Feasibility and Efficacy of a “Move and Learn” Physical Activity Curriculum in Preschool Children

Stewart G. Trost, Bronwyn Fees, and David Dzewaltowski

Background: This study evaluated the effect of a “move and learn” curriculum on physical activity (PA) in 3- to 5-year-olds attending a half-day preschool program. Methods: Classrooms were randomized to receive an 8-week move and learn program or complete their usual curriculum. In intervention classes, opportunities for PA were integrated into all aspects of the preschool curriculum, including math, science, language arts, and nutrition education. Changes in PA were measured objectively using accelerometry and direct observation. Results: At the completion of the 8-week intervention, children completing the move and learn curriculum exhibited significantly higher levels of classroom moderate-to-vigorous physical activity (MVPA) than children completing their usual curriculum. Significant differences were also noted for classroom VPA over the final 2 weeks. Conclusion: The results suggest that integrating movement experiences into an existing early childhood curriculum is feasible and a potentially effective strategy for promoting PA in preschool children.

Keywords: early childhood, intervention, exercise, movement, obesity

The prevalence of overweight among US children and adolescents has increased dramatically since the 1970s. Data from the 1999–2002 National Health and Nutrition Examination Survey indicate that 16% of young people between the ages of 6 and 19 years are overweight, an absolute increase of approximately 10%.1 Preschool-age children are also affected by the obesity epidemic. Data from the most recent National Health and Nutrition Examination Survey indicate that just over 10% of US children between the ages of 2 and 5 are overweight, with a further 12% considered to be at-risk for overweight.1,2 The rising trend in overweight among preschool children represents a critical public health problem. Overweight preschoolers are at significantly increased risk for child and adolescent obesity,3 and they are more likely than their nonoverweight counterparts to experience significant short- and long-term health problems such as hyperlipidemia, hypertension, insulin resistance, respiratory problems, and orthopedic complications.4,5 In addition, the adverse social consequences of childhood obesity might have long-lasting effects on psychological well-being and economic mobility.5

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Lack of physical activity is an important contributing factor to the development and maintenance of childhood overweight. Overweight preschool children have been shown to be less active than their nonoverweight counterparts, and long-term prospective studies have shown physical activity during early childhood to be either protective of accelerated weight gain or inversely associated with increases in adiposity. Despite the importance of regular physical activity, however, the activity patterns of preschool children are not well understood. Children in the 3- to 5-year-old age range are traditionally viewed as highly active; however, objective-monitoring studies conducted in the United States and the United Kingdom suggest that preschool-age children engage in relatively little moderate- to vigorous-intensity physical activity. These findings, taken alongside the continued rise in the prevalence of overweight among preschool children, highlight the need for effective policies and programs to promote physical activity in 3- to 5-year-old children.

Early childhood education programs are an ideal setting to promote physical activity in young children. In the United States, 56% of all children between the ages of 3 and 5 attend preschools or similar early childhood education centers, most of them spending 4 or more hours per day, 5 days per week in those settings. Unfortunately, very little is known about how to effectively promote physical activity in preschool settings. Physical educators and clinicians have developed a number of programs and resources to promote physical fitness and fundamental movement skills in preschoolers. Because such programs are stand alone and must be added to an increasingly crowded early childhood curriculum, however, their implementation has been limited and their adoption not widespread. A more realistic and potentially more sustainable approach to promoting physical activity that has not been systematically evaluated in the scientific peer-reviewed literature, is to integrate developmentally appropriate movement experiences into the existing early childhood curriculum. By incorporating movement experiences into traditional learning areas such as mathematics, science, and language arts, integrated physical activity curricula overcome the traditional implementation and adoption barriers associated with stand-alone physical activity programs. Moreover, there is evidence that integrating movement into everyday learning experiences can enhance learning outcomes in young children.

The purpose of this study was to assess the effect of an integrated move and learn curriculum on objectively measured physical activity behavior in 3- to 5-year-old children attending a half-day preschool program. We hypothesized that preschoolers exposed to the move and learn curriculum would exhibit significantly greater classroom moderate-to-vigorous physical activity (MVPA) than preschoolers completing their normal classroom curriculum.

