but **NOT walking or biking home from school**)
   a. 0 days   b. 1 day   c. 2 days   d. 3 days   e. 4 to 5 days

9. How much PA did you do last **Saturday**? *(This could be for exercise, work/chores, family outings, sports, dance, or play. If you don't remember, try to estimate)*
   a. No activity (0 minutes)
   b. Small amount of activity (1 to 30 minutes)
   c. Small to Moderate amount activity (31 to 60 minutes)
   d. Moderate to Large amount of activity (1 to 2 hours)
   e. Large amount of activity (more than 2 hours)

10. How much PA did you do last **Sunday**? *(This could be for exercise, work/chores, family outings, sports, dance, or play. If you don't remember, try to estimate)*
   a. No activity (0 minutes)
   b. Small amount of activity (1 to 30 minutes)
   c. Small to Moderate amount activity (31 to 60 minutes)
   d. Moderate to Large amount of activity (1 to 2 hours)
   e. Large amount of activity (more than 2 hours)

11. How much time did you spend **watching TV** outside of school time *(This includes time spent watching movies or sports but NOT time spent playing video games)*.
   a. I didn't watch TV at all
   b. I watched less than 1 hour per day
   c. I watched 1 to 2 hours per day
   d. I watched 2 to 3 hours per day
   e. I watched more than 3 hours per day

12. How much time did you spend **playing video games** outside of school time? *(This includes games on Nintendo DS, wii, Xbox, PlayStation, iTouch, iPad, or games on your phone)*
   a. I didn’t really play at all
   b. I played less than 1 hour per day
   c. I played 1 to 2 hours per day
   d. I played 2 to 3 hours per day
   e. I played more than 3 hours per day

13. How much time did you spend using **computers** outside of school time? *(This doesn’t include home work time but includes time on Facebook as well as time spent surfing the internet, instant messaging, playing online video games or computer games)*
   a. I didn’t really use the computer at all
   b. I used a computer less than 1 hour per day
   c. I used a computer 1 to 2 hours per day
   d. I used a computer 2 to 3 hours per day
e. I used a computer more than 3 hours per day

14. How much time did you spend using your **cell phone** after school? *(This includes time spent talking or texting).*
   a. I didn’t really use a cell phone
   b. I used a phone less than 1 hour per day
   c. I used a phone 1 to 2 hours per day
   d. I used a phone 2 to 3 hours per day
   e. I used a phone more than 3 hours per day

15. Which of the following best describes your **typical** sitting habits at home? *(Try to think about a typical week and not just last week)*
   a. I spent almost none of my free time sitting
   b. I spent little time sitting during my free time
   c. I spent a moderate amount of time sitting during my free time
   d. I spent a lot of time sitting during my free time
   e. I spent almost all of my free time sitting
APPENDIX B. INSTITUTIONAL REVIEW BOARD EXEMPT APPROVAL

DOCUMENT

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2307
515-294-4566
FAX 515-294-4297

Date: 4/8/2014
To: Dr. Senlin Chen
255 Forker Bldg

From: Office for Responsible Research

Title: The "SWITCH PE" Curriculum: Acceptability and Effectiveness in Upper Elementary Schools

IRB ID: 14-190

Study Review Date: 4/7/2014

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

1. Research conducted in established or commonly accepted education settings involving normal education practices, such as:
   - Research on regular and special education instructional strategies; or
   - Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
   - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
   - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.
- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. Only the IRB or designees may make the determination of exemption, even if you conduct a study in the future that is exactly like this study.
INSTITUTIONAL REVIEW BOARD (IRB)
Exempt Study Review Form

Title of Project: The "SWITCH PE" Curriculum: Acceptability and Effectiveness in Upper Elementary Schools

Principal Investigator (PI): Senlin Chen

University ID: 573253681
Phone: 5152948755
Email Address: slchen11@iastate.edu

Correspondence Address: 255 Forker Building

Department: Kinesiology
Account/Center/Institute: Human Sciences

PI Level: Tenured, Tenure-Eligible, & INTER Faculty
Adjunct/Affiliate Faculty
Collaborator Faculty
Emeritus Faculty
Visiting Faculty/Scientist
Senior Lecturer/Chronician
Lecturer/Chronician, w/Ph.D. or DVM
P&S Employee, P37 & above

For Student Projects (Required when the principal investigator is a student)
Name of Major Professor/Supervising Faculty:

University ID:
Phone:
Email Address: @iastate.edu

Campus Address:
Department:

Type of Project: (check all that apply)
Thesis/Dissertation
Class Project
Other (specify)

Alternate Contact Person:
Email Address:
Correspondence Address:
Phone:

ASSURANCE
- I certify that the information provided in this application is complete and accurate consistent with any proposal(s) submitted to external funding agencies. Misrepresentation of the research described in this or any other IRB application may constitute non-compliance with federal regulations and/or academic misconduct.
- I agree to provide proper surveillance of the project to ensure that the rights and welfare of the human subjects are protected. I will report any problems to the IRB See Reporting Adverse Events and Unanticipated Problems for details.
- I agree that modifications to the approved project will not take place without prior review and approval by the IRB.
- I agree that the research will not take place without the receipt of permission from any cooperating institutions when applicable.
- I agree to obtain approval from other appropriate committees as needed for this project, such as the IACUC (if the research includes animals), the IBC (if the research involves biohazards), the Radiation Safety Committee (if the research involves x-rays or other radiation producing devices or procedures), etc., and to obtain background checks for staff when necessary.
- I understand that IRB approval of this project does not grant access to any facilities, materials, or data on which this research may depend. Such access must be granted by the unit with the relevant custodial authority.
- I agree that all activities will be performed in accordance with all applicable federal, state, local, and Iowa State University policies.

Signature of Principal Investigator Date

Signature of Major Professor/Supervising Faculty Date
(Required when the principal investigator is a student)

Printed Name of Department Chair/Head/Director

Signature of Department Chair/Head/Director Date

For IRB
- Not Research Per Federal Regulations
- No Human Participants
- Review Date: 4/27/2014

Exempt Per 45 CFR 46.101(b): 1, 2

IRB Reviewer's Signature Date

Office for Responsible Research
Revised: 8/15/13