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METHODOLOGY

Generalization of Parkour Skill Trials From Physical Education to Organized Recess in Elementary School

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Abstract

To investigate the generalization of correct parkour skill trials from physical education to parkour recess in elementary school as a function of skill level. Seven 2nd grade classes with 147 children (55 girls) received a 10-lesson sport education parkour season. During the season, children could voluntarily participate in five parkour recess sessions during lunch recess. Children's voluntary participation in parkour recess was recorded and all skill trials in physical education and parkour recess were collected. There was no difference on voluntary participation in parkour recess between higher- (78%) and lower-skilled (77%) children. Higher-skilled children had higher percentages of correct skill trials than lower-skilled children in physical education (48% vs. 40%, p = .001) and parkour recess (42% vs. 32% p = .002). Most children voluntarily participated in parkour recess regardless of skill level. Parkour recess offered the opportunity to practice the skills learned in physical education.

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Introduction

Promoting a physically active lifestyle has been considered a key outcome in physical education curricula around the globe (Green, 2016; Sallis et al., 2012). Physical education provides children with an opportunity to develop physical competence and the necessary skills to participate in diverse physical activities (SHAPE America, 2015; WHO, 2022). The development of movement skills is therefore considered a prerequisite for participation in physical activities and can contribute to adopting a lifelong, physically active lifestyle (Rink, 2014; Stodden et al., 2008).

Hardman (2011) noted that the primary goal of a physical education curriculum is developing motor and sport-specific skills. Ennis (2011) echoes this point of view, arguing that being skillful is the cornerstone of lifelong engagement in physical activity. Performing skills correctly or successfully might serve as a reinforcer, increasing the likelihood that children will continue to engage in the activity (Stodden et al., 2008; Ulrich, 1987). Martinek et al. (2019) addressed that it is the important role of physical education programs in improving children's skills to foster enjoyable and ongoing sports participation outside of school. This is especially true for lower-skilled children, who are usually less active in physical education and recess (Erwin et al., 2012; Van der Mars, 2006). Therefore, it is reasonable to assume that if we want children to be able to participate in lifelong physical activity, some level of competence should be developed in physical education.

Transfer From Physical Education to Recess

Previous research has shown that a majority of elementary school children voluntarily participated in physical activities during recess that were tied to physical education content (i.e., parkour) (Cheng et al., 2022; Coolkens et al., 2018a). Cheng et al. (2022) found that 43% of children voluntarily participated in parkour during lunch recess. Coolkens et al. (2018a) found that 67% of higher-skilled, 55% of average-skilled, and 50% of lower-skilled children voluntarily participated in parkour during lunch recess. While in the beginning, fewer lower-skilled children participated, those differences faded over the course of the physical education lessons, leading the authors to conclude that perhaps lower-skilled children needed more time

to become components in the activity before participating in that activity during recess (Coolkens et al., 2018a). In a study by Iserbyt et al. (2022), a sport education fitness season in physical education with middle school students was connected to voluntary fitness sessions during recess. Similarly, they found higher participation for higher-skilled children only during the first of nine fitness recess sessions. The authors recommended future research to investigate some process measurement of children's successful performance in physical education (e.g., skill trials) since they assumed that children's experience in physical education affects their voluntary participation in that content during recess. Collectively, these studies investigated transfer using the science of behavior analysis, more specifically, the concept of generalization (Cooper et al., 2020). Stokes and Baer (1977) defined generalization as "the occurrence of relevant, learned behavior under different, non-training conditions (i.e., across subject, settings, people, behaviors, or time)." To foster generalization, in this study, the contexts of physical education and parkour recess we set up were identical: the same equipment was used, the equipment was arranged in the same way, and the same (i.e., physical education) teacher was present.

Physical education and recess are two key components of the Comprehensive School Physical Activity Program (CSPAP; SHAPE America, 2015), a framework that serves to support schools in increasing opportunities for children to engage in physical activity before, during, and after school days (van der Mars & Lorenz, 2019). One of the main goals of CSPAP is to maximize the application and practice of the skills learned in physical education (Carson & Webster, 2019; SHAPE America, 2015). Coolkens et al. (2018a) demonstrated that children spent a substantial amount of time performing skills learned in physical education during parkour recess regardless of skill level.