**Methods**

**Setting**

The study was conducted at a single child-care center and involved children enrolled in an inclusive half-day preschool program. The program was run in collaboration with the local school district and serviced 3- to 5-year-olds residing within the community of Manhattan, KS. The study was conducted in 2 classrooms licensed for 12 children with morning and afternoon class groups (4 class groups in total). Each session was 2.5 hours in duration with morning and afternoon sessions offered 4 days per week.
Recruitment

All parents and caregivers were provided with a letter of introduction describing the study and an informed consent packet. Parents were asked to sign and complete the written informed consent document and return it to a designated drop box located inside each classroom. The study was approved by the child-care center advisory committee and the University’s Institutional Review Board.

Study Design

The study was conducted over a 10-week period, with the first 2 weeks serving as a baseline assessment period. After baseline assessments had been completed, the classrooms were randomized to the intervention condition or the usual care control condition. Children attending the morning or afternoon session in the intervention classroom completed an 8-week move and learn curriculum, and children attending the morning or afternoon session in the control classroom completed their usual early childhood curriculum.

Intervention Overview

The primary aim of the intervention was to increase the amount of MVPA performed while attending preschool. To achieve this aim, opportunities for physical activity were integrated into all aspects of the preschool curriculum, including math, social studies and science, language arts, and nutrition education. Lead teachers selected activities adapted from *Let’s Move, Learn, and Have Fun!*, the physical activity component of *Nutrition: Good for You!* a comprehensive nutrition and physical activity curriculum for preschool children developed by the Kansas Nutrition Network and Kansas State University Research and Extension. Additional activities were adapted from activities developed for *Class Act*—an integrated physical activity curriculum developed for the Kansas Department of Health and Environment. Activities included counting and number-recognition games using scarves and balloons and music-based chasing and imagination games addressing concepts in language arts, science, social studies, and nutrition education (eg, letter launch, musical march, animal antics, broccoli broccoli, and pizza delivery man). Table 1 provides a detailed description of representative activities from each content area. At a minimum, teachers were required to include 2 move and learn curriculum activities lasting 10 minutes or longer in each 2.5-hour session. Activities were typically repeated several times throughout the week.

Before implementation, teachers and staff in the intervention classroom participated in a single 3-hour training session conducted by 1 of the authors of the curriculum. The training consisted of an introduction and discussion of the curriculum objectives, demonstration of activities, and practice of the move and learn activities. Teachers were also given a video demonstrating the different activities. The training session was typical of that given to center- and home-based child-care providers throughout the state of Kansas.
Table 1 Description of Selected Learning Activities From Each Content Area

<table>
<thead>
<tr>
<th>Sample activities by content area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td></td>
</tr>
<tr>
<td>Count Your Kicks</td>
<td>Teacher scatters balloons around the classroom. Children are given a time limit (e.g., 1 min), and children count how many balloons they can kick in 1 min. Teachers call time, and activity is repeated.</td>
</tr>
<tr>
<td>Hustling Hula Hoops</td>
<td>Children receive a hula hoop and are instructed to find a personal space in the area being used. Teacher calls out a spatial concept such as “Get in the hula hoop” or “Put the hula hoop over your head.”</td>
</tr>
<tr>
<td>Popcorn Popcorn!</td>
<td>Children form a circle around 1 person who is the leader. Children in the circle chant “Popcorn popcorn in a dish, how many pieces do you wish?” The leader selects a number between 1 and 10. Children then stomp, jump, hop, etc the number selected. At the completion of counting, all children clap and say “Pop!” The leader becomes part of the circle, and the next child takes a turn as leader.</td>
</tr>
<tr>
<td><strong>Language arts</strong></td>
<td></td>
</tr>
<tr>
<td>Letter Launch</td>
<td>Students receive a balloon with an uppercase letter written on it. Around the room the teacher places a companion balloon with the same letter in lower case. Children toss the balloon up in the air, not letting it hit the ground. When the teacher signals, children must find the companion balloon, matching the lowercase and uppercase letters. The activity is repeated so that children can try different letters of the alphabet.</td>
</tr>
<tr>
<td>Fun With Scarves</td>
<td>Children throw scarves in the air and catch with different body parts: hand, elbow, knee, nose, back, chest, tummy, foot.</td>
</tr>
<tr>
<td>Musical March</td>
<td>Teachers place letter carpet squares or laminated letters large enough to stand on in a circle. Using appropriate music (teacher’s preference), children march around the circle of letters. When the music stops, students must find a letter square and name the letter they are standing on. For variations, use other locomotor movements such as skipping, hopping, and running.</td>
</tr>
</tbody>
</table>

