



Physical Activity Levels in Physical Education Lessons at Singapore Primary School

Nur Syahida Binte Jamaluddin¹, Masato Kawabata^{1,2✉}

¹Physical Education and Sports Science Academic Group, National Institute of Education, Nanyang Technological University, Singapore

²School of Human Movement and Nutrition Sciences, The University of Queensland, Australia

DOI: <https://doi.org/10.15294/ajpesh.v1i2.52585>

Article Info

Article History

Submitted 2021-07-09

Revised 2021-09-29

Accepted 2021-11-17

Keywords

accelerometer, physical activity intensity, Physical Education, primary students

Abstract

Physical education (PE) lessons are the appropriate occasions to promote physical activity for children. Although the moderate-to-vigorous physical activity (MVPA) levels during PE lessons were investigated in several countries, MVPA levels during PE lessons were never reported at Singapore primary schools. Therefore, the present study aimed to investigate physical activity intensity levels during PE lessons at a Singapore primary school. A total of 93 students (40 girls) voluntarily participated in the study: 28 in Grade 1, 39 in Grade 4, and 26 in Grade 6. They were asked to wear an accelerometer on their non-dominant hand in two PE lessons to measure physical activity levels objectively. They also completed questionnaires on their experiences during the PE lessons. The average of the MVPA levels time (%) in the scheduled lesson time across the three grades was $46.98 \pm 5.25\%$, but the average of the MVPA levels time (%) in the actual lesson time was $69.74 \pm 7.31\%$. These results indicated that it would be possible to achieve the recommended MVPA time in PE lessons. The findings of this study would be useful for PE teachers to reflect whether their PE lessons are efficient to promote primary school student's physical activity levels.

INTRODUCTION

Engaging children in physical activity is important as physical inactivity often leads to obesity which poses a major risk factor for non-communicable diseases such as cardiovascular-related diseases (Fairclough & Stratton, 2006; Hardy et al., 2017). The World Health Organization (WHO) recommends 5-17 years old to engage in at least 60 minutes of moderate-to-vigorous physical activity (MVPA) every day (WHO, 2013). In Singapore, the Health Promotion Board (HPB) has a similar guideline for youths aged 7-18 years old (Health Promotion Board, 2012). However, there seems to be a low compliance to these recommended guidelines in Singapore. Singapore Health Promotion Board (HPB) reported that 12% of the primary school students (female: 10.6%; male: 13.2%) fell under the weight category of 'overweight' or 'severely overweight' in 2010. The rising obesity levels of Singaporean youths continue to be a big issue for the future generations if there are no interventions to curb the problem.

Youths spend almost half of their waking hours at school and schools provide children a key environment in the promotion of physical activity (Fairclough & Stratton, 2006; Rachele et al., 2016). Physical education (PE) could play a major role in promoting physical activity. Although PE lessons in Singapore schools are not scheduled daily, PE would be a promising opportunity to tackle the obesity

✉ Correspondence Author:
1 Nanyang Walk, 637616, Singapore
E-mail: masato.kawabata@nie.edu.sg



problem among Singaporean children. According to the PE syllabus in Singapore, one of the goals in PE is to “maintain health-enhancing fitness through regular participation physical activities” (Singapore Ministry of Education [MOE], 2014). PE lessons in Singapore aim to provide all children with a structured and regular physical activity program, targeting all aspects of motor coordination and physical fitness. Therefore, PE lessons are indeed the appropriate intervention as it acts as an important source of physical activity for children in Singapore.

There are several non-intervention studies that investigated the duration of MVPA levels during the PE lesson (e.g., Meyer et al., 2013; Nettlefold et al., 2011; Singerland et al., 2011; Tanaka et al., 2018; Zimmo et al., 2020). The percentage of time during PE spent in MVPA levels reported in the non-intervention studies ranged from 12.2% to 46.7%. Although the studies were conducted in different countries (Switzerland, Canada, Netherlands, Japan, and Qatar), all the studies reported the duration of the MVPA levels were lesser than 50% of total PE lesson time, which is a recommendation by U.S. Department of Health and Human Services (2010).

Among the five studies, four studies (Meyer et al., 2013; Nettlefold et al., 2011; Tanaka et al., 2018; Zimmo et al., 2020) reported that boys were more active than girls at the primary school level. In contrast, Singerland et al. (2011) reported no significant difference in the MVPA levels time between boys and girls at the primary school level although boys were more active than girls at the secondary level.

