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The Effect of Peer Presence on Moderate-to-Vigorous Physical Activity

Nancy Thao
University of the Pacific

THE EFFECT OF PEER PRESENCE ON MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY

by

Nancy Thao

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Nancy Thao

APPROVED BY:

Thesis Advisor:	Matthew P. Normand, Ph.D, BCBA-D.
Committee Member:	Carolynn Kohn, Ph.D, BCBA-D.
Committee Member:	Corey S. Stocco, Ph.D, BCBA-D.
Department Chair:	Scott Jensen, Ph.D.
Dean of Graduate School:	Thomas H. Naehr, Ph.D.

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DEDICATION

This thesis is dedicated to my parents, Nhia and Sia, thank you for always loving me and supporting me in everything that I do. To my husband, Wen, I would not have been able to complete this project without you. You have always been and will continue to be, my biggest cheerleader. You believed in me when I did not, made me laugh when days were dark, and gave me hope when there was none. I love you with all of my heart and appreciate everything that you have done, and will continue to unselfishly do for me in the future.

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Abstract

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The CDC estimated that rates of children's physical activity are extremely low which could lead to various health problems (e.g., hypertension, lipid disorders). Fortunately, previous research has demonstrated that peers, specifically peers identified as preferred, might influence children's levels of physical activity. However, this variable has not been experimentally manipulated. The purpose of the current study was to assess the effects of peer presence on the MVPA exhibited by kindergarten children, by exposing participants to peers identified as preferred. Results indicated that the presence of a peer identified as preferred increased the levels of MVPA for one participant but failed to increase three participants' levels of MVPA. Additionally, two participants' MVPA moderately increased during the first antecedent manipulation but failed to maintain in the second phase of the antecedent condition. In regards to engagement with peers, participants engaged in higher levels of interactive play with peers than parallel play.

Keywords: Physical activity, peer influence, antecedent manipulations, engagement

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

Chapter 1: Introduction and Review of the Literature

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization [WHO], 2016) and is correlated with various health benefits such as reduced risks of obesity, high blood pressure, and certain types of cancers (Baranowski et al., 1992). Moreover, research has shown that engaging in physical activity can increase an individual's life expectancy beyond age 40 (Moore et al., 2012). On the other hand, physical inactivity (sedentary behavior, e.g., sitting, lying down) is associated with increased risk of health problems such as cardiovascular diseases (Katzmarzyk, Church, Craig, & Bouchard, 2009). To prevent future health problems in children, major health organizations such as the Centers for Disease Control and Prevention (CDC; 2016) recommend that children engage in aerobic, muscle strengthening, and bone strengthening exercises on a daily basis, including 60 min of moderate-to-vigorous physical activities (MVPA). Unfortunately, most children in the United States do not meet this guideline (Toriano et al., 2008).

To reduce sedentary behaviors, researchers have attempted to identify environmental variables that increase physical activity. Antecedent manipulations have been used in a variety of ways to increase behaviors such as compliance (Wilder, Zonneveled, Harris, Marcus, & Reagan, 2007), textual accuracy (Marcus & Wilder, 2009), lateral sleeping positions with premature kids (Voulgarakis, Forte, Giacomelli, Bendell-Estroff, & Krous, 2017), and social skills (Stitcher, Randolph, Kay, & Gage, 2009), and decrease behaviors such as food refusal (Silbaugh, et al., 2016). In regards to physical activity, some antecedent manipulations includes increasing teachers' involvement (Brown, Googe, McIver, & Rathel, 2009), engaging in planned activities (Stellino, Sincliar, Partride, & McClary King, 2010), utilizing active video games (Duncan & Staples, 2010), and manipulating the outdoor environment. Hustyi, Normand,

Larson, and Morley (2012) manipulated antecedent variables by exposing participants to three outdoor activity contexts: outdoor toys, fixed equipment, open space, and a control condition. The authors found that fixed equipment evoked the highest levels of physical activity for all participants. Though effective, the effects of antecedent manipulations are likely to decrease over time if reinforcement is not contacted (Cooper et al, 2006, p. 261). Therefore, a next step is to look at how consequent variables might play a role in physical activity.

In two separate studies conducted by Larson, Normand, Morley, and Miller (2013, 2014), the authors manipulated consequent variables by delivering attention contingent on physical activity or engaging in interactive play contingent on physical activity. Results indicated that both adult attention and interactive play increased the amount of physical activity exhibited by participants. Although effective, a potential limitation of such interventions (e.g., contingent adult attention and interactive play) is that they typically involve one-to-one interaction between the child and the adult. In settings such as schools, adults may not be able to provide a child with one-to-one attention or interactive play because of the number of children they must supervise at one time, or because of competing obligations. Fortunately, various settings, such as schools and parks, do allow children to interact with their peers. Peers have been shown to influence a variety of behaviors such as increasing task engagement (Egel, Richman, & Koegel, 1981) and food consumption (Greer, Dorow, Williams, McCorkle, & Asnes, 1991), and decreasing problem behaviors (Solomon & Wahler, 1973). With mixed results, several studies have also examined the influence of peers on physical activity (Barkley et al., 2014; Brown et al., 2006; Larson et al., 2014; Savly et al., 2008; Salvy et al., 2009).

Larson et al. (2014) replicated and extended the method reported by Hustyi et al. (2012) to different group compositions. Eight preschool-aged children were systematically exposed to

the same test conditions and control condition described by Hustyi et al. (2012), but in conjunction with three different group compositions: solitary, one-peer present, and group arrangement. Results indicated that during the solitary condition, five out of eight participants' MVPA were highest during the fixed equipment condition, two participants engaged in higher levels of MVPA when one peer was present, and six participants engaged in higher levels of MVPA when two to three peers were present. Overall, the authors were able to replicate Hustyi et al.'s (2012) methodology and extend the findings to different group compositions. Moreover, the results suggested that group compositions might have influenced children's MVPA because of the differences in responding in each group. The results of these studies are promising in that they indicate that peers do have some influence over children's levels of physical activity. Thus, one variable that warrants further investigation is whether or not peers, who are identified as preferred, have an effect on children's levels of physical activity.

Zerger, Miller, Valbuena, and Miltenberger (2017) evaluated the effects of pairing an active peer with a less active peer and providing feedback to them about their step counts. During baseline, participants were instructed to wear sealed pedometers during recess periods. Following baseline, each participant's step counts were averaged and ranked from 1 to 16, with 1 representing the child with the lowest mean step count and 16 representing the child with the highest mean step count. During intervention, participants were organized into teams in which children with lower step counts were paired with children with higher step counts. Additionally, participants were informed that they were competing against the other teams, could look at their pedometers and their team member's pedometers during recess, and could encourage one another to take more steps. Overall, the results of Zerger et al. (2017) indicated that student pairing and feedback increased children's levels of physical activity. Moreover, the study demonstrated that

peer presence might play a role in children's levels of physical activity. That is, by pairing participants into teams, the verbal behavior (e.g., reminding team member to take more steps) of one team member could have influenced the behavior of the other team member.

Previous studies have found that the presence of preferred peers can increase physical activity, at least with children (Salvy et al., 2008; Salvy et al., 2009); however, research on the attempts to experimentally manipulate this variable is limited. Barkley et al. (2014) was among one of the first researchers who attempted to experimentally manipulate the presence of preferred peers and measure the impact on children's physical activity. Twenty participants were exposed to first a solo condition and then a peer condition. During the solo condition, participants had access to both physical (e.g., balls, jump rope) and sedentary equipment (e.g., books, crayons, paper) for 30 min. After 30 min, the experimenter asked the participant if they would like an additional 10 min of play. A 'yes' lead to the continuation of play; a 'no' lead to the end of session. Prior to the start of the peer condition, participants were instructed to identify a peer that was a "friend." To corroborate those participant self-reports, the peer had to also identify the participant as a friend. If the peer failed to do so, the peer was not included in sessions and the participant had to choose again. Overall, results from this study demonstrated that participants engaged in higher levels of physical activity when the identified preferred peer was present. However, one limitation was that only two sessions were conducted. That is, participants were only observed twice (i.e., once during the solo condition and once during the peer condition) and within a 30 min time frame. This is a limitation because it could affect the external validity of the study. With only two opportunities to observe and record physical activity and with the lack of direct replication (i.e., to determine if similar results could be achieved), this limits the authors' ability to definitively conclude if the change in children's

levels of physical activity was a true effect of the experimental variable (i.e., preferred peers). Thus, the influence of preferred peers on children's physical activity remains unclear.

In this context, the purpose of the current study was to assess the effects of peer presence on the MVPA exhibited by kindergarten children by exposing participants to peers who were identified as preferred via an indirect preference assessment. An indirect preference assessment, as opposed to other preference assessment methods (DeLeon & Iwata, 1996; Fisher, Piazza, Bowman, Hagopian, Owens, 1992; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Roane, Vollmer, Ringdahl, & Marcus, 1998), was used in this regard for practical reasons described below.

Chapter 2: Method

Participants

Eleven children (nine females and two males) between the ages of five and six were recruited from a kindergarten classroom in a public school. Primary and peer participants were chosen in the order in which consent forms were received. That is, the first four consent forms received by the experimenter were assigned to be primary participants (i.e., all females) while the rest (i.e., five females and two males) were peer participants. Consent forms were provided and signed by the parents of all participants, including the parents of peer participants. Parent consent forms outlined the purpose of the study, the benefits and risks to participants, information on confidentiality, and possible incentives. Assent forms were provided to, and signed by, all 11 children. The local institutional review board approved all procedures of the study prior to the recruitment of participants and data collection.

Setting

The setting was a school playground that consisted of a fixed play structure (e.g., slides, monkey bars, stairs, ladder), outdoor toys, open paved area, and an outdoor table. Participants were not restricted to a specific area of the playground during the experimental sessions.

Materials

Camcorders were used to record all sessions, with tripods used to stabilize the camcorders. A stopwatch was used to record the duration of each session. Both the primary and secondary experimenter had a printed sheet that contained a pre-determined list of activities to be conducted that day with each participant. Additionally, the primary experimenter had a printed sheet that contained the list of questions to be used during the indirect preference assessment (see below).

Response Definition and Measurement

We used the Observational System for Recording Physical Activity in Children, Preschool Version (OSRAC-P; Brown et al., 2006) activity categories to define MVPA: 1) stationary or motionless, 2) stationary with limb or trunk movement, 3) slow, easy movements, 4) moderate movements, and 5) fast movements. Using a 1-s whole-interval recording strategy, we scored MVPA as a dichotomous variable, meaning that it was scored as "off" when categories 1, 2, and 3 were observed, and scored as "on" when categories 4 and 5 were observed. We recorded MVPA for all children, both participants and peers.