(continued)
### Table 1 (continued)

<table>
<thead>
<tr>
<th>Sample activities by content area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social studies/Science</td>
<td></td>
</tr>
<tr>
<td>Sense Scramble</td>
<td>Teacher places large pictures of eyes, nose, ears, hands, tongue in different locations around the classroom. Teacher calls out a sensory word (e.g., taste) and an animal movement. Children use the specified animal movement to go to the picture that corresponds to the sensory word.</td>
</tr>
<tr>
<td>Animal Antics</td>
<td>Children are shown a picture of an animal. Children move, act, and sound like the animal.</td>
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<tr>
<td>Nutrition education</td>
<td></td>
</tr>
<tr>
<td>Broccoli Broccoli!</td>
<td>Children pass 2 or more balls (or age-appropriate objects) around a circle. When the teacher calls out “broccoli,” anyone holding the ball must run (skip, hop, gallop) around the outside of the circle and return to his or her place in the circle. If the teachers calls out “broccoli broccoli,” (broccoli twice) children not holding a ball run (skip, hop, gallop) around the circle and back to their places.</td>
</tr>
<tr>
<td>Pizza Delivery Man</td>
<td>Teachers make a pretend pizza out of cardboard. Children sit in a circle formation. One child is designated the pizza delivery person and walks around the circle carrying the pizza. The child places the pizza behind another child and touches him or her on the back and says, “Ding-dong.” The rest of the children say, “Pizza Delivery!” The child that has the pizza behind him stands up, grabs the pretend pizza, and runs (hops, marches, skips, gallops, etc) around the circle. The game continues until everyone has delivered a pizza.</td>
</tr>
</tbody>
</table>
Process Evaluation Methods

To monitor implementation of the curriculum, teachers and staff from the intervention classroom completed a structured checklist at the end of each session. The checklist recorded the day and time of implementation, the learning context in which move and learn activities were implemented, the number of children participating that day, and children’s responses during and after the move and learn activity. Children’s responses were evaluated in the following dimensions using a 1 to 5 Likert scale: enthusiasm, attention, persistence, verbal self-regulation, and physical self-regulation. In addition, teachers and staff met briefly with the investigators on a weekly basis to receive feedback and to discuss any problems related to the curriculum implementation.

Measurement Protocol

Over the course of the 10-week study, each class group had its physical activity levels monitored twice a week. On each monitoring day, all participating students in the class wore an accelerometer for the duration of the program. Accelerometers were attached on the child’s arrival to the classroom and taken off just before leaving the program. In addition, all participating preschoolers were observed for 15 minutes using a previously validated direct observational system. To avoid bias related to the time of day, participating students were randomly assigned to 15-minute time segments. To control for potential order effects related to the day of the week, the activity-monitoring schedule was rotated and counterbalanced on a 2-week cycle.

Instrumentation

Accelerometry. Physical activity during the preschool program was quantified using the Actigraph accelerometer (WAM 7164). Consistent with previous studies, the Actigraph was attached to an adjustable elastic belt and worn on the right hip. Because the typical 1-minute sampling interval might mask the short intermittent bursts of activity characteristic of young children, a 15-second sampling interval was used. Activity counts for each 15-second interval were uploaded to a customized data-reduction software program for the determination of minutes of vigorous physical activity (VPA) and minutes of MVPA. Counts were classified as moderate-intensity (3–5.9 METs) or vigorous-intensity (≥6 METs) activity using the age-specific cut-off derived by Sirard and colleagues. The Actigraph accelerometer has been shown to provide valid assessments of physical activity in preschool-age children.

