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Investigating the Impact of a Motor Program on Preschoolers With Disabilities

Findings From a Randomized Controlled Trial

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A semistructured preschool motor program was developed in response to the paucity of evidence-based motor programs for preschoolers with disabilities in inclusive classrooms. A randomized controlled trial (RCT) was undertaken to examine the impact of the *CHildren in Action: Motor Program for PreschoolerS* (*CHAMPPS*), a 21-week intervention that includes 42 Universal Design for Learning–embedded lessons with suggestions for supporting school readiness skills. Eight intervention and 8 control classrooms across 2 states participated in the RCT. Data on 51 children with disabilities provide initial evidence on how *CHAMPPS* positively impacted children's active engagement, motor, and social development. The promising results include gains in motor skills, sustained physical activity levels during motor play, increased on-task behavior, and high feasibility and usability ratings by teachers. Implications for practice and future research are discussed.
Key words: *disabilities, inclusion, intervention, motor, preschool, randomized controlled trial*

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ALTHOUGH motor skills develop naturally for most typically developing preschoolers, children with disabilities often experience deficits in this area (Emck et al., 2009, 2011; Provost et al., 2007; Van Damme et al., 2015; Wuang et al., 2008). Importantly, research has suggested that gross motor skills are linked to school readiness skills (Cameron et al., 2016). For example, Hernandez and Caçola (2015) found that motor proficiency predicted 4-year-old children's cognitive ability, and Holloway et al. (2018) suggested that motor skills predict social functioning for children with autism spectrum disorder. Also, because motor skills are the foundation for other areas of development (i.e., social interaction, physical well-being, cognition), children who have

motor delays may experience difficulties in other areas (Becker et al., 2014; Brown et al., 2009; Fedewa & Ahn, 2011; Palmer et al., 2013; Seymour et al., 2009). Moreover, because the development of motor skills requires support and practice, it is important that preschoolers with disabilities or delays are provided with multiple opportunities to hone these skills and offered intentional, planned support from teachers and parents (Goodway & Branta, 2003; Green et al., 2009; Logan et al., 2011; Marton, 2009; Pan et al., 2009; Parker, & Thomsen, 2019). However, the reality is that many young children do not spend enough time being physically active; increases in children's sedentary behavior has become an area of growing concern (Cardon & De Bourdeaudhuij, 2008; Hinkley et al., 2012; Hnatiuk et al., 2014; Palmer et al., 2013). The National Association for the Education of Young Children (NAEYC, 2020) and the U.S. Office of Disease Prevention and Health Promotion (ODPHP, 2018a) emphasize the importance of physical activity (PA) and play, which impacts all areas of child development. For instance, ODPHP (2018b) guidelines state that preschoolers should be physically active throughout the day, engaging in 60 min of structured motor play (i.e., motor lessons, sports, dance) and at least 60 min of unstructured motor play (i.e., gym, outdoor play) each day. Perhaps one of the unintended outcomes of the increased focus on young children's academic success has been decreased time and programming dedicated to PAs during play, the very context that supports motor development (Martin & Murtagh, 2015). These facts are alarming, given that PA is important for general health and in the preschool context, for motor development (Fisher et al., 2005; Lai et al., 2014; Parker & Thomsen, 2019; Ruiz-Esteban et al., 2020; Williams et al., 2008). In a comprehensive review of 39 studies including more than 10,000 children (aged 2–6 years), Tucker (2008) found that nearly half of preschoolers were not sufficiently physically active on a daily basis, and between 20% and 40% of U.S. schools have eliminated recess altogether (Center on Education Policy, 2008; Elkind, 2007). This trend of limited PA for preschoolers persisted years later as documented by Tandon et al. (2015). For example, Favazza et al. (2013) found that preschool teachers did not have a designated curriculum for promoting motor skill development and teachers reported that motor and play activities were the first things to be eliminated when teachers needed to alter their daily schedules. Research on the preparedness of educators to support motor skill development is also limited (Harris et al., 2011; Robinson et al., 2012; Tsangaridou, 2017). Because many children with disabilities have delayed motor development, and there is a strong link between motor development and school readiness skills, providing opportunities for PAs that are aligned with motor skill development is a necessity, not a luxury.

Notably, in the seminal work by Riethmuller et al. (2009), they conducted a systematic review of preschool motor interventions and found a limited number of interventions that had both a sound theoretical base and high research standards for evaluation of their efficacy. Of the more than 8,000 studies reviewed, only 17 met the authors' established criteria and of these studies, less than 20% had high methodological quality. This led the authors to make strong recommendations for preschool motor interventions that are theoretically based and possess sound methodological quality. Thus, the need for structured preschool motor programs that are responsive to national guidelines regarding motor play and that use evidence-based practices is imperative (Aronson-Ensign et al., 2018; Favazza et al., 2023), as they have the potential to positively impact children's development and school readiness skills (Palmer et al., 2013).

Employing Universal Design for Learning (UDL) strategies within lessons is one way for teachers to ensure that every child is engaged, supported, and challenged (CAST, 2018). UDL empowers teachers to adapt a

curriculum based on student needs, rather than creating separate activities for individual children. *CHildren in Action: Motor Program for PreschoolerS* (*CHAMPPS*) was developed in response to a need for a preschool motor program that includes embedded UDL strategies to support children's engagement in motor play and ensure that children with disabilities can participate fully in the program (Favazza et al., 2023).

