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IMPACT OF TEACHER IMPLEMENTED ACTIVITIES AND FREE PLAY ON PRESCHOOL CHILDREN'S PHYSICAL ACTIVITY AT INDOOR PLAYGROUND MARKINGS

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ABSTRACT

The paper contains two different studies on preschool children's physical activity at indoor playground markings. Both of these studies are designed as two-factor experiments. Participants were children (N=87, 41 females, 46 males; Mage= 66.4 months) from an urban public preschool. Two main hallways of the school were painted with playground markings. Data were gathered for two consecutive weeks (Week 1 = free play, Week 2 = teacher implemented activities). This forms the instruction type in these studies with two levels ('no' = free play time in Week 1, 'yes' = teacher implemented activities in Week 2). Physical activity level was assessed using the System for Observing Fitness Instruction Time for Preschoolers (SOFIT-P) with five levels (1 = lying down, 2 = sitting, 3 = standing, 4 = walking, and 5 = fast/highly active). Moreover, seven activity types were considered in the study (S = lie down/sit/stand/squat, C = climb/crawl, W = walk/ride, P = push/pull/throw, K = rock/swing, D = dance/jump/skip, and R = run/roll/rough/tumble). R (version 3.6.1) was used for the data analysis in both studies using a two-way analysis of variance (ANOVA). The goal of the first study was to evaluate the effects of instruction type and activity levels on the time spent by children during physical activities. The second study aimed to investigate the same outcome in the first study with respect to the instruction type and the activity type. The findings revealed that children spent more time doing high levels of activities at the playground markings when performing teacher implemented activities. The instruction type impacted physical activity levels more than the activity type. Increasing time spent in teacher implemented activities is a key element to encourage children to be more active at indoor playground markings.

Keywords: children, physical activity, indoor markings, playground markings

INTRODUCTION

Physical inactivity is associated with several chronic health problems among children (Booth et al., 2011) and it is considered as getting less than 30 minutes of moderate-intensity physical

activity each week (WHO, 2021). However, the physical activity levels of preschool children in many countries are insufficient to meet recommended guidelines (Barros et al., 2012; Reilly, 2010; Tucker, 2008). The latest global recommendations emphasize that preschool children aged 3-5 years should participate in an average of 60 minutes per day of moderate-to-vigorous intensity physical activity across the week and engage in high-intensity aerobic activities (Bull et al., 2020).

The school environment is an ideal environment to create physical activity time for children (Lu & Montague, 2016). Thus, effective strategies should be implemented in school settings to increase the physical activity engagement of preschool children (Frank et al., 2018). School playgrounds provide children with a powerful incentive to be physically active. Specifically, creative and colourful playground markings are identified as a low-cost strategy to meet physical activity guidelines for children in school settings (Stratton & Mullan, 2005). These markings can be designed in any shape, including lines, circles, hopscotches, and ladders to encourage children to perform locomotor skills. Thermoplastic or painted markings are generally utilized in playground areas. Gallagher (2019) described the major benefits of playground markings as follows:

i) encourage children to participate in physical activity during recess periods;
ii) provide a variety of activity options for teachers;
iii) support social development of children, such as communication, collaboration, and friendship;
iv) decrease bullying behaviours among children;
v) support other school topics, such as mathematics or science, and
vi) make playground areas more enjoyable for children.

Furthermore, playground markings support the creativity and imagination of children (Hill, 2013). Overall, playground markings aid in improving all developmental areas among children.

The effects of playground markings on children of different age groups have been investigated in a growing body of research (Crust et al., 2014; Hyndman et al., 2016; Stratton, 2000; Stratton & Mullan, 2005; Ridgers et al., 2010). Specifically, their impact has mainly been examined during recess periods with activity interventions (Baquet et al., 2018; Blaes et al., 2013; Ridgers et al., 2007; Stratton & Mullan, 2005). For instance, positive effects of playground markings on physical activity levels were found for primary school children aged 5 to 7 years over a short-term period (Blaes et al., 2013; Stratton, 2000), and for elementary school children aged 7 to 10 over a long-term period (Ridgers et al., 2007). Furthermore, Baquet et al. (2018) indicated that playground markings were effective in increasing moderate physical activity levels to vigorous activity levels among children aged 6 to 11 years from elementary schools. However, Cardon et al. (2009) examined the role of playground markings and game equipment on physical activity levels and found no significant effects of playground markings on 4 to 5 years old preschool children's activity time previous research has also focused on the instruction of children's physical activity levels at playground markings. For example, recent studies confirmed that young children can benefit from teacher implemented activities to encourage high levels of physical activity in playground settings (Tortella et al., 2019). However, some research findings showed that teacher implemented activities may not always increase the physical activity levels of children (Behrens et al., 2019). For instance, a literature review demonstrated that there was no evidence for the promotion of physical activity by staff in the experimental studies designed for preschool children (Broekhuizen, et al., 2014).

