SPORT TK-EuroAmerican Journal of Sport Sciences

https://revistas.um.es/sportk Online ISSN: 2340-8812

Received: **03/07/2025.** Accepted: **05/11/2025.** Published: **30/03/2026**

Unstructured play with active equipment enhances moderate-to-vigorous physical activity in children

Nguyen Huu Tri[1], Nguyen Quoc Tram[2*], Trinh Thi Thanh Minh[3], Nguyen Thanh Trung[3]

[1] Physical Education Department, Can Tho University, Vietnam.

[2] Physical Education Department, Phu Yen University, Vietnam.

[3] Physical Education Department, Tay Do University, Vietnam.

* Correspondence: Nguyen Quoc Tram; tramnguyenq2019@gmail.com

ABSTRACT

This study examined the impact of a daily 25-minute unstructured physical activity (PA) break on the PA levels of children aged 7–9 years. Recess periods provide valuable opportunities to boost PA and counteract sedentary behaviors, especially when active play equipment is available. In this randomized controlled trial, 71 children were allocated to either an experimental group (EG; n=39), which participated in daily 25-minute free play sessions with access to sports equipment, or a control group (CG; n=32) following standard recess protocols. Accelerometer measurements indicated a statistically significant increase ($p<0.05$) in moderate-to-vigorous PA (MVPA) in the EG relative to the CG, aligning with the World Health Organization's 2020 guidelines on reducing sedentary behavior. These findings suggest that incorporating brief, unstructured PA breaks equipped with active play tools can enhance the effectiveness of school-based PA interventions and promote higher activity levels among children. Future research should explore the long-term benefits of such approaches.

KEYWORDS

Recess; Active Play; School Health Promotion; Sedentary Behavior

1. INTRODUCTION

Children's health and well-being have become a prominent public health concern in recent years (Chomitz et al., 2008; Committee on Physical Activity and Physical Education in the School Environment, Food and Nutrition Board et al., 2013). Regular PA has been scientifically proven to exert significant positive effects on children's overall development, encompassing social,

psychological, and physiological domains (Brown et al., 2016; Chen et al., 2020; Whiting et al., 2020). However, despite these well-documented benefits, a substantial proportion of children, particularly those in middle childhood (ages 10–12), fail to engage in the recommended levels of moderate-to-vigorous PA. This lack of PA is particularly alarming given that children spend a significant portion of their school day engaged in sedentary behaviors (Whiting et al., 2020).

Schools, therefore, play a crucial role in providing opportunities for PA, especially for children who may have limited access to such opportunities outside of the school environment (Whiting et al., 2020). Research consistently demonstrates that children who participate in unstructured outdoor play during recess and structured physical education classes exhibit higher levels of PA (Reznik et al., 2015). While recess often serves as the primary source of school-based PA in many public schools, it often fails to compensate for inadequate PE curricula (Tran et al., 2013).

The Institute of Medicine recommends that children in kindergarten through twelfth grade engage in 60 minutes of PA daily. However, disparities in access to and the quality of PE persist, particularly for students identifying as Hispanic and those from low-income backgrounds (Committee on Physical Activity and Physical Education in the School Environment, Food and Nutrition Board et al., 2013). These disparities underscore the critical need to ensure equitable access to high-quality PE for all students within the education system. By doing so, we can help guarantee that all children can reap the numerous social, psychological, and physiological benefits associated with regular PA.

Recognizing the profound impact of PA on young people's development, schools bear a significant responsibility to create environments that encourage and support PA. Prioritizing physical education and providing ample time for unstructured PA, such as recess, are essential steps toward ensuring that students achieve adequate levels of PA. Addressing inequalities in access to quality physical education is paramount to achieving this goal. By fostering a culture that values and promotes PA, schools can play a transformative role in shaping healthier lives for all students.