A randomized controlled trial (RCT) was undertaken to examine the impact of *CHAMPPS* on preschoolers with disabilities. The following research questions were addressed: (a) Were significant pre-/postmotor and social gains made by children who participated in *CHAMPPS*? (b) Were there posttest motor differences between *CHAMPPS* participants and the control group? (c) Did participation in *CHAMPPS* result in benchmark levels of PA (i.e., were children engaged in nonsedentary behavior for at least 50% of the *CHAMPPS* class)? (d) What percentage of time during *CHAMPPS* did children spend on-task and engaged in appropriate motor behaviors? (e) What percentage of time during *CHAMPPS* did teachers spend leading motor activities, organizing the children and materials, or transitioning children? and (f) What were teachers' perceptions about the feasibility and usability of CHAMPPS?

METHODS

Design

A pre- and post-randomized assignment to treatment design, with class as the unit of randomization, was employed to assess treatment effects on child outcomes that were targeted by the intervention.

Recruitment of participants

Once institutional review board approval was obtained, eight inclusive preschool classes in each of two states (Massachusetts and Illinois) were recruited by providing local early childhood principals with an overview of the study. Administrators who expressed an interest in the project provided information on the possible number of classes and teachers who might participate. Principals confirmed teachers' interest and then 16 classes were randomly assigned as either intervention (i.e., *CHAMPPS*) or control classrooms. Randomization was conducted by writing classroom "names" on folded paper and then arbitrarily selecting and sorting them into treatment or control groups. No attempt was made to match classrooms. It should be noted that randomization was not achieved in one school due to the lack of cooperation from some teachers. Therefore, convenience sampling was used to identify two treatment and two control classrooms in that school.

CHAMPPS and control teachers identified children with diagnosed disabilities and/or those who were suspected of having a disability (i.e., they were in the referral/evaluation process) who might participate in data collection (a maximum of four children per class) based on the following inclusion criteria: (a) child was able to walk independently (and therefore able to participate in a motor assessment), (b) child could maintain attention for a 20- to 30-min motor assessment (based on teacher report), and (c) child attended school regularly. This criterion was used across school sites in both states. A consent form was sent to all parents of teacher-identified children who met the criteria to affirm interest in the data collection portion of the study. Thus, although all 16 classes included children with and with no disabilities, data were collected only on 51 children with a diagnosed disability or those who were suspected of having a disability (see Table 1). Throughout this article, children who participated in data collection are referred to as *target children*.

All classes had two adults (one lead teacher and an assistant teacher, or two coteachers) and approximately 15 children. Twelve classrooms (six control, six *CHAMPPS*) were situated in inclusive public schools whereas four inclusive classrooms (two control, two *CHAMPPS*) were in a separate Head Start

Table 1. Target Child Demographics

	Intervention Group (n= 29)	Control Group (n = 22)
Gender (n)		
Girls	9	11
Boys	20	11
Age (mean)	4.17	4.18
Home language (n)		
English	26	22
French	1	0
Spanish	2	0
Disabilities		
Developmental delays (19%)	6	4
Autism (12%)	5	1
Down syndrome (8%)	3	1
Speech and language delays or disorders (16%)	4	4
Health impairment (6%)	1	2
Vision and speech (2%)	1	0
Behavior disorder (2%)	1	0
Communication and motor (2%)	1	0
Suspected, unknown diagnosis (33%)[a]	7	10

[a]Many participants were suspected of having a disability but evaluation to confirm a diagnosis was not yet complete.

building. No schools were implementing a designated motor curriculum at the time of the study.

Of the 51 preschoolers who participated in data collection (20 girls [39%], 31 boys [61%]), 27 were from Illinois classes whereas 24 were from Massachusetts. Across the two states, 29 target children were in the eight *CHAMPPS* (intervention) classrooms, and 22 target children were in the eight control classrooms. Children's ages ranged from 3 to 5 years (M = 4.18). Participants' home languages were 94% English, 4% Spanish, and 2% French.

The Abilities Index (AI; Bailey & Simeonsson, 1988) was used to describe the target children who participated in data collection. The AI enables teachers to describe a child's abilities in nine areas such as Intellectual Functioning, Intentional Communication, Physical Health, and Social Skills. Ratings in each of the nine areas are made on a scale of 1–6, with 1 indicating "normal" ability, 2 indicating that a disability is suspected (i.e., teacher has concerns about the child's ability), and 3–6 indicating severity of disability (i.e., mild, moderate, or significant disability) compared with other children the same age. The AI has generally strong test–retest reliability (α = .77; Bailey, 1993) and strong validity (Buysse et al., 1993).

Based on teachers' ratings on the AI, 77% of the 51 children had mild disabilities and 23% had significant disabilities. Target children's disabilities fell into three primary AI categories: behavior and social skills (37%), intentional communication (37%), and intellectual functioning (20%); the remaining 6% were spread across the other AI areas (i.e., Physical Health). Specific disabilities represented in this sample of children, as described by participating teachers in response to an open-ended question, included developmental delays (19%), language delays or disorders (16%), autism (12%), Down syndrome (8%), health impairment (6%), vision and speech (2%), behavior disorder: impulse

control (2%), communication and motor (2%), and suspected disability/unknown diagnosis (33%). Information was not collected on specific therapies that target children were receiving at the start of the study.

Procedures

Prior to the start of the study, project staff were trained to administer the Test of Gross Motor Development-2 (TGMD-2; Ulrich, 2000) and the Social Skills Improvement System—Rating Scales (SSIS-RS; Gresham & Elliot, 2008); these tools are described in the section on measures. Staff were trained by senior researchers who had experience administering and scoring these tools. This training included an overview of the measures, demonstration of test administration and scoring on children who were not a part of the project, and practice administering and scoring each test with children not included in this study. Once *CHAMPPS* and control classroom teachers completed the AI (discussed earlier) on the target children, project staff pretested these children using the TGMD-2 and teachers were instructed on how to complete the SSIS-RS.

