Children's physical activity levels during primary school break times: A quantitative and qualitative research design

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Abstract

The overall aim of this study was to assess the diversity of primary school children's physical activity (PA) during outdoor recess. The study was grounded in a mixed method approach, assisting in the identification of multifaceted predictors of children's PA, including insights to social behaviours during break time. Data were obtained from children aged 7–10 years across five primary schools in the West Midlands, United Kingdom. Data were collected during the English winter months from November 2013 to January 2014 and involved two distinct phases. In the quantitative phase ($n = 82$), children's PA levels and social play behaviours were directly observed at break time using the system for observing children's activity and relationships during play (SOCARP).The SOCARP instrument coded 820 minutes of school break time across the categories of: physical activity; group size; activity type and social play behaviours. In the qualitative phase ($n = 80$), children participated in group interviews in relation to their perceptions and experiences of the playground environment. Findings indicated boys and girls have different predictors of their PA levels. Participating in sports activities and engaging in large groups were positive predictors of boys' moderate to vigorous physical activity (MVPA), whereas pro-social interactions and small/medium groups were positive predictors of girls' MVPA. The qualitative findings highlighted several themes including: boys and sport; power hierarchies; girls' walk and talk; and imaginary play. Drawing from the current findings, it is suggested that interventions should focus on the social

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environment of break times, facilitating walk and talk routes for girls and sporting opportunities for boys.

Introduction

Worldwide, the level of physical activity (PA) in children and adults has been insufficient to maintain good health (Bauman et al., 2012). In the recent Active Healthy Kids 2014 Report Card on PA, England was awarded a C/D grade for younger children and adolescents, indicating a higher provision of PA opportunities in England than other westernised countries such as Canada, Australia and the United States (Tremblay et al., 2014). Despite this higher provision for PA in England, more effort is still required to increase participation in children. Across the UK, only 51% of children and young people reach their daily MVPA target of 60 minutes (Griffiths et al., 2013). As the public health message has become more prominent regarding the benefits of PA, so has the need for effective and sustainable interventions. Schools have been placed at the forefront of preventative public health as a key community setting to increase children's PA levels (Hyndman et al., 2014). Break time has been identified as a critical window in the school day for providing PA opportunities (Roberts et al., 2012), as it does not interfere with daily schedules and therefore has been considered an ideal context for children to accumulate their daily recommended PA (Erwin et al., 2014). School break time has been defined as the non-curriculum time between lessons when children can freely engage in PA and leisure activities, including morning break time and lunchtime (Parrish et al., 2013; Ridgers et al., 2006). In the UK, daily break time is mandatory and can account for up to 25% of the school day (Ridgers et al., 2010a). It has been suggested that a target of 40% MVPA during break time would be equivalent to children accumulating around 30 minutes of their recommended daily PA guidelines (Ridgers and Stratton, 2005). Ridgers et al. (2012a) reported that morning break time accounted for 23.8% of younger girls' daily moderate PA (MPA) and 26% MPA during lunchtime, with younger boys accumulating 26% MPA at morning break time and 27.5% MPA during lunchtime.

There have been a number of interventions that have targeted school break times, reporting successful increases in children's PA levels including: the use of playground markings (Stratton, 2000); incorporating adult provision to promote PA (Sallis et al., 2003); the use of fixed (Ridgers et al., 2007); and portable equipment (Verstraete et al., 2006) and the use of recycled materials to encourage children's unstructured play (Hyndman et al., 2014). Some intervention studies, however, have reported a decrease in PA levels, including an intervention which used the multiple strategies of playground markings, a walking club and organised activities, which had a declining effect on boys' PA over a 12 month period (Elder et al., 2011). Therefore, an important consideration for future research could be to identify strategies that target sub-groups of populations, such as males and females (Parrish et al., 2013; Ridgers et al., 2012b).

A systematic review of PA during break times supported previous research findings that boys are more active than girls (Ridgers et al., 2012b), with boys enjoying sports and competitive games, whilst girls are more likely to socialise with their peers (Blatchford et al., 2003). A Ready for Recess intervention discovered differences in effects across sub-groups of boys, girls, overweight, obese and healthy weight children, with the highest increases in MVPA in the sub-groups

of overweight and obese boys and girls (Huberty et al., 2011). The intervention used a mixture of staff training and recreational equipment, with the findings suggesting that more research is needed to ascertain the contributing components of a physically active environment across all sub-groups. Parrish et al. (2013) recommended that future break time interventions should focus on the effects of social variables on children's PA behaviours, as few studies have investigated the social interactions amongst children and the composition of social groups during break times (Ridgers et al., 2012b).