Regarding the MVPA levels across different age groups, mixed results were reported in the five studies. Tanaka et al. (2018) found that the MVPA levels of younger age students (Grades 1 and 2) were higher than older primary students (Grades 5 and 6). On the other hand, Meyer et al. (2013) found no significant difference in the MVPA levels between Grades 1 and 5 students. Singerland et al. (2011) found the Grade 5 students were more active than Grades 4 and 6 students. In Zimmo et al.'s (2020) study, they reported that Grade 4 boys were more active than Grade 1 boys, but the significant difference was not observed for girls.

Although MVPA levels during PE lessons were investigated in several countries, no studies were conducted to understand MVPA levels during PE lessons at Singapore primary schools. Therefore, the present study aimed to investigate the physical activity intensity of PE lessons at a Singaporean primary school. To this end, it was also examined that how demographic variables (e.g., age, gender) and the students' enjoyment levels were associated with the MVPA levels during PE lessons.

According to the literature and our own previous studies, it was hypothesized that a) Singapore primary school students would the time conducted at MVPA levels would be less than 50% of the scheduled PE lesson (H_1), b) younger students would be more active than older students (H_2), and c) boys would be more active than girls (H_3), and d) students who perceived higher enjoyment levels during PE would generate higher MVPA levels (H_4).

METHODS

Method is written with a length of 15-20% of the manuscripts length and contain: (1) the study designs; (2) data collection techniques and data sources; and (2) method of data analysis. Studies with sensitive topic or treated human and/or other living-creatures should mention the number of Ethical Clearance Letter and the institution which declare it.

Participants

Participants recruited were Singaporean primary school students ($N = 93$) from one primary school. Of the 93 primary school students, 28 were in Grade 1 (ages 6-7), 39 were in Grade 4 (ages 9-10) and 26 were in Grade 6 (ages 11-12).

Measures

General Positive Feelings on PE. A 10-item questionnaire was developed to measure participants' enjoyable feelings on PE lessons in general. The two of seven items measured their positive affect towards PE (e.g., “I enjoy PE lessons”, “I like PE lessons”). The other five items assessed to what extent each of the five domains (athletics, gymnastics, dance, games and sports, and outdoor education) listed in the Singapore's PE Syllabus (MOE, 2014) is enjoyable for the participants. Participants responded the 7 items on a 5-point scale ranging from 1 (*do not enjoy it at all*) to 5 (*enjoy it very much*). The remaining three items assessed how type of activities, PE teacher, and classmates were

important for the participants to enjoy the PE lesson, on a 3-point scale ranging from 1 (*not important at all*) to 3 (*very important*).

Enjoyment in PE lessons. A 2-item questionnaire was developed to measure to what degree participants enjoyed each PE lesson and which activity was most fun. Participants were asked to assess their enjoyment level on a 5-point scale ranging from 1 (*do not enjoy it at all*) to 5 (*enjoy it very much*).

Physical Activity Levels in PE lessons. Participants were instructed to wear the GENEActiv (Original) accelerometer (Activinsights Ltd, Cambridgeshire, UK) on their non-dominant wrist for 1-hour PE lessons to objectively measure the intensity of their PA levels.

Procedures

Ethics approval for the study was obtained from the Institutional Review Board at Nanyang Technological University, Singapore (Ref No: IRB-2016-01-032). Data collection approval was also obtained from Singapore Ministry of Education (Ref No: RP20-16[06]). The principal from the primary school was contacted to share the scope of the study. The first author attended PE lessons to explain the aims of the study and to distribute the information sheets and consent forms. Students were given time to ask questions regarding the study requirement and to discuss their participation with their parents. Those who gave their consent and returned the informed consent forms were eligible to participate in the study. Some students, whose parents did not provide consent to participate in this study, were not included in the study, although they participated in the same PE lessons as their classmates.

Physical activity levels were measured in two lessons for each class. All six lessons (2 lessons \times 3 classes) were taught by the respective PE specialized teachers and each lesson was 60 min long. At public primary schools in Singapore, however, PE teachers bring students from their home room to the PE lesson venue at the beginning of the PE lesson and bring them back to their home room after the PE lesson. The travelling time between home room and the PE lesson venue was excluded from the 60-min scheduled lesson time. The first author recorded what time PE teachers had started and ended each lesson and calculated the actual PE lesson time. PE teachers were requested to conduct their PE lessons with their usual routines. All the lessons mainly focused on the games and sports domain, one of the domains listed in the Singapore's PE Syllabus (MOE, 2014).