Although teachers in the control classrooms continued with business as usual regarding motor activities (e.g., daily indoor or outdoor motor play, short motor breaks between activities), teachers from the *CHAMPPS* classes were provided with training and materials for implementation. Training was developed during Years 1 and 2 of the grant, as part of the development of the *CHAMPPS* program. This training was informed by research, the lead researchers' experiences working in preschool motor programs, and feedback from participating teachers in Years 1 and 2. For the current study, the first four authors provided the same training across early childhood sites in each state (i.e., PowerPoint slides, materials, activities, etc.). In addition to asking intervention teachers to refrain from sharing *CHAMPPS* information with their colleagues, the *CHAMPPS* program was kept separate from control classes by scheduling the *CHAMPPS* intervention at a time when the control classes were engaged in other activities within the school. Moreover, *CHAMPPS* was implemented in a separate space, away from control classes (i.e., motor room, gym).

Control teachers received training and materials following the completion of the study. The 2-hr in-person training consisted of (a) information about the current preschool landscape including a lack of sufficient daily PA by preschoolers with and with no disabilities, (b) the linkage between motor development and school readiness skills, (c) information on the importance of motor play and PA, and (d) an overview of *CHAMPPS*.

CHAMPPS teachers then identified a time in their schedules and a space for implementing the intervention to ensure consistency as well as to enable a maximum number of children to participate. At all sites, *CHAMPPS* took place in a room that was separate from the classroom. For this study, *CHAMPPS* was implemented across 21 weeks. This semistructured preschool motor program utilized UDL-embedded lessons to support school readiness skills (e.g., social, language, preacademics) and active engagement (PA level) by preschoolers. The classwide program is designed for use in inclusive preschool classes, addressing foundational motor skills (i.e., motor imitation, visual tracking, body awareness) and fundamental motor skills (i.e., walk/run, balance/jump/hop, catch, throw, strike, kick) through enjoyable motor activities, music videos, a home component, and teacher training (Favazza et al., 2023). The repeated lessons within *CHAMPPS* include warm-up, three core activities that focus on the target motor skills, corresponding music videos, and a cool down activity. Each of the seven units includes six repeated lessons designed to increase PA levels while supporting development in motor, social, language, and preacademics. Teachers were provided with a lesson summary, called a "Walk Around Card," which contained an abbreviated version of the lesson that could be used as they implemented the motor lessons.

Each lesson started with a warm-up activity, presented in a large group format for approximately 5 min, followed by two or three core activities, which across the seven units gradually shifted from a whole-group format to small groups and partner formats, as well as independent practice. The class also watched and imitated movements from a music video depicting motor actions that corresponded to the unit; each *CHAMPPS* lesson ended with a cool down activity. *CHAMPPS* was implemented 2–3 days a week and then once a week previously introduced *CHAMPPS* activities were sent home (in an abbreviated form) for families to implement with their preschoolers. No training was provided to parents. Throughout the intervention, we regularly confirmed with *CHAMPPS* teachers that they were not sharing information about the intervention with control teachers who were in the same schools; all teachers reported that they had not shared motor materials or information about the intervention.

Data analysis

All analyses were performed using IBM SPSS Statistics (Version 26) software. Children's demographic and baseline data were calculated using independent sample *t* tests. Paired sample *t* tests were used to examine the effects of *CHAMPPS*; group was the independent variable whereas scores for various measures were the dependent variables. A *p* value of less than .05 was considered significant.

Primary measures

Four outcome measures were used in the study to examine the impact of *CHAMPPS* on children's motor skills, social skills, PA levels, and on task behavior. The TGMD-2, a primary outcome measure, is widely used in research. It is a standardized test that examines 12 gross motor skills divided into two subtests: locomotor (run, hop, gallop, leap, horizontal jump, and slide) and object control (ball skills such as striking a stationary ball, stationary dribble, catch, kick, overhand throw, and underhand roll). This tool possesses respectable reliability and validity. The coefficient alpha index of internal consistency averages .85 for the Locomotor subset, .88 for Object Control, and .91 for the Gross Motor Composite. Test–retest reliability coefficients range from .84 to .96. The TGMD-2 was used pre- and postintervention in this study.

Another outcome measure was the CHAMPPS Observer Impression Scale (CHOIS; Favazza et al., 2016), which was adapted from the Academic Learning Time-Physical Education Coaching Manual (ALT-PE; Siedentop et al., 1982). This observation tool was used to describe children's behavior during the 30-min *CHAMPPS* program. For example, when project staff used the CHOIS, they observed what the target child was doing (i.e., engaging in motor activities, exploring equipment, cheering on their peers, and/or waiting for activities to begin). At the same time, staff observed the context of *CHAMPPS* (what the class was doing; i.e., teacher providing instructions, organizing children and equipment, and transitioning children from one activity to another). The CHOIS employs a paper–pencil interval recording system, which involves observing and recording every 30 s for the duration of each *CHAMPPS* lesson. Training on the CHOIS involved three parts: a 2-hr in-person information session, group practice using classroom videos, and individual practice using both videos and real-time observation. Research staff were required to achieve at least 80% reliability on classroom videos before utilizing the CHOIS in the field. Monthly team meetings were held throughout the duration of *CHAMPPS* to discuss CHOIS observations and assess interrater reliability. Before using the CHOIS to observe a *CHAMPPS* lesson, the observer predetermined what order to observe children, intentionally rotating the order of who was observed first, second, and so forth. The observer coded both the *context* (what the class was doing) and the *child* (what the child was doing). Context codes describe what is happening in the class for the *majority* of the 30-s interval (i.e., the

