The Effects of Integrating Children From Lower And Upper Primary School Years During Lunch Times On Physical Activity And Social Behavior

Tracey J. Devonport
University of Wolverhampton

Emma Powell
Newman University

Alan Nevill
University of Wolverhampton

Abbe Brady
St. Mary's University

The present study examined physical activity (PA) and play behaviors of primary school children (N = 210) during segregated and mixed age group play. We hypothesised that providing more choice regarding who to play with would (1) increase PA and (2) reduce anti-social behaviors among children. In a mixed-method design, lunch time observations were recorded using the System for Observing Children's Activity and Relationships during Play (SOCARP, Ridgers et al., 2010). These were completed whilst children were physically separated by lower (hereafter referred to as key-stage-one: four-seven years of age) and upper (hereafter referred to as key-stage-two: eight-11 years of age) primary year play, and following integrated age group play. Two playground supervisors and the head teacher were interviewed to ascertain perceptions of behavior under the two conditions. Observational results indicated moderate-to-vigorous PA (MVPA) increased significantly for mixed play. Significant reductions in anti-social physical behaviors were also observed post-integration. Qualitative results indicate playground supervisors and the head teacher perceived increased post-integration PA to improve post lunch break classroom behavior and reduce anti-social physical and verbal behaviors. Findings illustrate the benefits of mixed age group play for increased physical activity and pro-social behaviors.

Address correspondence to: Tracey Devonport, Institute of Human Sciences, Faculty of Health, Education and Wellbeing, University of Wolverhampton, Gorway Road, Walsall, WS1 3BD, UK. Email: T.Devonport@wlv.ac.uk; @TjDevonport; Telephone +441902323113

Within a school environment, recess and lunch periods allow children time to detach themselves from work in the classrooms (Pellegrini & Blatchford, 2004), and present an ideal time for children to become active (Parrish et al., 2013; Powell et al., 2018). During break periods children engage in play, typically defined as a self-chosen activity that is engaging, satisfying and undertaken for its own sake, rather than being a means to an end (Woods & Bond, 2018). As play commonly involves physical activities such as skipping, jumping, climbing, running and even exaggerated movements through role-play (Pellegrini & Smith, 1998), children subconsciously gain health benefits through play. For this reason, within the primary school setting, recess times have been identified as a key part of the school day in which children's PA can be promoted (Ridgers et al., 2007; Tercedor, 2017). Indeed, recess PA has been reported to contribute up to 40% of children's recommended daily PA (Ridgers et al., 2006), with a recent study indicating that children spent 12.3% of recess time, and 4.5% of lunch break time in MVPA (Gao et al., 2017). Ridgers et al. (2006) argue this is important as children outside of school could face barriers which may prevent them from partaking in sufficient PA. Indeed, UK Chief Medical Officers physical activity guidelines (Department of Health and Social Care, 2019) state that children and young people (5 to 18 years) should accrue at least 60 minutes of daily moderate to vigorous physical activity (MVPA) to gain health benefits. Whist school environments, and in particular schoolyards during recess (Dobbins et al., 2013), have long been recognized as an effective setting for PA initiatives, PA behavior during recess can vary widely. This can be dependent on schoolyard space (Pawlowski et al., 2014) facilities (Nielsen et al., 2012) and social grouping (Fairclough et al., 2012). Social groupings are social factors that can influence participation in physical activity and include children's age, gender, and friendship groups. When looking to increase children's MVPA, guidelines for PA interventions produced by the UK's National Institute for Health and Clinical Excellence (NICE) advocate the need to consider environmental, social, community, and individual factors (NICE, 2014). The present study examines the influence of social groupings on PA and play behavior through observations of play during segregated and mixed age group play. This offers a contribution to existing literature as few studies have considered social factors influencing PA during school breaks. The findings may be used to inform recommendations for encouraging and maximizing mixed age group play.