Skill Performance in Physical Education

Participating in an activity during or outside of physical education requires a certain level of skillfulness, and when that participation is successful, it might lead to higher levels of engagement in the activity (Rink, 2014; Stodden et al., 2008). Lund (1990) and Ward (1993) indicated that the number of responses (i.e., skill trials) is an important variable in explaining skill performance in physical

education. Previous work on students' motor skill performance in physical education found that high-skilled students performed more correct or successful skill trials in physical education units (e.g., volleyball, soccer, fitness, handball) (Graham, 1987; Hastie et al., 2011; Son, 1989). To further examine students' skill performance in physical education, Iserbyt and his colleagues (2015) assessed student skill performances in a high school badminton unit. Their findings showed that higher-skilled students performed more correct trials than average and lower-skilled students.

Research in physical education has demonstrated a relationship between skill trials and achievement (Ashy et al., 1988; Silverman, 1990; Silverman, 1985; Silverman et al., 1988). Ashy et al. (1988) and Silverman (1985) found that significant relationships existed between appropriate or correct skill trials and student achievement. However, the total number of skill trials students performed was not significantly related to student achievement (Ashy et al., 1988). In physical education, the amount of skill trials students performed within the time they engaged in skill practice rather than the time spent in an activity determined the quality of sport-specific skill learning (Lund, 1990; van der Mars, 2006). To precisely analyze skill trials children performed in physical education, the amount of skill trials per minute children achieved during practice time can be measured. The findings of Graham (1987) and Lund (1990) have shown that higher-skilled students had more skill trials per minute than lower-skilled students. In addition, the proportion of appropriate or correct skill trials students performed in physical education was observed to investigate student skill performance (Silverman, 1985; Ward et al., 2022). Ward et al. (2022) found that higher-skilled students had a significantly higher proportion of correct skill performance compared with lower-skilled students in the physical education badminton unit.

Skill Performance in Recess

Previous research has shown that lower-skilled children participated less in physical activity programs at school (Coolkens et al., 2018a; Drijvers et al., 2022). Coolkens et al. (2018a) found that lower-skilled children (50%) had lower participation in parkour recess compared to average-skilled (55%) and higher-skilled children (67%) in elementary schools. Drijvers et al. (2022) found

that higher-skilled students (77%) had higher participation in team physical activity recess programs (e.g., basketball, soccer) compared to average-skilled (71%) and lower-skilled students (63%) in secondary schools. It has been suggested that the lack of skill might hinder lower-skilled children's participation in physical activity programs in schools (Coolkens et al., 2018a; Drijvers et al., 2022). Therefore, investigating children's correct skill trials in a physical activity program during recess might provide insight into the quality of their motor engagement, which can affect their enjoyment of the activity and lead to sustained participation outside of the school. A skill trials study conducted by Cheng et al. (2023) showed that boys and girls had similar percentages of correct skill trials in physical education (44% vs. 45%) and parkour recess (36% vs. 42%) during parkour season. To our knowledge, previous research has not investigated children's correct skill trials as a function of skill level during recess.

Study Purpose

Physical education aims to help children learn generalizable skills to promote physical activity outside class time (McKenzie & Lounsbery, 2013). In this study, we extended previous work that ties physical education content with physical activity sessions during recess (Cheng et al., 2022; Coolkens et al., 2018a). We investigated the generalization of parkour skill trials (e.g., correct skill trials per minute, percentage of correct skill trials) from physical education to organized recess in elementary school. Children's voluntary participation in parkour recess and their correct skill trials during a parkour sports education season and parkour recess as a function of skill level were assessed. We tried to answer two research questions: (1) What is the effect of skill level on children's voluntary participation in parkour recess? and (2) What is the effect of skill level on children's correct skill trials in physical education and parkour recess? We hypothesized that (a) a higher proportion of higher skilled children would voluntarily participate in parkour recess, (b) higher skilled children would perform more correct skill trials and have a higher proportion of correct skill trials in both physical education and parkour recess sessions, (c) children would perform more correct skill trials per minute in physical education compared to parkour recess.

Methods

Participants

A total of 147 (55 girls) 2nd grade children and seven physical education teachers (two females) from seven different elementary schools participated in this study. The number of children per class ranged between 14 and 27, the average age of children was 8 years. Before the start of the study, the physical education teachers were asked to label all children as lower, average, or higher skilled based on previous physical education assessments and their experience in teaching these children. A detailed overview of participants can be found in Table 1. Teachers were invited to participate based on the following criteria: (a) willingness to participate in a professional development workshop with the duration of four hours to learn how to teach parkour using the sport education model; (b) willingness to teach a 10-lesson sport education parkour season in physical education; (c) willingness to organize ten 20 minutes' parkour recess sessions in the school's gymnasium during sport education seasons. The first author's university's social and societal ethics committee (G-2020-2133) approved this study. Informed consent was obtained from parents, teachers, and principals.