It has been suggested that the use of the social ecological model (McLeroy et al., 1988) can assist in gaining a full understanding of children's PA behaviours during break times, as it can allow for the acknowledgement of multifaceted constructs (Salmon and King, 2010). However, in a recent systematic review, it was highlighted that only three studies examined all correlates across a social ecological model (Ridgers et al., 2012b), with the majority of variables being associated with the individual and the physical levels of the model. Although a growing body of research investigating children's PA behaviours during break times has accumulated over the past 20 years, there are still gaps in the knowledge base, with an emerging need to focus on children's social behaviours during break times (Ridgers et al., 2011). In order to investigate children's social behaviours, both quantitative and qualitative methods need to be utilised (Knowles et al., 2013). The use of qualitative methods can assist in understanding the social context of break time from a child's perspective, which will in turn provide valuable information for future break time interventions to increase children's PA levels (Knowles et al., 2013). In a recent qualitative study, Knowles et al. (2013) concluded that social interactions during break times amongst children aged 7–11 was the most commonly cited theme in regards to their likes and dislikes and provided insights into a range of social behaviours during break times. Thus, to truly understand the social environment of break times, qualitative methods need to be employed to understand children's perceptions of this specific context.

Rationale

The study addressed the following research objectives through a convergent parallel mixed methods design (Creswell, 2014). The design, although parallel in nature, allowed the study to have two distinct phases. In phase one, the objective was to assess the diversity of primary school children's PA during outdoor break time, and in phase two, the objective was to explore children's perceptions and experiences in relation to their playground environment. In both the qualitative and quantitative research objectives, sex differences were investigated to ascertain any differences amongst sub-groups in relation to their PA behaviours.

Methods

Participants

Participants were selected from five mixed sex primary schools, located in areas of high social and economic deprivation in one of England's major cities in the West Midlands. Schools were selected through a variety of sampling strategies. Initially, 50 schools from across the West Midlands were selected through systematic sampling (Thomas et al., 2011). However, because of a poor response rate, with only one school agreeing to take part, a further four schools were recruited via purposive sampling (Cohen et al., 2011), to match the demographics of the systematically sampled school. All children aged 7–10 years in each of the five schools were provided with

information regarding the study. Random sampling was then applied to a list of children who returned their written informed consent; therefore, schools differed in the number of participants (ranging from 10–25 in each school). An element of stratified sampling was also applied with the criteria of: children, who speak English, represent diversity in activity level and are comfortable speaking in group situations. The criteria were used to ensure that a range of activity behaviours would be observed and that the children would feel comfortable discussing their break time experiences during the group interviews. Eighty two children (49 boys, 33 girls) took part in the quantitative phase, and from this sample 80 (47 boys and 33 girls) took part in the qualitative phase. A priori power analysis was performed for sample size estimation using G*power 3 (Faul et al., 2007). The calculation involved effect size estimation based on both pilot study data and what was considered to represent a meaningful difference between groups. As such, a large effect size of 0.8 (see Cohen, 1988) was used in the calculation, with an alpha error probability of .05, and power 1 – beta of .95. This resulted in a projected sample size of $n = 84$ needed to determine this size of effect. Therefore, the researchers aimed to recruit 84 participants, and received full consent from 82 children.

Setting

The mean playground size for all five schools was $1795.95m^2$ ($+627.47$), with a mean morning break time of 16 minutes ($+2.2$) and lunchtime of 51 minutes ($+6.5$). Four of the five schools (schools 1, 2, 3 and 5) had a range of fixed equipment including trim trails (obstacle courses), climbing frames, rubber tyres and basketball posts. Two of the schools (schools 2 and 3) had a caged area for children to play organised sports. One of the schools (school 1) had an outside children's gym which included a range of weight-bearing equipment. All schools had seating areas. One school (school 4) was poorly resourced, with only seating areas and two basketball posts. All schools were supervised by one teacher during morning break time, at lunchtimes all playgrounds had between three and four lunch time supervisors and in four of the schools (schools 1, 3, 4 and 5) a play leader or sports coach was employed to encourage organised sports. In four out of the five schools (schools 1, 2, 3 and 5) children were provided with a range of portable equipment including footballs, basketballs and skipping ropes.

The study's protocol was reviewed and approved by the research ethics committee at the corresponding author's institution. Written informed consent was gained from the head teachers and the children's legal guardians. In addition, information leaflets were provided and verbal assent was sought by all children who took part. All researchers who visited the schools were cleared by the Criminal Records Bureau and were experienced in working with children within a school setting. Data were collected during the English winter months from November 2013 to January 2014.