Play as a phenomenon evolves as children grow up, this is due to maturation, the discovery of new things, and associations with new friendship groups (Bredikyt et al., 2015). However, play remains something all children have in common; and as such, integrated key stage play presents opportunities for children to share experiences together and build relationships (Thomas & Pring, 2004). In the UK, children progress through primary education

in two recognized key-stages; key-stage-one (KS1: lower primary: four-seven years of age) and key-stage-two (KS2: upper primary: eight-11 years of age). Because play is self-initiated and driven by a child's interests (Trawick-Smith, 2006), increasing options of who to play with via integrated key stage play may motivate children to interact with their environment in different ways. Gray (2011) undertook a review of research on age-mixed play, including his own research conducted in a school where students from ages four to eighteen mixed freely. Gray (2011) concluded that when children are not segregated by age, all children benefit. Younger children learn more from older playmates than they could from playing with only their peers as older children act as role models for more sophisticated behaviors. Even when younger children are not directly playing with older children in age-mixed play environments, they learn by observing and listening to older children. Older children also provide more emotional support than the young child's age group peers could. Older children derive benefits from integrated play by having more opportunities to learn by teaching and practicing nurturance and leadership; often being inspired by the imagination and creativity of their younger playmates. For example, older children may instruct younger children about appropriate ways to behave toward their peers and still younger children (Gray, 2011). Such acts represent prosocial verbal and physical behaviors (e.g., helping, sharing, and co-operating) that may be captured using SOCARP (Ridgers et al., 2010). An outcome of increased prosocial behavior may be reduced anti-social physical and verbal behaviors observed using SOCARP as 'verbal conflict' (where a target for observation confronts or insults another individual through verbal communication) and 'physical conflict' (this is when the observed child touches another person in a violent manner, such as kicking or punching).

It is worth noting research indicating that during age-mixed play older children and boys can dominate play spaces (Blatchford, Baines, & Pellegrini, 2003; Pellegrini, & Blatchford, 2004). In particular, soccer has been found to be problematic with boys often playing and dominating soccer, and thus available playground space (Swain, 2000; Thomson, 2005). This can lead to the marginalization of (the majority of) girls to small groups situated on the periphery of the playground resulting in discontent (Swain, 2000). Knowles, Parnell, Stratton, and Ridgers (2013) recommended that schools could improve recess play satisfaction by organising separate areas for dominant activities to allow children to enjoy recess.

In summary, research suggests that integrated play increases play options, produces more sophisticated and imaginative play behaviors, and provides opportunities to practice leadership. We argue that these outcomes increase pro-social play behaviors and MVPA during play. This study examined the physical activity and play behaviors of primary school children during segregated and mixed key stage play. The first author was given the opportunity to work with the focal school in establishing a natural experiment. At the focal school,

play had historically been physically segregated by key-stage one and key-stage two. The school had expressed an intent to move to integrated key-stage play, and so by introducing experimental control, the present study allowed examination of the hypothesise that providing more choice regarding who to play with via integrated play will (1) result in increased MVPA and (2) reduce anti-social behaviors among children.

Methods

Participants

The focal primary school head teacher provided consent for observations to take place over the duration of the study. Parents were made aware of the study via a parent newsletter, were provided opportunity to ask questions at a meet-the-head teacher coffee morning and could opt-out consent for participation at any time (no such requests were received). The school was located just outside a city centre in the South-West of England, and at the time of study accommodated 210 pupils (100 females and 110 males).

In accordance with legal requirements, children in foster care (n = 9) were removed from the list of eligible observation targets. The remaining pupils were split into four categories determined by age (i.e., KS1 (four-seven years) and KS2 (eight-11 years)) and gender (i.e., male and female). Twelve female targets for KS1 and 13 targets for KS2 were randomly selected for observation from the participant pool. Thirteen male targets for KS1 and 12 targets for KS2 were randomly selected for observation. The same children were observed pre and post-KS integration during lunch time play. Of the selected children, four male and female targets per KS were randomly identified for follow up observations. In preparing for the possibility that selected participants may not attend school on the day of observations, or be unavailable for outside play, reserve children were identified in advance for observation should the need arise. However, at no point was there a need to use these reserve participants.