The questionnaire on the general positive feelings on PE was administered to the participants one week before the first lesson. The post-lesson questionnaire was administered immediately after the second lesson. Participants were informed that there were no incorrect answers and were reassured about the confidentiality of their responses. It took approximately 10 minutes to complete the questions.

Data Analysis

Data collected from the accelerometers was extracted from the GENEActiv software and then converted into the Microsoft Excel Macro file prepared by Activinsights. The data consisted of the various intensity levels: (i) light; (ii) moderate; and (iii) vigorous levels. Actual lesson time was calculated based on the time PE teachers had started and ended each lesson. The percentage of the duration in which physical activity were conducted at moderate-to-vigorous levels was calculated as the MVPA levels time (%). Only the MVPA levels time was analyzed in the subsequent data analysis.

Descriptive statistics of the MVPA levels time (%) was calculated to examine the first hypothesis (H_1). A 2 (gender) \times 3 (age groups) ANOVA was conducted on the MVPA levels time to examine the second and third hypotheses (H_2 , H_3). Correlation tests (Pearson Correlation) were conducted to find strength of associations between MVPA levels and the questionnaire items. Correlation analyses were conducted to examine the fourth hypothesis (H_4). A 2 (gender) \times 3 (age groups) MANOVA was conducted on the general positive feelings on PE for a preliminary analysis.

RESULTS AND DISCUSSION

Preliminary Analysis

Descriptive results of the positive feelings on PE revealed that in general, participants like and enjoy the subject very much. The average scores of liking and enjoying PE for the entire sample were 4.7 ($SD = 0.7$) and 4.6 ($SD = 0.8$) respectively (see Table 1). A 2 (gender) \times 3 (age groups) MANOVA on the general positive feelings towards PE revealed that the main effect of age groups was statistically

significant only for the linking PE score: $F(2, 87) = 7.82, p = .001; \eta_p^2 = .16$. Post-hoc tests with the Bonferroni adjusted p -value (.017) indicated that Grades 1 and 4 students like PE more than Grade 6 students (see Table 1). However, either main effects of gender and age groups or their interaction effect was found non-significant for the enjoying PE score.

Table 1. Descriptive Statistics of General Positive Feelings on PE and the MVPA Levels Time (%) in PE Lessons

Grade	Age	Overall	Boys								Girls					
			Like PE	Enjoy PE	MVPA (SLT)	MVPA (ALT)	n	Like PE	Enjoy PE	MVPA (SLT)	MVPA (ALT)	n	Like PE	Enjoy PE	MVPA (SLT)	MVPA (ALT)
G1	6-7	28	4.9 (0.3)	4.8 (0.5)	50.3 (3.6)	73.7 (5.2)	15	4.9 (0.4)	4.8 (0.6)	51.2 (3.6)	74.9 (5.2)	13	5.0 (0.0)	4.8 (0.4)	49.4 (3.4)	72.3 (5.0)
G4	9-10	39	4.8 (0.6)	4.6 (0.8)	44.1 (5.6)	66.1 (8.3)	24	4.9 (0.3)	4.7 (0.6)	45.3 (6.0)	67.9 (8.9)	15	4.5 (0.9)	4.4 (1.0)	42.2 (4.5)	63.2 (6.7)
G6	11-12	26	4.2 (1.0)	4.3 (1.0)	47.8 (3.6)	71.0 (4.6)	14	4.4 (0.6)	4.4 (0.7)	47.6 (5.5)	71.1 (5.2)	12	4.0 (1.2)	4.3 (1.3)	47.6 (3.0)	71.0 (4.1)
Total		93	4.7 (0.7)	4.6 (0.8)	47.0 (5.2)	69.7 (7.3)	53	4.8 (0.5)	4.6 (0.6)	47.6 (5.5)	70.7 (7.6)	40	4.5 (0.9)	4.5 (1.0)	46.1 (4.9)	68.5 (6.8)

Note. MVPA = The percentage of the moderate-to-vigorous physical activity; ALT = actual lesson time; SLT = scheduled lesson time (60 min); PE = physical education; G1 = Grade 1; G4 = Grade 4; G6 = Grade 6. SD is presented in parentheses.