Additionally, we recorded participant engagement with peers as an auxiliary measure. For recording purposes, we defined two categories of engagement: parallel play and interactive play. We defined parallel play as participants and peers engaging in an activity (e.g., drawing on cement, building castles, hula hooping, one child playing at one end of the fixed play structure and the other child playing at the other end of the fixed play structure) without interacting with one another (e.g., no talking, no eye-contact, no body contact with peers). We defined interactive play as participants and peers engaging in an activity (e.g., playing tag, climbing up and down the slide, jump rope) and interacting with one another (e.g., talking, eye-contact, body contact with peers). Each engagement category was scored using a 1-s whole interval recording method**.**

Interobserver Agreement

We calculated interobserver agreement (IOA) for MVPA and for parallel play and interactive play for 100% of sessions for all participants. For both MVPA and engagement, an agreement was defined as two observers scoring the target behavior as occurring or not occurring

in the same 1-s interval. We divided the number of agreements (occurrence and nonoccurrence) by the number of agreements and disagreements and multiplied the result by 100.

For participant MVPA, the mean IOA was 93% (range, 79% to 100%) for Alex, 92% (range, 79% to 100%) for Claire, 93% (range, 75% to 100%) for Haley, and 92% (range, 86% to 100%) for Lily. For peer MVPA, the mean IOA was 90% (range, 71% to 99%) for Alex, 93% (range, 75% to 99%) for Claire, 90% (range, 70% to 99%) for Haley, and 90% (range, 80% to 98%) for Lily.

For parallel play, the mean IOA was 93% (range, 69% to 100%) for Alex, 91% (range, 63% to 100%) for Claire, 93% (range, 54% to 100%) for Haley, and 98% (range, 93% to 100%) for Lily. It is important to note that low IOA scores (i.e., below 80% agreement) resulted from only one session (i.e., session 19) for Alex, one session (i.e., session 22) for Claire; and two sessions (sessions 32 and 34) for Haley. For interactive play, the mean IOA was 82% (range, 47% to 99%) for Alex, 83% (range, 62% to 99%) for Claire, 84% (range, 51% to 100%) for Haley, and 90% (range, 74% to 100%) for Lily. It is important to note that low IOA scores resulted from only two sessions (sessions 7 and 18) for Alex, two sessions (sessions 8 and 21) for Claire, two sessions (sessions 7 and 34) for Haley, and one session (session 7) for Lily.

Observer Training

We provided each observer with a statement of the study's purpose, a list of definitions for the target behaviors, and a task analysis outlining the experimental procedures. The observers then completed a short quiz that assessed their comprehension of the materials. Once they scored 80% or higher, they watched videos that depicted staged scenes of adults engaging in MVPA and were required to record the MVPA. This activity was then repeated with videos of actual participants engaging in MVPA from previous studies. All video codes were compared to

previously coded master videos and calculated with a software called InstantData (Samaha, 2002) in which a score of 90% agreement or higher was required to move forward. An agreement was defined as the observer recording the exact, second-by-second account of physical activity as the master code.

A similar procedure was used to train observers on how to code participant's engagement with peers; however, only videos of participants playing in groups were used. Moreover, there were no staged scenes of children playing in groups and only videos from previous and current studies were used. First, observers were provided with a list of definitions for the target behaviors (i.e., interactive and parallel play). Second, observers were required to watch videos of participants playing in groups and record the levels of engagement with peers. Video codes were compared to previously coded master videos, and a 90% agreement or higher must be achieved before observers could move to the next step. Third, observers coded videos from the current study and were required to obtain a 90% agreement or higher with a trained observer's codes.

Procedure

All sessions were 5 min, with 2-3 sessions conducted per day. A reversal design was used to compare baseline conditions to experimental conditions. No programmed consequences were arranged for MVPA, and the setting and the number of peers present remained constant throughout the experimental sessions. Prior to the start of the session, the primary experimenter separately asked the participant and peer if they would like to go play outside (i.e., "Do you want to go outside and play today?). If yes, the primary experimenter or the secondary experimenter guided participants to the session area, delivered the instructions to play, stepped away from the session area, and then turned on the video camera. Secondary experimenters were present for all

sessions. If participants did not want to go outside and play, sessions with the child were cancelled for the day. If peers did not want to go outside and play, participants were asked to choose a new peer. Fortunately, no sessions were cancelled (i.e., no participants refused outside play) nor did participants had to choose a new peer for any sessions (i.e., no peers refused outside play). Experimenters only interacted with participants and peers if they engaged in unsafe play (e.g., standing on the edge of the slides).

Baseline. The experimenter guided the participant to the session area and delivered the instruction: "You can play here while I do some work." After these instructions were delivered, the primary experimenter stepped away from the session area and the secondary experimenter turned on the video camera. No peers were present during this condition and the participant played alone. The purpose of the baseline condition was to assess the levels of MVPA exhibited by the participant in the absence of any experimental manipulations.

Presence of Preferred Peer. An indirect preference assessment was conducted prior to the start of session. It is important to note that during this time, primary participants also had the opportunity to be chosen as peers during other participant's sessions. An indirect preference assessment was utilized because of the relative efficiency with which it could be implemented and because it did not require participants to indicate, especially in a rank-order fashion, how much they preferred various peers.

During the indirect preference assessment, the primary experimenter used a printed sheet that consisted of the question "Who do you think (name of participant) will want to play with today?" with numbers 1, 2, and 3 listed below the question. The primary experimenter instructed the primary teacher to nominate three peers with whom they believed the participant would want to play. The teachers completed the same question sheet for each participant prior to the start of

all experimental conditions for the day. The primary experimenter then asked the focal participant to choose someone to play outside, and their choices were recorded on the same sheet as the teacher nominations. If both the teacher and the participant identified the same peer, the peer was included in the session. If the nominations differed, the peer named by the participant was included in that session. The purpose of obtaining self-reports from participants was to corroborate teachers' nominations of participants' peers.

After the indirect preference assessment, the secondary experimenter then took the focal participant to the playground. Once participant was outside, the primary experimenter asked the chosen peer if they would like to go outside and play. If yes, the primary experimenter guided the peer outside. When both children were together on the playground, the primary experimenter delivered the instruction "Both of you can play here while I do some work." The purpose of the preferred peer condition was to assess the amount of MVPA exhibited by the participant in the presence of peers, as opposed to when playing alone.

Antecedent Instruction. Because the school year was coming to an end and primary participants were still engaging in low levels of MVPA, the antecedent instruction condition was added as a last effort to try and increase participant's MVPA. This condition was identical to the preferred peer condition, except that when both children were together on the playground, the primary experimenter delivered the instruction "Remember that when you're outside, you can run, jump, and climb on the playground toys! So run around and have fun!"

Chapter 3: Results

Figures 1-4 depicts the percentage of intervals with MVPA for all participants and their corresponding peers. Figures 5-8 depicts the percentage of interactive and parallel play for all participants. Table 2 depicts the correspondence and non-correspondence between teacher and participant nominations of preferred peers. Figures 9-12 depicts the distribution of MVPA of corresponding and non-corresponding reports for all participants. Figures 13-16 depicts the distribution of engagement (i.e., interactive and parallel play) of corresponding and non-corresponding reports for all participants.

Alex. Data for Alex's levels of MVPA are depicted in Figure 1. During baseline, Alex engaged in little MVPA (range, 0% to 1% of intervals), and continued to do so in the preferred peer conditions (range, 1% to 7% of intervals). During the first antecedent instruction condition, Alex engaged in more MVPA (*M* = 15%; range, 1% to 29%). During the second antecedent instruction condition, Alex engaged in similar amounts of MVPA (M = 18%; range, 4% to 28%). Throughout all experimental conditions, Alex's peer engaged in MVPA during an average of 3% of intervals (range, 0% to 8%) in the first preferred peer condition, 7% (range, 1% to 11%) in the second preferred peer condition, 16% (range, 2% to 29%) in the first antecedent instruction condition, and 19% (range, 10% to 29%) in the second antecedent instruction condition. Figure 5 depicts the amount of interactive play (M = 80%; range, 32% to 100%) and parallel play (M = 4%; range, 0% to 41%) observed.

Claire. Data for Claire's levels of MVPA are depicted in Figure 2. During baseline, Claire engaged in little MVPA (range, 0% to 32% of intervals) and continued to do so in both the preferred peer (range, 0% to 18% of intervals) and antecedent instruction conditions (range, 6% to 18% of intervals). Claire's MVPA were at similar levels in both the first preferred peer

condition (M = 9%; range, 0% to 17%) and the second preferred peer condition (M = 8%; range, 4% to 18%). During the antecedent instruction condition, Claire's MVPA were at stable levels (M = 12%; range, 6% to 18%). Throughout all experimental sessions, Claire's peer engaged in MVPA during an average of 7% of intervals (range, 0% to 14%) in the first preferred peer condition, 7% (range, 1% to 16%) in the second preferred peer condition, and 7% (range, 1% to 14%) in the antecedent instruction condition. Figure 6 depicts the amount of interactive play (M = 76%; range, 22% to 96%) and parallel play (M = 9%; range, 0% to 21%) observed.

Haley. Data for Haley's levels of MVPA are depicted in Figure 3. During baseline conditions, Haley engaged in very low levels of MVPA (range, 0% to 3% of intervals). In the first preferred peer condition, Haley's levels of MVPA continued to remain low (M = 1%; range, 0% to 3%). During the second preferred peer condition, Haley's MVPA increased (M = 11; range, 2% to 21%). During the third preferred peer condition, Haley engaged in slightly higher levels of MVPA when compared to the second preferred peer condition (M = 16%; range, 4% to 28%). With the reversal back to baseline, Haley's MVPA decreased to near zero levels (range, 0% to 3% of intervals). During the antecedent instruction condition, Haley's MVPA increased (M = 12%; range, 5% to 20%) to about the same levels as the second preferred peer condition. Throughout all experimental sessions, Haley's peer engaged in MVPA during an average of 2% of intervals (range, 0% to 6%) in the first preferred peer condition, 10% (range, 1% to 16%) in the second preferred peer condition, 16% (range, 2% to 28%) in the third preferred peer condition, and 10% (range, 2% to 34%) in the antecedent instruction condition. Figure 7 depicts the amount of interactive play (M = 82%; range, 44% to 100%) and parallel play (M = 7%; range, 0% to 51%) observed.

Lily. Data for Lily's levels of MVPA are depicted in Figure 4. During baseline, Lily's MVPA averaged 5% of intervals (range, 0% to 20%) in the first baseline condition, 6% (range, 5% to 7%) in the second baseline condition, and 4% (range, 0% to 9%) in the third baseline condition. During the preferred peer conditions, Lily's MVPA were similar to baseline levels in that it averaged 5% of intervals (range, 1% to 7%) in the first preferred peer condition and 8% of intervals (range, 3% to 21%) in the second preferred peer condition. During the first antecedent instruction condition, Lily's MVPA dramatically increased (i.e., session 21) and eventually stabilized (M = 19%; range, 13% to 40%). During the second antecedent instruction condition, Lily's MVPA decreased (M = 9%; range, 7% to 11%). Throughout all experimental sessions, Lily's peers engaged in MVPA during an average of 6% of intervals (range, 1% to 11%) in the first preferred peer condition, 6% (range, 0% to 12%) in the second preferred peer condition, 17% (range, 9% to 27%) in the first antecedent instruction condition, and 11% (range, 8% to 15%) in the second antecedent instruction condition. Figure 8 depicts the amount of interactive play (M = 89%; range, 50% to 100%) and parallel play (M = 1%; range, 0% to 12%) observed.