In Vietnam, physical education classes typically average less than 45 minutes, with only about 11 minutes dedicated to moderate-to-vigorous physical activity (MVPA) three times a week (Pham et al., 2023). While this schedule provides some opportunity for PA during school hours, research exploring the impact of more frequent recess periods on overall activity levels remains limited. Recess breaks, typically ranging from five to fifteen minutes, offer a valuable opportunity to

increase daily MVPA. Studies have shown that outdoor recess, in particular, is associated with higher activity levels among students, suggesting that these short breaks can contribute significantly to overall PA during the school day (Tran et al., 2013; Zavacky & Michael, 2017).

However, a concerning trend in Vietnam, reflecting global patterns, is the increasing prioritization of academics over PA opportunities, including recess. This shift is worrisome, as prolonged inactivity during childhood can contribute to long-term health problems (Committee on Physical Activity and Physical Education in the School Environment, Food and Nutrition Board et al., 2013). Recess represents a unique and valuable opportunity for children to engage in unstructured PA with minimal adult supervision during school hours (Zavacky & Michael, 2017). The American Academy of Pediatrics has emphasized the importance of frequent recess breaks throughout the school day, highlighting recess as a crucial cognitive break and a chance for children to engage in much-needed PA.

Despite the provision of school recesses, many children still fail to engage in sufficient PA during these times. This highlights the need for further investigation into the factors influencing children's PA during recess and the development of effective strategies to promote more active play during these breaks.

Numerous studies have demonstrated that children typically only achieve moderate-to-vigorous PA levels for approximately one-third of their recess time (Viciana et al., 2016). This trend has been observed both domestically and internationally, including in Vietnam. This finding raises significant concerns given the Institute of Medicine's recommendation of 60 minutes of daily PA for children. This concern is further amplified by the fact that children from low-income communities often lack sufficient opportunities for PA outside of school, highlighting the crucial need for robust school-based PA programs (Tran et al., 2013).

While initiatives such as providing sports equipment during recess and implementing other strategies to promote PA have shown promise in increasing MVPA among children, the potential impact of recess duration on children's ability to achieve recommended daily PA levels remains unclear.

The extant literature underscores the critical role of physical activity (PA) in fostering both the physiological and cognitive development of children. Several studies have documented that regular engagement in MVPA not only enhances physical fitness but also correlates with improved academic outcomes and overall well-being (Chomitz et al., 2008; Whiting et al., 2020). In response

to growing concerns over sedentary behaviors, particularly in school settings where academic demands often limit PA opportunities, researchers have explored diverse strategies to augment daily activity levels among children.

A substantial body of work has focused on school-based interventions, highlighting the efficacy of both structured physical education and unstructured play periods in increasing MVPA. Notably, investigations by Tran et al. (2013) and Reznik et al. (2015) have demonstrated that modifications to recess protocols—especially those that incorporate active play equipment—can lead to significant improvements in children's activity levels. These studies suggest that providing children with access to engaging sports equipment during recess not only promotes self-directed play but also markedly increases the proportion of time spent in MVPA (Verstraete et al., 2006).

Methodologically, the utilization of accelerometry in PA research has facilitated a more precise quantification of activity intensities. The validation studies by Cain et al. (20110 and Pfeiffer et al. (2006) have established accelerometers as reliable instruments for capturing the nuanced variations in PA, thereby strengthening the evidence base for school-based interventions. This objective measurement approach has allowed researchers to rigorously assess the impact of unstructured play breaks on daily PA, further corroborating the link between recess activity and overall MVPA accumulation.

Moreover, in the context of Vietnamese schools, challenges such as abbreviated physical education sessions and an academic culture that prioritizes classroom instruction over physical movement have been identified as critical barriers to achieving recommended PA levels (Pham et al., 2023). Such findings emphasize the need for innovative, cost-effective interventions—like the incorporation of regular, unstructured play breaks with active equipment—that can be seamlessly integrated into the school day to enhance PA outcomes.