Setting

The school had a substantive outdoor area comprised of a KS1 tarmac play area (1,053m^2), a KS2 tarmac play area (852m^2), each with an adjacent field (KS1 field = 4186m^2; KS2 field = 6,350m^2) providing a combined play area of 12,441m^2 (KS1, KS2, and school fields). Physical segregation of play by KS was enabled by allocating one tarmac play space and adjoining field to KS1 and KS2. The KS1 school building presented a physical barrier between the KS1 and KS2 play areas making the two areas distinct. A path running along the outside of this KS1 building connected the two play areas and offered the means

by which children moved between the two areas post-integration. Segregation was maintained by two playtime supervisors controlling movement along this path. Located alongside the KS1 and KS2 play areas were wooden trim trails (a series of climbing and balancing installations). There was a wooden covered quiet area in the KS1 and KS2 tarmac play areas, hopscotch markings painted onto the KS1 tarmac and a netball court painted onto the KS2 tarmac. A range of portable equipment was available to children in both tarmac play areas including mini tennis racquets and balls, hula hoops, bean bags, and agility ladders.

Observations took place over lunch time, which for all children was 60 minutes in duration. KS1 pupils began their lunch break at 12.45, whilst KS2 pupils started their lunch break at 13.00. For all children, their lunch break began in the dining hall with a meal, followed by outdoor play. As children took 15-20 minutes to eat, the busiest outdoor playtime period was between 13.20 to 13.45, the latter being the point at which KS1 children were brought back into class.

Instruments

System for observing children's activity and relationships during play (SOCARP)

SOCARP is an observational system designed to collect data in a playground setting (see Ridgers et al., 2010). The validity of SOCARP as an observational tool has been demonstrated using uni-axial accelerometry (Ridgers et al., 2010), presenting a commonly used means of observation (Massey et al., 2018). The SOCARP tool collects data across the following four categories: 'activity level', 'group size', 'activity type' and 'social interactions'. In an illustrative example, the activity level of children is rated on a scale of 1-5. The lowest category, number one, reflects a child lying down, two is where a child is sitting, three is standing but not moving, four is walking, and five is vigorous (i.e., running). The activity level of the observed child is coded according to the behavior displayed on the 10th second of the record period. Using this tool, each child was observed for one 10-minute observation period, whereby the child's behavior was observed for a 10-second period, followed by 10-seconds of recording time. To maintain consistency, a timing device connected to headphones beeped every ten seconds so observers were aware of when to observe and record.

In striving for reliability, four researchers underwent SOCARP training which included: memorizing the SOCARP categories and codes, 15-hours of practice using video recordings and field-based practice. Inter-rater reliability was established prior to data collection, with scores exceeding the recommended 80% for all four categories; activity level - 84.2%, group size - 95.1%, activity type - 93.7%, and social interactions – 86.7% (Powell et al., 2015).

Semi-Structured Interviews

Semi-structured interviews with two playground supervisors (PS1; PS2) and the head teacher were undertaken after all observations had concluded. Questions were designed to enable a deeper understanding of play behaviors under both conditions. For example, 'If you were to compare separate and integrated key-stage play, what, if any differences have you noted?', 'Have you observed any changes in the physical activity levels of children pre and post integration?', and 'Have you noted any differences in the behavior of children pre and post integration?'. Following consent, interviews were recorded and transcribed verbatim (Gratton & Jones, 2010). Interviews were undertaken in a private room on the school premises and lasted 20 to 40 minutes.