Indirect Preference Assessment. Data for the indirect preference assessment are depicted in Table 2. For Alex, her self-report and the teachers' report corresponded for 13 sessions and failed to correspond for 9 sessions. For Claire, her self-report and teachers' report corresponded for 14 sessions and failed to correspond for 3 sessions. For Haley, her self-report and teachers' report corresponded for 14 sessions and failed to correspond for 11 sessions. For Lily, her self-report and teachers' report corresponded for 21 sessions and failed to correspond for 1 session.

Figures 9-12 depict the amount of MVPA observed during sessions for which teacher and participant peer-nominations corresponded and during sessions for which they did not

correspond. Figure 9 depicts the distribution of MVPA across corresponding and non-corresponding sessions for Alex. Alex's MVPA averaged 12% of intervals (range, 1% to 28%) in corresponding sessions and 11% (range, 1% to 28%) in non-corresponding sessions. Figure 10 depicts the distribution of MVPA across corresponding and non-corresponding sessions for Claire. Claire's MVPA averaged 9% of intervals (range, 0% to 18%) in corresponding sessions and 12% (range, 7% to 17%) in non-corresponding sessions. Figure 11 depicts the distribution of MVPA across corresponding and non-corresponding sessions for Haley. Haley's MVPA averaged 10% of intervals (range, 0% to 28%) in corresponding sessions and 12% in non-corresponding sessions (range, 2% to 23%). Figure 12 depicts the distribution of MVPA across corresponding and non-corresponding sessions for Lily. Lily's MVPA averaged 10% of intervals (range, 1% to 40%) in corresponding sessions and 9% in one non-corresponding session. Overall, results indicate that participants' levels of MVPA did not vary as a function of the correspondence between participant and teacher nominations.

Figures 13-16 depict the amount of parallel and interactive play observed during sessions for which teacher and participant peer-nominations corresponded and during sessions for which they did not correspond. Figure 13 depicts the distribution of engagement across corresponding and non-corresponding sessions for Alex. For interactive play, Alex's levels averaged 79% of intervals (range, 32% to 100%) in corresponding sessions and 81% in non-corresponding sessions (range, 40% to 100%). For parallel play, Alex's levels averaged 1% of intervals (range, 0% to 8%) in corresponding sessions and 8% (range, 0% to 41%) in non-corresponding sessions. Figure 14 depicts the distribution of engagement across corresponding and non-corresponding sessions for Claire. For interactive play, Claire's levels averaged 73% of intervals (range, 22% to 98%) in corresponding sessions and 88% (range, 82% to 92%) in non-corresponding sessions.

For parallel play, Claire's levels averaged 11% of intervals (range, 0% to 60%) in corresponding sessions and 0.33% (range, 0% to 1%) in non-corresponding sessions. Figure 15 depicts the distribution of engagement across corresponding and non-corresponding sessions for Haley. Haley's levels averaged 79% of intervals (range, 46% to 100%) in corresponding sessions and 86% (range, 52% to 100%) in non-corresponding sessions. For parallel play, Haley's levels averaged 8% of intervals (range, 0% to 51%) in corresponding sessions and 4% (range, 0% to 36%) in non-corresponding sessions. Figure 16 depicts the distribution of engagement across corresponding and non-corresponding sessions for Lily. Lily's levels averaged 89% of intervals (range, 50% to 100%) in corresponding sessions and 86% in one non-corresponding session. For parallel play, Lily's levels averaged 1% of intervals (range, 0% to 12%) in corresponding sessions and 0% in one non-corresponding session. Overall, results indicate that participants' levels of interactive and parallel play did not vary as a function of the correspondence between participant and teacher nominations.

Chapter 4: Discussion

The purpose of the present study was to evaluate whether the presence of a nominated peer would influence the MVPA exhibited by kindergarten-aged children on a school playground. Overall, results indicated that the presence of a peer nominated by the participant resulted in more MVPA for one participant (Haley), but not for the other three participants (Alex, Claire, Lily). In regards to engagement, participants engaged in higher levels of interactive play with their peers than they did parallel play. This finding is consistent with previous research suggesting that children at this age are more likely to engage in group play (Goldstein, 2012).

However, there were certain sessions during which participants engaged in low levels of interactive play. One possible reason for this is because some interaction might have been overlooked due to the camera placement and the setup of the playground. That is, at times the camera was unable to capture both children engaging in a similar activity. For example, one child might have been at one corner of the playground, while the other child was at a different corner. This occurred during three sessions (sessions 7, 14, and 16) for Alex, four sessions (sessions 7, 20, 22, and 24) for Claire, one session (session 18) for Haley, and two sessions (sessions 7 and 19) for Lily. When both children or when one child was only in camera's view, coding was turned off for the purpose of consistency and objectivity. This might have led to an underestimation of parallel or interactive play if such play occurred when the participants were out of view of the camera.

One participant, Haley, engaged in more MVPA during the second preferred peer condition. One possible explanation for this might be that she was exposed to the antecedent condition prior to session 13 while acting as a peer for Alex during an antecedent instruction

session (during session 17 for Alex). That is, Haley was still in the preferred peer condition as a focal participant and the exposure to the instruction while acting as a peer might have influenced her behavior during her preferred peer conditions. Because no other variables were manipulated at that time, there is a chance that the increase in Haley's MVPA might have been an effect of the antecedent instruction as opposed to the presence of the preferred peer.

Previous research had used antecedent interventions in various ways to increase physical activity in school settings (Brown et al., 2009; Hustyi et al., 2012; Stellino et al., 2010). Because peer presence failed to increase MVPA for three participants, we introduced the antecedent instruction condition as a last effort to increase MVPA. During the antecedent condition, two participants (Alex, Lily) engaged in more MVPA during the first antecedent instruction condition but did not continue to do so in the second antecedent instruction condition. For Alex, the cyclical data during the first antecedent instruction condition could be due to the presence of the peer. That is, Alex's MVPA increased in session 18 (29% of intervals) when she chose Haley as a peer, decreased when she chose a different peer in session 19 (12% of intervals), and increased again when she chose Haley as a peer in session 20 (16% of intervals) and 21 (28% of intervals). During the second antecedent instruction condition, the decrease in Alex's MVPA in session 26 to 28 could have been due to fatigue. Some children tend to engage in higher levels of physical activity when initially exposed to an activity, it could be that Alex might have engaged in higher levels of physical activity during the initial session for the day (i.e., session 26) and due to repeated exposure (e.g., being chosen as a peer for another focal participant's session and then going outside again as the focal participant), engaged in lower levels of MVPA in later sessions.

For Lily, habituation might explain the lower levels of MVPA in the second antecedent instruction condition. One explanation is that repeated exposure to the instruction might have weakened the instruction as a discriminative stimulus (SD) because no reinforcement was delivered when the behavior occurred (Cooper et al., 2006, p. 261). Overall, the data from Alex and Lily suggest that antecedent manipulations can, at least temporarily, increase MVPA for some children. However, MVPA did not persist under these conditions. Future research should investigate the addition of consequences, such as delivering adult attention (Larson et al, 2013), playing with the child (Larson et al. 2014), delivering tokens (Patel, 2017) contingent on MVPA, or peer mediation (Beaulieu, Hanley, & Roberson, 2013).

As for the indirect preference assessment, teachers nominated the same peer as Alex during 59% of opportunities, as Claire during 82% of opportunities, as Haley during 56% of opportunities, and as Lily during 95% of opportunities. The distribution of MVPA and engagement for corresponding and non-corresponding reports are at similar levels for all participants (see indirect preference assessment results). These data suggest that there is no correlation between MVPA and engagement and corresponding and non-corresponding reports as levels of MVPA and engagement varies within each individual participant.

Like all research, the data must be considered in the context of several limitations. First, only 11 out of 25 consent forms were signed. This is a limitation in that participants sometimes chose peers who were not allowed to participate. This happened during one session for Claire, Lily, and Alex, and during four sessions for Haley. If a nominated peer was not on the consent list, the participant had to choose again, which could have resulted in a less preferred peer being present during the session. Moreover, out of 11 children with permission to participate, only 2 were males, thus limiting the number of boy peers that teachers and participants could nominate.

This is especially true for Haley, in that she twice nominated a boy peer who did not have permission to participate. It would have been interesting to observe Haley in the presence of a boy peer.

Second, changes in weather over the course of the study could have influenced participant behavior. During certain weeks of data collection, participants might have been more hesitant to play on the fixed play structure because of the wetness of the play structure. Anecdotally, some participants stated that they did not want to play on the play structure because it was wet (e.g., wet slides and monkey bars). As the study progressed, focal participants and their peers were engaging more with the fixed play structure (e.g., climbing up and down the slide, engaging in pretend play on top of fixed structure). As previous research has demonstrated that fixed play structures typically produce higher levels of MVPA (Larson et al., 2013; Larson et al., 2014; Larson et al., 2014), this might have contributed to the variability in MVPA observed for some participants (e.g., Claire, Lily).

Third, focal participants had the opportunity to be chosen as peers for other focal participant's sessions, which compromised the internal validity of the study. This is especially true for Haley, as she was still in the peer condition when she was chosen as a peer for Alex, who already was in the antecedent instruction condition.

Fourth, some participants (e.g., Claire, Lily) engaged in low levels of physical activity across baseline and experimental conditions. Because participants did not engage in high levels of MVPA during baseline, the introduction of a peer might have not done much to increase participants' MVPA. Relatedly, baseline MVPA of peer-only participants (8 sessions for Alex, 14 sessions for Claire, 16 sessions for Haley, and 20 sessions for Lily) were not recorded. Thus, it is unclear as to whether or not peers engaged in high MVPA and exposure to participants

decreased it, or both children engaged in overall low levels of MVPA and when placed together, continued to engage in low MVPA. In a study conducted by Zerger et al. (2017), the authors found that less active children engaged in more MVPA when they were paired with children who were more active. Thus, future research should look into pairing participants with peers who are preferred, and who also engage in high levels of MVPA.

Fifth, as mentioned above, the camera placement and setup. Not only did the camera placement limited participants' engagement data, it also limited two participants' (i.e., Haley, Lily) MVPA data. That is, the camera was unable to capture the children when they were playing in certain areas of the play structure. This occurred during three sessions for Haley (sessions 15, 16, and 31) and two sessions (sessions 23 and 24) for Lily. When coding MVPA, if both children's legs are not seen, coding was turned off for the purpose of objectivity. The impact of this limitation might lead to underestimating the levels of MVPA that had occurred as the camera was unable to capture the child's legs going up and down the slide, climbing the ladder, and going up the stairs.

In summary, the results of the current study differed from previous studies in that peer presence, specifically the presence of a peer identified as prefer, failed to increase MVPA for three participants (Larson et al, 2014; Barkley et al., 2014). Moreover, antecedent manipulations were moderately effective in increasing MVPA for two participants; however, the effects did not persist. Although the results of this study suggest that the presence of peers identified as preferred does not reliably influence children's MVPA, peer presence is still an important variable that warrants further research. Hopefully, the data obtained from the present study will be able to guide future research towards a direction in which interventions involving peers, could be implemented as a way to address the ongoing issue of physical inactivity in young children.