Research Settings

To investigate the effect of generalization of parkour skill trials from physical education to parkour recess in elementary school. All physical education teachers individually received 4 hours of professional development workshop on how to teach parkour using the sport education model (Siedentop, Hastie, and van der Mars, 2020). Seven physical education teachers each taught 10-lesson sports education parkour season to their 2nd grade children. Layne and Hastie's (2016) study showed that the sports education model is developmentally appropriate for 2nd grade children. Parkour is an individual motor activity where students move across various obstacles using running, jumping, and climbing (Coolkens et al., 2018b). Parkour was chosen because it is an individual sport, which could provide children with an equal opportunity to participate (Cheng et al., 2022; Coolkens et al., 2018a). The physical education teacher organized a 20-minute parkour recess every two lessons on a weekday

Table 1
Characteristics of Physical Education Teachers and Children

Participants	Study sample
Physical education teacher	7
Age	39 (26-60)
Female	2
Male	5
Years of teaching experience	14 (4-38)
Sex	
Girls	55
Boys	92
Skill level	
Lower skilled	32
Average skilled	61
Higher skilled	54
Class size	21 (14-27)

when no physical education class was scheduled. Parkour recess was implemented during children's traditional lunch recess; all children could voluntarily participate in parkour recess or choose to stay on the playground as they usually do. In total, five parkour recess sessions were organized in each school during the sport education parkour season. A member of the research team supervised all physical education and parkour recess sessions to check adherence to the study protocol, and no violations of the protocol were found.

Physical Education

Physical education in this study served as the training set; parkour as content was taught throughout a 10-lesson sports education season. The average duration of each physical education lesson was 45 minutes.

Sports education is a curriculum and instructional model designed to provide children with authentic experiences in physical

education classes (Siedentop et al., 2020). Within the sport education model, children fulfilled different roles (e.g., coach, referee, scorekeeper) in their team to make contributions, being competent, literate, and enthusiastic athletes (Siedentop et al., 2020). During the 10-lesson sport education parkour season, children were divided into three heterogeneous teams representing different countries. In addition, children within their teams served different roles (e.g., fitness coach, equipment manager), and the team's performance and scores were posted in the school's gym after each class. A culminating event was organized at the end of the sports education parkour season. Children performed a parkour freestyle routine in a festive setting with peers from other classes, teachers, and principals as the audience.

Parkour Recess

Recess settings in this study were scheduled after the children's lunch break. Children were allowed to participate in either traditional or parkour recess. During traditional recess, children can play on the playground using a variety of equipment provided by the school. Classroom teachers or school staff supervise and guarantee children's safety.

During traditional lunch recess every two physical education classes, physical education teachers organized parkour recess in the school's gym. A total of five 20-minute parkour recess sessions were organized and videotaped during the 10-lesson sport education parkour season. Parkour recess sessions were organized on the days without physical education class. Within the parkour recess, the context was identical to the previous physical education lessons in school gym. Physical education teachers supervised children's safety and did not teach new parkour skills. They prompted children to be physically active, for example: "You can play for five minutes. You can use all the equipment in the gym." These prompts were standardized for all teachers in the study.

Skill Level Determination

Based on previous motor skill assessments in physical education activities, this study categorized children's skill levels as lower-, average-, and higher-skilled by their physical education teachers. Physical education teachers must consider their students' skill levels

before deciding what to teach and how to teach (Hastie et al., 2011). Physical education teachers in this study taught their children other content for more than a year and should be able to judge their skill level well. In general, researchers in previous studies have left skill level determination to physical education teachers (Van der Mars, 2006), which has shown to be a valid method (Coolkens et al., 2018a; Fairclough & Stratton, 2005).

Dependent Variables

Voluntary Participation in Parkour Recess

The proportion of children's voluntary participation was calculated by dividing the number of participating children by the total number of children who had the opportunity to participate in parkour recess. To correctly calculate the proportion of participating children in parkour recess, the researchers recorded their names during each parkour recess session.