Descriptive Statistics of the MVPA Levels Time (%)

The average of actual lesson time across the six 1-hour lessons was 40.50 ± 3.56 min. The results of the MVPA levels time (%) in the scheduled lesson time (i.e., 60 min) and the actual lesson time are presented in Table 1. The average of the MVPA levels time (%) in the scheduled lesson time across the three grades was $46.98 \pm 5.25\%$ and just less than 50% of the scheduled lesson time (60 min). For Grade 1, the average of the MVPA levels time (%) was $50.33 \pm 3.56\%$ of the scheduled lesson time, reaching the recommendation by U.S. Department of Health and Human Services (2010). Moreover, the average of the MVPA levels time (%) in the actual lesson time was $69.74 \pm 7.31\%$. Both boys and girls in every grade spent more than 50% of the actual lesson time conducting MVPA. According to these results, the first hypothesis (H_1) was supported. However, the hypothesis was rejected unexpectedly when the percentage of the MVPA levels time was calculated based on the actual lesson time.

Comparison of the MVPA Levels Time (%) Between Gender and Age Groups

A 2 (gender) \times 3 (age groups) ANOVA on the MVPA levels time (%) in the actual lesson time was conducted to examine whether younger students would be more active than older students (H_2) and boys would be more active than girls (H_3). Neither the main effect of gender nor the interaction effect of gender and age groups was significant. However, the main effect of age groups was found statistically significant: $F(2, 87) = 17.60, p < .001; \eta_p^2 = .29$. Post-hoc tests with the Bonferroni adjusted p -value (.017) indicated that Grades 1 and 6 students' the MVPA levels time (%) were significantly longer than Grade 4 students (see Table 1). These results were the same as the MVPA levels time (%) in the schedules lesson time (i.e., 60 min). According to these results, either the second or third hypothesis was not supported.

Association Between the MVPA Levels Time (%) and Enjoyment Level

A Pearson's correlation analysis was conducted to examine the fourth research hypothesis (H_4). The MVPA levels time (%) in the actual lesson time was not significantly related to student's enjoyment level in the PE lesson ($r = .11, p = .31$). However, this unexpected result was considered due to the ceiling effect as student's perceived enjoyment score was very high ($M = 4.42, SD = .94$).

Discussion

The present study investigated the physical activity intensity of PE lessons at a Singaporean primary school. This is the first study to investigate the physical activity intensity of non-intervention PE lessons at a primary school level in Singapore. The average of the MVPA levels time (%) in the scheduled lesson time across the three grades was $46.98 \pm 5.25\%$ and just less than 50% of the scheduled lesson time (60 min). However, it was close to the recommendation by U.S. Department of Health and Human Services (2010). This result was relatively higher than the MVPA levels time reported in the studies by Meyer et al. (2013), Nettlefold et al. (2011), Tanaka et al. (2018), and Zimmo et al.

(2020), which ranged from 12.2% to 32.8%. Furthermore, the average of the MVPA levels time (%) in the actual lesson time was more than 50% of the actual lesson time in the present study.

No gender difference but age group difference was observed for the MVPA levels time (%) in the scheduled and actual lesson time. These results were consistent with Singerland et al.'s study (2011), but different from the studies by Meyer et al. (2013), Nettlefold et al. (2011), Tanaka et al. (2018), and Zimmo et al. (2020). The difference between scheduled and actual lesson time was 19.50 min (32.50%), which is much larger than the difference reported by Singerland et al. (2011). At public primary schools in Singapore, PE teachers bring students from their home room to the PE lesson venue at the beginning of the PE lesson and bring them back to their home room after the PE lesson. This travelling time between home room and the PE lesson venue often takes 10-15 min and contribute to the large difference between scheduled and actual lesson time. As Singerland et al. (2011) suggested, the time assigned for PE should be used more productively to increase the actual lesson time.

Limitations and Future Studies

There are some limitations in the present study. First, the study was conducted in one primary school, with three classes of different age groups. The other age groups (i.e., Grades 2, 3 and 5) were not explored. Thus, the findings of this study cannot be generalized without further research with many Singapore primary schools. Second, the PE lessons in this study targeted only games and sports domain. The physical activity intensity of PE lessons should also be measured in future studies for other domains of activities such as gymnastics or dance. Third, the post-lesson questionnaire was administered only after the second lesson. It should have been administered after both two lessons.

