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Physical activity and children with disabilities

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Abstract
Few studies to date have examined the effect of an in-school curricular Physical Activity (PA) intervention for preschool children with disabilities. The purpose of this study was to determine the effect of a classroom PA intervention on 12 children's PA, measured via accelerometry. Six children were identified with a disability. Intervention participants received two daily PA breaks for a period of two weeks within an ABA reversal design. Results demonstrated significantly higher levels of PA for this group and overall teacher satisfaction with the curricular intervention.

Introduction
The present study serves as a pilot to investigate the effects of a brief physical activity intervention for preschool children who are identified with a disability. The study investigated three primary aims: 1) How much physical activity do preschool children identified with disabilities receive on a daily basis sans intervention? 2) Do children with disabilities participate in activity at the same level (i.e., physical activity dosage or amount of time engaged in physical activity) as children not identified with disabilities? 3) Do teachers implementing the physical activity intervention believe that it is an acceptable and effective intervention for children with identified disabilities?

In a systematic review of the literature regarding physical activity in youth with developmental disorders, results demonstrated reoccurring themes of positive effects in aerobic capacity, improved gross motor function, and high levels of participant and parent satisfaction that all decreased the secondary impairments so prevalent in children with developmental disorders (Johnson, 2008). Additionally, extracurricular PA programs have been found to result in increased motor skills in children with disabilities (Capio et al., 2014). Yet limited literature to date has examined the effects of in-school interventions designed to increase physical activity of preschool children identified with a developmental disability, indicating the need for further investigation. Available preliminary data indicate improvements on motor skill development of children with developmental delays following an in-school physical activity intervention (Favazza et al., 2013).

Background
Physical activity has long been known to produce positive health effects in children. A number of psychosocial benefits have been documented in the literature, including the enhancement of pro-social behaviors, an increase in levels of maturity and social competence, a reduction in social and emotional problems, and an improvement of self-esteem (Lamb & Gulliford, 2011). Despite these benefits, the research has demonstrated that preschool children only engage in 42.8 minutes of moderate to vigorous

physical activity (MVPA) per day (Bornstein, Beets, Byun, Wonwoo, & McIver, 2011), far less than the 60+ minutes per day as suggested by the National Association for Sport and Physical Education (NASPE, 2009). Although approximately 53% of 3 to 5 year-old children in the United States attend preschools (Annie E. Casey Foundation, 2012), the scientific literature shows a limited number of studies on physical activity levels among preschool aged children in particular, with a growing literature base related to children with disabilities and physical activity intervention in general (Capio et al., 2014; Favazza et al., 2013). Much like the physical activity literature for typically developing preschool children, even less is known for young children identified with disabilities. Approximately 18% of children and adolescents in the United States have a chronic condition or disability (Murphy & Carbone, 2008), and among this population, very little is known about the percentage of children who actually engage in the recommended amount of physical activity. However, the scientific literature does demonstrate low participation rates of physical activity levels in adults with disabilities (USDHHS, 2000).

Although research is limited, most of the literature base regarding children and adolescents with disabilities engaging in physical activity has targeted students with developmental disabilities and children with externalizing behaviors such as hyperactivity or attention concerns (Chang, Suyen, Yu, & Lee, 2012) with existing evidence suggesting that youth with disabilities in general are likely to participate in physical activities to a lesser degree than typically developing peers (Tonkin et al., 2014). According to the National Health Interview Survey in 2008, developmental disabilities accounted for approximately 15.04% of childhood diagnoses (Boyle et al., 2011), which includes conditions such as Autism, Down syndrome, Cerebral Palsy, and Developmental Delay. A pertinent issue regarding all individuals with developmental disabilities is that many of them are at a higher risk of developing secondary impairments that may potentially develop due to the less active nature and sedentary lifestyles of these individuals (Johnson, 2008).

Participants

The sample consisted of 12 preschool-aged children (6 typically-developing, 6 with a developmental or physical disability), ages 3-4 years (M = 3.9; SD = .3). The 12 children were enrolled in a University-based daycare and preschool center in 2012 that housed two preschool classrooms. Given the focus of the study, children with a developmental, externalizing, or physical disability (6 children who had an Individualized Education Plan [IEP]) were compared to a random sample of 6 typically developing children in the preschool classrooms. The children were distributed equally across both classrooms. The project was approved by the University Institutional Review Board.