In summary, the literature converges on the premise that structured modifications to the school environment, particularly through the strategic use of unstructured play breaks, can serve as a pivotal mechanism for increasing MVPA among children. Future research should aim to refine these intervention models by elucidating the optimal duration, frequency, and contextual factors that maximize PA benefits, thereby providing a robust framework for both policy development and practical application in diverse educational settings.

The objective of this study is to evaluate the effectiveness of incorporating a 25-minute unstructured free play break, equipped with active play tools, on the physical activity levels of

children aged 7 to 9 years. The study aims to determine whether this brief interval can enhance MVPA in accordance with World Health Organization guidelines, thereby reducing prolonged sedentary behavior among children. By employing accelerometers to precisely quantify various activity intensities, the study seeks to provide robust scientific evidence supporting the integration of physical activity-promoting strategies into school curricula, ultimately contributing to improved health outcomes and holistic development in children.

2. METHODS

2.1. Participants

This study was conducted at a Global International School (GIS) in Vietnam's Mekong Delta region. A total of 71 children (37 boys and 34 girls) from grades 1 through 3 participated, representing a diverse age range within early elementary education (28 children from Grade 1, 20 from Grade 2, and 23 from Grade 3).

Following ethical approval and parental consent, participants were randomly assigned to either an experimental group (EG; N = 39) or a control group (CG; N = 32) using a computer-generated random number sequence. This randomization process employed stratification to ensure balanced representation of each grade level (1, 2, and 3) across both groups.

2.2. Measurement of Physical Activity (PA)

PA was objectively measured using ActiGraph GT1M accelerometers. Children wore the accelerometers, securely fastened to their waists with elastic bands, from the time they left for school in the morning until they returned home in the evening. Adherence to accelerometer wear was monitored, and data were deemed valid for analysis if recorded for at least 9.6 hours per day (representing 80% of the allotted wear time) between 7:00 a.m. and 7:00 p.m. Following the established methodology of Cain et al. (2013), continuous periods of inactivity lasting twenty minutes or more (categorized as "zero" activity) were excluded from the analysis.

PA intensity was categorized based on established cut-off points for school children, as defined by Pfeiffer et al [12]:

Sedentary activity: 0 – 1488 counts per minute

Light PA: 1489 – 2336 CPM

Moderate PA: 2337 – 3520 CPM

Vigorous PA: > 3520 CPM

2.3. Intervention Protocol

Data collection occurred during August and September, with all recess observations conducted outdoors on the school playground. The school's designated recess time, totaling 35 minutes and commencing at 9:50 a.m. after the second class period, was divided into two distinct segments for the purpose of this study. The first 10 minutes were allocated for breakfast, followed by 25 minutes designated for play or semi-structured PA.

Experimental Group: The experimental group participated in a structured recess intervention designed to promote light PA. This intervention, averaging 24.2 ± 2.5 minutes in duration, took place on the school playground and incorporated a variety of toys and games, including jump ropes, hoops, balls, badminton rackets, and hockey sticks.

Under the supervision of GIS school physical education instructors, children were encouraged to engage in active play using the provided equipment. Instructors provided demonstrations and guidance on equipment use, fostering an environment of active participation while allowing children the freedom to choose their preferred activities.

Control Group: The control group followed the school's standard recess procedures, engaging in 25 minutes of unsupervised play either in the classroom or outdoors. While safety was monitored, no structured activities or sports were provided.

2.4. Statistical Analyses

A multivariate General Linear Model (GLM) was used to examine the effects of age, sex, and group membership on physical activity (PA), with baseline PA and BMI included as covariates. Homogeneity of variances was assessed using Levene’s test; when violated, Welch’s t-test was applied.

Associations were evaluated using Pearson correlation with Bonferroni correction for multiple comparisons. Effect sizes were calculated using Cohen’s d, and results are reported with 95% confidence intervals.

Missing data (mainly due to insufficient accelerometer wear time) were handled using listwise deletion, with sensitivity analyses conducted to assess robustness. All analyses were performed using SPSS version 20.0.