A similar literature reviews also revealed that providing free play at playground markings, with or without activity materials, was ineffective in improving the physical activity levels of pre-schoolers aged 2-5 years (Escalante et al., 2014). Overall, intervention studies generated inconclusive results regarding playground markings for preschool children.

Moreover, playground markings are placed in outdoor settings, school playgrounds, or recreation areas. Numerous studies have highlighted that children are more active in outdoor than indoor settings (Pearce et al., 2014; Romar et al., 2019; Tandon et al., 2013). However, indoor settings should be considered for providing opportunities for physical activity, especially among children living in countries with harsh climates, such as the winter conditions in the Central Anatolia of Turkey. The weather is cold and snowy. School children may prefer to remain indoors during the wintry weather. In addition, the local climate restricts children's education activities to indoor settings. Numerous studies support that children's physical activity levels decrease in wintry weather (Duncan et al., 2008; Hjorth et al., 2013). Furthermore, previous studies show that classroom teachers do not allow their students to go outside for playtime (Copeland et al., 2011). In addition, although children spend most of their days in indoor, less attention has been paid to the role of indoor settings in promoting physical activity. Some studies have shown that physical activity level of children increases at proper indoor setting (Segura-Martínez, 2020; Frank et al., 2018; Burdette & Whitaker, 2005). Thus, indoor settings should be organized to provide physical activity opportunities, and playground markings may be painted in safe and appropriate indoor areas during harsh weather conditions.

It should be also emphasized that most of the work on physical activity level preschool children is on structured play, gross motor equipment role, or free play outdoor activities. Free play might be a useful approach to increase the amount of physical activity of children (O'Dwyer et al., 2013; Goldfield et al., 2012). Free play is defined as "a form of gross motor or total body movement in which young children exert energy in a freely chosen, fun, and unstructured manner." (Truelove, et al., 2017, p. 164). During free play, children can play games that include physical activity in or outside the classroom, or they can also prefer sedentary activities. It has been shown that children spend less than 50% of their free play time participating in physical activity (Sleap & Warburton, 1996). At the same time, the research results show that structured play is more effective than free play in providing high physical participation (Tortella et al., 2019; Frank et al.,2018; Verstraete et al., 2006; Scruggs et al., 2003; Connolly & McKenzie, 1995). Frank et al. (2018) in their study with preschool children (3-5 years old) found that structured play practiced indoor significantly increased physical activity behavior in children who were moderate to least active during free play. Another research findings showed that there was a significant difference in the level of physical activity for 5-year-olds free play in favour of partially structured play (Tortella et al., 2019).

However, limited studies are available regarding indoor playground markings and the role of teacher guidance or free play in these settings, and more research is necessary. Thus, this study aimed to explore the impact of teacher implemented activities and free play time (instruction types) on preschool children's physical activity at indoor playground markings. The two main research questions were as follows:

i) What are the effects of instruction type on the physical activity levels of children at the playground markings?
ii) What are the effects of instruction type on the activity type of children at the playground markings?

METHODOLOGY

Participants and Settings

Participants of the study were enrolled in five different classrooms in an urban area public preschool in Ankara, Turkey. All participants (N=87; 41 females, 46 males) were preschool children, with a mean age of 66.4 months. The mean height of children was 115.9 cm, and the mean weight of children was 21.6 kg. Four children were selected from each class for the classroom observations (N=50) based on the observation tool protocol (see instrument section).

The preschool, which provides services to children from 48 months to 69 months, was purposefully selected for this study. It follows the Ministry of Education's preschool curriculum and aims to support the physical, social-emotional, and cognitive development of children. Each class has one main preschool teacher and one assistant teacher.

Procedures

The hallways at the research setting, where children usually spent time during wintry weather, had ample space to paint the playground markings. For the study, two main hallways of the school were painted by the researchers with the same multi-coloured markings, such as lines, circles, triangles, hopscotch, and zigzag (Figure 1). Simple, brightly coloured markings were used so that children could easily engage in physical activities. The markings were placed at a safe distance apart in a manner that ensured that they were appropriate for performing different locomotor skills, such as running, jumping, skipping, leaping, galloping, and hopping. Before the study commenced, a group of preschool children tested the markings to confirm their suitability.