All six children identified with a disability were receiving instructional, physical, or occupational therapy supports throughout the implementation of the current study. None of these services changed or were altered during the course of the study. Although there was overlap in the concerns exhibited by children with disabilities, only two children had similar IEP goals related to their speech and motor functioning (Child 1 and Child 4). Out of the six children not identified with a disability, three were males and three were females. Eleven out of the 12 children were Caucasian, while the other child (typically-developing) was Asian-American. All participants came from a similar socio-economic (middle-class) background.

Procedure

Two graduate students in the Psychology field, along with the authors, served as the primary researchers for this project. The initiation of data collection began by attaching GT3X+ Actigraph accelerometers (http://www.theactigraph.com/products/gt3x-plus/) to the 12 children participating in the study. Data were collected in 5-second epochs. Accelerometers are known for being the most objective and reliable measure for assessing individual's physical activity patterns (Welk, 2002). For the other children in the classroom who were not either randomly assigned to participate or did not have an IEP, they were given sealed "dummy" pedometers. The researchers arrived at the beginning and end of the school day to attach and remove the accelerometers from the 12 children participating in the study. All accelerometers were placed on the right hip of the child via an elastic belt. The children were all told the accelerometers were "movement catchers" as the devices informed us "how much they were moving" throughout the day. No problems were reported by the teachers regarding the children's accelerometer use during the first two weeks of baseline data collection.

The study began with a week of "washout" data that involved simply having the children wear the accelerometers, but without the collection of data to account for any novelty effects. After this period, two weeks of baseline data collection commenced without any change to the children's typical schedule. Following the baseline data collection, the authors trained the two preschool teachers on how to implement the physical activity intervention designed to be administered on a class wide-scale. The physical activity intervention consisted of implementing two movement breaks throughout the school day (each lasting 5-10 minutes each; one in the morning and one in the afternoon) through the use of a set of standardized movement cards (Pangrazi, Beighle, & Pangrazi, 2009). These break cards provided activity descriptions and games that were designed to increase physical activity levels of children. The intervention was implemented twice a day for two weeks to gauge the level of additional physical activity resulting from the movement breaks. Following the intervention, the teachers also completed a 5-item social validity scale designed by the researchers. The questions were open ended and assessed the perceived effectiveness and ease of use for the physical activity break cards given that these cards have not been documented for children identified with disabilities.

Design

The authors chose a Reversal or ABA design (Kazdin, 2010) to track the activity patterns of the 12 children and to examine the degree to which the break cards increased movement for the children. Baseline data was collected across the 12 participants for two weeks, the physical activity intervention phase was implemented for two weeks, and then follow-up data collection resumed for the final two weeks during the "withdrawal" phase via the accelerometers.

Results

The accelerometry data provided a profile of children's movement throughout the school day, and resulted in a percentage of active versus sedentary time. A cut-off accelerometry output was set to 1100 step counts per minute to distinguish between sedentary and physically active behavior in preschool children (Reilly, Coyle, Kelly, Burke, Grant & Paton, 2003). Data were then collected from each child's school day, resulting in a total of 30 data points per child (i.e. 10 per baseline, 10 per intervention, and 10 per withdrawal or post-intervention phase). The two weeks for each phase of the study (i.e., baseline, intervention, and withdrawal) were collapsed to present a clearer picture of the data.

Within Groups. Because scores were not normally distributed, a nonparametric (i.e., Mann-Whitney's U) independent t-test was used to compare physical activity levels from baseline to intervention. When examining only those students with disabilities, the intervention significantly increased their physical activity levels ($U = 5.5$, $p < .05$), suggesting that the physical activity break cards were effective for preschool children identified with a disability, as follow-up indicated a significant drop to near baseline levels of physical activity for children identified with a disability. Graphs are available by contacting the primary author via email, and illustrate the effect of the break card intervention on the children's physical activity levels. Children's physical activity levels were much higher during the intervention phase compared to the baseline or post-intervention phases. However, it is notable that the time spent in physical activity for children during the 8 hour school day with disabilities varied tremendously, with a high of 19% time spent in MPA for Child 2 compared to a low of 1.59% for Child 5.

Between Groups. When assessing children based on IEP status, there were notable differences, although these differences were not statistically significant. Children who were not classified as having a disability were more active at baseline and withdrawal than those with a disability, but the difference approached significance ($U = 18$, $p < .05$). Moreover, children without an identified disability did not increase their time spent in MPA as a result of the intervention as did children with a disability ($U = 17.5$, $p < .05$), possibly suggesting a differential effect for children with disabilities.