3. RESULTS

No significant interactions were observed between sex, age, or the interaction of sex and age on PA levels ($p > .05$). Therefore, data were pooled for all participants to increase statistical power. As shown in Table 1, a significant difference in MVPA was found between the experimental group (EG) and control group (CG) during the 25-minute recess period ($p < .05$).

Table 1. School break activity: experimental vs. control group

	CG (n=32)	EG(n=39)	p value
Low physical exercise (min)	1.02 ± .82	1.86 ± .83	< .001 (1.2)
Moderate physical exercise (min)	.79 ± .78	3.10 ± 1.39	< .001 (3.0)
Moderate to vigorous physical exercise (min)	1.09 ± 1.10	7.69 ± 3.92	< .001 (6.1)
Overall Physical Exercise (cpm)	624 ± 350	769 ± 356	< .001 (5.4)
Physical inactivity (min)	13.1 ± 2.20	3.96 ± 2.49	< .001 (4.3)
Vigorous physical exercise (min)	.31 ± .45	4.58 ± 2.24	< .001 (9.1)

Children in the EG, who had access to active play equipment, spent more than half of their recess time engaged in MVPA (mean = 57.2%, SD = 18.0%), while children in the CG only averaged 7.04% (SD = 1.24%). This finding highlights the potent impact of structured opportunities for active play on children's activity levels.

Further analysis of daily PA data, presented in Table 2, revealed that the EG demonstrated significantly higher levels of overall PA (7.3% higher, $p = .045$), light-intensity PA (14.5% higher, $p = .012$), vigorous-intensity PA (22.5% higher, $p = .031$), and MVPA (15.3% higher, $p = .025$) compared to the CG.

Table 2. Comparison of daily physical activity between experimental and control groups

	CG (n=32)	EG (n=39)	p value
Low physical exercise (min)	44.3 ± 10.5	50.6 ± 10.9	.012 (.61)
Moderate physical exercise (min)	38.5 ± 11.6	43.3 ± 12.2	.073
Moderate to vigorous physical exercise (min)	73.3 ± 23.8	86.0 ± 25.9	.025 (.52)
Overall Physical Exercise (cpm)	750 ± 169	826 ± 185	.045 (.45)
Physical inactivity (min)	586 ± 35.5	573 ± 38.5	.113
Vigorous physical exercise (min)	34.9 ± 16.1	42.7 ± 17.0	.031 (.49)

While most children accumulated over 60 minutes of MVPA daily, a noteworthy difference emerged in the proportion of children consistently achieving this benchmark. Only 9% of children in the EG failed to reach this recommended level of MVPA, compared to 30% of children in the CG. This finding underscores the potential of short, unstructured active play sessions to contribute meaningfully to children's overall daily PA and promote adherence to health guidelines.

Table 3 presents a correlation analysis exploring the relationship between PA levels during recess and total daily PA. This analysis was conducted for all participants as a whole, as well as separately for the EG and CG.

Table 3. Comparison of correlations: recess PA and daily activity in experimental and control groups

	EG (n=39)	**CG(n=32)**	**Pooled (n= 71)**
Low physical exercise (min)	.029	.501	.278
Moderate physical exercise (min)	.476	.312	.441
Moderate to vigorous physical exercise (min)	.243	.421	.338
Overall Physical Exercise (cpm)	.232	.421	.301
Physical inactivity (min)	.122	.12	.168
Vigorous physical exercise (min)	.209	.381	.297

A significant positive correlation was observed between MVPA during recess and the total daily amount of MVPA, both for the EG ($r = .476$; $p < .001$) and for all participants combined ($r = .441$; $p < .001$). This suggests that higher levels of MVPA during recess are associated with higher overall daily MVPA levels.

Interestingly, a significant correlation was also found for vigorous PA, but only when considering all participants together ($r = .338$; $p = .001$). This indicates that the relationship between recess VPA and total daily VPA might be influenced by factors beyond the intervention itself.