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APPENDIX A: TABLES

Table 1

The Observational System for Recording Activity Level, Preschool Version

Level	Activity	Operation Definitions
1	Stationary or motionless	Stationary or motionless with no major limb movements or major joint movement (e.g., sleeping, standing, riding passively in a wagon)
2	Stationary with limb or trunk movements	Stationary with easy movements of limb(s) or trunk without translocation (e.g., standing up, holding a moderately heavy object, hanging off of bars)
3	Slow, easy movements	Translocation at a slow and easy pace (e.g., walking with translocation of both feet, slow and easy cycling, swinging without assistance and without leg kicks)
4	Moderate movements	Translocation at a moderate pace (e.g., walking uphill, two repetitions of skipping or jumping, climbing on monkey bars, hanging from bar with legs swinging)
5	Fast movements	Translocation at a fast pace (e.g., running, walking upstairs, three repetitions of skipping or jumping, translocation across monkey bars with hands)

Note: Adapted from Brown et al. (2006).

Table 2

Indirect Preference Assessment

Participant	Correspondence	Non-Correspondence	Total Sessions
Alex	13	9	22
Claire	14	3	17
Haley	14	11	25
Lily	21	1	22

Correspondence and non-correspondence between teacher and participants' reports.

APPENDIX B: FIGURES

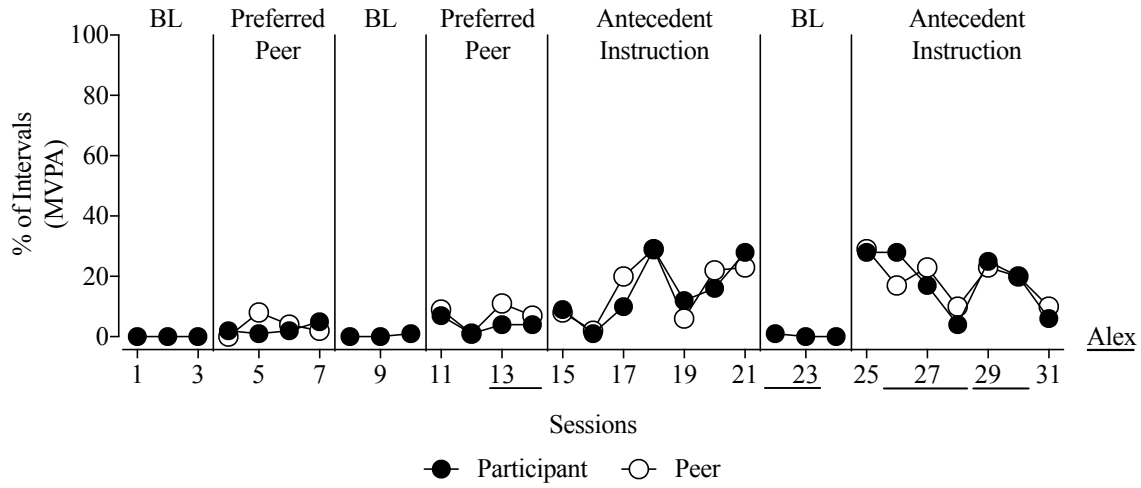

Figure 1: Percentage of MVPA observed for Alex and peers. Underlined sessions indicate same-day sessions.

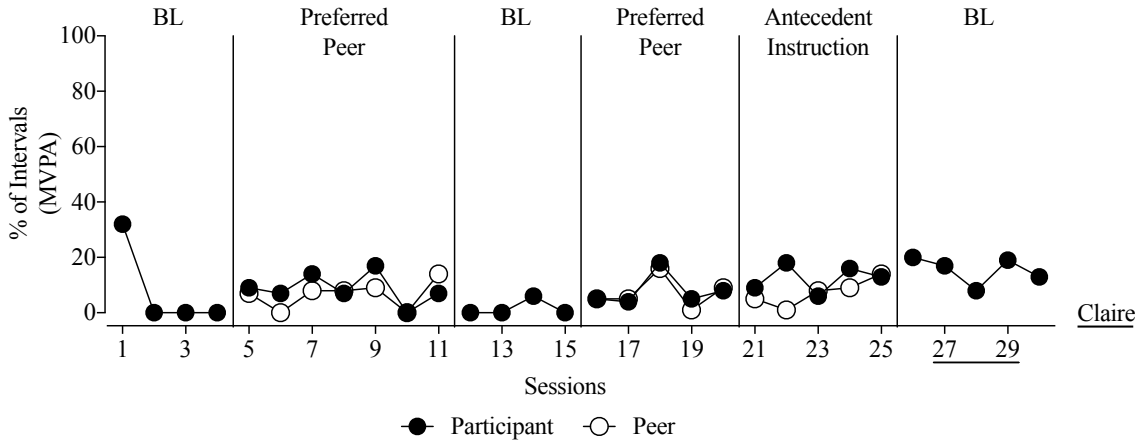

Figure 2: Percentage of MVPA observed for Claire and peers. Underlined sessions indicate same-day sessions.

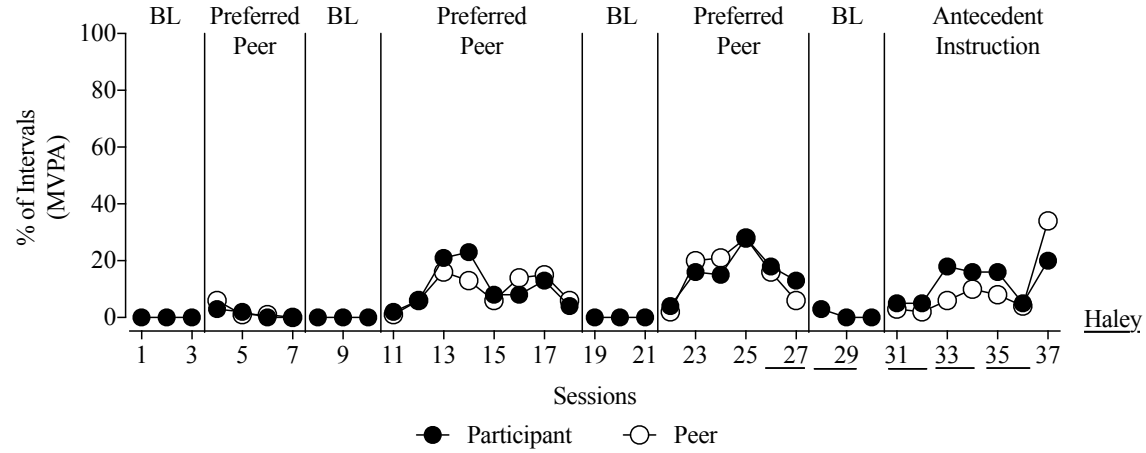

Figure 3: Percentage of MVPA observed for Haley and peers. Underlined sessions indicate same-day sessions.

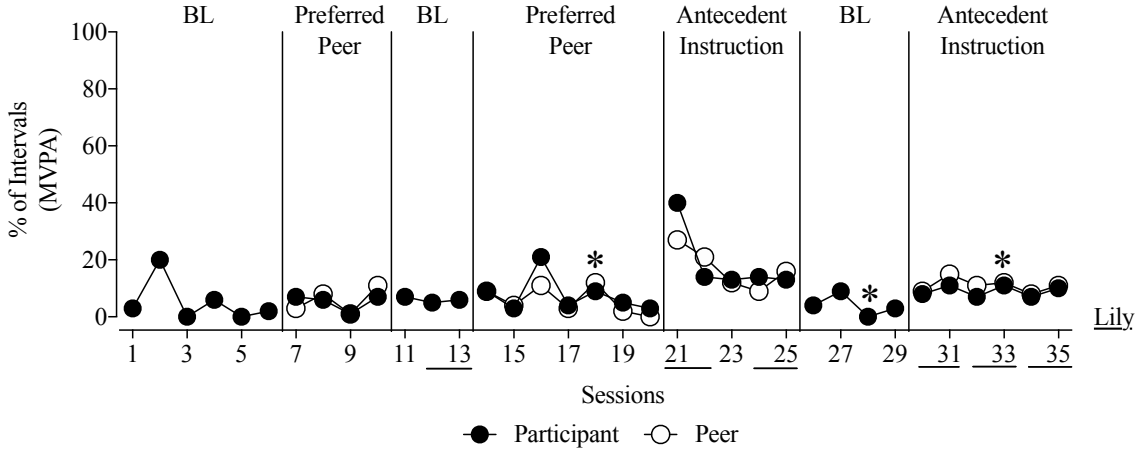

Figure 4: Percentage of MVPA observed for Lily and peers. For session 18, the asterisk denotes video malfunction. For session 28 and session 33, the asterisk denotes shorted session duration. Underlined sessions indicate same-day sessions.

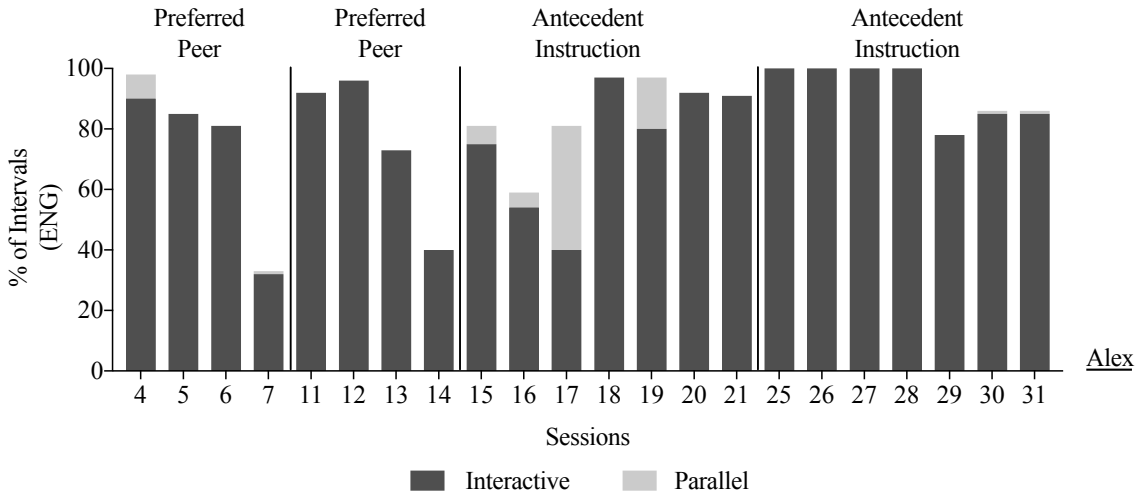

Figure 5: Percentage of intervals of engagement observed for Alex.