Parkour Skill Trials

A skill trial was defined as performing a discrete parkour movement (i.e., skill). In this study, fourteen parkour skills were taught by physical education teachers during physical education, such as a speedstep over the vault box. Each parkour skill's critical elements were based on the parkour handbook (Coolkens et al., 2018b). An overview of these skills and their critical elements are presented in the supplementary material. Skill trials were coded as correct if children's parkour skill performance met all critical elements. Skill trials were coded incorrectly when one of the critical elements was not demonstrated. Additionally, we also coded trials as incorrect if (1) children stopped the trial during their performance; (2) children sat down on the object during a skill trial; (3) the teacher stopped the performance of the skill trial; and (4) children fell during or following the skill trial. In addition, the amount of parkour skill trials per minute and the proportion of correct skill trials in both physical education and parkour recess sessions were collected and calculated by observers.

Observer Training and Reliability

Each physical education class and parkour recess session were videorecorded. Eighteen observers were trained before collecting

data from skill trials using event recording (Cooper et al., 2020) from the videos through seven steps. First, the observers learned the definitions of all parkour skill trials based on a parkour handbook (Coolkens et al., 2018). Second, the written test included 21-item multiple choices on definitions of parkour skills, and six-item multiple choices on coding conventions were given to check their understanding of coding parkour skills trials. Third, another 48-item multiple choice situation during video coding was given to assess their understanding of the parkour skill trial coding protocol. Observers were required to achieve a 100% score before moving to the next step in the second and third steps. Fourth, 14 videos related to 14 parkour skills were provided to help observers discriminate between successful and unsuccessful skill trials. Fifth, observers were asked to code two practice videos, and the interobserver agreement (IOA) on skill trials should be 100%; otherwise, the observers had to redo the fifth step until it was 100%. Sixth, researchers organized a workshop on 14 parkour skills to give observers an opportunity to experience all parkour skills, and their understanding of each parkour skill was further enhanced. Finally, observers had to code extra videos with a reliable coder, and their IOA was required to achieve at least 80% before becoming an independent observer. A total of 34% of all skill trials data was checked for IOA. To ensure the quality of the data, the reliability of observations is necessary and assessed by the degree to which two observers coded the same video agree on what they observed (Cooper et al., 2020; Son, 1989). The average of interobserver reliability for the skill trials was 82%, and 83% for successful skill trials.

Data Collection

Data collection was conducted from September 2020 to May 2021. Skill trial data was collected based on video observation in both physical education and parkour recess sessions using event recording, which is a reliable and validated method to systematically observe behaviors (Cooper et al., 2020). Parkour skill trials were recorded each time children attempted to perform in physical education and parkour recess. Studies have shown that discrete trials were easily observed and counted when measuring children's behaviors (i.e., activities) (Ashy et al., 1988).

In this study, we coded parkour skill trials during practice time in physical education lessons. Parkour skill trials were not collected in lesson 1 and lesson 10 since the exercises in lesson 1 contained balancing, stride steps, and precision jumps, which were not the parkour skills we focused on. Lesson 10 was a culminating event (e.g., a performance show) during which children demonstrated what they learned to peers, teachers, and principals. All dependent variables of parkour skill trials calculated the mean values from lesson 2 to lesson 9 and all five parkour recess sessions. Total skill trials were the total skill trials children performed during parkour skills practice time in each physical education lesson and parkour recess session. Skill trials per minute and correct skill trials per minute were calculated by the total parkour skill trials or correct parkour skill trials dividing the amount of parkour skill practice time. The percentage of correct or incorrect parkour skill trials was calculated by the total correct or incorrect skill trials by dividing the total skill trials and multiplying 100%.

In total, data from 147 children constituting seven classes from seven elementary schools. A total of 39 hours and 30 minutes of observations of physical education classes and 11 hours and 30 minutes of observations of parkour recess sessions in seven elementary schools were conducted in this study.

Data Analysis

All data were analyzed using the Statistical Package for the Social Science (SPSS, version 28, IBM, Armonk, New York). Chi-square tests were used to determine whether children's voluntary participation in each parkour recess was equal among lower-, average-, and higher-skilled children. Since seven different schools and teachers were involved in this study, the clustering effects of school and children were investigated for each dependent variable. The intraclass correlation coefficient (ICC) suggested clustering effects of school and children, so generalized linear mixed models were used to investigate the fixed effects of skill level and settings for dependent variables with random effects of school and children. The model's assumptions of normality and homogeneous variance were satisfied according to the residual effects. The significance level was set at $p < .05$, and effect sizes were reported using fixed effects estimates.