These findings highlight the potential importance of recess in promoting daily PA, particularly MVPA. Further investigation is warranted to better understand the factors contributing to the observed correlations and to explore the potential impact of targeted interventions during recess on overall activity levels.

4. DISCUSSION

This study reinforces the critical importance of unstructured PA during the school day for children's overall health and well-being. Our findings provide compelling evidence that even short, unstructured breaks can significantly influence children's activity levels, aligning with previous research emphasizing the value of recess in promoting PA (Ramstetter et al., 2010; Verstraete et al., 206; Ridgers et al., 2012; van Stralen et al., 2014).

Children in the experimental group, provided with opportunities for active play, dedicated a remarkable 57.2% of their break time to MVPA, exceeding the 50% benchmark suggested by Ridgers et al. (2012) for achieving daily PA recommendations. This finding aligns with Verstraete's observation of Belgian children engaging in MVPA for 56% of a 16-minute morning break “cited in

Ramstetter et al. (2010)", further strengthening the argument for the effectiveness of short, unstructured active breaks. This high level of engagement translated to 92% of the experimental group meeting daily MVPA guidelines, a stark contrast to the 69% observed in the control group. This disparity underscores the significant impact of facilitating active play during recess, even within limited timeframes.

While structured physical education classes are undeniably important, recess offers a unique advantage by providing children with autonomy over their PA. This self-directed, unstructured play, as highlighted by Ramstetter et al. (2010) can be a powerful motivator, potentially contributing to higher activity levels compared to more structured settings.

The positive correlation between recess duration and MVPA levels observed by Guinhouya suggests that longer breaks might further enhance PA (Guinhouya et al., 2005). However, our findings demonstrate that even within the constraints of shorter recesses, significant contributions to daily PA can be achieved. This is particularly relevant in contexts like Vietnamese schools, where longer or more frequent breaks may be challenging to implement.

Despite the recognized benefits, the actual implementation and effectiveness of recess in promoting PA vary widely. This study contributes valuable data to this discourse, highlighting the potential of short, unstructured breaks to significantly increase children's daily PA levels. The stark contrast between the experimental group (9.4% of daily MVPA achieved during recess) and the control group (1.3%) underscores the crucial role of schools in actively promoting PA and ensuring minimum standards are met.

This study's findings have important implications for educational policy and practice. Integrating short, active breaks throughout the school day, coupled with the provision of adequate equipment and environments conducive to PA, can empower children to lead healthier, more active lives.

Future research should focus on optimizing the timing and duration of these breaks and exploring factors influencing PA across different age groups to develop more effective intervention programs.

5. LIMITATIONS

This study assessed the impact of unstructured play breaks over a limited timeframe. Further research with long-term follow-up is necessary to gain a comprehensive understanding of the sustained effects of these interventions.

While the study demonstrates promising results within a specific group of children, the scalability and effectiveness of implementing this model in larger, more diverse educational settings require careful consideration.

6. CONCLUSIONS

This study provides compelling evidence for the substantial positive impact of incorporating a 25-minute unstructured PA break into the school day for children aged 7-9. Our findings demonstrate that such breaks can significantly increase the time children dedicate to MVPA, a crucial component of their physical health and overall development. This increase in activity levels aligns with the World Health Organization's recommendations for mitigating sedentary behavior among children, highlighting the direct applicability of these findings to public health initiatives.

The study carries significant implications for educational institutions, particularly those operating within contexts of limited resources for structured physical education. Integrating regular, short, unstructured PA breaks presents a cost-effective and logistically feasible strategy for enhancing students' physical fitness. Schools can leverage these findings to advocate for policy changes that prioritize PA within the school day, potentially yielding benefits for both student health outcomes and academic performance, given the established link between physical exercise and cognitive function.