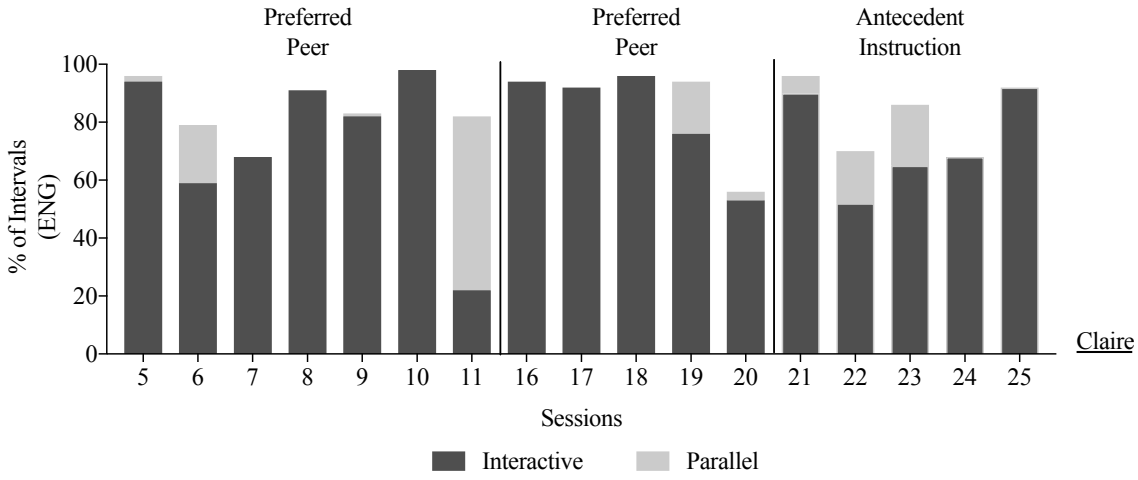

Figure 6: Percentage of intervals of engagement observed for Claire.

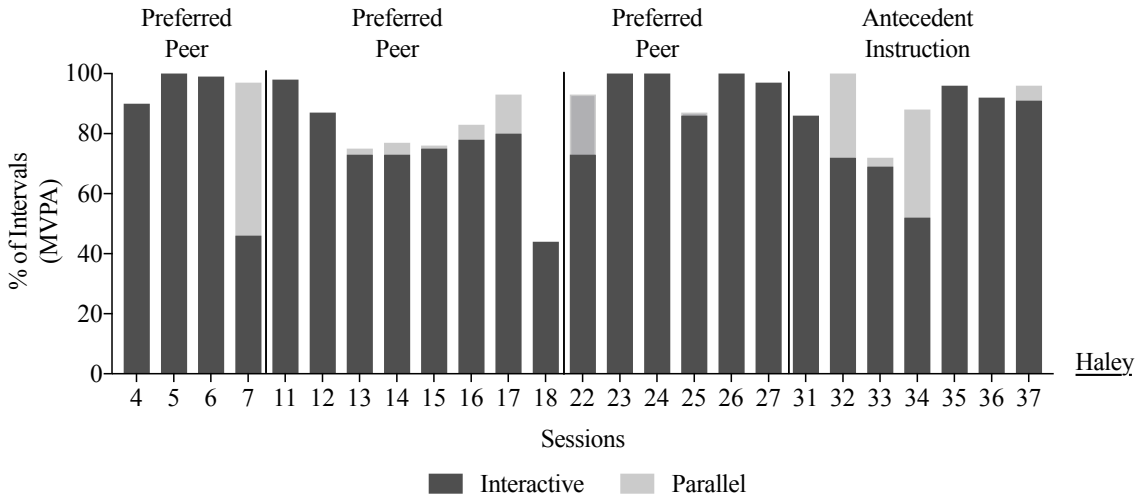

Figure 7: Percentage of intervals of engagement observed for Haley

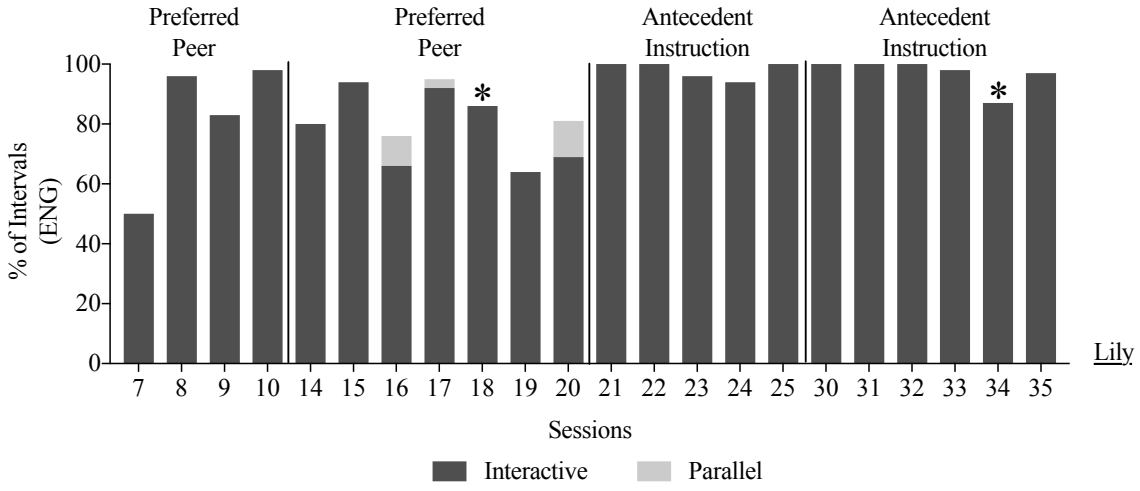

Figure 8: Percentage of intervals of engagement observed for Lily

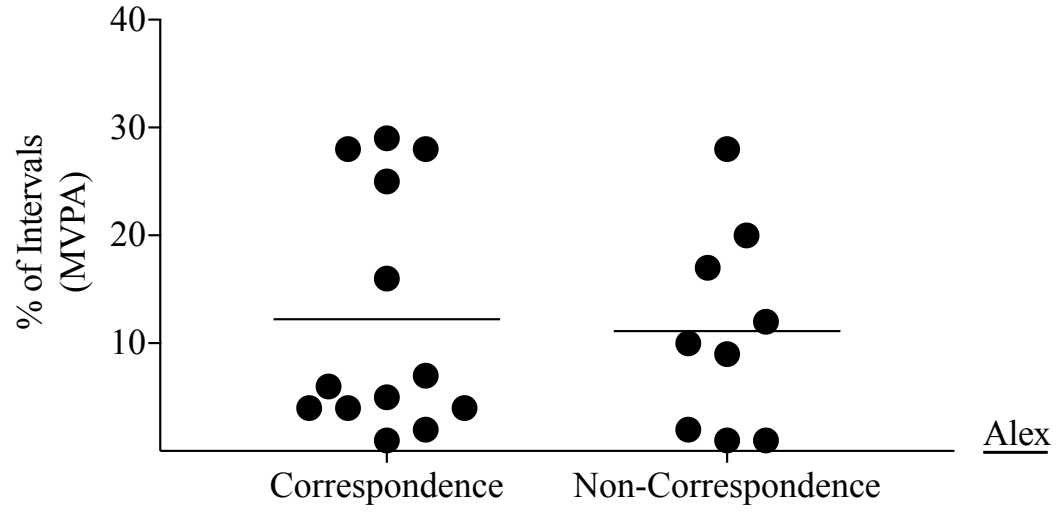

Figure 9: Distribution of MVPA of corresponding and non-corresponding reports for Alex.

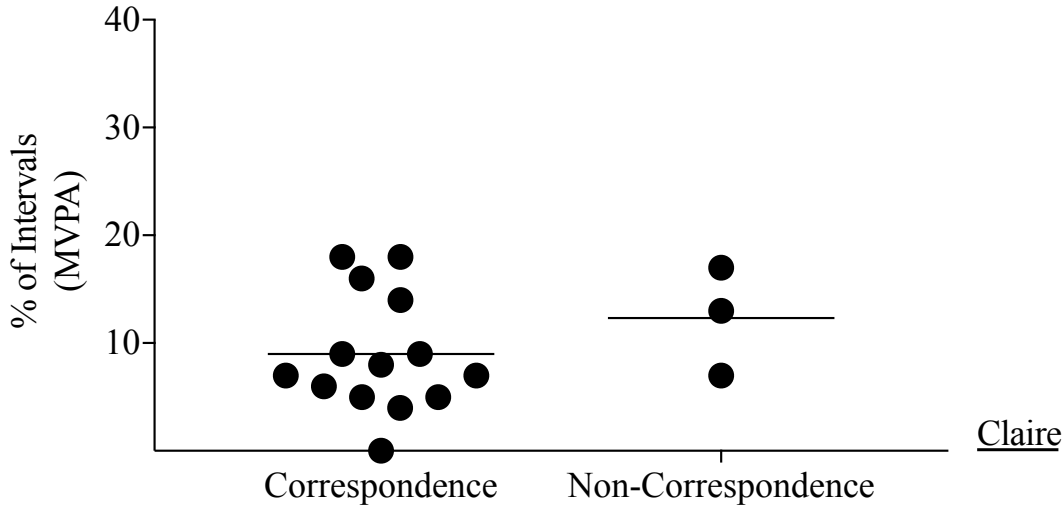

Figure 10: Distribution of MVPA of corresponding and non-corresponding reports for Claire.

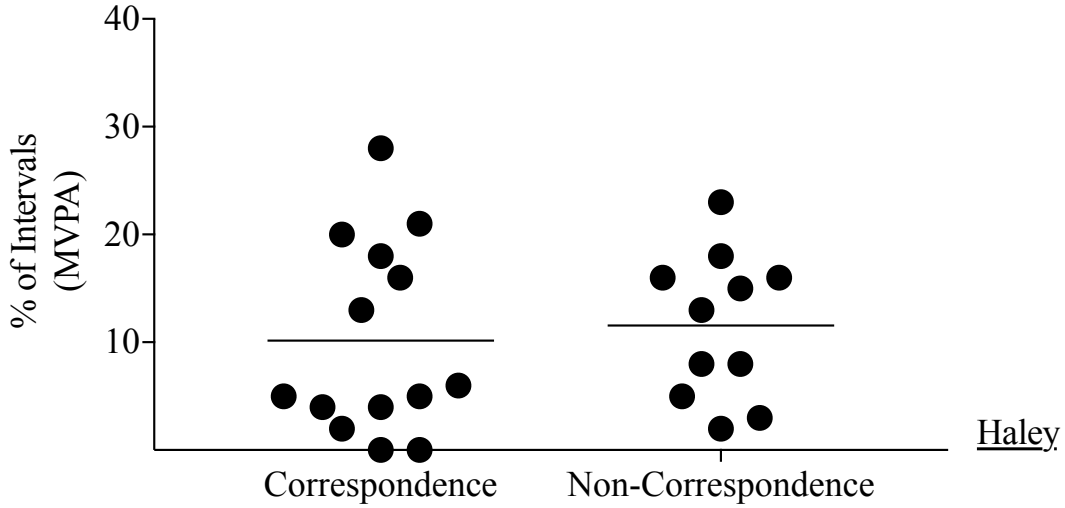

Figure 11: Distribution of MVPA of corresponding and non-corresponding reports for Haley.