Procedure

Ethical approval for the present study was provided by the University of [omitted] ethics committee. All four trained observers attended the school during lunch breaks for two-weeks in advance of data collection. This was to de-sensitise children to their presence, determine the best positions to make play observations from, and rehearse live data collection. During pre-integration observations, one observer was positioned on the KS1 tarmac play area, with a second observer on the KS2 tarmac play area. The observation points for both KS play areas allowed an open view of the school fields. During post-integration observations, observers migrated between play areas as determined by the activities of their observation target. When observing children, observers sought to be as inconspicuous as possible to minimise interference with children's interactions (Briesch et al., 2018). All observations were undertaken between 13.00 and 13.45pm, the time when all children were able to play outside.

Observations were first undertaken during segregated KS play conditions between 1st – 12th February 2016. Each KS had their own playground, and were prohibited from mixing (i.e., physically prevented from migrating to each other's playgrounds). Fifty observations took place across KS1 and KS2 playgrounds on the 25 predetermined male and 25 predetermined female targets. Following these observations, integrated KS play was introduced whereby children could physically move between each other's playgrounds and therefore mixed key-stage play could occur. Observations were not undertaken during the first week of the integrated play, as the children may have acted irregularly due to novelty and uncertainties (Morrow, 1990). Fifty observations of integrated KS play were completed between 22nd February to 7th March across the same 25 males and 25 females.

Mixed key stage play continued and 16 follow up observations (4 male and female targets per KS) were undertaken from the 18th to 20th of May. Follow-up observations were

delimited by the headteacher as pupils in the final year of KS1 and KS2 were about to undertake Scholastic Assessment Tests (SATS). Observations ceased in advance of these tests, to ensure the research did not intrude on this important examination period. Weather conditions were average for the time of year (sunny, around 14-16 degrees with a slight breeze – recorded using UK met office data: https://www.metoffice.gov.uk/).

Quantitative Analysis of Data

The SOCARP tool collects data using systematic observation across the four categories of 'activity level', 'group size', 'activity type' and 'social interactions'. Essentially the data is ordinal; however, it has been treated as interval data due to the time sampling periods of 10 seconds observe followed by 10 second record. The frequencies of the recorded intervals were then calculated and converted to percentages, so for example, the percentage of time observed undertaking MVPA. In accordance with SOCARP's validation study (Ridgers et al., 2010), sedentary behavior was defined by combining the lying, sitting and standing activity codes; MVPA was calculated through the sum of the walking and vigorous categories.

Descriptive statistics were applied to explore the data, and because ANOVA's failed to meet tests of normality (Kolmogorov-Smirnov; Shapiro-Wilk), we performed equivalent non-parametric tests. These were undertaken to examine the outcome variables of activity level, group size, activity type and social interactions by sex and by time (pre-integration, post-integration and follow-up observation).

Qualitative Analysis of Data

To enhance trustworthiness of the data, during interviews the interviewer asked descriptive open-ended questions, which followed the participants' dialogue, and used active listening to facilitate rapport and trust (Uphill & Jones, 2007). Questions focussed on the collection of detailed, reflective, first-person accounts from participants regarding their observations of playground activity and behaviors pre and post-integration.

Braun and Clarke's (2006) method of thematic analysis was utilized to identify, organise, evaluate, and report data trends relative to the research questions. Thematic analysis is adaptable and flexible allowing the researchers to utilize a deductive and constructionist position (Clarke & Braun, 2013). The coding process was deductive in the sense that authors used the SOCARP categories to present four themes of 'activity level', 'group size', 'activity type', and 'social interactions' (Ridgers et al., 2010). In analysing data, the authors familiarized themselves with the data by reading and re-reading the transcripts identifying illustrative quotes that reflected each of the four deductive themes. After independently coding the data by hand, to further enhance trustworthiness, discussions took place between the first

and last author with the intent of acting as critical friends, who's role was 'not to "agree" or achieve consensus but rather to encourage reflexivity by challenging each other's construction of knowledge' (Cowan & Taylor, 2016, p. 508). This helped to construct interpretations of the data that were accepted as plausible despite possible agreements and disagreements (Smith & McGannon, 2017). The coding process was constructionist as we did not seek to focus on individual ideologies, but instead sought to illustrate the general context of the focal primary school (Braun & Clarke, 2006).