Social Validity. Both teachers perceived the intervention break cards to help increase the physical activity of all children in their classroom. Although the teachers felt that the cards offered a variety of activities, the teachers thought that most of the cards were "too difficult to implement" with preschoolers. Also of importance is that the teachers felt the cards could be appropriately modified for all of the children with identified disabilities, but the real concern for the teachers was the developmental level of the cards as a whole, given that the activities were not preschool-appropriate from their perspective. This was an

interesting finding since the accelerometry data indicated a significant increase in physical activity expenditure with the use of the break cards for those children identified with a disability. Teachers may have inadvertently spent additional time working with the preschoolers identified with disabilities during the physical activity intervention to ensure they were benefitting fully from the activities. This could help explain why the children without disabilities did not see a significant gain in physical activity levels, as perhaps they were not as engaged with the activity if teachers were assisting other children. In terms of teacher satisfaction with the intervention, the teachers noted that overall they were very happy with the physical activity breaks because all of their kids enjoyed the activities.

Discussion

Students classified as having a disability were more active during the intervention than during baseline, suggesting that the activities were feasible for teachers to implement with them to participate in and were able to meet their individual needs. This also indicates that the addition of two activity breaks per day can significantly increase the amount of physical activity these children obtain, as has been found with older children (Erwin, Beighle, Morgan, & Noland, 2011). It was interesting to note the wide variation of time spent in physical activity by individual child. Perhaps the activities presented by the teachers were more appealing to some students than others, or as has been found in prior research, the type of disability likely influenced the amount of physical activity each child accrued (Sit, Lindner, & Sherrill, 2002).

When comparing physical activity outcomes by group, children without a disability were more active than those with a disability at baseline. This is to be expected, given previous research conducted on individuals with disabilities that demonstrate lower levels of physical activity compared to those without disabilities (Arim, Findlay, & Kohen, 2012). However, a very interesting and promising finding was that the intervention appeared to be more effective for students with a disability. This may have resulted because the teachers may have unintentionally focused on providing activities that would accommodate this particular group of students. Or it may have resulted because of the 'ceiling effect,' insinuating that the children without disabilities had reached their maximum physical activity and those with disabilities had more "room for improvement." The final amounts of physical activity revealed that students with disabilities were most active during the intervention weeks. This finding is promising, as gains in motor development may be indicative of subsequent gains in additional areas of development, such as social skills (Favazza et al., 2013) for young children with developmental delays.

Teachers noted satisfaction with the use of the cards, but perceived it difficult to adapt the cards fully for those children with disabilities. Ensuring children's' interest in the activities is essential, as lack of interest has been show to be a barrier to children with disabilities engaging in physical activity (Yazdani, Yee, & Chung, 2013). Teachers also noted that the students' behaviors and focus improved. Although there was no formal measurement of on-task behavior in the present study, the anecdotal observations are consistent with previous literature (Ericsson, 2008) and provide more impetus for teachers to incorporate movement within the school day for preschool-aged children.

Conclusions

Although results are promising, a number of limitations are inherent in the present study. First, given the brevity of the intervention, it is unclear whether these effects can be sustained over a longer period of time. Future research is warranted that will incorporate a longer intervention throughout the school year to ascertain whether these same effects can be demonstrated over time. Second, without first-hand observation, it is unclear to what extent modifications are necessary for children with disabilities and how this may have impacted their physical activity levels. Third, with such a small sample of students with disabilities, it is impossible to generalize the efficacy of implementing physical activity break cards for all preschool children with disabilities. Much larger samples are warranted to enhance the external validity of the intervention in generalizing to larger populations of preschool children. The current study showed promising effects of a classroom physical activity intervention on preschool children's physical activity levels. Children with a variety of disabilities benefitted from participating in the intervention, and the teachers indicated that the physical activity cards were feasible to implement. This intervention was achieved with very little additional exertion placed upon the teachers, and was cost effective. The time asked of the teachers was minimal and thus the intervention was feasibly implemented. The integration of two or more physical activity breaks per day during the preschool day positively impacted the physical

activity levels of children identified as having disabilities; thus, teachers should be encouraged to utilize the break cards to enhance student physical activity and ultimately, student health.

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