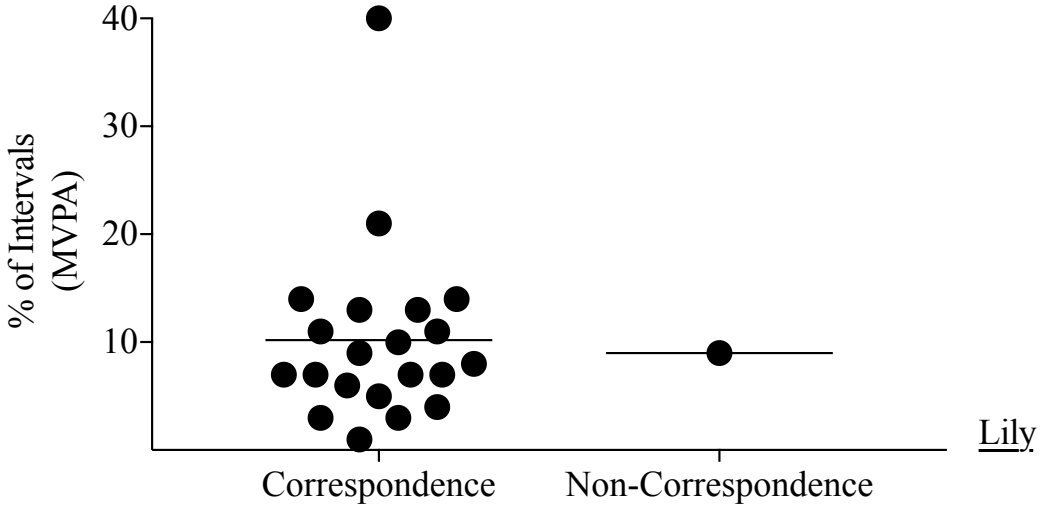

Figure 12: Distribution of MVPA of corresponding and non-corresponding reports for Lily.

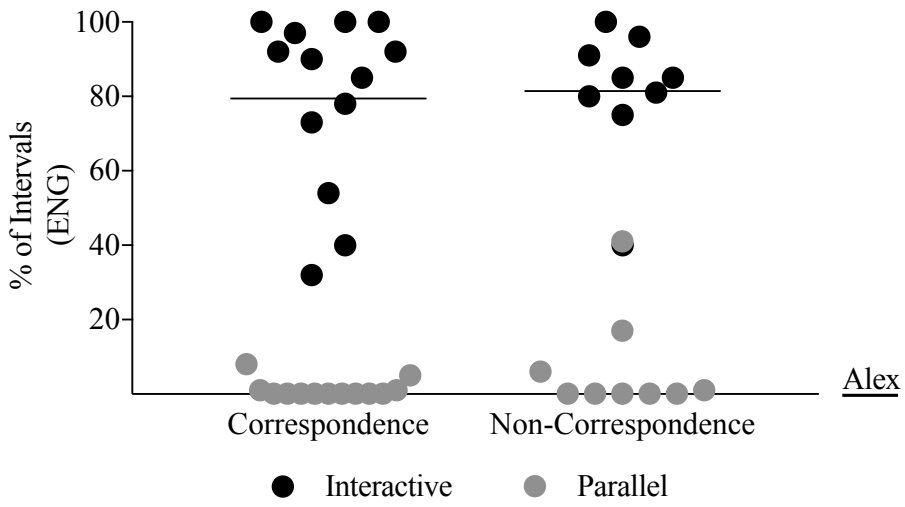

Figure 13: Distribution of interactive and parallel play of corresponding and non-corresponding reports for Alex.

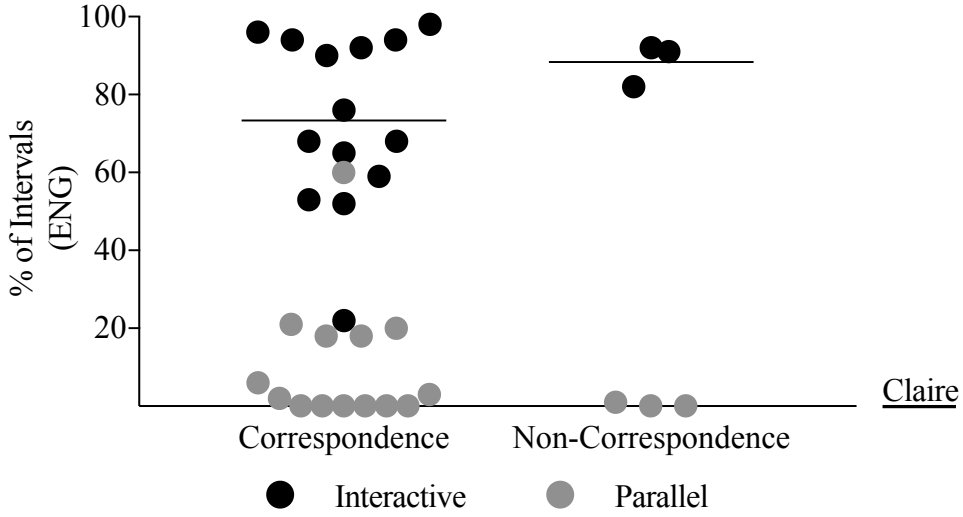

Figure 14: Distribution of interactive and parallel play of corresponding and non-corresponding reports for Claire.

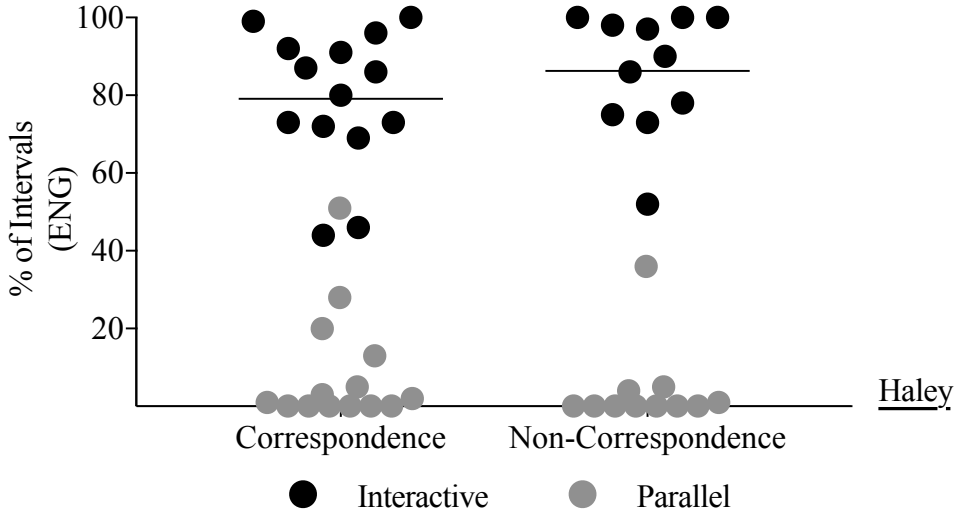

Figure 15: Distribution of interactive and parallel play of corresponding and non-corresponding reports for Haley.

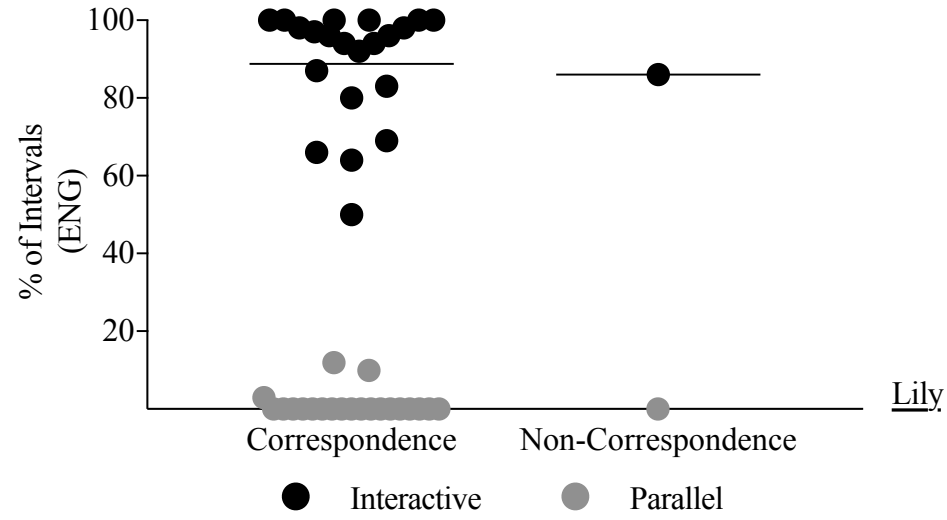

Figure 16: Distribution of interactive and parallel play of corresponding and non-corresponding reports for Lily.

APPENDIX C: THE EFFECT OF PEER PRSENCE ON MODERATE-TO-VIGOROUS PHYSICAL ACTIVITY: FULL REVIEW

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization [WHO], 2016) and is correlated with various health benefits such as reduced risks of obesity, high blood pressure, and certain types of cancers (Baranowski et al., 1992). Moreover, research has shown that engaging in physical activity can increase an individual's life expectancy beyond age 40 (Moore et al., 2012). On the other hand, physical inactivity (sedentary behavior, e.g., sitting, lying down) is associated with increased risk of health problems such as cardiovascular diseases (Katzmarzyk, Church, Craig, & Bouchard, 2009). To prevent future health problems in children, major health organizations such as the Centers for Disease Control and Prevention (CDC; 2016) recommend that children engage in aerobic, muscle strengthening, and bone strengthening exercises on a daily basis, including 60 min of moderate-to-vigorous physical activities (MVPA). Unfortunately, most children in the United States do not meet this guideline (Toriano et al., 2008).

To reduce sedentary behaviors, researchers attempt to identify environmental variables that increase physical activity. For example, physical activity exhibited by children can be influenced by environmental variables such as outdoor contexts (Hustyi, Normand, Larson, & Morley, 2012), adult attention (Larson, Normand, Morley, & Miller, 2013), interactive play with adults (Larson, Normand, Morley, & Miller, 2014), and the presence of peers (Barkley et al., 2014). Although adult-delivered attention and interactive play have been shown to increase physical activity with children, a major limitation of those interventions is that they typically involve one-to-one interaction between the child and the adult. In settings such as schools,

adults may not be able to provide a child with one-to-one attention or interactive play because of the number of children they must supervise at one time, or because of competing obligations.

Fortunately, various settings, such as schools and parks, do allow children to interact with their peers, which have also been shown to influence physical activity. For example, Barkley et al. (2014) assessed physical activity exhibited by two children when they were playing alone and when they were playing with a peer. The researchers found that both children were more active in the peer condition when compared to the solitary condition. Savley et al. (2008) examined the influence of peer presence on children's physical activity. Their results indicated that children were more active when peers were present than when they were alone. It is important to note, however, that although a correlational relationship was identified between peer presence and participants' physical activity, a functional relationship was not identified. This is problematic because peer presence cannot be said to have caused the increase in physical activity. Therefore, future research should attempt to experimentally investigate the ways that peers might influence the physical activity of other children.