CONCLUSION

In summary, the findings of this study revealed the average of the MVPA levels time (%) was just less than 50% of the scheduled lesson time. However, it was close to the recommendation by U.S. Department of Health and Human Services (2010), and relatively higher than the MVPA levels time reported in previous studies. Replication studies should be conducted to determine whether the findings of the present study are due to the good teaching practice of the primary school participated in the study.

ACKNOWLEDGEMENT

The present study was partially supported by a fund by Singapore Ministry of Education under the Education Research Funding Program (OER 24/15 MK) and administered by National Institute of Education (NIE), Nanyang Technological University, Singapore. The views expressed in this paper are the author's and do not necessarily represent the views of NIE.

REFERENCES

- Fairclough, S.J. & Stratton, G. 2006. A Review of Physical Activity Levels during Elementary School Physical Education. *Journal of Teaching in Physical Education*, 25 (2): 240–258. <https://doi.org/10.1123/jtpe.25.2.240>
- Hardy, L.L., Mhrshahi, S., Bellew, W., Bauman, A. & Ding, D. 2017. Children's Adherence to Health Behavior Recommendation Associated with Reducing Risk of Non-Communicable Disease. *Preventive Medicine Reports*, 10 (8): 279-285. <https://doi.org/10.1016/j.pmedr.2017.10.006>
- Meyer, U., Roth, R., Zahner, L., Gerber, M., Puder, J., Hebestreit, H. & Kriemler, S. 2013. Contribution of Physical Education to Overall Physical Activity. *Scandinavian Journal of Medicine & Science in Sports*, 23 (5): 600–606. <https://doi.org/10.1111/j.1600-0838.2011.01425.x>
- Nettlefold, L., McKay, H., Warburton, D., McGuire, K., Bredin, S. & Naylor, P. 2011. The Challenge of Low Physical Activity during the School Day: at Recess, Lunch and in Physical Education. *British Journal of Sports Medicine*, 45 (10): 813–819. <https://doi.org/10.1136/bjism.2009.068072>
- Rachele, J.N., Cuddihy, T.F., Washington, T.L. & McPhail, S.M. 2016. School-Based Youth Physical Activity Promotion: Thoughts and Beliefs of Pre-Service Physical Education Teachers. *Australian Journal of Teacher Education*, 41 (5): 52-64. <https://files.eric.ed.gov/fulltext/EJ1102063.pdf>

- Singapore Health Promotion Board. 2012. *Start the New School Year on the Right Foot with 60 Minutes of Physical Activity a Day*. <https://www.hpb.gov.sg/article/start-the-new-school-year-on-the-right-foot-with-60-minutes-of-physical-activity-a-day>.
- Singapore Ministry of Education. 2014. *Physical Education Teaching & Learning Syllabus Primary, Secondary & Pre-University*. https://www.moe.gov.sg/docs/default-source/document/education/syllabuses/physicalsports-education/files/physical_education_syllabus_2014.pdf.
- Singerland, M., Oomen, J. & Borghouts, L. 2011. Physical Activity Levels during Dutch Primary and Secondary School Physical Education. *European Journal of Sport Science*, 11 (4): 249–257. <https://doi.org/10.1080/17461391.2010.506661>
- Tanaka, C., Tanaka, M. & Tanaka, S. 2018. Objectively Evaluated Physical Activity and Sedentary Time in Primary School Children by Gender, Grade and Types of Physical Education Lessons. *BMC Public Health*, 18 (1): 948. <https://doi.org/10.1186/s12889-018-5910-y>
- U.S. Department of Health & Human Services. 2010. *Strategies to Improve the Quality of Physical Education*. Washington, DC: Author.
- World Health Organisation. 2013 Global action plan for the control and prevention of non-communicable diseases. Retrieved November 2019 from http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf
- Zimmo, L., Almudahka, F., Ibrahim, I., Al-kuwari, M.G. & Farooq, A. 2020. Moderate to Vigorous Physical Activity during Physical Education, Recess, and Class time among Elementary School Children in Qatar. *Journal of Teaching in Physical Education*, 39 (1): 1-8. <https://doi.org/10.1123/jtpe.2018-0351>