7. RECOMMENDATIONS

Based on our results, we propose the following recommendations to promote children’s physical activity (PA) in schools:

- Implement regular unstructured PA breaks: Schools should schedule at least one 25-minute unstructured break daily, allowing children to engage in self-directed physical activities that increase moderate-to-vigorous physical activity (MVPA).
- Provide diverse and engaging equipment: Access to sports and active play equipment during these breaks encourages exploration of different types of movement and motivates participation.
- Encourage self-directed play: Promoting free, child-led play during recess empowers children to choose activities they enjoy, supporting adherence and overall development.
- Develop integrated PA programs: Combine structured physical education lessons with unstructured, equipment-rich play periods to optimize physical, cognitive, and emotional benefits.

- Monitor and evaluate PA levels: Implement continuous evaluation, potentially using accelerometers, to track PA and adjust strategies to ensure they effectively enhance MVPA.
- Future considerations: Research should explore the long-term effects of regular unstructured PA breaks and the impact of varying their frequency and duration to determine an optimal schedule for maximizing health benefits.

8. REFERENCES

1. Brown, H E., Atkin, A J., Panter, J., Wong, G., Chinapaw, M J M., & Sluijs, E V. (2016). Family-based interventions to increase physical activity in children: a systematic review, meta-analysis and realist synthesis. *Wiley-Blackwell*, *17*(4), 345-360. https://doi.org/10.1111/obr.12362
2. Cain L., Sallis F., Conway L., Van Dyck D., & Calhoon L. (2013). Using Accelerometers in Youth Physical activity Studies: A Review of Methods. *Journal of Physical activity and Health*, *10*(3), 437–450. https://doi.org/10.1123/jpah.10.3.437
3. Chen, P., Wang, D., Shen, H., Yu, L., Gao, Q., Mao, L., Jiang, F., Luo, Y., Xie, M., Zhang, Y., Feng, L., Gao, F., Wang, Y., Liu, Y., Luo, C., Nassis, G. P., Krustrup, P., Ainsworth, B. E., Harmer, P. A., & Li, F. (2020). Physical activity and health in Chinese children and adolescents: expert consensus statement (2020). *British Journal of Sports Medicine*, *54*(22), 1321–1331. https://doi.org/10.1136/bjsports-2020-102261
4. Chomitz, V R., Slining, M M., McGowan, R., Mitchell, S., Dawson, G F., & Hacker, K. (2008). Is There a Relationship Between Physical Fitness and Academic Achievement? Positive Results from Public School Children in the Northeastern United States. *Wiley-Blackwell*, *79*(1), 30-37. https://doi.org/10.1111/j.1746-1561.2008.00371.x
5. Committee on Physical Activity and Physical Education in the School Environment, Food and Nutrition Board, Institute of Medicine, Kohl, H. W. III, & Cook, H. D. (Eds.). (2013). *The effectiveness of physical activity and physical education policies and programs: Summary of the evidence*. In *Educating the student body: Taking physical activity and physical education to school*. National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK201508/
6. Diener, M. J. (2010). Cohen's d. In J. W. Wright (Ed.), *The Corsini encyclopedia of psychology* (4th ed., pp. 1–1). John Wiley & Sons.
7. Guinhouya, C. B., Hubert, H., Dupont, G., & Durocher, A. (2005). The recess period: A key moment of prepubescent children's daily physical activity? *The International Electronic Journal of Health Education*, *8*, 126–134.
8. Pfeiffer, K. A., McIver, K. L., Dowda, M., Almeida, M. J., & Pate, R. R. (2006). Validation and calibration of the Actical accelerometer in preschool children. *Medicine and Science in Sports and Exercise*, *38*(1), 152–157. https://doi.org/10.1249/01.mss.0000183219.44127.e7
9. Pham, V H., Rokita, A., Cichy, I., Wawrzyniak, S., & Bronikowski, M. (2023). Effectiveness of Brainball program on physical fitness of primary school pupils in Vietnam. A longitudinal study. *Frontiers Media*, *11*, 1-8. https://doi.org/10.3389/fpubh.2023.978479
10. Ramstetter, C L., Murray, R., & Garner, A S. (2010). The Crucial Role of Recess in Schools. *Wiley-Blackwell*, *80*(11), 517-526. https://doi.org/10.1111/j.1746-1561.2010.00537.x
11. Reznik, M., Wylie-Rosett, J., Kim, M., & Ozuah, P. O. (2015). A classroom-based physical activity intervention for urban kindergarten and first-grade students: a feasibility study. *Childhood Obesity*, *11*(3), 314-324.
12. Ridgers, N. D., Timperio, A., Crawford, D., & Salmon, J. (2012). Five-year changes in school recess and lunchtime and the contribution to children's daily physical activity. *British Journal of Sports Medicine*, *46*(10), 741–746. https://doi.org/10.1136/bjsm.2011.084921
13. Tran, I., Clark, B. R., & Racette, S. B. (2013). Physical activity during recess outdoors and indoors among urban public school students, St. Louis, Missouri, 2010-2011. *Preventing Chronic Disease*, *10*, E196. https://doi.org/10.5888/pcd10.130135

