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THE ROLE OF MULTISTATION EXERCISES IN PHYSICAL ACTIVITY EXPOSURE DURING A CURRICULAR PRIMARY SCHOOL LESSON: A PILOT STUDY

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Abstract

Background: The benefits of physical activity on primary school children are well reported. Nevertheless, the percentage of children meeting the minimum daily amount of recommended moderate-to-vigorous physical activity (MVPA) declines continuously. Many countries worldwide promote projects in primary schools to sensibilise children to physical activity to fight against this phenomenon. However, most of the interventions focused on the available time dedicated to physical activity and not on the quality of time usage. Thus, this study aimed to identify the role of exercise set-up on the actual time spent by active moving during PA intervention using the "multistation exercise" method. Methods: Twenty children from the third grade of a primary school were recruited to perform 60 minutes of extra-curricular PA intervention. Children performed three different exercise formats, and active time spent by moving or exercising was calculated by video recording the intervention. Results: The final sample size was 12 primary school children (weight 26.83 ± 4.26 kg; height 125.83 ± 6.07 cm, BMI 16.87 ± 1.804 kg/m2). The mean active time spent moving or exercising was 50.75 ± 6.46 seconds in the one-station format and 100.13 ± 10.78 seconds in the two-station format, and 148.71 ± 7.26 seconds in the four-stations format. Repeated measure ANOVA showed a significant solid difference among the three formats ($p<0.001$). Bonferroni Post Hoc showed a considerable difference between one and two workstation formats ($p< 0.001$; +97% of active time), between two and four workstation forms ($p<0.001$; +49% of active time) and between one and four workstation set-ups ($p<0.001$; +193% of active time) Conclusions. The multistation exercise method may be an excellent opportunity to optimise PA intervention in primary school children.

Key Words: Physical Education In Primary School; Active Time; Exercise Organisation, Exercise Management, Physical Education Teacher

INTRODUCTION

Nowadays, the benefits of physical activity on children are well reported. A large number of studies declared that an appropriate amount of physical activity during childhood helps children improve cardiovascular fitness, body composition, and insulin sensitivity and prevent medical conditions such as overweight and obesity (Carrel et al., 2005; D W Harsha, 1995; Errisuriz et al., 2018). Moreover, regular physical activity can also provide multiple benefits to school performance (de Greeff et al., 2018). Despite this, the percentage of children meeting the minimum daily amount of recommended moderate-to-vigorous physical activity (MVPA) declines between 6–8 years (76.1%) and 9–11 years (64,7%) (Dobbins et al., 2013). In addition, the increased emphasis on academic success and the common belief that some subjects are more important than others in school careers have reduced physical education time in schools(Davison & Birch, 2001; Murray & Ramstetter, 2013). However, physical education interventions at school are the best way to reach many children across demographic groups (Weedon et al., 2022). Therefore it has become a popular method to target physical education and fitness development on a large scale (Errisuriz et al., 2018; Fakhouri et al., 2013). Many countries all over the world encourage physical activity (PA) classes to try to guarantee the minimum daily amount of MPVA for their children. However, most of the PA interventions mainly focused on the general amount of time spent on physical activity (i.e. 10 hours of intervention) without considering the actual active time that children spent moving themselves.

A 60-minute lesson full of movement, plays and motor task is entirely different from the same intervention but characterised by long sitting time due to game or rules exposition or waiting for your turn to play. Despite this, no data are available about the efficacy of PA intervention management on physical activity exposure. Thus, this study aims to identify the role of exercise set-up on the actual time spent by active moving during PA intervention using the "multistation exercise" method. This approach is utilised in a team sport or activities with many participants because it optimises time, space and the coach's control (Singh et al., 2018). We hypothesise that this approach could be extended

to children's classes, which could help manage the intervention better and upgrade the time spent by active moving.

Research Question

Is the time spent in Physical Activity interventions really "active" for primary school children? Efficacy of the multistation exercise approach to increase the active time during PA intervention in primary school children.

MATERIALS AND METHODS

Study design and ethical considerations

The present study was conducted in a primary school in the metropolitan area of Turin (North-western Italy). Children from the third grade of the Italian primary school system were asked to perform a "one-shot" of extra physical activity. Participation was voluntary-based and extra-curricular. Parents should give their consent by signing an informed consent statement. Children without parents' approval were excluded from this study.

Participants

Twenty children from the third grade of a primary school in the metropolitan area of Turin were recruited for this study. Participants should be eight years old and regularly attend third-grade classes to be included in this study. In addition, parents must give written permission to participate by signing informed consent and an image release form. Finally, all participants should not suffer from any physio-psychological pathology (medically certified), have been severely injured in the last three months before the study (i.e. broken arm or leg) or be considered unfit to practice any physical activities because of physical or cognitive disabilities.