Figure 1. Indoor playground markings at hallways

Two different conditions were created in this study. After the hallways were painted, data were gathered over two consecutive weeks. In the first week, preschool teachers provided 15 to 20 minutes of free play time for their students to be physically active on the hallway

markings, for five days of the week. Teachers merely observed their students and did not provide any activity suggestions or feedback to the children. In the second week, teacher implemented activities were promoted by the teachers. Teacher implemented activities were organized with specific objectives, and teachers provided deliberate instructions. They explained and demonstrated activities at each marking. They also encouraged diverse types of activities that could be performed in the hallways using the markings. They then led the entire group through specific activities, providing instructions at each marking, allowing the children to play, and monitoring them as needed. The same amount of time was given in the second week. Only one class at a time was allowed to use the hallway markings to give children ample opportunities to utilize them. Preschool teachers received two hours of training on how to guide their students through physical activities. Free play (Week 1) and teacher implemented activities (Week 2) were described as different instruction types in this study.

All preschool classes in the study were videotaped every weekday for both Weeks 1 and 2 to examine the effects of teacher implemented activities and free play on physical activity promotion at indoor markings. Prior to the study, a human research ethical report was gathered for the study. Necessary permissions were then obtained from the school administrator, parents (written informed consent forms), and all children in the classes (child assets). In this study, an observation tool was utilized and permission to use the tool was gathered from the tool developers via e-mail. The data was gathered during the 2016/2017 school year.

Instrument

The physical activity level of children was assessed using the System for Observing Fitness Instruction Time for Preschoolers (SOFIT-P). SOFIT-P was previously validated for preschool settings (Sharma et al., 2011). It is a modified version of the SOFIT direct observation instrument developed by McKenzie and colleagues (1991). SOFIT-P measures the percentage of time children spend engaging in moderate to vigorous physical activity (Sharma et al., 2011). The instrument includes three major categories: the activity level, activity type, and activity context. The activity level refers to the body position, including lying down, sitting, standing, walking, and fast/highly active (categories 1 to 5, respectively). Specifically, category 1 includes stationary or motionless positions. Category 2 involves stationary positions with limb or trunk movements. Category 3 refers to slow movements. Category 4 relates to a moderate level of movements, and category 5 signifies fast movements (Sharma et al., 2011).

Further activity types are lie down/sit/stand/squat (category S), climb/crawl (category C), walk/ride (category W), push/pull/throw (category P), rock/swing (category K), dance/jump/skip (category D), and run/roll/rough and tumble (category R). Information regarding the indoor and outdoor contexts could also be obtained by the instrument. The categories of activity level and type were coded every 20 seconds (10 seconds of observation, 10 seconds of recording), using the momentary time sampling method for four randomly selected children to represent the activity level of the entire class. According to the SOFIT-P protocol, when children arrive at the observation area, the 4^{th}, 8^{th}, 12^{th}, and 16^{th} children must be selected. In this study, all procedures in the SOFIT-P instrument were followed by the researchers.

In total, 10 videotaped observations were made for each class, and a total of 50 observations were made using SOFIT-P. In addition, two independent observers analysed the randomly selected 10 observations for the inter-rater observer agreement and intra-rater

observer agreement reliability. One observer was a graduate research assistant working on physical activity levels and motor competence of children in a physical education and sports department. The other observer was a researcher in this study, with 15 years of experience in studying the motor competence of children and their physical activity levels. Based on Van der Mars' (1989) scored-interval method of observer agreement, the calculation of agreements was made using the following formula: (agreements/agreements + disagreements) × 100. The inter-rater reliability observer agreement was 87.5% for the activity level and 84.5% for the activity type. The intra-rater observer agreement was 82.4% for the activity level and 81.1% for the activity type.

Study Design and Data Analysis

The studies in this paper are designed as two-factor experiments. Therefore, a two-way analysis of variance (ANOVA) was conducted to investigate two main objectives: the first objective is to assess the influence of the grouping variables instruction type ('no' = free play time in Week 1, 'yes' = teacher implemented activities in Week 2) and activity levels using categories 1 to 5, as described in the instrument section, on the time spent by children doing physical activities. The second goal is to evaluate the time children spent on physical activities regarding the instruction type and the activity type using categories S to R (see the instrument section). Comprehensive analyses of both objectives were conducted using R (version 3.6.1).