14. van Stralen, M. M., Yıldırım, M., Wulp, A., te Velde, S. J., Verloigne, M., Doessegger, A., Androutsos, O., Kovács, É., Brug, J., & Chinapaw, M. J. (2014). Measured sedentary time and physical activity during the school day of European 10- to 12-year-old children: the ENERGY project. *Journal of Science and Medicine in Sport, 17*(2), 201–206. https://doi.org/10.1016/j.jsams.2013.04.019
15. Verstraete, S. J., Cardon, G. M., De Clercq, D. L., & De Bourdeaudhuij, I. M. (2006). Increasing children's physical activity levels during recess periods in elementary schools: the effects of providing game equipment. *The European Journal of Public Health, 16*(4), 415-419. https://doi.org/10.1093/eurpub/ckl008
16. Viciana, J., Mayorga-Vega, D., & Martínez-Baena, A. (2016). Moderate-to-Vigorous Physical activity Levels in Physical Education, School Recess, and After-School Time: Influence of Gender, Age, and Weight Status. *Human Kinetics, 13*(10), 1117-1123. https://doi.org/10.1123/jpah.2015-0537
17. Whiting, S., Buoncristiano, M., Gelius, P., Abu-Omar, K., Pattison, M W D., Hyska, J., Duleva, V., Milanović, S M., Zamrazilová, H., Hejgaard, T., Rasmussen, M., Nurk, E., Shengelia, L., Kelleher, C., Heinen, M M., Spinelli, A., Nardone, P., Abildina, A., Abdrakhmanova, S., . . . Breda, J. (2020). Physical activity, Screen Time, and Sleep Duration of Children Aged 6–9 Years in 25 Countries: An Analysis within the WHO European Childhood Obesity Surveillance Initiative (COSI) 2015–2017. *Karger Publishers, 14*(1), 32-44. https://doi.org/10.1159/000511263
18. Woods, A M., Graber, K C., & Daum, D N. (2012). Children's Recess Physical activity: Movement Patterns and Preferences. *Human Kinetics, 31*(2), 146-162. https://doi.org/10.1123/jtpe.31.2.146
19. Zavacky, F., & Michael, S L. (2017). Keeping Recess in Schools. *Taylor & Francis, 88*(5), 46-53. https://doi.org/10.1080/07303084.2017.1295763

ACKNOWLEDGMENTS

The authors gratefully acknowledge the invaluable contributions of the students, their families, and the administrative and teaching staff at the Global International School in the Mekong Delta region, whose cooperation was essential to the successful execution of this study. We also extend our sincere appreciation to the physical education instructors and research personnel whose expertise and commitment ensured rigorous data collection and analysis. The support provided by our respective institutions, in terms of both resources and ethical oversight, has been fundamental to the realization of this project.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

COPYRIGHT