Results

Voluntary Participation in Parkour Recess

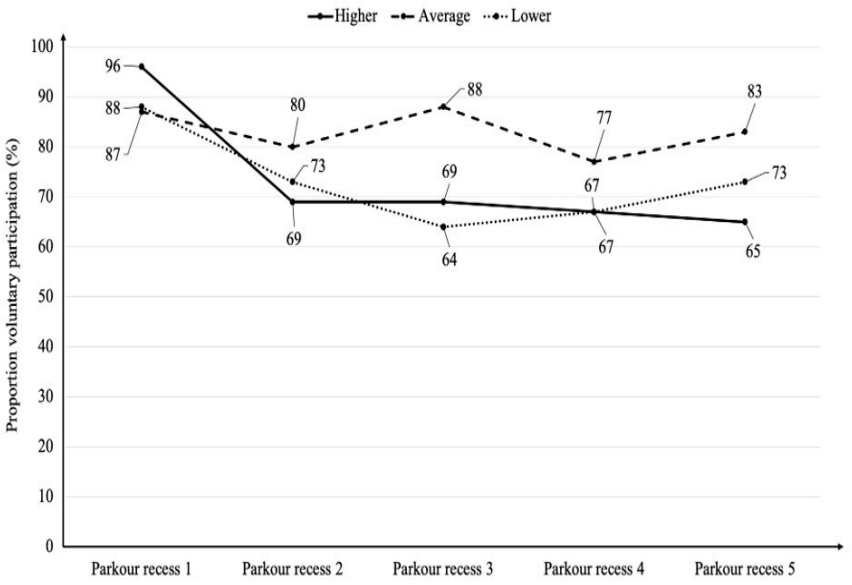
Figure 1 shows the mean proportions of higher-, average-, and lower-skilled children voluntarily participating in each parkour recess session during sport education parkour season. Overall, an average of 78% of children voluntarily participated in parkour recess, namely 78% of high-skilled children, 80% of average-skilled children, and 77% of lower-skilled children. Chi-square test only showed that average-skilled children (88%) had higher voluntary participation proportion in parkour recess 3 compared to higher-skilled (69%) and lower-skilled children (64%),^{2} (1, 147) = 9.28, p = .01. No significant differences were found on voluntary participation in other parkour recess sessions as a function of skill level.

Parkour Skill Trials in Physical Education and Parkour Recess

Table 2 shows skill trials variables relative to skill levels in physical education and parkour recess. In physical education, high-skilled children performed significantly more total skill trials than lower-skilled children (84 vs. 74, p = .011). However, average-skilled children (79) performed similar total skill trials compared with lower-skilled children (79 vs. 74, p = .229) and higher-skilled children (79 vs. 84, p = .121). Furthermore, higher-skilled children executed more skill trials per minute compared to lower-skilled children (3.91 vs. 3.47), p = .007, F(2, 138) = 3.80. However, no differences were found in skill trials per minute between average-skilled children and lower-skilled (3.73 vs. 3.47, p = .20) or higher-skilled level children (3.73 vs. 3.91, p = .103). In addition, lower-skilled children performed significantly less correct skill trials per minute than higher-skilled children (1.42 vs. 1.89, p < .001) and average-skilled children (1.42 vs. 1.75, p = .009), F(2, 138) = 7.33. Accordingly, significant differences were found for the percentage of correct skill trials between higher-skilled and lower-skilled children (48% vs. 40%, p = .001) as well as between average-skilled children and lower-skilled children (45% vs. 40%, p = .048), F(2, 138) = 5.40.

In parkour recess, lower-skilled children significantly performed less total skill trials than higher-skilled children (45 vs. 59, p < .001)

Figure 1
Proportion of Higher-, Average-, and Lower-skilled Children Voluntarily Participating in Parkour Recess (n=147).



and average-skilled children (45 vs. 53, $p = .007$), $F(2, 126) = 10.293$. Likewise, significant differences were found in total skill trials per minute between higher-skilled and lower-skilled children (3.91 vs. 3.05, $p < .001$) as well as higher-skilled and average-skilled children (3.91 vs. 3.57, $p = .006$), $F(2, 126) = 10.058$. In addition, lower-skilled children performed significantly less correct skill trials per minute than average-skilled children (1.03 vs. 1.57, $p < .001$) as well as higher-skilled children (1.03 vs. 1.74, $p < .001$), $F(2, 126) = 9.847$. In terms of the percentage of correct skill trials, lower-skilled children had a lower percentage of correct skill trials than average-skilled (32% vs. 42%, $p = .002$) and higher-skilled children (32% vs. 41%, $p = .002$), $F(2, 126) = 6.228$.