The ANOVA model used for the first objective contains two main effects (i.e., instruction type and activity level) and their interaction. Thus, it is used to evaluate three sets of hypotheses which are discussed below, respectively.

- H_0: $\mu_{no.} = \mu_{yes.}$
  H_a: $\mu_{no.} \neq \mu_{yes.}$

  Hypothesis H_0 states that the average times children spent on physical activities in Week 1 and Week 2 are the same, and thus, main effect for instruction type does not present. Hypothesis H_a specifies that the average times in Week 1 and Week 2 are different from each other, and thus, main effect for instruction type presents.

- H_0: $\mu_{.Very\ low} = \mu_{.Low} = \mu_{.Medium} = \mu_{.High} = \mu_{.Very\ high}$
  H_a: At least one average is different than others

  Hypothesis H_0 indicates that the average time children spent on physical activities does not change across activity levels, and thus, main effect for activity level does not present. Hypothesis H_a states that this time is different for at least one activity level, and thus, main effect for activity level presents.

- H_0: All μ_{ij}'s are the same for $i = 1, 2$ and $j = 1, 2, 3, 4, 5$,
  H_a: At least one μ_{ij} is different than others.

  Hypothesis H_0 states that interaction effect between the two instruction types and five activity levels does not present, while hypothesis H_a specifies that this interaction effect presents.

Note that, all these hypotheses containing main effects or interaction effects are evaluated using the ANOVA overall F test. Based on the test results, the data support the alternative hypothesis H_a for each set of hypotheses above. Stated otherwise, both the instruction type and the activity level and their interaction exert a significant influence on the time children spent on physical activities.

Similarly, three sets of hypotheses are formulated for the second objective in terms of two main effects (i.e., instruction type and activity type) and their interaction. These hypotheses are not presented here, but would be made available upon request. For these sets of hypotheses, the overall F test results indicated that both the instruction type and the activity type, but not their interaction, have significant impacts for predicting the outcome. The results of the overall F tests for all the main and interaction effects will be elaborated in the results section.

For the model containing the main effects instruction type and activity level, the Durbin-Watson test (D = 2.26; p = .69) indicated that the data satisfied the independence of residuals assumption in the ANOVA. Similarly, a Levene's test (F = 1.35; p = .24) showed that the assumption of the constancy of variance of residuals across groups was not violated. The Shapiro-Wilk normality test (W = .85; p < .001) indicated that the residuals were not normally distributed. However, it is well-known that the ANOVA is robust against the violation of the normality assumption of residuals. This was illustrated for the data in this study using the method of nonparametric bootstrapping to estimate model parameters and their standard errors, which does not make distributional assumptions on residuals. The *p*-values obtained were remarkably close to those obtained using the regular analysis. This shows that violating the normality assumption of residuals does not have a detrimental impact on the estimates of the model parameters and *p*-values. For the model containing the main effects instruction type and activity type, the Durbin-Watson test (D = 2.02; p = .59) and the Levene's test (F = 1.84; p = .11) results showed that the independence of residuals and the constancy of variance of residuals assumptions were not violated by the data. The Shapiro-Wilk test (W = .87; p < .001) indicated that the residuals of the ANOVA model were not normally distributed.

For the model containing the main effects instruction type and activity level, the effect size is determined based on Cohen's f (Cohen, 1992) with 10 groups. The Cohen's f is calculated as

$$f = \frac{1}{\sigma}\sqrt{\frac{1}{10}\sum_{i=1}^{2}\sum_{j=1}^{5}(\mu_{ij} - \mu)^2} = 0.96,$$

where σ = 10.15 is the pooled standard deviation and μ = 11.40 is the overall mean. Based on Cohen (1992, p. 157), the value of 0.96 is considered as a large effect size. Cohen (1992, p.158) shows that the necessary sample size to distinguish large dissimilarities between the means of 7 groups for significance level α = 0.05 (5% risk of making a Type I error) and power of 1-β = 0.80 (20% risk of making a Type II error) is N = 13. Thus, N = 50 is considered as an adequate sample size to detect large differences between the means of 10 groups for α = 0.05 and 1-β = 0.80. Similar effect size calculation is made for the model containing the main effects instruction type and activity type with sample size N =40 and 8 groups. For this model, the Cohen's f is calculated as f = 0.69 with σ = 8.75 and μ = 14.10 which is a large effect size. Therefore, because of the same reason as given above, N = 40 is considered as a reliable sample size to detect large differences between the means of 8 groups.