Qualitative and quantitative data were triangulated enabling an examination of consistencies and inconsistencies across data sources. The combination of findings from two or more rigorous approaches provides a more comprehensive overview of the phenomenon under investigation than either approach could do alone (Tashakkori & Teddle, 2003). This allowed a more comprehensive understanding of the influence of integrated play on PA and play behaviors (Carter et al., 2014).

Results

Quantitative Results

Descriptive statistics for observations undertaken at pre-integration, post-integration and follow up are presented in Table 1.

Descriptive data illustrated a trend whereby the percentage of time spent lying, sitting and standing (sedentary behavior) reduced post-integration and remained lower than pre-integration observations at follow-up observations. Conversely, the percentage of time spent walking and being very active increased post-integration. Complementing these findings, less sedentary play was observed post-integration with the percentage of time spent in locomotive play increasing.

Data for group size of children playing together revealed a trend towards reduced large group play (ten or more children) and increased medium (5-9 children) and small group (2-4 children) play post-integration. Finally, a reduction in anti-social behaviors (physical, verbal and ignoring) was observed and maintained post-integration with a corresponding increase in prosocial verbal and physical behaviors.

In undertaking further analysis, only findings of statistical significance are reported (no significant differences found in activity type (nature of playground activity e.g., active games, sedentary activities) and prosocial behavior). Kruskal-Wallis results revealed that MVPA (combined walking and vigorous activity) increased significantly over time following integration of KS1 and KS2 ($c^2 = 13.7$ (df = 2); $p = .001$), effects that were maintained over time (see Table 1). Medians for pre, post and re-test were 70%, 80% and 80% respectively.

Table 1: Descriptive Statistics for SOCARP Observations

	Pre-integration			Post-integration			Follow-up observation		
	Number of observations	Mean (% Time)	Std. Deviation	Number of observations	Mean (% Time)	Std. Deviation	Number of observations	Mean (% Time)	Std. Deviation
Lying	50	.33	1.21	50	.27	1.48	16	.21	.83
Sitting	50	7.93	17.44	50	5.33	10.39	16	6.04	9.37
Standing	50	27.26	18.20	50	17.00	14.56	16	17.08	9.65
Walking	50	47.67	19.39	50	56.33	21.29	16	57.50	17.83
Very active	50	16.80	11.59	50	21.07	15.38	16	19.17	15.99
Sedentary	50	35.53	21.36	50	22.60	17.65	16	23.33	14.25
MVPA	50	64.47	21.36	50	77.40	17.65	16	76.67	14.25
Alone	50	17.33	19.73	50	18.07	21.56	16	17.08	15.39
Small group	50	57.60	28.09	50	61.53	25.75	16	57.92	22.70
Medium group	50	16.87	21.04	50	14.07	16.62	16	23.33	24.10
Large group	50	8.20	18.46	50	6.33	14.60	16	1.67	2.98
All group play	50	82.67	19.73	50	81.93	21.56	16	82.92	15.39
Playground Games	50	36.47	30.46	50	48.87	27.93	16	32.08	21.43
Sedentary activities	50	19.00	16.91	50	14.73	14.24	16	13.75	7.49
Locomotion	50	30.73	21.77	50	30.67	20.72	16	42.71	20.95
Prosocial physical	50	15.50	12.82	50	15.48	13.21	16	22.96	14.84
Prosocial verbal	50	77.79	15.83	50	81.53	15.22	16	73.35	13.08
Antisocial physical	50	3.58	5.22	50	1.83	4.58	16	1.02	2.08
Antisocial verbal	50	2.97	5.96	50	.88	2.68	16	2.67	6.96
Antisocial ignore	50	.17	.83	50	.28	1.43	16	.00	.00

Time (%) spent engaging in MVPA increased from 64.4% at baseline, to 77.4% post-integration and 76.7% at follow up observation. Thus, an evidenced increase in MVPA was maintained at follow up observation.