Procedures

Children considered eligible for this study were invited to participate in a 60-minute of additional physical activity intervention on a Saturday morning in the local sports centre, where an outdoor futsal pitch was booked and dedicated to this study. The futsal pitch

is meanly 36-42 meters long and 18-22 meters large. These measures are stringent to a typical Italian school gym, so the futsal pitch was considered the best choice to replicate the usual space of movement that children have in a school gym. After a 10-minute warm-up (Figure 1), the children were ready to start the intervention.

The exercise focus was on motor and cognitive performance abilities. Children had to run along the track with or without a ball and pay attention to the teacher's colour call. Each colour was related to a specific task or target, so children had to remember the association between the colour and the correct motor task. Detailed exercise procedures are described in Figure 1.

The exercise was administered in three different formats to reach the aim of this study. Each form was 10 minutes long, and five minutes of rest were observed between each trial to guarantee a complete recovery and avoid that results may be affected by the incoming fatigue.

The first format involved only one station (starting/ending point). Thus, while one child performed the exercise, the remaining participants waited, standing in a row. Conversely, the second format involved two symmetrical stations (starting/ending points). Therefore, the group was divided into two rows, and two children could perform the exercise simultaneously. Furthermore, only two markers were added to the existing exercise track to create this new format. Finally, the third format involved four symmetrical stations (starting/ending points). Therefore, the group was divided into four rows, and two children could perform the exercise simultaneously. Four new cones and markers were added to the exercise track to create this new format. In conclusion, children observed five minutes of final debriefing with the PE teacher, and then the intervention was cleared.

The PA intervention was video recorded using an iPad Pro 11" (Apple Inc., Cupertino, California, USA). Then, the video was analysed using the open-source Kinovea version 0.9.5 (www.kinovea.org) to detect the real active time of every child in each exercise format.

Statistical Analysis

All data were analysed using the open-source JASP, version 0.16.4 (Jeffreys's Amazing Statistics Program., University of Amsterdam, the Nederlands).

Descriptive statistics ((mean and standard deviation (SD)) were used to present participants' characteristics and data distribution. In addition, repeated measures ANOVA was used to assess differences in real active time spent during PA intervention between the three different exercise formats. Significance was assumed at $p < 0.05$.

RESULTS

Twenty children were recruited for this study. However, eight were excluded from this study because they did not meet the inclusion criteria or their parents did not sign written permission for participation. Therefore, the remaining twelve children participated in this study and their data were collected for further analysis. Participants' anthropometric characteristics are represented in Table 1.

The mean weight was 26.83 ± 4.26 kg; the mean height was 125.83 ± 6.07 cm, and the mean BMI was 16.87 ± 1.804 kg/m^2. The entire sample belonged to the third grade of the Italian primary school system, and all were male and eight years old when this study was realised**.**

Furthermore, descriptive data regarding the active time spent during PA intervention are shown in Table 2.

Data from all formats were sampled on a 10-minute exercise. For the set-up with only one workstation, the mean active time during 10 minutes of exercise was 50.75 ± 6.46 seconds. Conversely, in the 2-station format, the mean active time during 10 minutes of exercise was 100.13 ± 10.78 seconds. Finally, in the four-station form (multistation), the mean active time during 10 minutes of exercise was 148.71 ± 7.26 seconds. Repeated measure ANOVA showed a significant solid difference among the three formats ($p<0.001$). Bonferroni Post Hoc showed a considerable difference between one and two workstation formats ($p< 0.001$; +97% of active time), between two and four workstation forms ($p<0.001$; +49% of active time) and between one and four workstation set-ups ($p<0.001$; +193% of active time). Data from repeated measure ANOVA and Bonferroi Psot Hoc are represented in Tables 3, 4 and 5.

DISCUSSION

This study aimed to identify the role of exercise set-up on the actual time spent by active moving during PA intervention using the "multistation exercise" method. This approach is commonly used in team sports training schedules to enhance performance and prevent injuries (Eils et al., 2010; Pérez-Silvestre et al., 2019) because it provides the opportunity to train the entire squad at the same time on specific tasks. Therefore, this approach seems to be an excellent method in PA intervention in primary school to optimise the active time spent by moving and physically exercising. The results of this study show that moving from one to two workstations in a ten-minute exercise improved 97% of the time paid by active moving or exercising. Furthermore, moving from two to four workstations increased 49% of time spent actively moving or exercising. Finally, the most significant gains were detected moving from one to four workstations, where the time expended actively moving or exercising increased by up to 193%. Thus, "multistation exercise" may reveal an intelligent PA intervention management able to raise the total active time spent by moving or exercising in optimal use of space and stuff. Only four cones and four markers were added to increase from one to four workstations. Cones and markers are simple elements that are usually supplied in each school to increase up to 193% of the active time of each child. Unfortunately, no studies have investigated this topic the same way as this research did. Thus, a comparison of our results is not properly accessible. Most literature focuses on the active recess's crucial role (Murray & Ramstetter, 2013). It was estimated that an active recess with moderate to vigorous PA could significantly improve school aptitudes, creativity and cognitive flexibility (Pedro Ángel et al., 2021), reduce BMI (Thalken et al., 2021) and positively affect physical fitness and social factors (Chen et al., 2018; Haapala et al., 2014). Our findings agree with these studies underlining the need to improve the time spent actively moving during primary school. However, this research moves further and provides a way to manage PA interventions to optimise time and space during physical education lessons.