Functional Behavior Assessment

Functional behavior assessments (FBAs) are designed to identify relationships between specific environmental variables and target behaviors. FBAs are important because when a relationship between an environmental variable and behavior is identified, researchers can alter that relationship to change behavior (Cooper, Heron, & Heward, 2006, p. 502). Some FBAs are used to identify correlational relationships between an environmental event and a specific behavior, while others are used to identify a functional relationship between specific environmental events and behavior (Hanley, Iwata, & McCord, 2003; Schlinger & Normand,

2013). The three most commonly used FBAs are indirect assessments, descriptive assessments, and functional analysis, with each having certain strengths and limitations.

Indirect Assessments. Indirect assessments are "indirect" because the assessment does not involve observing the behavior of interest and instead involves obtaining proxy reports from individuals (e.g., teachers, parents, caregivers) who are familiar with the person's behaviors (Cooper et al., 2006, p. 509). Indirect assessments are typically administered to informants in the form of structured interviews, checklists, rating scales, or questionnaires. Indirect assessments are beneficial in they are convenient, time efficient, require little training, and can provide information about the effects of potential environmental variables on behaviors. However, the data can be biased or inaccurate, as reports are largely based on informant recollections and interpretations of behavior (Cooper et al., 2006, p. 510).

Descriptive Assessments. Descriptive assessments permit a relatively accurate depiction of the association between environmental events and behavior, as this method involves directly observing the behavior of interest as it occurs in some environment. There are three ways in which descriptive assessments are commonly conducted: scatterplots, antecedent-behavior-consequence (ABC) narrative recording, and ABC continuous recording.

Scatterplots are used to identify the extent to which the behavior of interest occurs at a particular time more than at other times (Touchette, MacDonald, & Langer, 1985). This method involves dividing the days into blocks and observing the behavior over a period of days. The data are then analyzed to determine if there are any temporal patterns in the occurrence of behavior. A primary benefit of scatterplots is their ability to identify periods in which the target behavior is most likely to occur, which enables researchers to save time by focusing only on those times during which behavior is likely to occur. However, a major limitation of scatterplots

is that it fails to identify possible antecedents and consequences correlated with behaviors and can involve the recording of behavior over prolonged periods of time before any patterns emerge, if they emerge at all (Kahng et al., 1998).

Alternatively, the ABC discontinuous recording method involves collecting data during periods in which problem behavior is occurring. The method involves recording what happened before the behavior, sometimes what happened during the behavior, and what happened after the behavior. Once potential antecedent and consequent variables are identified, these variables can be manipulated to determine if they are functionally related. Because data are collected only when the behavior of interest occurs, the ABC narrative recording method can be less time-consuming than some other methods. However, one major limitation of the method is that the relationships that are identified can be false positives. That is, the method only involves collecting antecedent and consequent data when the target behavior occurs and therefore does not show whether or not these specific events also occur in the absence of the target behavior. A second limitation of the narrative method is that data can be inaccurate meaning that because environmental events may occur in close proximity to one another, it may be difficult to precisely pinpoint the environmental event that precedes the target behavior.

The ABC continuous recording method is similar to the discontinuous method in that the observer records environmental events that accompany the behavior of interest. However, the continuous recording method differs in that environmental events and target behaviors are observed during a period of time in the individual's natural routine. The primary benefit of the ABC continuous recording method is that it enables researchers and practitioners to identify a correlational relationship between an environmental variable and a behavior, does not require interruption of the individual's normal routine, and can provide useful information in subsequent

analyses (e.g., functional analysis; Cooper, et al., 2006, p. 508). For example, in a study conducted by Bijou, Peterson, and Ault (1968), the authors described a descriptive analysis procedure that included a detailed recording of the antecedents, behaviors, and consequences related to a specific behavior of an individual. The authors were able to identify a relationship between the participant's behavior, his teacher, and his peers. Although a relationship was identified, one limitation of the ABC continuous recording method, and of descriptive assessments in general, is that without directly manipulating the relevant environmental variables, only correlational relationships was identified.

With regard to physical activity, Brown et al. (2006) reported a descriptive analysis of physical activity using the Observational System for Recording Physical Activity in Children, Preschool Version (OSRAC-P). The OSRAC-P requires researchers to directly observe and record the intensity level (e.g., stationary, moderate) and the topography (e.g., running, walking, sitting) of a child's physical activity along with any social and nonsocial contextual information (e.g., group compositions, environmental contexts). The OSRAC-P consists of five intensity levels of physical activity: 1) stationary or motionless (e.g., sleeping, standing); 2) stationary with limb or trunk movements (e.g. hanging off bars); 3) slow-easy movements (e.g., cycling); 4) moderate movements (e.g., walking uphill); and 5) fast movements (e.g., running). Codes 1 through 3 represents slow-to-easy movements and codes 4 and 5 represents moderate-to-vigorous physical activity (MVPA). Along with the intensity codes, the OSRAC-P allows trainers to record the environmental context (e.g., fixed equipment, sandbox) and other environmental variables (e.g., solitary, peer prompting, group adult) that are occurring simultaneously with physical activity.

Overall, Brown et al. (2006) found that children engaged in higher levels of physical activity when playing alone than when peers were present. Moreover, children engaged in higher levels of physical activity in three environmental contexts: open space, outdoor toys, and fix equipment. The OSRAC-P's ability to record the intensity level, environmental context, and other environmental variables (i.e., group compositions, teacher and peer prompting, outdoor and indoor activity contexts) that might be associated with a child's physical activity is advantageous in that it provides a more comprehensive account of physical activity. Yet, like all descriptive analyses only a correlational relationship can be identified.

Functional Analysis. In the field of applied behavior analysis, functional analysis (FA) is considered by many to be the gold standard of conducting assessments because it enables researchers to identify the reinforcing function that is maintaining the individual's behavior (Hanley, Iwata, & McCord, 2003; Schlinger & Normand, 2013). Moreover, this procedure involves the direct manipulation of relevant antecedent variables or consequent variables. Based on previous literature, FAs have been used mainly to assess problem behaviors exhibited by individuals with intellectual disabilities (Hanley et al., 2003). The most commonly assessed behaviors include SIB, aggression, and disruption (Hanley et al., 2003). More recently, Beavers, Iwata, and Lerman (2013) found that FA methods have been extended to problem behaviors associated with diagnoses such as dementia, Tourette syndrome, and schizophrenia. Additionally, FA methods have been applied to behaviors such as gagging (Najdowski, et al., 2008; as cited by Beavers et al., 2013), disrobing (Kuhn, Hardesty, & Luczynski, 2009; as cited by Hanley et al., 2003), hyperventilating (Asmus et al., 2004; as cited by Beavers et al., 2013) breath holding (Kern, Mauk, Marder, & Mace, 1995; as cited by Hanley et al., 2003), elopement, drug ingestion (Chapman, Fisher, Piazza, & Kurtz, 1993; as cited by Hanley et al., 2003), and

bizarre vocalizations (Durand & Crimmins, 1987; as cited by Hanley et al., 2003), and conducted in various settings (e.g., vocational programs, community).

Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) were among the first researchers to develop an FA methodology to identify response-reinforcer relations for problem behavior. Iwata et al. exposed participants to three experimental conditions: social disapproval, academic demand, alone, and an unstructured play condition. During the social disapproval condition, both the experimenter and the participant were placed in a room. The participant was told to go play with the toys while the experimenter did some work. Contingent on problem behavior, the experimenter would deliver attention in the form of statements of concern and disapproval (e.g., "You're going to hurt yourself."). The purpose of the social disapproval condition was to determine if behavior was maintained by positive reinforcement in the form of access to attention. During the academic demand condition, participants were presented with a task. Contingent on problem behavior, the experimenter would remove the task for approximately 30 s, then reinstate the task. The purpose of the academic demand condition was to determine if behavior was maintained by negative reinforcement in the form of escape from demands. During the alone condition, participants were placed in a room without any access to preferred tangibles and no consequences were delivered contingent on problem behavior. The purpose of the alone condition was to determine if behavior was maintained by automatic reinforcement. The unstructured play condition served as a control condition in which participant's behaviors were expected to be low as reinforcements were continuously available and no demands were present.

Overall, the results of Iwata et al. (1982/1994) indicated that six out of nine participants consistently had high levels of problem behavior when in a specific stimulus condition. Four

participants engaged in high levels of problem behavior in the alone condition, which suggested that their behavior was maintained by automatic reinforcement. On the other hand, two participants engaged in high levels of problem behaviors in the academic demand condition, which suggested that those behaviors were maintained by negative reinforcement (i.e., escape from task demands). Taken together, their results demonstrated that the function of self-injury varied both within and across participants.

In terms of physical activity, Hustyi et al. (2012) were among the first researchers to use an FA methodology to assess the effects of different environmental contexts on physical activity. The researchers experimentally manipulated activity contexts that were reported by previous researchers (i.e., Brown et al., 2006) to produce high levels of physical activity in children. Four pre-school aged children were exposed to three outdoor activity contexts: outdoor toys, fixed equipment, open space, and a control condition. During the outdoor toys condition, the experimenter guided the participant to the session area where a variety of toys were present. After, the experimenter instructed the participant to "play with the toys," then stepped away from the session area to turn on the video camera. During the fixed equipment condition, the experimenter guided the participant to the school's jungle gym that consisted of slides, monkey bars, stairs, and multiple climbing areas. Similar to the previous condition, the experimenter instructed the participant to "play on the jungle gym," stepped away from the session area, and turned on the video camera. During the open space condition, the experimenter guided the participant to an open grassy area where no toys were made present. Like the previous conditions, the experimenter instructed the participant to "play in the grass," stepped away, and turned on the video camera. During the control condition, the experimenter guided the participant to a table located near the playground. The table consisted of activities (e.g., coloring

books, blocks) meant to evoke low levels of physical activity. Overall, three of the four participants engaged in higher levels of physical activity in the fixed equipment condition when compared to the open space, outdoor toys, and control conditions. The results for one participant were undifferentiated.

Preference Assessments

For behavior to change (i.e., decrease or increase), it is critical that individuals come into contact with the reinforcement contingencies that are put in place. A reinforcer is defined as a contingent stimulus change that increases the likelihood of the occurrence of a behavior (Cooper et al., 2006, p. 702) and is an essential component to a behavior change program. The issue with using stimuli that do not function as reinforcers is that it could lead to less effective treatments. However, if stimuli in the individual's environment are accurately identified as reinforcers, the opposite effect could be achieved. Preference assessments are assessments that have been created to help researchers and practitioners identify stimuli that function as reinforcers for individuals. Over time, various preference assessments have been evaluated to determine which methods are most practical and time-efficient. The most commonly used preference assessments include indirect, single-stimulus, paired-stimulus, multiple-stimulus without replacement (MSWO), and free operant preference assessments.

Similar to indirect functional assessments (described above), indirect preference assessments involve self and proxy-reports and are typically administered in the form of interviews, surveys, checklists, or ratings. Indirect assessments are beneficial in that they are time-efficient, easily administered, and might provide useful information that could be used in more systematic preference assessments. Yet, a major limitation to self and proxy reports are

that they can be unreliable and do not always correspond to direct assessments (Cote, Thompson, Hanley, & McKerchar, 2007).