The effect of school, setting, and skill level were investigated using generalized linear mixed model. No significant difference was found in total skill trials per minute between physical education and parkour recess (3.71 vs. 3.51, $p = .051$). Due to the different duration between physical education and parkour recess (45 minutes vs. 20 minutes), On average, children performed significantly more total

skill trials in 10-lesson physical education (79) than in five-session parkour recess (52), $p < .001$. In addition, children performed more correct skill trials per minute in physical education compared with parkour recess (1.68 vs. 1.43), $F(1, 274) = 10.183$, $p = .002$. Furthermore, children had a higher proportion of correct skill trials in physical education (44%) than in parkour recess (38%), $p < .001$, $F(1, 274) = 12.993$.

Table 2
Means of Parkour Skill Trials in Physical Education and Parkour Recess as a Function of Skill Level (n=147)

	Physical education				Parkour recess			
	Overall (n=147)	Higher (n=54)	Average (n=61)	Lower (n=32)	Overall (n=135)	Higher (n=48)	Average (n=60)	Lower (n=28)
Skill trials/minute	3.71*	3.91[a]	3.73	3.47[a]	3.51*	3.91[a]	3.57[b]	3.05[a,b]
Correct skill trials/minute	1.68*	1.89[a]	1.75[b]	1.42[a,b]	1.43*	1.74[a]	1.57[b]	1.03[a,b]
Correct skill trials (%)	44*	48[a]	45[b]	40[a,b]	38*	42[a]	41[b]	32[a,b]
Incorrect skill trials (%)	56*	52[a]	55[b]	60[a,b]	62*	58[a]	59[b]	68[a,b]

Discussion

This study investigated the generalization of correct parkour skill trials from physical education to parkour recess in elementary school. Children's voluntary participation in parkour recess and their correct skill trials during a parkour sports education season and parkour recess as a function of skill level were assessed. This study aimed to answer two research questions: (1) What is the effect of skill level on children's voluntary participation in parkour recess? and (2) What is the effect of skill level on children's correct skill trials in physical education and parkour recess?

Voluntary Participation in Parkour Recess

On average, 77% of all children voluntarily participated in parkour recess, which was higher compared to previous work in parkour of Coolkens et al. (2018a) and Cheng et al. (2022), who had participation of 60% and 43%, respectively. High voluntary participation in parkour recess in this study confirms the positive effect of general-

ization that connects physical education content with activities during recess. De Meester et al. (2014) found that of 1049 children from 35 elementary schools, approximately 76% of them did participate in extracurricular school-based sports, which is consistent with our finding. Moreover, in this and Coolkens et al.'s (2018a) study, lower-skilled children had similar participation proportions as average-and higher-skilled children. Despite higher-skilled children performing more correct skill trials than lower-skilled children during physical education in this study, a similar proportion of both higher- and lower-skilled children participated in parkour recess.

In the physical education parkour session, children were asked to perform a parkour freestyle routine during the culminating event, which might have served as a motivating operation (Cooper et al., 2020; Iserbyt et al., 2022). In behavioral science, a motivating operation is an environmental variable (i.e., the upcoming culminating event) that increases the reinforcing value of a certain behavior (i.e., participating in parkour recess) (Cooper et al., 2020). Knowles and colleagues (2018) connected a sports education season in rugby and handball with recess to see whether students wanted to continue participating in those sports during recess in elementary school. The results showed that no girls participated in handball games during recess.