RESULTS

Physical Activity Time with Respect to Instruction Type and Activity Level

Table 1 shows the average time (in minutes) that children spent on different activity levels based on the instruction type. Children spent 40 minutes engaged in medium to very high levels of activity during free play. However, they spent around 70 minutes engaged in medium to very high levels of activity during the teacher implemented activities.

Table 1
Time children spent in the activity levels based on the instruction type (in minutes).

Instruction Type	Activity level	Mean	Std. Deviation	N
Free Play	Very low	0.47	0.87	5
	Low	0.67	0.85	5
	Medium	17.87	5.15	5
	High	13.73	6.05	5
	Very high	8.40	1.62	5
Teacher implemented	Very low	0	0	5
	Low	3.27	3.74	5
	Medium	20.07	14.96	5
	High	28.40	7.66	5
	Very high	21.13	6.96	5

Table 2 shows the two-way ANOVA of whether the grouping variables (and their interaction) significantly predicted the outcome. Both the instruction type ($p = .001$) and activity level ($p = .000$) as well as their two-way interaction ($p = .036$) influenced the amount of time children spent engaged in physical activities.

Table 2
Two-way ANOVA table for grouping variables instruction type and activity level.

	Df	Sum Sq	Mean Sq	F value	Pr(> F)
Instruction type	1	504	504.00	12.22	0.001**
Activity level	4	3757	939.25	22.79	0.000***
Instruction type: activity level	4	469	117.25	2.85	0.036*
Residuals	40	1649	41.23		

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Figure 2 displays the box plots for the time children spent engaged in physical activities according to each instruction type and activity level. The children spent little time engaged in very low to low levels of physical activity, regardless of the instruction type. However, they spent more time engaged in medium, high, and very high activity levels for each instruction type.

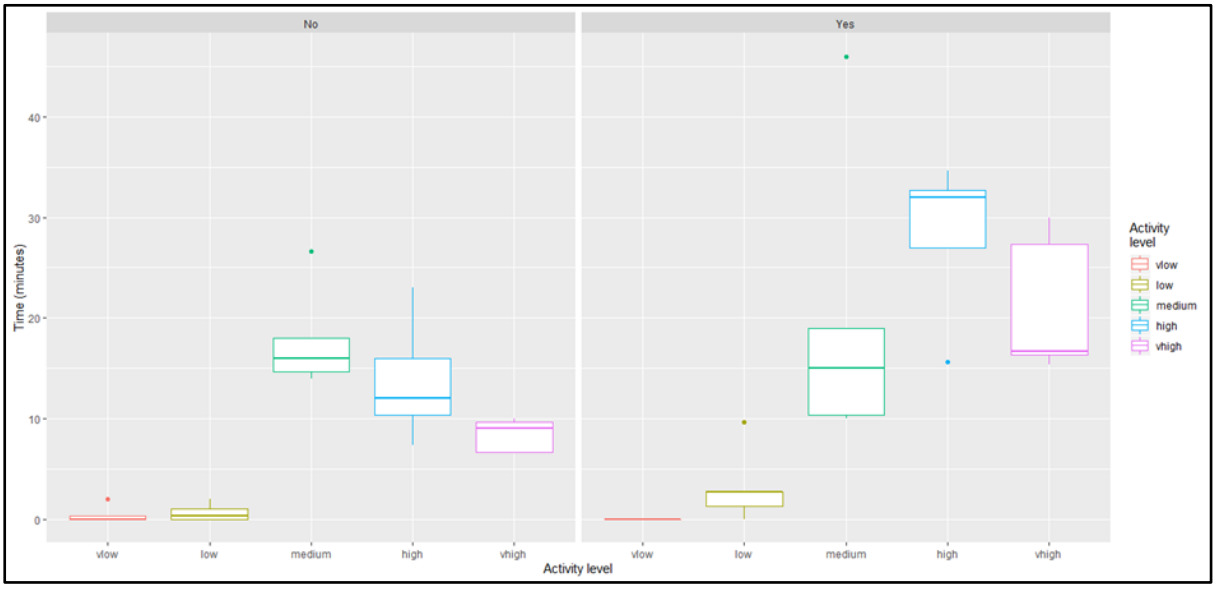

Figure 2. Box plots for the time children spent in physical activity for free play (no) and teacher implemented activities (yes)

Figure 3 displays the interaction plots for the impact of the instruction type on the time children spent engaged in physical activities. On average, there was little change in the time children spent engaged in very low, low, and medium activity levels during teacher implemented activities in Week 2. However, the change in time was more apparent for high and very high activity levels.