teacher is transitioning students to a new activity, providing instruction/organization, leading a motor activity, etc.). Child codes describe what the target child is doing for the *majority* of the 30-s interval (i.e., engaged in motor-appropriate behavior, engaged in motor support such as passing out equipment, not engaged, etc.). The CHOIS was used to determine whether children were engaged in motor play for the majority of the *CHAMPPS* session as opposed to listening to instructions, transitioning between activities, and so forth. In addition, children were observed to determine whether their behaviors were appropriate versus inappropriate, not engaged, and so forth (see Table 2 for coding definitions of CHOIS).

The third outcome measure was the Actigraph accelerometer, a device used to evaluate the quantity and quality of PA expended by target children. Specifically, the 2-in. device is worn on a Velcro belt attached around the child's waist to register and quantify the amount of PA (e.g., 5 s, 30 s, 1 min,

Table 2. CHOIS Coding Definitions

Coding Definitions for Context **The adult leader** . . .	
Transition	Has verbally indicated that there will be a change in activity and the class is either moving (e.g., walking, hopping) to the new activity or cleaning up/putting away equipment from the previous activity.
Organizing	Is setting up equipment or organizing class.
Instruction	Is giving instructions, directions, demonstrating or modeling the activity, or introducing the activity.
Motor play	Is leading a primary motor activity.
Coding Definitions for Child Behavior **The child** . . .	
Motor appropriate	Is engaged in a motor activity that is related to the primary activity or during wait-time (i.e., completing a motor activity, following directions of the leader to sit/stand etc.).
Motor appropriate: equipment	Is engaged manipulating equipment, gathering equipment, exploring equipment, and trying out different materials.
Motor appropriate: talk	Is talking about the activity, equipment, or peer with the leader or a peer (e.g., engaging in conversation, commentary, questions).
Motor appropriate: support	Is helping the class and/or peers in the primary, ongoing motor activity (e.g., cheering, clapping hands, shaking instruments) with his or her attention on the primary, ongoing motor activity while helping.
Motor inappropriate	Is engaged in motor activity or behavior that is maladaptive (e.g., self-stimulation, rocking, hand flapping, tantruming, hitting, spitting, biting, running away from the group, wandering around the room).
Waiting	Is waiting for a turn after being told to wait (explicit directive) by the leader (e.g., "wait your turn," "sit and wait") or expected (implied) to wait (e.g., the activity is structured such as children take turns by standing in line to go through obstacle course).
Not engaged	Is not attending to or focused on the motor activity but instead is stationary (not moving) and disengaged (e.g., looking out the window, staring blankly at music video with no movement, sitting/laying on the ground in the midst of ongoing motor activity).
Not present	Is not in the room where the motor program occurs.

and 5 min) and intensity (i.e., sedentary, moderately vigorous, or vigorous). The device has been widely used in studies of preschoolers' motor movements and PA levels (Tucker, 2008). Target children wore accelerometers on 21 days (3 days per *CHAMPPS* unit; during Lessons 3–5 of each unit) to determine whether the intervention yielded sustained PA levels (i.e., light, moderate, and vigorous vs. sedentary) for the majority of the time during the *CHAMPPS* lessons. On one of the days when children wore the accelerometers, project staff also completed the CHOIS to describe the behaviors of the target children during *CHAMPPS*.

The purpose of using accelerometers was twofold. First, they were used to determine whether the *CHAMPPS* program was structured in such a way that participants engaged in moderate to vigorous activity levels during *CHAMPPS*. In addition, accelerometers were used to document whether children with disabilities were actively engaged in motor-appropriate behavior when they demonstrated benchmark activity level (moderate to vigorous) for the majority of the time during *CHAMPPS* (i.e., high/low PA level on accelerometer was not because of self-stimulatory behavior or off task running around room). This was important as children with disabilities are often described as engaging in sedentary behavior, self-stimulatory behavior, and off task behavior. Children in the control classes were not participants in the *CHAMPPS* intervention, nor were they participating in another structured motor program; therefore, it was not necessary to collect accelerometer data from them to answer the research questions that were the focus of this study (on the efficacy of *CHAMPPS*).

The fourth and final primary measure was the SSIS-RS. The SSIS-RS was used to evaluate the acquisition of specific social behaviors and to track progress in social skill development from pre- to postintervention. Teachers provided a frequency-based rating ("never," "almost always," and "always") of target children's social skills in areas such as cooperation, assertion, empathy, engagement, and self-control. The SSIS-RS preschool teacher form has an established internal consistency reliability of .85–.90 and test–retest reliability of .73–.86. Validity studies showed a high positive correlation with the Behavior Assessment System for Children (Reynolds & Kamphaus, 2004), the Social Skills Rating Scale (Gresham & Elliot, 1990), and the Vineland Adaptive Behavior Scales (Sparrow et al., 2005, 2006).

Secondary measures

In addition to the four aforementioned primary data collection sources, two secondary outcome measures were used to examine the fidelity of implementation and teachers' perceptions about the program's usability and feasibility.