Quantitative data collection

SOCARP. Observational data were collected using the SOCARP tool (Ridgers et al., 2010c), which was designed to be specifically applied to the context of the primary school playground and simultaneously collects data according to the four categories of: activity levels; group size; activity type and social interactions. In accordance with SOCARP's validation study (Ridgers et al., 2010c), sedentary behaviour was defined by combining the lying, sitting and standing activity posture codes; MVPA was calculated through the sum of the walking and very active categories and VPA was defined through the very active category. The social group size was determined by

the total number of children in the group in which the target child was located during their observation period. The group size included the target child and other children but adults were not included. Group sizes were classified as alone (child by him or herself), small (2–4 children), medium (5–9 children) and large (10+ children). Activity type related to the type of activity the target children engaged in during their observed period. The activities were classified as: sports (e.g. an activity that was a modification of a sport with or without its official structure, e.g. rules or numbers of players. Examples of sports included: football, basketball, hockey, tennis and cricket); active games (e.g. a physically active or non-sport game, for instance chasing games, imaginary role play, exercises, dance, skipping, rough and tumble); sedentary behaviour (e.g. reading, sitting/standing talking to friends) and locomotion (e.g. walking and jogging that was not part of a game or sport). The interactions category reflected the children's social interactions during their observed break time. These were divided into pro-physical, pro-verbal, anti-physical and anti-verbal. Each child was observed for one 10 minute observation period. Within this timeframe, the researcher observed the child's behaviour for 10 seconds and then had 10 seconds to record their behaviour against the four categories. Activity levels, group size and activity type were all coded according to the behaviour displayed on the 10th second of the observed period, whereas the researcher recorded all social behaviours observed across the 10 second observation period for the social interactions category. This process was repeated for 30 observed intervals for each child. The data collection in four of the five schools took place over a two day period, due to the number of participants as well as heavy rainfall, which prevented some data collection break time periods from taking place. To keep the consistency of the observation intervals, a pacer was used through an MP3 player. All 82 children were directly observed for a 10 minute period each, totalling 2460 observed intervals and 820 minutes of coded observation. Full details of the SOCARP protocols can be found elsewhere (Ridgers et al., 2010c).

Protocols, validity, reliability and observer training. On each observation day, five trained observers arrived at the school before morning break time and were present during both the morning and lunchtime breaks. The SOCARP data collection method has a positive degree of content validity through its validation against other PA measures such as uni-axial accelerometers and pedometers, with correlation coefficients revealing a positive significant association between energy expenditure scores (2.5 + 0.5) and mean accelerometer counts (154.5 + 74.1 CPE; $r = .67$; $p < .01$) (Ridgers et al., 2010c).

Inter-observer reliability was established prior to data collection, with an advised inter-observer agreement of >80% for each of the SOCARP categories (Ridgers et al., 2010c). Observer training included becoming familiar with the study protocols, memorising categories and codes and practising using video recorded examples. Initial training required 22 hours to establish acceptable inter-observer agreement prior to data collection (activity level 93.3 to 96.6%; group size 93.3 to 96.6%; activity type 96.6 to 100% and social interactions 83.3 to 90%). In addition, an inter-observer reliability check was conducted after data collection amongst all observers (activity level 86.6 to 93.3%; group size 86 to 96.6%; activity type 90 to 93% and social interactions 86.6 to 90%). A field reliability check also took place, with one of the observers coding against the lead observer. The field reliability scores recorded were: activity level 90%; group size 85%; activity type 95% and social interactions 95%. The inter-observer reliability checks which took place before and after data collection involved observers coding video recorded examples against the lead observer, using training videos that had been established from pilot study data.

Quantitative data analysis

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 element of 10 seconds observe–10 second record periods. The frequencies of the recorded intervals were then calculated and converted to percentages. Due to the ordinal data being treated as interval data and converted to percentages, the data were considered as continuous for the purpose of analysis. Initial exploratory analysis of the data set through the inspection of histograms (Aldrich and Rodriguez, 2013) revealed that the data were not normally distributed. However, in accordance with the central limit theorem (CLT) (Rice, 2007), the observations were coded in such a way that they did not depend on the values of the other coded observations; therefore, the data were treated as parametric.

Descriptive statistics were applied to describe the final sample, and independent *t*-tests were conducted to establish whether significant sex differences occurred. Thereafter, the sub-groups of boys and girls were analysed separately in light of differences in their PA levels. Pearson product–moment correlations were also conducted to provide preliminary examination of associations between variables. Multiple linear regression was applied to establish whether the covariates from the SOCARP tool predicted children's PA intensity. This involved the outcome variables of children's PA behaviours (sitting, lying, standing, walking, MVPA and VPA) and the predictor variables of group size (alone, small, medium and large), activity type (sport, active games, sedentary, and locomotion) and social interactions (pro-physical, pro-verbal, anti-physical, anti-verbal, and none). A backward elimination procedure was used for the analysis, where the non-significant predictor variable that was least strongly associated with the outcome variable was removed. Predictor variables were retained if they significantly predicted the outcome variables. All statistical analysis was conducted using the Statistical Package for the Social Sciences v.21 and the alpha level were set at $P < .05$.