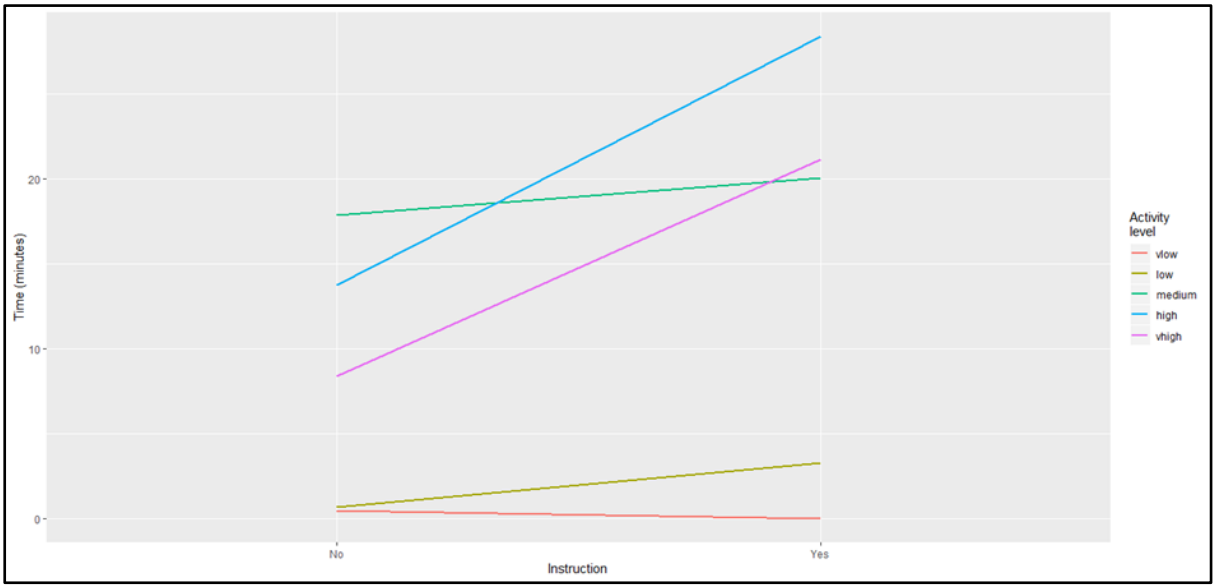

Figure 3. The interaction plots for the instruction type (no: free play, yes: teacher implemented activities) and physical activity level

Table 3 displays the results of Tukey's post hoc honest significance difference (HSD) test evaluating pairwise differences between the group means for the levels of variables according to the instruction type and activity level. Note that Tukey's HSD is resistant to non-normal residuals when the assumption of the constancy of variance is not violated (Salkind,

2010, p. 1570). Results indicated that when children engaged in teacher implemented activities in Week 2, the time spent increased for high (*diff* = 14.67; *p* = .026) and very high (*diff* = 12.73; *p* = .083) activity levels. However, the pairwise differences between the other groups were not statistically significant.

Table 3
Pairwise comparisons of group means for instruction and activity types using Tukey's post hoc HSD test.

	Diff	Lwr	Upr	P adj
T:very low - F:very low	-0.47	-14.06	13.13	1.000
T:low - F:low	2.60	-10.99	16.19	1.000
T:medium - F:medium	2.20	-11.39	15.79	1.000
T:high - F:high	14.67	1.07	28.26	0.026
T:very high - F:very high	12.73	-0.86	26.33	0.083

Note: T refers to teacher implemented activities, F refers to free play

Physical Activity Time with Respect to Instruction Type and Activity Type

The two-way ANOVA was utilized to investigate the impact of the grouping variables of instruction and activity types, and their interactions on the outcome. Table 4 shows the time children spent engaged in different activity types during free play and teacher implemented activities. Findings indicated that children spent more time engaged in the D and R activity categories during the teacher implemented activities.

Furthermore, the impact of the interaction between the instruction and activity types on the outcome was not statistically significant. Thus, this interaction effect was excluded from the two-way ANOVA model.

Table 4
Time children spent in different activity types based on the instruction type (in minutes).

Instruction Type	Activity Type	Mean	Std. Deviation	N
Free Play	S	15.93	5.28	5
	W	12.60	6.74	5
	D	3.80	1.39	5
	R	7.93	1.66	5
Teacher implemented	S	21.20	20.44	5
	W	23.47	6.85	5
	D	14.07	6.42	5
	R	13.80	5.28	5

Note: S: lie down/sit/squat/stand, W: walk/ride, D: dance/jump/skip, and R: run/roll/rough/tumble

Table 5 shows the main effects of the two variables on the outcome. Both the main effects of the instruction type (*p* = .005) and activity type (*p* =.029) were statistically significant in influencing the time children spent engaged in physical activities. The two-way interaction showed no significance.