Pace, Ivancic, Edwards, Iwata, and Page (1985) established the first systematic preference assessment meant to identify potential reinforcers to be used during the intervention phase. Pace et al. (1985) used a single-stimulus presentation format to assess the preference of six individuals diagnosed with intellectual disabilities. The general methodology consisted of exposing participants to one item at a time. Preference was measured as whether or not participants approached the stimulus within 5 s of presentation. The single-stimulus presentation methodology described by Pace et al. (1985) identified high and low preferred stimuli for participants; however, one major limitation is that the procedure can produce false positive results. That is, some individuals might consistently approach all or most of the presented stimuli even if the items are not preferred.

To address the limitation of the single-stimulus preference assessment, Fisher et al. (1992) developed the paired-stimulus preference assessment that used a forced-choice presentation method. A trial would begin with the experimenter presenting two stimuli to participants and delivering the instruction to choose one stimulus. Once a stimulus is selected, access was provided for approximately 5 s while the other was removed. Overall, a total of 16 stimuli were presented in a counterbalanced fashion (i.e., each stimulus paired to each other an equal number of times). The paired-stimulus assessment identified a more distinct hierarchy of participants' preference. However, a limitation is that it is time-consuming and therefore may not be practical to implement in naturalistic settings (e.g., schools, homes).

To make preference assessments more time efficient and practical to implement in naturalistic settings, DeLeon and Iwata (1996) developed the multiple-stimulus-without-

replacement (MSWO) preference assessment that involves presenting four to five stimuli at once. Participants are instructed to select one item from the array and once a selection is made, access to the stimulus was provided for approximately 30 s while the other stimuli were removed. Prior to the next trial, the stimulus selected was removed from the array of stimuli and the remaining items that are not chosen are rotated (i.e., left stimulus moves to the right and all other stimuli are shifted until they are equally spaced) and presented again to participants. This procedure continues until all items are selected or if participants failed to respond within 30 s. Some major strengths of the MSWO preference assessment is that the procedure requires less time to conduct and produces a distinct hierarchy of participants' preference.

The free-operant preference assessment was developed to make the preference assessment more time efficient for researchers, staff, and parents to implement (Roane, Vollmer, Ringdahl, & Marcus, 1998). In a free-operant preference assessment, participants are allowed to freely interact with an array of stimuli for 5 min. Preference for a stimulus was measured by the duration in which participants spent engaging with the stimulus. No items are removed from the array of stimuli. The major benefits of the free-operant preference assessment is that the procedure required less time to implement and was associated with less problem behaviors from participants. However, the free-operant method makes it more difficult to identify a clear hierarchy of participants' preferences.

Based on the preference assessment literature, the forced-choice methods (i.e., paired stimulus and MSWO preference assessment) are the better options when one wants to identify a distinct hierarchy of more-preferred to less-preferred stimuli. As noted above, these two methods typically require participants to repeatedly choose between two or more stimuli until either all stimuli are chosen or until all items have been counterbalanced with one another. Thus,

researchers and practitioners are essentially asking children to repeatedly choose between the items that they like best. The items selected first are viewed as the more preferred items and the items selected last are viewed as the less preferred items. When choosing between edibles or tangible items, few ethical considerations come into play because the child's choice does not influence the behavior of the edible or the tangible item. However, when asking a child to choose among peers, there are ethical considerations. For example, the child's choice could influence their peers' behavior, which could potentially lead to "hurt feelings" or "lowered self-esteem" of peers. That is, the peer chosen first will be viewed as the most preferred peer and the peer chosen last will be viewed as the least preferred peer. This could influence the behaviors of peers that are chosen last in that they are now considered to be the least preferred peers. Moreover, the behavior of the child that is choosing could also be affected as the child might have never thought about choosing between which peer they liked best, but if they were placed in a situation where they had to choose; the repeated pairing between the child's private talk and selection of peers could potentially lead to a learning history of "I chose these peers first, so I must like them more." Because of this, indirect preference assessments may be a better alternative when identifying potential preferred peers, especially with young children.

Additionally, many studies have used indirect preference assessments to identify potential preferred peers. For example, in a longitudinal study conducted by Dodge et al. (2003), the authors asked 1,259 kindergarten children to rate how much they "liked" a classmate using a 5-point Likert-type scale. Participants were then instructed to name three peers that they liked and three peers that they did not like, after which the ratings were used to determine the extent to which peers were rejected (i.e., identified as not preferred) by their classmates. Beginning from kindergarten to first grade, participants' teachers were also instructed to report on participants'

aggression by completing a checklist. These reports from participants and teachers were used to indicate whether or not peer rejection predicted aggression in students by comparing the relationship between the measures of peer rejection with independent measures of student aggression. In a study using similar methods, Martin-Anton, Monja, Garcia Bacete, and Jimeniz-Largares (2016) asked first-grade students to identify which classmates they "liked best" and which classmates they "liked least." Participants' teachers were instructed to report on participants' levels of problem behaviors and the context in which they occur in by completing two questionnaires. Self-reports from participants were used to identify "rejected peers" (i.e., identified as less preferred) and self-reports from teachers were used to identify the contexts in which rejected peers might experience the most difficulty. In yet another study using self-report methods, Stormshak et al. (1999) used interviews to assess peer preference. First-grade students were instructed to name peers they liked and peers they disliked. Participants' teachers were instructed to rate participants' behaviors in the classroom. Two behavioral models (i.e., person-group similarity model and social skill model) were used to identify whether peer preference were associated with student problem behaviors in the classroom.

In terms of physical activity, Barkley et al. (2014) utilized an indirect preference assessment (i.e., self-report) to identify participants' preferred peers. Participants were asked to identify a peer that was a "friend." To corroborate participants' reports, the peer had to also identify the participant as a friend. During the experimental condition, participants were exposed to the identified prefer peer. Overall, results from this study indicated that participants engaged in higher levels of PA when the identified prefer peer was present. Although a major limitation of these types of assessments is that the reports may not be reliable (as described above). Given these studies, indirect assessments allow researchers and practitioners to bypass asking children

to repeatedly choose between the peers they like best and least. This helps researchers avoid the ethical concerns described above.

Preference for Peers

Peers have been shown to influence behaviors such as task engagement (Egel, Richman, & Koegel, 1981), food consumption (Greer, Dorow, Williams, McCorkle, & Asnes, 1991), and problem behavior (Solomon & Wahler, 1973). With mixed results, several studies have also examined the influence of peers on physical activity (Barkley et al., 2014; Brown et al., 2006; Larson, Normand, Morley, & Hustyi, 2014; Savly et al., 2008; Salvy et al., 2009). For instance, Zerger, Miller, Valbuena, and Miltenberger (2017) evaluated the effects of pairing an active peer with a less active peer and providing feedback on children's step counts. Participants were 16 children, ranging from 9 to 12 years old. The authors used a reversal design to expose participants to baseline and intervention conditions. During baseline, participants were instructed to wear sealed pedometers during their recess period. After the baseline phase, each participant's step counts were averaged and ranked from 1 to 16, with 1 representing the child producing the lowest mean step count and 16 representing the child producing the highest mean step count. During the intervention phase, participants were organized into teams in which children with lower step counts were paired with children with higher step counts (e.g., Participant 1 paired with Participant 16). Participants were then informed that they were competing against the other teams and that they could look at their pedometers and their team member's pedometers during recess. Moreover, participants were told that they could encourage one another to obtain higher step count. Prior to the start of each session, feedback about how each team was doing was shown to the class with a bar graph that ranked each team from the highest to the lowest step count.

Overall, the results of Zerger et al. (2017) indicated that student pairing and feedback increased children's levels of physical activity. Moreover, the study demonstrated that peer presence might play a role in children's levels of physical activity. That is, by pairing participants into teams, the verbal behavior (e.g., reminding team member to take more steps) of one team member could have influenced the behavior of the other team member. Additionally, the visual feedback on all of the team's step count could have served as a motivating operation for the teams with the lower step counts to obtain more steps. However, these potential effects were not systematically evaluated.

In a separate study conducted by Larson et al. (2014), the authors replicated and extended Hustyi et al. (2012; described above) study to different group compositions. Eight preschool-aged children were systematically exposed to the same test conditions (i.e., outdoor toys, fixed equipment, and open space) and control condition described by Hustyi et al. (2012), but in conjunction with three different group compositions: solitary, one-peer present, and group arrangement. In the solitary condition, participants were exposed to all conditions with only the experimenter present. In the one-peer condition, the participant and peer were exposed to all conditions. In the group condition, two to three peers along with the participant were exposed to all four conditions. Results indicated that during the solitary condition, five out of eight participants' MVPA were highest during the fixed equipment condition, two participants engaged in higher levels of MVPA when one peer was present, and six participants engaged in higher levels of MVPA when two to three peers were present. Overall, the authors were able to replicate Hustyi et al.'s (2012) methodology and extend the findings to different group compositions. Moreover, the results suggested that group compositions might have influenced children's MVPA because of the differences in responding in each group. However, a limitation

of the study was that group compositions were not experimentally manipulated, thus the extent to which group composition influenced children's MVPA is unknown.

In a subsequent study, Livingston (2014) replicated and extended Larson et al.'s (2014) study by experimentally manipulating group compositions. Participants were five children between the ages of 4 and 5. The author used a combined multielement and reversal design (i.e., ABACADA) to expose participants to a baseline and three outdoor activity context phases (i.e., open space, outdoor toys, fixed equipment). Group and solitary conditions were alternated within each phase. During the baseline phase of the group and solitary conditions, participants were exposed to all three outdoor activity contexts (i.e., fixed equipment, outdoor toys, and open space). Participants were guided to the session area where they were instructed by an experimenter to "play on the playground" and no programmed consequences were delivered. Similar to the baseline phase, in the solitary condition participants were exposed to the same outdoor activity contexts. Participants were led to the session area where they were instructed by an experimenter to "play on the playground." Again, no programmed consequences were delivered. The group condition was similar to the solitary condition but differed in that one to four peers were present and the prompt to "play on the playground" was directed towards the group (i.e., peers and participant).

Overall, the results of Livingston (2014) indicated that there were no differences in the amount of MVPA observed between the group and solitary conditions. These results differed from Larson et al. (2014) in that participants' MVPA were undifferentiated across solitary and group conditions. This could be because participants' preferences for the peers in the group arrangements were not identified. That is, the peers present might have not been those with which participants typically interacted during school recess, and this might have influenced

participants' MVPA. Hence, the influence of the presence of peers identified as preferred on preschool children's MVPA remains unknown and is a variable that warrants further attention.

The purpose of the proposed study is to evaluate the effects of peer presence on the MVPA exhibited by kindergarten children by exposing participants to peers identified as preferred. Previous research has shown that peer presence might influence MVPA (e.g., Larson et al., 2014; Barkley et al., 2014), and one study was able to experimentally evaluate peer presence but failed to address the influence of the presence of peers identified as preferred on MVPA (Livingston, 2014). The present study will expose participants to a peer identified as prefer and record the associated levels of MVPA exhibited by a focal child.

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