First, teachers were observed weekly as they implemented *CHAMPPS* to assess fidelity using the Fidelity of Implementation Checklist (FIC; Favazza & Ostrosky, 2015). The FIC was developed on the basis of the four aspects of fidelity (Dane & Schneider, 1998): (1) *adherence*—*CHAMPPS* components were delivered as prescribed in lessons; (2) *exposure*—the *CHAMPPS* intervention was received by children as documented using attendance records; (3) *quality of delivery*—the teacher responded to the diversity in children's abilities using UDL strategies and varied whole group, small group, partner, and individual instruction strategies as needed; and (4) *participant responsiveness*—high levels of engagement were observed by *CHAMPPS* participants as evidenced by sustained attention and motor movement during lessons. In summary, the FIC was used to ensure consistent implementation of *CHAMPPS*, participant responsiveness and engagement, and the quality of delivery.

Second, to evaluate the usability and feasibility of the *CHAMPPS* intervention, teachers completed the 76-item Teacher Implementation and Evaluation Log (TIEL; Favazza et al., 2013). After completing each *CHAMPPS* unit, teachers responded to questions about the unit content and activities

with regard to usability and feasibility. Usability questions focused on the extent to which the teacher understood or knew how to use the manual/materials (i.e., Did you understand how to implement each lesson activity: warm-up, Core 1, 2, 3, music video, cool down? Were you able to complete the activity?). Examples of technical feasibility questions included the following: Are the instructions of this activity easily understood? Were you able to adapt the lesson, based on suggestions provided? Examples of operational feasibility questions included the following: Is the 30-min duration of *CHAMPPS* lessons doable? Was the quantity/quality of equipment adequate for this activity? TIEL data were analyzed using descriptive statistics (i.e., frequencies, percentages). In addition, on the TIEL form, teachers were encouraged to note changes in children's skills or behaviors during *CHAMPPS*. Content analysis (Johnson & LaMontagne, 1993) was used to analyze the qualitative data describing observed child changes.

RESULTS

Results from the AI and demographic data indicate that there were no statistically significant differences in child demographics between the sites (IL, MA) or groups (control, *CHAMPPS*) regarding age, gender, home language, severity of disability, and type of disability. As described earlier, the FIC was used to examine four aspects of fidelity of implementation. Across the seven units, fidelity ratings were 92% for adherence (teachers consistently implemented *CHAMPPS* during observed lessons); 66% for exposure (attendance); 98% for one measure of quality (UDL strategies were used regularly during observed lessons); 94% for a second measure of quality (teachers incorporated school readiness suggestions during observed lessons); and 69% for participant responsiveness (high levels of student engagement were observed during lessons). Fidelity scores ranged from 66% to 98% ($M = 84\%$ across all fidelity indicators), with school attendance being the lowest fidelity indicator. FIC interrater reliability across all units and all sites was 91%.

Raw scores on the TGMD-2, one of our primary outcome measures, were first converted to standard scores and then the standard scores were converted to a gross motor quotient, which is a composite of the two subtests (Locomotor and Object Control). The gross motor quotient indicated that all target children had below age-level motor abilities prior to the study. No statistically significant differences ($p > .05$) were found in pretest scores on the TGMD-2 across sites (IL, MA), or between children in the control group and the *CHAMPPS* group. These results suggest that all participants had similar *below-level* motor skills at the onset of the study.

Differences in mean scores between pretests and posttests for various motor skills on the TGMD-2 were calculated. The *CHAMPPS* group participants showed improvements in all motor skill measures whereas the control group participants saw decreases in posttest mean scores for the Standard Total Score (−1.81), Gross Motor Quotient (−4.19), Gross Motor Quotient Percentile (−4.62), Object Control Subtest Raw Score (−2.24), Object Control Percentile (−16.36), Locomotor Standard Score (−0.25), Jump (−0.63), Strike (−0.38), Kick (−1.44), and Underhand Throw (−0.94). Statistically significant differences ($p < .05$) were found on TGMD-2 pre- to postscores between the control group and the *CHAMPPS* group. Compared with the control group, the *CHAMPPS* group demonstrated significant greater improvements on the Sum of Standard Scores (5.27 vs. −1.81); Gross Motor Quotient (21.08 vs. −4.19); Gross Motor Quotient Percentile (21.55 vs. −4.62); Object Control Subtest Raw Score (8.46 vs. −2.24); Object Control Percentile (16.75 vs. −16.36); Locomotor Subtest Raw Score (11.16 vs. 1.65); Locomotor Standard Score (3.27 vs. −0.25); Locomotor Percentile (21.73 vs. 2.07); Gallop (2.81 vs. 0.5); Jump (2 vs. −0.63); Kick (1.81 vs. −1.44); and Underhand Throw(1.5 vs. −0.94).

Overall, there were pre- to postintervention improvements in most children's motor skills ($n = 42$), regardless of group assignment (with the exception of subscores in run, strike, dribble, kick, and underhand throw). Statistically significant differences ($p < .05$) were found on the TGMD-2 pre- to postscores between the control group and the *CHAMPPS* group. Specifically, the *CHAMPPS* group made significant gains compared with the control group on the gross motor quotient: object control (27.30 vs. 17.86) + locomotor (30.67 vs. 18.33), as well as separate object control (54.81 vs. 31.98) and locomotor percentile scores (11.15 vs. 7.32). Statistically significant differences were found in the skill areas of gallop (5.93 vs. 3.26), jump (5.52 vs. 3.21), dribble (3.56 vs. 1.84), kick (6.37 vs. 4.79), overhand throw (5.49 vs. 2.86), and underhand throw (4.33 vs. 2.63).