Observational System. To determine the effect of the curriculum on instructional practices, physical activity levels during specific learning contexts were characterized using a direct-observation system known as OSRAP—Observational System for Recording Activity in Preschoolers. In short, the OSRAP uses a momentary time-sampling procedure to collect contextual and behavioral information in a variety of common preschool settings. The observation system is a focal child system.
in which a designated child serves as the focus of data collection for a specified time interval, and all coding decisions about contextual and behavioral information are made in reference to that focal child. OSRAP measures the following major variables: (1) children’s physical activity level (5 levels ranging from inactive [sedentary] to vigorous); (2) type of activity (eg, running, walking, crawling, climbing); (3) physical location (outside versus indoors); (4) learning context (circle or group time, free choice, snack time, transition); and (5) social grouping (solitary, one-on-one with adult, one-on-one with peer, group with adult, group without adult). All observational data were entered directly into a PDA with the aid of a customized data-entry form. For the current study, the physical activity variables of interest were percent of total observations with an activity rating of moderate intensity or greater (%MVPA) in the following preschool locations or learning contexts: circle time, outdoor free choice, indoor free choice, snack time, and transitions. In addition, because the PDA and accelerometers were synchronized to the same computer clock, the observational system was used to identify the times children were in the classroom or outdoors on the playground. This information was used in the processing of the accelerometer data files to delineate classroom-only activity from overall activity (classroom and outdoor time combined).

Observations were completed by 2 of the investigators and 2 research assistants. Before data collection, all observers completed the training procedures recommended by McKenzie. These included (1) observer orientation, (2) study of the observational manual and familiarization with the coding scheme, (3) direct practice using videotaped segments, (4) assessments and feedback using a reference video tape, (5) practice in the observational setting with feedback, and (6) field practice with concurrent reliability assessment with a certified assessor. Interobserver agreement for each component of the OSRAP were as follows: activity level (83.9%), activity type (83.9%), physical location (100%), learning context (100%), and social context (80.6%).

Statistical Analysis

All statistical analyses were conducted using SAS version 9.1. The effects of the intervention on the accelerometer-derived activity variables were tested using a mixed-model repeated-measures ANOVA (PROC Mixed), which accounted for the use of intact class groups. Within each model, condition, time, and the condition by time interaction were included as fixed effects with children nested with classroom nested within treatment included as a random effect. Tests of simple effects were used to evaluate the significance of differences between intervention and control participants at each 2-week interval. Because the primary goal of the intervention was to integrate physical activity into the existing classroom curriculum, we analyzed classroom-only accelerometer data as well as data collected during classroom time and normally scheduled outdoor time. For the observational data, logistic regression analyses was used to calculate the relative likelihood of MVPA occurring during circle time, indoor free-choice time, snack time, transitions, and outdoor free-choice time. Statistical significance was set at an alpha level of .05.
Results

Participants

Forty-two of the 48 students enrolled in the half-day program participated in the study (87.5% recruitment). Descriptive characteristics for the intervention (n = 20) and control (n = 22) groups are shown in Table 2. No significant between-group differences were noted for age, height, weight, body mass index, gender distribution, and parental education.

Results of Process Evaluation

A total of 88 movement experiences were planned, of which 82 were completed. Most of the experiences were conducted during circle or group time (96%), and most were conducted indoors (88%). Teachers reported repeating the activity (often with some variation on the theme) sometime during the week 99% of the time. Based on teacher self-reports, only 74% of the activities met the 10-minute requirement. Some movement experiences were ended prematurely when other activities had to take priority, such as a fire drill, a guest speaker, or a planned field trip. Teachers attempted to integrate the movement experiences with the existing curriculum based on the children’s interests, and reported that they were successful in doing so 98% of the time. Movement experiences addressed all content areas but were more likely to address nutrition education (37.5%) and math (30%) rather than language arts (20%) or science and social studies (12.5%). Teachers reported that during activities, children were enthusiastic about the move and learn activities (mean = 4.6), were attentive (mean = 4.5), and were persistent (mean = 4.4). After the move and learn activities, teachers reported that the children were attentive (mean = 4.4), were persistent in other work (mean = 4.5), and demonstrated physical self-regulation (mean = 4.4), as well as verbal self-regulation (mean = 4.5).