Table 5
Two-way ANOVA table for grouping variables instruction and activity types.

	Df	Sum Sq	Mean Sq	F value	Pr(> F)
Instruction Type	1	650.70	650.70	9.07	0.005**
Activity Type	3	725.70	241.90	3.37	0.029*
Residuals	35	2510.50	71.73		

Note: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 6 shows the pairwise comparisons between the activity types and between the instruction types. Since the model did not contain an interaction effect, the activity types were compared to each other, but they were not crossed with the instruction types. Similarly, the time periods children spent engaged in physical activities were compared with each other separately within each week.

Results indicated that some activity types played a crucial role in influencing the time children spent doing physical activities. For example, children spent more time doing S and W type physical activities than D type physical activities. However, these differences were significant with the significance level $\alpha = .10$. That is, *diff*{D - S} = -9.63 with $.05 < p < .10$, and *diff*{D - W} = -9.10 with $.05 < p < .10$. The impact of the instruction type on the outcome was more apparent than that of the activity type since the overall time spent by children doing physical activities in Week 2 was more than in Week 1 (Yes – No = 8.07; $p < .01$).

Table 6
Pairwise comparisons of group means for instruction type and activity level using Tukey's post hoc HSD test.

	Diff	Lwr	Upr	P adj
W - S	-0.53	-10.75	9.68	1.000
D - S	-9.63	-19.85	0.58	0.070
R - S	-7.70	-17.91	2.51	0.196
D - W	-9.10	-19.31	1.11	0.095
R - W	-7.17	-17.38	3.05	0.250
R - D	1.93	-8.28	12.15	0.956
Yes - No	8.07	2.63	13.50	0.005

Note: S: lie down/sit/squat/stand, W: walk/ride, D: dance/jump/skip, and R: run/roll/rough/tumble

DISCUSSION AND IMPLICATIONS

The purpose of this study was to explore the impact of teacher implemented activities and free play on preschool children's physical activity levels using indoor playground markings. The findings revealed that children spent more time engaged in the high-level activities at the playground markings when performing teacher implemented activities. The results support the idea that teacher implemented activities are critical in increasing the activity levels of children in school environments. Specifically, these activities are vital in promoting physical activity among preschool children (Cardon et al., 2008). Previous studies have reported similar findings, showing that teacher implemented programs or activities were effective in facilitating the physical activity engagement of preschool children (Frank et al., 2018; Palmer et al., 2017;

Williams et al., 2009). This is because structured physical activity environments provide children with well-defined goals and routines as well as comprehensive guidance during their endeavours (Frank et al., 2018; Kinder et al., 2020). In addition, children in this study do not spend time exploring activities at the playground markings and simply do what is required. Thus, teachers may control children's activity levels using highly organized activities.

Conflicting results were also found in the literature. A similar study conducted by Kelly et al. in 2012 provided unclear results regarding the effects of teacher facilitated games at playground markings among primary school children. Kreichauf et al. (2012) also indicated in their narrative review that playground markings with play equipment or sports were ineffective in increasing the physical activity levels of preschool children. However, in their study, portable equipment (balls, throwing discs, ring, hula hoops, bean bags etc.) was associated with physical activity. A literature review focusing on preschool physical activity interventions in school settings had comparable results (Temple & Robinson, 2014). Therefore, gross motor equipment, such as balls, skipping ropes, and hula hoops should be provided for children under the supervision of preschool teachers. It is important to note that teacher implementing and embedding of activities with motor skill equipment might have a great potential to support children's physical activity level throughout the preschool day (Brown et al., 2009).

In this study, results showed that children spent more time on performing specific skill categories, such as S (stand), W (walk/ride), R (run), and D (jump/skip). For example, children spent more time in S and W type physical activities when compared with D type physical activities. These findings show that teacher implemented activities may also influence children's activity types. Teachers easily manipulate the environment and change the activities in structured contexts. Thus, specific activity types might be integrated into the physical activities at the playground markings to support the activity levels of children. For instance, enjoyable activities can be integrated into playground activity lists which may be developed for the preschools. In addition, technology-based devices should be considered by school administrators. For example, interactive flooring or interactive lights may be used at the playground marking areas. These may also encourage children to run, skip, or jump in their unstructured time. In addition, play cards posted on the wall can be used to encourage children to do different gross motor activities.