The SSIS-RS was used to evaluate the acquisition of specific social behaviors and to track progress in social skill development from pre- to postintervention. There were no statistically significant differences in pretest scores on the SSIS-RS between sites or groups. Although no statistical posttest differences were found between the *CHAMPPS* and control groups, children in both *CHAMPPS* and control groups demonstrated statistically significant improvement in SSIS-RS pre-/posttest scores ($p < .05$). Specifically, children in the *CHAMPPS* group made improvements in the four subcategories of empathy (8.3–10.7), engagement (10.0–11.7), self-control (8.9–10.7), and bullying behavior (1.4–26). In addition, they demonstrated an increase in their overall social skill percentile rank from 14.5 to 31.6 ($p < .05$). Control group participants demonstrated improvements in one subcategory, assertion (6.8–8.4), with an increase in their overall social skills percentile rank from 22.6 to 31.7 ($p < .05$).

Accelerometers were used to monitor the PA levels during *CHAMPPS* of the 29 target children who participated in the intervention; this number decreased to 24 children due to attrition. Accelerometer data revealed that target children spent at least half of each 25-/30-min lesson engaged in PA. Figure 1 illustrates the percentage of time children spent in PA for Units 1–7 and the average percentage in PA across all units (52.9% combined across units). In 5 of the 7 *CHAMPPS* units (71% of units), students spent at least 50% of their time in PA. The exceptions were Unit 3 (Jump/Balance) and Unit 4 (Catching) where children were physically active in 49% and 44% of the lessons, respectively.

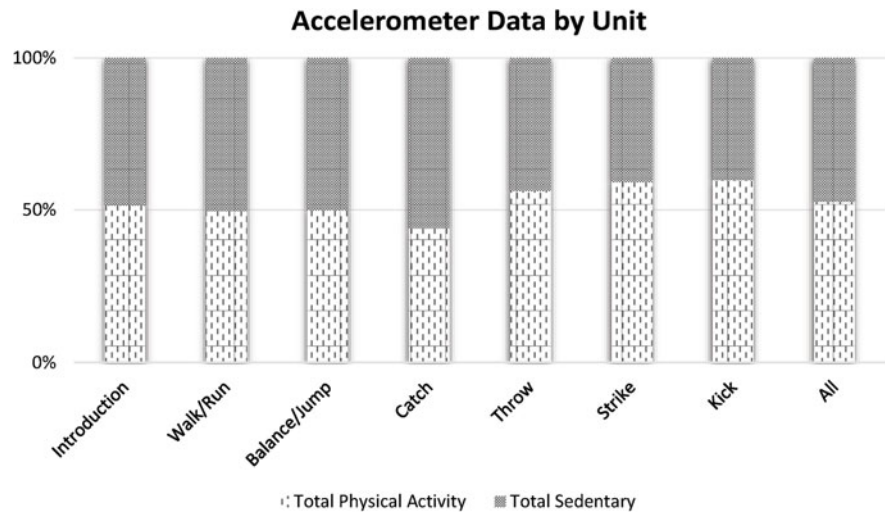

Figure 1. Percentage of sedentary versus physically active behavior across units.

We suspect that Unit 3 data are below the benchmark because children were focused on walking across a balance beam, standing on one leg, and so forth, which do not require extensive PA, and during Unit 4 the majority of activities focused on arm and hand movements (reaching and grasping). Nonetheless, across all *CHAMPPS* units, students spent slightly more than half of their time engaged in nonsedentary motor behavior.

The CHOIS child data were used to describe what the target child was doing during *CHAMPPS* (i.e., engaging in motor activities, exploring equipment, cheering on their peers, and/or waiting for activities to begin). The CHOIS context data were used to describe what the class was doing (context of *CHAMPPS*) such as teacher providing instructions, organizing children and equipment, and transitioning children from one activity to another. Interrater reliability was collected on 33% of *CHAMPPS* lessons across the 7 units. Interrater reliability for CHOIS Context ranged from 82% to 88% (M = 86%) and 77% to 84% (M = 79%) for CHOIS Child. Although we strived to meet an 80% benchmark for reliability, coding child behavior during an active motor class proved difficult, resulting in some lower than ideal reliability scores for the CHOIS child observational data. CHOIS context data indicated that target children remained on task and in motor play for most of the time during the *CHAMPPS* lessons. The *CHAMPPS* classes spent 77% of their time in motor activities, 8% in transition, and 6% of time involved teachers organizing materials. The remaining time was spent in activities such as cleanup (see Figure 2).

CHOIS child data indicated that children spent 72% of their time in appropriate motor behavior as opposed to 3% of their time engaged in inappropriate motor behavior. These data suggest that *CHAMPPS* supports the on-task engagement of children while maximizing PA levels during motor play and minimizing time spent waiting, organizing activities, and transitioning between activities. Significant positive correlations ($p < .05$) were found between each of the following: motor-appropriate and sedentary time ($r = .599$), light activity time ($r = .867$), moderate/vigorous activity time ($r = .909$); motor-inappropriate and light activity time ($r = .488$), moderate/vigorous activity time ($r = .477$); waiting and sedentary time ($r = .645$); not engaged and sedentary time ($r = .494$),