Table 2  Descriptive Characteristics of Students in the Intervention and Control Conditions

<table>
<thead>
<tr>
<th></th>
<th>Intervention (n = 20)</th>
<th>Control (n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>4.1 ± 0.7</td>
<td>4.0 ± 0.7</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>102.4 ± 25.0</td>
<td>101.7 ± 23.6</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>17.9 ± 2.2</td>
<td>18.0 ± 2.8</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>15.3 ± 2.2</td>
<td>15.8 ± 1.3</td>
</tr>
<tr>
<td>% Male</td>
<td>55.0</td>
<td>54.5</td>
</tr>
<tr>
<td>% Parents with high school educationa</td>
<td>20.0</td>
<td>27.3</td>
</tr>
</tbody>
</table>

*a Highest level of education is high school diploma.
Accelerometer Data

Over the course of the 10-week study, 769 (91.5%) of the 840 possible accelerometer assessments (42 participants × 2 times/wk × 10 weeks = 840) were successfully completed. Twenty-one accelerometer assessments were missing because of absenteeism, with a further 50 accelerometer-data files lost as the result of downloading errors or accelerometer malfunctions. All 42 participants completed at least 15 of the 20 scheduled days of objective monitoring, with over 80% of the participants completing 18 or more days of accelerometry. The average days of monitoring for participants in the intervention and control classrooms were 18.1 and 18.6, respectively.

The effects of the curriculum on objectively measured MVPA are shown in Figure 1. For classroom and outdoor time combined, preschoolers in the intervention classroom exhibited similar MVPA levels to controls, with the exception of weeks 7 and 8, during which intervention preschoolers exhibited significantly higher levels of MVPA. When only classroom time was examined, preschoolers in the intervention classroom exhibited significantly higher levels of MVPA than controls during weeks 5 and 6 and weeks 7 and 8 (P < .05).

A similar pattern of findings emerged for objectively measured VPA. Preschoolers in the intervention classroom exhibited significantly higher levels of classroom-based VPA than preschoolers in the control classroom during the last 4 weeks of the intervention period (P < .05, Figure 2).

Observational Data

Over the course of the 10-week study, project staff completed approximately 168 hours of direct observation. Intervention and control classrooms were equally observed, with 10,060 and 10,114 30-second coded observation epochs completed in the intervention and control classrooms, respectively. On average, preschoolers in intervention classroom were observed on 17 occasions (range 13–20), with each observation session lasting, on average, 14:47 minutes (29.6 30-second observation epochs). Preschoolers in the control classroom were observed on 16.1 occasions (range 10–20), with each observation session lasting, on average, 14:15 minutes (28.5 30-second observation epochs). The percentage of observations occurring outdoors for the intervention and control classrooms was 13.7% and 14.9%, respectively.

Logistic regression analyses were used to calculate the relative likelihood of MVPA occurring during specific segments of the preschool day (circle time, indoor free-choice time, snack time, transitions, and outdoor free-choice time) in the intervention versus the control classroom. Results are shown in Table 3. Preschoolers in the intervention classroom were significantly more likely than preschoolers in the control condition to exhibit MVPA during circle time (OR = 2.6), free-choice time outdoors (OR = 1.4), and free-choice time indoors (OR = 1.2; P < .05). During transitions and snack time, the proportion of observations with at least moderate-intensity physical activity did not differ between the 2 groups.
Figure 1 — Mean ± SD for minutes of MVPA for children in the intervention (N = 20) and control (N = 22) classrooms. Program duration was 2.5 hours for both classrooms. Upper panel represents classroom activity. Lower panel represents classroom and outside activity combined. * denotes statistically different at the .05 level of significance.
Figure 2 — Mean ± SD for minutes of VPA for children in the intervention (N = 20) and control (N = 22) classrooms. Program duration was 2.5 hours for both classrooms. Upper panel represents classroom activity. Lower panel represents classroom and outside activity combined. * denotes statistically different at the .05 level of significance.
Table 3  Effect of the Intervention on the Likelihood of MVPA According to Lesson Context