Qualitative data collection

Group interviews were employed to gain an understanding behind the quantitative findings, which are ideal to use in a mixed method design as they can illuminate emerged themes from the quantitative data (Menter et al., 2011). A group interview can broadly be defined as a verbal interchange in which information, beliefs and opinions are collected (Kumar, 2014). In the study, two group interviews in each school took place and consisted of eight children in each group ($n = 80$) (aged 7–10 years); a mixture of boys and girls participated in each group interview (47 boys and 33 girls) to ensure heterogeneity within the groups (Krueger and Casey, 2002). The group interview topics reflected the SOCARP variables and included questions such as 'What do you enjoy/not enjoy doing during break time?', 'How active/busy do you think you are at break time?' and 'What did you do at break time today?' Each group interview lasted for approximately 30 minutes and was recorded using a Dictaphone to capture the verbal interactions of the participants. To maintain consistency all group interviews were conducted, transcribed and analysed by the lead researcher. The trustworthiness of the data can be reflected in terms of the structured approach adopted and the verbatim extracts, ensuring the participant's voice had not been lost; this enables the reader to check the interpretations made. The trustworthiness of the data was also aided by analysis triangulation through the researcher discussing their assumptions with a critical colleague (Norris, 2007). It has been suggested that critical colleagues assist the researcher in addressing bias through the discussion of interpretations, omissions and sampling (Norris, 2007).

Qualitative data analysis

The group interviews were analysed using interpretive phenomenological analysis (IPA) (Smith, 1997). IPA is a version of phenomenology which accepts that it is not possible to gain direct access to a participant's worldviews, but rather such an approach will always be affected by the researcher's own views and interpretation of the participant's experience (Willig, 2001). IPA is grounded in three key areas of philosophy: phenomenology, idography and hermeneutics (Smith et al., 2009). It is phenomenological as it is concerned with the human experience; it is hermeneutic due to its interpretive nature (even doubly hermeneutic because the researcher interprets the participants' interpretations) and it is idiographic as it is committed to the detailed examination of each case (Smith et al., 2009). An IPA approach was adopted because it was consistent with the epistemological position of the qualitative research objective in regards to placing a focus on the children's perceptions and experiences of their playground environment (Smith et al., 2009). These trends represent the phenomenological and interpretative aspects of IPA. The participants' perceptions and experiences were firstly explored, and then compared and contrasted with the components of the social ecological model. The process of bracketing assisted in maintaining a phenomenological approach, as the constructs within the social ecological model were initially placed to one side so that they did not screen the participants' experiences (Smith et al., 2009).

A systematic approach. A systematic analysis of each transcript took place, in which the first step involved reading and re-reading the transcripts; at this stage of the analysis initial notes were recorded. Smith et al. (2009) advise that this allows the researcher to maintain their focus with the data, knowing that their 'first impressions' have been captured. In the second step, exploratory comments were produced and broken down into: descriptive (e.g. a description of the content); linguistic (e.g. specific use of language) and conceptual (e.g. an interrogation and interpretation) comments (Smith et al., 2009). The third step led to the development of emergent themes; here, the focus was placed upon reducing the large amount of data to discrete phrases representing the large data set. This entailed breaking up the narrative flow of the interviews and fragmenting the hermeneutic cycle. The next stage of the analysis progressed onto the abstraction of themes. At this point the themes were drawn together and a structure was produced providing organisation to the analysis. This systematic process was repeated for all 10 interviews. Further information on the use of IPA can be found elsewhere (Smith et al., 2009).

Results

Overall, both the quantitative and qualitative findings indicated that boys and girls have different predictors of their PA levels. Boys spent significantly more time engaged in larger groups than girls (t (80) = 5.38, P = < 0.01) (Table 1). A significant relationship was found between boys' MVPA and sport (r (47) = .392, P = < 0.01, r^2 = .153) and VPA and sport (r (47) = .512, P = < 0.01, r^2 = .262). There was a significant association between boys' MVPA and the contextual variable of equipment. Further analysis using multiple regression models also indicated that large and medium groups were a positive predictor of boys' VPA (F*(2,46)* = 3.401, P = < 0.05, r^2 = .129, r^2adjusted = .091) (Table 3). For girls, a significant relationship between MVPA and locomotive activities (r(31) = .478, P = < .005, r^2 = .228) was found (Table 2), along with girls spending the largest proportion of their observations walking (39.5%) (Table 1). The pro-physical and pro-verbal variables were positive predictors in girls' walking activity (F*(2,30)* = 2.989,

Table 1. The mean (M ± SD) proportion of time children spent in the SOCARP variables of: activity level, group size, activity type and social interactions during outdoor break times.