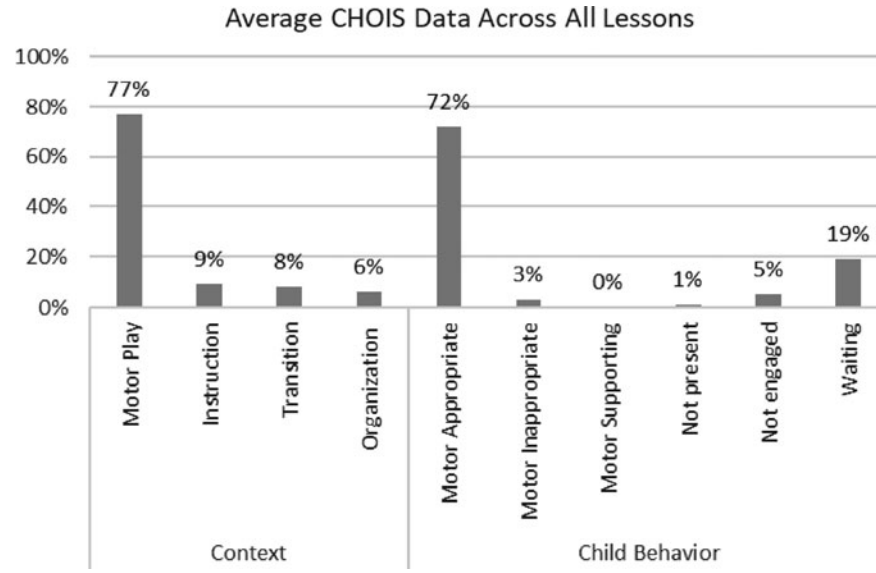

Figure 2. CHOIS data across all units. CHOIS = CHAMPPS Observer Impression Scale.

light activity time ($r = .487$), and moderate/vigorous activity time ($r = .593$; see Figure 2).

Teachers evaluated the program's feasibility and usability by completing the TIEL after finishing each of the seven *CHAMPPS* units. Results from across all units show that 97% of teachers' responses indicated high usability of the *CHAMPPS* intervention and 100% of teachers' responses indicated that the *CHAMPPS* manual had high usability. In addition, across all 7 units, 95% of teachers' responses indicated high technical and operational feasibility of the *CHAMPPS* intervention. In addition, on the TIEL form teachers recorded any observed changes in children's skills after completing each unit. Improvements were noted in six areas: motor, social–emotional, preacademic, communication/language, approaches to learning, and other; these data are presented in another article due to space limitations (Yang & Ostrosky, 2023).

Data were gathered on parents' reported use of *CHAMPPS* activities at home with the target children. Across both sites, 524 *CHAMPPS* at Home Cards were sent home in backpacks with children; there was an overall 37% return rate with 84% of the parents who returned the cards noting that they completed the suggested motor activities with their children. These percentages were similar across both sites (37% return rate at both sites, with 87% of IL families who returned the cards reporting that they had engaged in motor activities, and 81% of the MA families who returned the cards reporting that they had engaged in motor activities).

DISCUSSION

CHAMPPS is a research-based intervention with promising findings that indicate that preschoolers with diagnosed disabilities and those suspected of having a disability made gains in motor skills and were physically active while engaging in appropriate on-task behavior. Target children's gains in motor skills might be attributed to the internal structure of this motor program, which includes repeated UDL infused lessons with a repetitive structure of several brief motor activities (warm-up, three core PAs, music video, cool down), four of which include singing or music. Parker and Thomsen (2019) noted how children learn best when curriculum content is integrated across the day and when children have multiple opportunities to be exposed to content. The repeated lessons and individualized supports may have supported children's familiarity with the *CHAMPPS* activities and acquisition of specific skills by children in the *CHAMPPS* classes, as measured on the TGMD-2 and the SSIS-RS. In addition to the repeated lessons, the internal structure of *CHAMPPS* likely contributed to children's elevated PA levels (measured by the accelerometer) and high rates of motor-appropriate engagement (measured on the CHOIS) as teachers quickly moved through a variety of motor activities during each 30-min lesson. Looking across all significant correlations, motor-appropriate behaviors (CHOIS data) had the strongest correlation ($r = .909$) to moderate/vigorous PA levels (accelerometer data). Moreover, when we triangulated accelerometer data with the CHOIS context data and CHOIS child data, we believed that the content, internal structure, and individualized supports provided in *CHAMPPS* may have contributed to children being highly engaged the majority of time in motor-appropriate behavior, thereby resulting in moderate/vigorous PA levels.

The SSIS-RS data indicated that children in the *CHAMPPS* intervention showed improvements in areas of empathy, engagement, self-control, and bullying behavior whereas the children in control classes made gains in assertion. One possible explanation for the gains seen in *CHAMPPS* participants is the way in which teachers supported social emotional skill development. Throughout *CHAMPPS*, teachers encouraged all children to use respectful play behaviors (sharing, taking turns, helping a friend) and provided them with lots of positive descriptive feedback for these behaviors. These child behaviors and evidence-based teaching strategies

are key to the development of a variety of social skills and emotional competencies (Hemmeter et al., 2021). In addition, *CHAMPPS* is structured in such a way that children quickly shift from large group to small group to partnered activities. Having multiple opportunities to work in various peer groupings, supported by teachers, also might have contributed to these positive social emotional outcomes.

Finally, the appropriate, consistent, and effective delivery and implementation of motor activities is highly dependent on teachers as they have the main responsibility for planning the curriculum in most preschool classrooms. However, there is limited research on the professional development of early childhood teachers related to motor development (Tsangaridou, 2017), on teachers' implementation of motor activities and their teaching of motor skills, and on the availability of early childhood motor curricula (Favazza et al., 2013). In essence, an understanding of teachers' training and background knowledge of gross motor development and instruction is relatively unknown. Teachers in the current study implemented *CHAMPPS* with fidelity and were positive about its usability, feasibility, and effectiveness. This highlights their interest, willingness, and skills in supporting the development of young children's motor behaviors.