<table>
<thead>
<tr>
<th>Lesson context</th>
<th>% MVPA&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intervention</td>
<td>22.8</td>
<td>2.6</td>
<td>2.2–3.0&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>control</td>
<td>10.3</td>
<td>1.0</td>
<td>referent</td>
</tr>
<tr>
<td>Transitions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intervention</td>
<td>42.0</td>
<td>0.8</td>
<td>0.7–1.0</td>
</tr>
<tr>
<td>control</td>
<td>46.3</td>
<td>1.0</td>
<td>referent</td>
</tr>
<tr>
<td>Snack time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intervention</td>
<td>2.5</td>
<td>1.3</td>
<td>0.8–2.2</td>
</tr>
<tr>
<td>control</td>
<td>3.3</td>
<td>1.0</td>
<td>referent</td>
</tr>
<tr>
<td>Free choice outdoor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intervention</td>
<td>78.3</td>
<td>1.4</td>
<td>1.2–1.8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>control</td>
<td>71.7</td>
<td>1.0</td>
<td>referent</td>
</tr>
<tr>
<td>Free choice indoor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intervention</td>
<td>26.7</td>
<td>1.2</td>
<td>1.1–1.3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>control</td>
<td>23.5</td>
<td>1.0</td>
<td>referent</td>
</tr>
</tbody>
</table>

Abbreviation: MVPA, moderate-to-vigorous physical activity.
<sup>a</sup> Percent of all 30-s observation epochs with activity rating of moderate or greater.
<sup>b</sup> Statistically significant, *P* < .05.

Discussion

The results of this study support the view that integrating movement experiences into an existing early childhood curriculum is feasible and a potentially effective strategy for promoting physical activity in preschool children. Over the final 4 weeks of the 8-week intervention, children completing the move and learn curriculum exhibited significantly higher levels of classroom MVPA than children completing their usual preschool curriculum. Significant differences were also noted for VPA over the final 2 weeks. Regular classroom teachers and staff were able to implement most of the move and learn activities as planned, and children were enthusiastic, attentive, and persistent in their learning tasks during the activities. It is important that the addition of movement into the curriculum was not disruptive to the learning environment, and teachers and staff reported high levels of child physical and verbal self-regulation after completing the move and learn activities.

When classroom and outdoor MVPA estimates were combined, the activity differences between the intervention and control classrooms were diminished, particularly in weeks 5 and 6 of the study. This finding could be attributable, at least in part, to the tendency of children in the control classroom to spend more time outdoors than children in the intervention classroom. Time outdoors has been consistently shown to be positively associated with physical activity in preschool children.<sup>24,25</sup> It is noteworthy, however, that the preschoolers in this study only accumulated an additional 3 to 4 minutes of MVPA during outdoor playtime. It is possible that the small amount of time allocated to outdoor play in this half-day program (10–20 minutes per day) might have been insufficient for meaningful MVPA opportunities to develop. Alternatively, the inability of the accelerometer
to accurately measure certain types of playground activities (eg, riding bikes, playing on the swings, climbing and hanging on fixed equipment) might have led to an underestimation of the amount of MVPA performed outdoors. Considering that only 25% of the 30-second observation epochs taking place outdoors had an activity rating of moderate or higher, it appears that the children were not highly active during outdoor time. The relatively small amount of time spent outdoors by all 4 class groups in this study reinforces the needs for program directors and teachers to monitor and enforce policies related to time for outdoor free play or free play.26

The mostly null findings observed during the first 4 weeks of the intervention suggest that teachers were experiencing difficulty implementing the movement experiences as planned. Although process-evaluation data indicated that teachers had successfully implemented most of the move and learn experiences and rated them favorably, classroom observations during the first 4 weeks of the intervention suggested that teachers were not consistently meeting the project requirements of implementing 2 or more move and learn curriculum activities lasting 10 minutes or longer. To rectify the situation, the investigators met with the classroom teachers to reiterate project requirements and to reexamine the concepts covered in the initial training session. The apparent success of this strategy over the final 4 weeks of the intervention confirms that a single group training session is not adequate for effective implementation. A training model that includes on-site or online booster sessions and opportunities for individual evaluation and feedback is, therefore, strongly recommended.