Finally, a limitation of this study can be the small sample size. However, Italian primary school classes could guest up to 25 children. Thus, extensive samples must be obtained involving more than one grade and, consequently, more than one school. Therefore, as a pilot study, we decided to limit the intervention to one school and one grade. Future researchers should increase the sample size by using the multistation exercise method on large numbers of classes to confirm and improve these findings.

CONCLUSION

In conclusion, this study underlines the efficacy of the multistation exercise method in increasing the active time spent by moving or exercising during PA intervention. With some simple "tricks", it can quickly move from one to four stations guaranteeing children an increase of up to 193% of active time during PA intervention. These findings may be beneficial for primary school teachers to raise the quality of physical education lesson management.

FIGURES AND TABLES

Descriptive Statistics of anthropometric characteristics

	WEIGHT (kg)	HEIGHT (cm)	BODY MASS INDEX (BMI) (kg\m^2)
Valid	12	12	12
Missing	0	0	0
Mean	26.833	125.833	16.871
Std. Deviation	4.260	6.073	1.804
Minimum	21.000	113.000	14.640
Maximum	34.000	139.000	20.450

Table 1. Anthropometric characteristics of the sample. Participants belonged to the third grade of the Italian primary school system, and all were eight years old when this study was realised. Mean weight was 26.83 ± 4.26 kg; mean height was 125.83 ± 6.07 cm and mean BMI was 16.87 ± 1.804 kg/m^2

Repeated Measure Anova - Within Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
RM Factor 1	57576.264	2	28788.132	404.451	< .001
Residuals	1565.923	22	71.178		

Note. Type III Sum of Squares

Descriptive Statistics of real active time spent during PA interventions

	1 WORKSTATION	2 WORKSTATIONS	4 WORKSTATIONS
Valid	12	12	12
Missing	0	0	0
Mean	50.750*	100.125*	148.708*
Std. Deviation	6.455*	10.773*	7.216*
Minimum	43.900*	87.200*	129.600*
Maximum	64.900*	123.800*	157.300*

*seconds

Table 2. Descriptive representation of real active time spent during PA interventions. For the one-station format, the mean active time during 10 minutes of exercise was 50.75 ± 6.46 seconds. Conversely, in the 2-station format, the mean active time during 10 minutes of exercise was 100.13 ± 10.78 seconds. Finally, in the four-station format (multistation), the mean active time during 10 minutes of exercise was 148.71 ± 7.26 seconds.

Table 3. Repeated Measure ANOVA, Within Subject Effects. A significant difference was detected among different formats

Repeated Measure Anova - Between Subjects Effects

Cases	Sum of Squares	df	Mean Square	F	p
Residuals	741.859	11	67.442		

Note. Type III Sum of Squares

Table 4. Repeated Measure Anova, Between Subject Effects.

Post Hoc Comparisons – with Bonferroni Method

			95% CI for Mean Difference					
		Mean Difference	Lower	Upper	SE	t	p_{bonf}	
1 WORKSTATION	2 WORKSTATIONS	-49.375	-58.300	-40.450	3.444	-14.335	< .001	***
	4 WORKSTATIONS	-97.958	-106.883	-89.033	3.444	-28.441	< .001	***
2 WORKSTATIONS	4 WORKSTATIONS	-48.583	-57.508	-39.658	3.444	-14.106	< .001	***

*** p < .001

Post Hoc Comparisons – with Bonferroni Method

		95% CI for Mean Difference				
	Mean Difference	Lower	Upper	SE	t	p_{bonf}

Note. P-values and confidence intervals were adjusted for comparing a family of 3 estimates (confidence intervals were corrected using the Bonferroni method).

Table 5. Post Hoc comparison with Bonferroni Method. A significant difference was detected between one and two workstation formats ($p< 0.001$), between two and four workstation forms ($p<0.001$) and between one and four workstation set-ups ($p<0.001$).

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