Limitations and implications for future research

The limitations of the study focus on three specific areas: sample, intensity of intervention, and support for social skill development and play skills. Although *CHAMPPS* data were collected in two states, the small sample size is a limitation and was the result of some difficulties with recruitment (i.e., limited number of children with disabilities in classes, parental consent). It is recommended that a similar RCT be undertaken with a more robust sample size. In addition, only those children with a diagnosed disability or those who were suspected of having a disability were included in data collection. Results of the current study might be different if the target children had other diagnoses (i.e., disabilities that included limb differences, visual impairment, and hearing impairment). Moreover, we did not gather data on the intensity of outside services that children received (i.e., a childcare or other early education setting in which motor skills were practiced or encouraged, or private therapy, etc.). Therefore, it is possible that some children received more intensive opportunities in motor learning, which could have impacted our findings. Future studies could extend this research by measuring pre–/post–social and motor gains of all children in a class (children with and with no disabilities), include preschoolers with a broader range of disabilities, and include information on the intensity of outside services.

In addition, the intensity of the program might be viewed as a limitation of this study. *CHAMPPS* was developed to be implemented 3–5 days a week in both half-day and full-day preschool programs to meet the National Association for Sport and Physical Education standards of daily PA. However, it was difficult to locate full-day publicly funded preschool programs, with the exception of some Head Start classes. Because of this, most teachers could not insert *daily* 30-min motor play activities into their schedules while competing with other curricular demands. This necessitated the adaptation of the curriculum to 2–3 days each week in *all* classrooms. It is possible to restructure classroom schedules to better accommodate the inclusion of a curriculum such as *CHAMPPS*, though research is needed to evaluate the impact of such modifications. Also, because school readiness skills are addressed in *CHAMPPS*, the use of this type of motor intervention in half-day programs could be strengthened by helping teachers see the alignment of school readiness skills within such a motor curriculum. Future research also might focus on activities within the *CHAMPPS* units to determine whether specific skill areas might be adapted and therefore result in more robust child outcomes. Finally, more research is needed

on supporting social skills during *CHAMPPS*. Although teachers reported major improvements in social skills on the TIEL (Yang & Ostrosky, 2023) and anecdotally, the breadth of these gains was not reflected in the SSIS-SR data. *CHAMPPS* could be improved by adding more intentional support for social skill development and examining generalized results in the natural context of motor play. For example, throughout the *CHAMPPS* intervention there are multiple opportunities to support children's social communication skills during active motor play activities. Researchers such as Stanton-Campbell and Snell (2011) and Zhao and Chen (2018) have demonstrated positive social communication outcomes for children with disabilities during active play. Future research could include additional support for social communication skills during *CHAMPPS* and also an examination of generalized gains during free play on the playground.

Implications for practice

NAEYC (2020) suggests that early childhood is the ideal time to support child development in the context of play as young children learn best when curriculum content is integrated across the day and when children are actively engaged with multiple opportunities to be exposed to content (Parker & Thomsen, 2019). In fact, the use of movement activities in the classroom, ranging from low to moderate and high levels of PA, can help support children's social and emotional development as well as their physical development (Sterdt et al., 2013; Temple & Robinson, 2014). By incorporating structured motor play into the preschool day, educators can address school readiness skills across domains as children participate in fun and engaging activities. *CHAMPPS* provides teachers with the "well-developed bones" of a lesson while simultaneously encouraging adaptations (e.g., choice of UDL strategies and school readiness content) to meet the needs of the classroom both on an individual level and a whole-group level (Favazza et al., 2023). Given the paucity of preschool motor curricula that utilize UDL-embedded lessons to support PA and school readiness skills, motor interventions such as *CHAMPPS* provide a way to support children with disabilities in inclusive preschool settings. Moreover, with relatively new benchmarks for PA levels for preschoolers (U.S. Office of Disease Prevention and Health Promotion [ODPHP], 2018a), school districts need to determine how teachers can make time and space for programs such as *CHAMPPS* to increase children's opportunities for PA. Teacher education and professional development in this area can be supported by motor curricula such as *CHAMPPS* that are comprehensive and theoretically sound, addressing the gaps in preschool motor programs (Riethmuller et al., 2009).

Noteworthy, the development of the CHOIS was a by-product of this study but is a tool that could prove useful for both practice and research as it enables one to determine the amount of time children are engaged in an activity as opposed to waiting or not being engaged. It also provides data on children's appropriate versus inappropriate behaviors. Researchers could use the CHOIS when watching children on the playground or during gym times, and likewise practitioners might find it beneficial when assessing the amount of time that a child exhibits on-task behavior during a lesson and how this behavior corresponds to the classroom context.

Converging realities point to the need for thoughtfully planned opportunities for PA and motor play for preschoolers. Research continues to document delays in motor skills and increases in sedentary behaviors among young children, including those with disabilities, which has been exacerbated by the global pandemic. At the same time, our knowledge about child development affirms that children learn best in an integrated fashion with multiple opportunities that address school readiness skills, as children are actively engaged in play-based learning. Finally, many schools do not have an established research-informed motor curriculum and instead rely

on preschool teachers to design activities that support motor development, many of whom lack the training needed to create a motor curriculum, embedded with UDL strategies and school readiness skills. Collectively, these realities point to the need for major changes in our preschool programs that result in integrating school readiness curriculum into motor activities, increasing time in the school day for motor and PAs, and the adoption of theoretically sound and efficacious motor curriculum.

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