To our knowledge, only 2 published studies have formally evaluated programs to promote physical activity in preschool children. Reilly and McDowell27 tested the effects of a 12-week program of structured physical activity that aimed to increase habitual levels of physical activity and improve motor skills. The 30-minute physical activity sessions were delivered 3 times per week in nursery schools in Glasgow, Scotland. The intervention was supplemented with a home-based educational component that targeted reductions in sedentary behavior. The weekly program was associated with a significant increase in objectively measured physical activity, both on the days the program (40% increase) was offered and on the days when it was not (29% increase). A significant improvement in motor-skill performance was also noted.

The Hip-Hop to Health Junior study tested the effects of a culturally proficient diet and physical activity intervention in a Head Start preschool program in Chicago, Illinois.28 The intervention was implemented over a 14-week period and consisted of three 45-minute lessons weekly. Half of the 45-minute lesson focused on healthy eating through the use of age-appropriate puppets that represented different food groups. The remaining half focused on physical activity and involved structured exercise to music. The child intervention was complemented by an intensive parent component consisting of a weekly newsletter, homework assignments, and twice weekly aerobic classes conducted at the children’s Head Start center. After 1- and 2-year follow-ups, children receiving the intervention exhibited significantly smaller increases in body mass index than children in the control centers. With the exception of saturated-fat intake at the 1-year follow-up, however, there were no significant differences for any of the dietary or physical activity outcomes.29 The
absence of positive findings for physical activity might be related, in part, to the use of self-reported rather than objectively measured physical activity.

Although both of the aforementioned studies represent stand-alone programs that must be added to the existing early childhood curriculum, their generally positive findings, along with our own, suggest that programs to promote healthy eating and regular physical activity in early childhood settings have strong potential to curb the continued rise in childhood obesity rates.

A major strength of this study was the use of 2 independent objective measures of physical activity to rigorously assess change in classroom- and individual-level physical activity behavior. Over the course of the 10-week study, participants completed, on average, 18 to 19 days of objective monitoring with an accelerometer. In addition, each child’s physical activity behavior was directly observed in a variety of learning contexts and social groupings on 16 to 17 occasions. The combination of these 2 methods allowed us to examine the effect of the curriculum in specific learning contexts and segments of the preschool program. A further strength was our use of existing classroom teachers and staff to implement the curriculum. This approach was in contrast to previously conducted obesity-prevention studies that have used outside early childhood professionals or trained research staff to implement the intervention. Although conducted as an efficacy study in a single child-care center, the positive results achieved by the teachers and staff in this study suggest that the move and learn approach has strong potential for dissemination to other child-care settings.

Opposing these strengths were a number of limitations. First and foremost, the study was conducted as a preliminary efficacy study and involved a relatively small number of children attending a single child-care center. Although providing evidence of feasibility and efficacy are important first steps in developing effective translatable intervention programs, it is imperative that the move and learn approach be evaluated in other child-care centers that offer greater racial/ethnic diversity and provide both half-day and full-day programs. Second, because the move and learn curriculum was specifically designed to increase physical activity while attending preschool, we did not monitor physical activity levels outside of the program. As a result, we cannot rule out the possibility that the more active children in the intervention classrooms might have compensated for this increase by decreasing activity levels at home or elsewhere. Observational studies involving elementary school children suggest, however, that this is an unlikely possibility. Third, although teachers in the intervention classroom reported consistently high levels of child self-regulation after completing the move and learn activities, we did not directly evaluate the effect of the curriculum on academic performance or learning-related outcomes such as time on task. Future investigations should rigorously evaluate the potential for move and learn curricula to positively enhance learning outcomes in addition to promoting physical activity.

In conclusion, an 8-week curriculum integrating opportunities for physical activity into all aspects of the preschool curriculum, including math, science, language arts, and nutrition education, was effective in promoting greater MVPA in preschool children. The curriculum was well-received by teachers, staff, and students and did not adversely affect child behavior or the learning environment. These promising findings suggest that the move and learn approach to physical
activity promotion is worthy of replication and should be tested in the context of a larger group-randomized trial.

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References