Sedentary behavior (combined lying, sitting and standing activity) decreased significantly over time ($c^2 = 13.7$ (df = 2); p = .001), effects that once again were maintained over time. Medians for pre, post and re-test were 30%, 20% and 20% respectively. Time (%) spent in sedentary behavior decreased from 35.5% at baseline, to 22.6% post-integration and 23.3% at follow up observation point. In view of these findings, we accept the hypothesis that integrated KS play would increase children's MVPA during lunch times.

The time (%) spent exhibiting anti-social physical behaviors (when the observed child touches another person in an aggressive manner, such as kicking or punching) for boys (Median = 3.33%) was significantly greater than for girls (Median = 0.96%) (Mann-Whitney U test; U = 1327, p = .017). Kruskal-Wallis tests revealed a significant difference over time ($c^2 = 7.5$ (df = 2); p = .024) in anti-social physical behaviors following KS integration. Time (%) spent in anti-social physical behaviors decreased from 3.58% at baseline, to 1.83% post-integration, and 1.02% at follow up observation. Thus, we accept the hypothesis that integrated KS play would reduce anti-social behaviors.

A Mann-Whitney U test of group size (% of time spent in group play - combining small, medium and large group play activity) by gender revealed a significant difference (U = 1240, p = .014). Medians for the percentage of time spent in group play for boys and girls respectively were 53.3% and 70% for small group play, 3.4% and 10% for medium group play, with no observations of large group play. When testing for difference in the percentage of time in group play over time (pre, post and re-test), the Kruskal-Wallis test revealed no significant difference ($c^2 = .31$ (df = 2); p > .05).

Qualitative Results

Activity Level

Qualitative data are congruent with quantitative data in that MVPA was perceived by interviewees as increasing, with sedentary behavior decreasing post KS integration.

> *"I didn't think it would be that much different, but everyone is together and seem to be in one of the main playgrounds and where the field is, and erm I just think they seem a lot more active"* (Playground supervisor one: PS1).

Playground supervisor two (PS2) believed that an increase in MVPA was particularly evident among the older KS2 girls:

> *"Definitely I would say they were on the go a lot more at lunchtime… before the year six girls especially, the number of times you would find them just sat in that quiet area on the benches chatting, it was like go and play, go and do something, go and get yourself moving… whereas now they love having the younger ones and I think they have been more active just by having a different choice."*

Group Size

Interviewees did not perceive changes to the size of groups children elected to play with, however, they all felt that children had more options for play thus reducing solitary play.

"Some of the children that don't normally like to join in with anything have joined in by having the choice of going with the younger ones, or with the older ones. That's what I've noticed anyway." (PS2).

Activity Type

As illustrated by the head teacher, interviewees perceived children as having more options for what they might be able to play, with whom, and where:

> *"They've got more people to play with and they've got more activities because they have twice the amount of space therefore there are more activities on the go, I wonder then if you just meet more needs that way. Socially and with what interests them in terms of physical activity."*

Playground supervisors perceived boys to be more inclined to partake in organised sport (particularly football) whilst girls were described as leaning more towards imaginative and maternal play both pre- and post-integration. Though as the head teacher observed, post-integration, children partook in a broader range of activity types that defied such stereotypes;

> *"I was pleased to see the boys interacting with younger children. I guess there was a stereotype around that, still, the girls would be the ones who would want to be playing with, or helping out the younger children, but actually you do see a lot of the boys with the younger children."*

Social Interactions

Interviewees all perceived reduced physical and verbal conflict following integrated play noting that this positively influenced classroom management and learning. PS1 reflected:

> *"It has come from all the staff that have fed back to me, there's a lot less arguments between the children, ummm we are actually finding the older ones are tending to the younger ones so the adults are having to get involved less… and it's great, we have had less injuries. I've noticed a massive drop in the first aid book, I mean we still get the odd tripping over and the odd bump but I mean they are children it's bound to happen… I have noticed fewer problems being bought back into school in the afternoon, in year six we were getting a lot of disagreements that were carrying over into the classroom, so then the teachers are having to intervene. I must admit, in these last couple of week since we've been all together there's been less of that."*