Notably, physical indoor environments in preschool settings have the potential to support children's well-being and physical activity (Segura-Martínez, 2020; Sando, 2019). Therefore, large, and safe indoor areas at the preschools could be organized for structured physical activity (Cardon et al., 2008). These places may be attractive areas for children. Similarly, Smith and Connolly (1980) reported that large playgrounds may encourage children to be more active. Cardon et al. (2008) suggested that while more playgrounds for preschool children were associated with higher activity levels, the presence of playground markings or play equipment did not account for the differences in children's activity levels. Thus, simply drawing attractive markings on the playground for free play is insufficient for increasing the physical activity of children. Teacher implemented activities are required. Previous studies also revealed the importance of the role of teachers in influencing children's levels of physical activity (Coe, 2018; Eather et al., 2013; Koka & Hein, 2003). Encouragement or modeling by the teacher may be required to increase physical activity participation. In this study, preschool teachers were in a passive position to help children only during free play and to intervene in emergency situations, while teacher implemented introduced children to the lines drawn in places, gave them instructions and guided them. Preschool children may need more guidance and encouragement to enhance their activity levels (Mohamad Khalid, et al., 2013). Finn et al.

(2002) and Dowda et al. (2004) reported low levels of physical activity during preschool education. Furthermore, children aged 4 to 5 years spent most of their break time doing sedentary activities (McKenzie et al., 1997). Similarly, Reilly et al. (2006) showed that 30 minutes of physical activity, three times a week, is insufficient. Previous studies conducted with preschool children revealed that the time given to children is a key element for increasing their level of physical activity (Alhassan et al., 2007; Stratton & Mullan, 2005; McKenzie, 1997; Zask et al., 2001). In our study, presenting structured teacher implemented activities enabled children to play with playground markings for longer times. Stratton and Leonard (2002) also showed that playground markings have a significant and positive effect on young children's energy expenditure. Therefore, the development of this type of intervention to raise physical activity levels is a priority in school settings (Heath et al., 2012).

It should also be emphasized that playground physical activity interventions focus on outdoor settings. However, indoor areas should not be ignored by researchers. Children should be given physical activity opportunities in both indoor and outdoor spaces. Therefore, the number of these types of studies should be increased. Importantly, playground markings should frequently be updated at preschool settings, since the enthusiasm of children regarding the playground markings may eventually decrease. Thus, repainting playgrounds may rekindle the enthusiasm for physical activity participation. Hyndman (2017) emphasized that updating playground markings encourages children to engage in diverse types of activities. Thus, playground markings should be checked and re-designed every six to eight months to capture children’s attention.

This study is the first study to examine the effects of teacher implemented activities and free play on young children’s physical activity levels at indoor playground markings. However, this study had some limitations. First, playground markings were painted for one school and the generalizability of the findings may be constrained. Secondly, the walls of the hallways had some fine motor equipment, which may have distracted the children and negatively affected their activity levels. Third, only two weeks of observations were conducted in the present study. Long-term observations should be carried out by researchers or school administrators to examine the effects of indoor playground markings on children’s activity levels (Hydman, 2017; Stratton, 2000). In addition, different school types may play a crucial role in the activity levels of children. Children from private preschools might be enrolled in future studies. The role of teachers’ beliefs and classroom practices might be investigated for physical activity opportunities at playground setting (Wai Leng et al., 2021). Furthermore, objective measurement tools, such as accelerometers or pedometers, could be added to measure the physical activity levels of children.

CONCLUSION

The findings of this study revealed that children spent more time doing high levels of activities at the playground markings when performing teacher implemented activities. The instruction type impacted physical activity levels more than the activity type. In conclusion, creating an outdoor environment with only playground markings in preschools may be inadequate to increase children's physical activity levels. Increasing the time engaged in teacher implemented activities is a key element to encourage children to be active, and many children can benefit from structured physical activity opportunities in school settings. Simple changes in physical activity policies in schools can influence many children’s activity levels. In addition, teachers' support and guidance can increase the physical activity levels of children in these areas from

moderate to vigorous intensity (Senol, 2021). Therefore, playground markings can be painted in appropriate indoor areas at preschools, which can support the daily physical activity levels of many children at a low cost. However, limited research is available regarding indoor settings. Thus, more research is warranted to understand the role of teacher implemented activities at indoor playground markings in increasing the activity levels of children.

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