Skill Trials in Physical Education and Parkour Recess

Physical education is believed to develop children's motor and sport-specific skills (Hardman, 2011), the cornerstone of lifelong engagement in physical activity (Ennis, 2011). Research has shown that, in general, higher-skilled children participated more in physical activity programs in schools, while lower-skilled children participated much less. Since some level of skillfulness is needed to participate in an activity, we speculate that a lack of skill might hinder lower-skilled children's participation in those programs. Therefore, in this study, we analyzed children's parkour skill trials in sport education season and during parkour season as a function of skill level. Results showed that higher-skilled children had a higher proportion of correct skill trials than lower-skilled children (42% vs. 31%). Previous studies have shown that lower-skilled students had less than 50% of correct trials in physical education for volleyball (Graham, 1987) and badminton Iserbyt et al., 2015). However, Graham (1987) and

Iserbyt, Ward and Li (2015) found that higher-skilled students had over 67% of correct or successful trials in physical education, which is much higher compared to higher-skilled children (42%) in this study. There are a couple of reasons why higher-skilled children had lower proportions of correct skill trials in parkour. First, previous studies used different standards for coding skill trials in physical education. Graham (1987) coded successful motor skill responses in terms of the outcome of skills; for instance, a skill was coded successfully when the ball went into the basket. Iserbyt et al. (2015) coded the skill trial as correct when the students successfully performed two or three out of the critical elements. In this study, we coded a skill trial as correct when children's performance met all critical elements of that skill. Each skill had two to three critical elements. Second, children in this study learned 14 parkour skills within 10-lesson physical education, and each skill contains at least two critical elements. Critical elements of each parkour skill were based on a published source (Coolkens et al., 2018b) independent from the instruction of the teachers. Possibly, the teacher might have presented a certain skill incorrectly which affected our data collection. Third, the reported skill trial data represent the mean of parkour skill trials children performed at three different stations from lesson two to nine. Due to the variety of skills taught in this season, it is not unreasonable to think that all children, regardless of skill level, were more successful in certain skills compared to others. This could have affected their participation in parkour recess since children were given more freedom to choose what skills to engage in during parkour recess.

In addition, results showed that higher-skilled children performed more total skill trials than lower-skilled children in physical education. This finding is consistent with previous work in which it was found that higher-skilled students performed more skill trials than lower-skilled students in volleyball, badminton, and fitness content (Graham, 1987; Iserbyt et al., 2016; Son, 1989). Furthermore, Lund (1990) and van der Mars (2006) insisted that the exact time children engaged in skill practice instead of the number of skill trials children performed determined the quality of sport-specific skill learning in physical education. Lund (1990) found that higher-skilled students performed more volleyball skill trials per minute

compared to lower-skilled students in physical education, which is in line with the finding of this study that higher-skilled children performed significantly more parkour skill trials per minute than lower-skilled children. Correspondingly, results in this study also showed that in physical education, higher-skilled children performed more correct skill trials per minute than lower-skilled children.

Although it has been recommended that children learn generalizable skills in physical education to promote their engagement in physical activity outside of the class (McKenzie & Lounsbery, 2013), to date, few studies have investigated children's skill trials in recess. Investigating children's skill trials during recess is one way to assess that what was learned in physical education can be applied in another setting. School recess can provide children with equal opportunity to apply and improve skills learned in physical education if teachers set up an identical environment with physical education and encourage them to engage, which is in line with the goal of CSPAP (SHAPE America, 2015). Results showed that higher-skilled children performed significantly more skill trials than lower-skilled children in parkour recess. The reason might be that without much time spent on management and organization by teachers, higher-skilled children had more free time to be active during parkour recess. In addition, the results showed that children performed fewer correct skill trials per minute in parkour recess than in physical education, and the proportion of correct skill trials was also lower in parkour recess.

Limitations and Strengths

There are some limitations in this study. First, teachers and children had no previous experience with parkour. A "novelty effect" could, therefore, exist and have affected voluntary participation in physical activity during recess. Second, a 10-lesson parkour sport education session might be short for children to learn parkour skills, and we do not know whether children would maintain their participation in parkour recess after the ten lessons of parkour in physical education were over. Third, preparing parkour physical education classes and recess settings requires a lot of time to set up the equipment, which could be a potential barrier for teachers. Fourth, we don't know whether children would perform parkour skills learned in physical education on the playground during school or other activities after school.

This study extends the literature investigating transfer from physical education to recess and has several strengths. First, instead of using a sample, the parkour skill trials of all children were coded by eighteen trained and reliable observers in physical education and parkour recess sessions. Second, this is the first study connecting physical education content to recess using the concept of generalization that investigated elementary school children's correct trials as a function of skill level.

Conclusion

A high proportion of children voluntarily participated in the content offered during recess taught in physical education. As such, this study shows that children can apply what they have learned in physical education in another setting (e.g., recess). Future work can investigate the effect of generalizing skill trials in other content (e.g., team-based sports) from physical education to organized recess in elementary school. (Ashy et al., 1988)

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