The head teacher also explained:

> *"Our afternoons are short… so they need to be in and on it with their learning straight away, and what was happening was that you were spending half an hour sometimes sorting out issues that had arose* [in the playground] *in the classroom … Teachers have said they* [children] *are calmer coming back in, and more ready to do their afternoon learning so they are maximising learning time, which is great."*

Discussion

Results from the present study show promise with regards integrated KS play as an intervention to increase MVPA and encourage pro-social behaviors during and following recess. Data indicate that time spent engaging in MVPA increased significantly following KS1 and KS2 integration whilst sedentary behavior decreased significantly.

Research examining recess interventions has advocated investment in resources such as playtime equipment (Nielsen et al., 2012), playground markings (Ridgers et al., 2007), or staffing for supervised play (Scruggs et al., 2003). However; in delivering interventions the cost and ease of implementation should be a key consideration. Few intervention studies have targeted the social environment of break times (Parrish et al., 2013). Pellegrini and Smith (1993) reviewed the effects of individual and group-level variables on children's

behavior during recess, concluding that factors such as age and gender interact with each other and relate to playground activity and behavior. The present study supports this notion. Children of different ages were observed playing together by school staff. Interviewees noted that younger children brought their imagination and creativity into play transactions, whilst older children modelled more advanced behaviors, and offered emotional and informational support to younger children as necessary (Gray, 2011).

The interviewees also described the benefits of integrated KS play resulting from an increased range of play options. Firstly, they noted that children had a wider range of other children to play with, and especially important was the opportunity to mix with others beyond the child's usual classmates. Secondly, there were options to access a greater number of play activities which was linked to the third option, more choice about where to play. These increased options were considered to provide children with more opportunities to find satisfying play experiences (Standage et al., 2014). These findings highlight the role of social and environmental factors in PA behaviors (Brown et al., 2009).

Non-parametric tests indicate that the time (%) spent exhibiting anti-social physical behaviors decreased significantly over post-integration. Evidence-based observations in support of this finding were made by the interviewees. Each noted that records showed fewer yellow and red cards had been issued for anti-social behavior by playground supervisors, and there was a '*massive drop'* in reported accidents requiring medical attention. Whilst no significant differences in prosocial behaviors were observed using SOCARP, playground supervisors, who had more intimate knowledge of the schoolchildren and their typical behaviors perceived an increase in prosocial behaviors (e.g., more physical and verbal support of each other). Thus, it seems in this school, integrated play encouraged safer play and more prosocial play. However, it must be recognized that an increase in MVPA and reduced injuries post-integration may be partially accounted for via the increased play area available to children (access to KS1 and KS2 playgrounds). Increasing the play area available to children not only reduces the likelihood of injuries, but can also encourage MVPA (Delidou et al., 2016; D'Haese et al., 2013; Ridgers et al., 2010). Qualitative data indicate that in the present study, it is reasonable to propose that mixed-age play opportunities contributed to the significant increase in observed MVPA.

In exploring why integrated play may have decreased anti-social behaviors and increased pro-social behaviors, increasing the range of play options was perceived as having influence. Having more options of who to play with, and which activities to engage in post-integration allowed children more opportunity to fulfil their play needs. This had the effect of reducing social isolation, increasing physical activity, and contributing to increased play satisfaction. Research indicates that reduced social isolation (as noted in the qualitative

data) and increased MVPA both reduce anti-social behaviors and increase pro-social behaviors in schools during recess (Dake et al., 2003; Veenstra et al., 2005).

Whilst quantitative data identified benefits of integrated play for recess play behavior, qualitative data indicate that these benefits extended beyond lunch break to post lunch classroom behavior. Interviewees referred to a post-integration reduction in spill-over effects whereby anti-social playground behaviors continued to influence behavior in the classroom. The reduced spill-over effects were described as markedly improving children's readiness to quickly engage in on task behaviors, thus requiring less intervention from teachers and classroom assistants. This in turn maximised time available for learning and resulted in the children having more time on task. The findings of the present study support those of previous research whereby social behavior at playtime and post-playtime attention to classroom task behaviors were significantly related (Murray et al., 2013; Pellegrini & Davis, 1993).

Limitations

The findings of the present study are derived from a single school, and thus must be interpreted with caution. However, this case study helps to illustrate the potential value of targeting the social environment of break times. Schools should consider how interactions between boys and girls of different ages may be facilitated during break times to benefit physical activity and social behavior.

A limitation of the present study was that the children's perceptions of mixed and segregated KS play were not investigated. Thus, we recommend that schools seek the perceptions of children with regards mixed and segregated KS play, as boys and girls may have different preferences for physical activity promoting activities and facilities. For example, Pawlowski, Tjørnhøj-Thomsen, Schipperijn, and Troelsen (2014) found that boys preferred physical activity promoting facilities (e.g., obstacle course, climbing frames) whereas girls preferred smaller secluded places where they could hang out in smaller groups (e.g., bird's nest swings and small huts). Whilst research suggests that boys generally engage in more break time PA than girls pre- and post-intervention (Ridgers et al., 2007; Verstraete et al., 2006), after the age of nine boys daily PA can reduce (Escalante et al., 2014; Kimm et al., 2000). Thus, future research should also seek to interrogate observed changes in PA by gender and age.

With regards behavioral observations, data were collected during the winter and spring months. Research examining the effects of seasonal variation on children's break time PA has produced mixed findings (Ridgers et al., 2012), however, it is possible that this could have impacted on children's PA behaviors. For example, a study of seasonal changes in physical activity during school recess and lunchtime among Australian children found no

seasonal changes in recess activity. However, children engaged in significantly less MVPA and vigorous physical activity during lunchtime in spring and summer compared to winter (Ridgers et al., 2018).

A further consideration for future research is the classification of sedentary behaviors using SOCARP. In the present study, sedentary behavior was classified in accordance with SOCARP's validation study (Ridgers et al., 2010). In other words, sedentary behavior was defined by combining the lying, sitting and standing activity codes. Recent literature defines sedentary behavior for adults as any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs) (Tremblay et al., 2017). However, for children it is recommended that the MET threshold for sedentary behavior should be increased from 1.5 to 2.0 (Saint-Maurice, Kim, Welk, & Gaesser, 2016). On this point, it should be noted that standing can be a passive or active behavior. In examining this notion, Ridley, Ainsworth and Olds (2008) produced a compendium of energy expenditures for youth, and reported the following MET values: sending text messages while standing, 1.8 METs; talking while standing, 1.8 METs; standing quietly, 1.5 METs; arts and crafts while standing, 1.9 METs; reading while standing, 1.8 METs; drinking while standing, 2.0 METs; and eating while standing, 2.0 METs. This illustrates that the classification of standing as a sedentary behavior is subject to debate. As such, whilst in the present study we adhered to reporting SOCARP data according to the original validation paper (Ridgers et al., 2010), we encourage careful consideration of the classification of standing in future research.

Conclusions

To conclude, integrated play resulted in a significant increase in MVPA and a significant reduction in sedentary behavior with effects sustained at follow-up. Anti-social physical behaviors declined significantly post-integration in ways that were deemed by the interviewees to be meaningful. Improvements in lunch time play was identified as facilitating a more efficient transition to 'on task' classroom behaviors, thereby extending quality learning time.

We suggest that practitioners target the social as well as physical environment when seeking increase PA and pro-social behaviors during recess. Targeting the social environment utilizes the positive attributes of each age group, as younger children bring their imagination and creativity into play transactions whilst older children model more advanced PA and play behaviors (Gray, 2011; Pellegrini & Smith, 1993).

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