	Boys ($n = 49$)	Girls ($n = 33$)	p	Boys and girls ($n = 82$)
Activity level				
Lying down (%)	.00 ± .00	.10 ± .6	.22	0 ± .4
Sitting (%)	2.4 ± 6.4	9.2 ± 11.1	<.001*	5.2 ± 9.2
Standing (%)	27.3 ± 17.2	33.4 ± 20.7	.15	29.8 ± 18.8
Walking (%)	46.1 ± 16	39.5 ± 17.1	.08	43.4 ± 16.6
Vigorous (%)	23.9 ± 11.6	17.3 ± 13.1	<.01*	21.3 ± 12.6
Sedentary (%)	29.8 ± 17.5	42.7 ± 20.3	<.001*	35 ± 19.6
MVPA (%)	70 ± 17.7	56.8 ± 20.1	<.001*	64.7 ± 19.7
Group size				
Alone (%)	13 ± 18.2	13 ± 15.3	.99	13 ± 17
Small (%)	30.3 ± 28.1	59.3 ± 27.8	<.001*	42 ± 31.3
Medium (%)	14.2 ± 22.3	23.5 ± 25.8	.08	18 ± 24.1
Large (%)	42.2 ± 39.4	4.2 ± 10.9	<.001*	26.9 ± 36.3
Activity type				
Sports	42.1 ± 42	4.6 ± 13.2	<.001*	27 ± 38.1
Games	21.3 ± 28.5	26.8 ± 24.9	.37	23.5 ± 27.1
Sedentary	15.2 ± 15.8	34.1 ± 20.6	<.001*	22.8 ± 20.1
Locomotion	21.4 ± 20.9	34.5 ± 18.4	<.001*	26.7 ± 20.9
Social interactions				
Pro-physical	16.6 ± 14.7	21.1 ± 14.6	.18	18.4 ± 14.7
Pro-verbal	74.5 ± 17.2	76 ± 15.1	.67	75.1 ± 16.3
Anti-physical	5 ± 6.6	.9 ± 2	<.001*	3.3 ± 5.6
Anti-verbal	2.5 ± 4.5	.7 ± 1.6	.03	1.8 ± 3.7

Descriptive statistics were used to find the mean values for girls and boys across the four variables. Independent samples t-tests were applied to ascertain any sex differences. *P <.01.
SOCARP: system for observing children's activity and relationships during play.

$P = < 0.05, r^2 = .166, r^2\text{adjusted} = .111$) (Table 4). However, small and medium groups ($F_{(2,30)} = 4.915, P = < 0.05, r^2 = .247, r^2 adjusted = .197$), along with pro-physical and pro-verbal predictors ($F_{(2,30)} = 6.113, P = < 0.05, r^2 = .290, r^2 adjusted = .242$) were negatively associated with girls' VPA (Tables 3 and 4).

In the qualitative findings, three main themes emerged in the data set: physical environment (well resourced versus poorly resourced schools, boys' football dominance and girls' skipping); social environment (adult input, boys and sport, and girls' walk and talk); and individual environment (imaginary role play, power hierarchy, manipulation of fixed equipment and challenge and competition).

Children's perceptions of school break time

The physical environment (emergent themes: well resourced versus poorly resourced schools; boys' football dominance and girls' skipping). The children expressed that they enjoyed using the fixed and portable equipment. A dominant theme across several schools was the use of the fixed rubber tyres: 'I like to use the tyres because I like jumping on them' (female, school 1) and 'we run all the way around the

Table 2. Activity type as a predictor of boys' ($n = 49$) and girls' ($n = 33$) activity levels (standing, walking, MVPA and VPA) during outdoor break times.

Predictors	Standing			Walking			MVPA			VPA		
	B (SE)	β	P	B (SE)	β	P	B (SE)	β	P	B (SE)	β	P
							Boys					
Constant	52.03 (5.3)		<.001	−10.67 (11.92)		.38	15.95 (13.65)		.25	31.83 (2.37)		<.001
Locomotion	−.54 (.12)	−.66	<.001	1.104 (.19)	1.44	<.001	.94 (.21)	1.12	<.001	−.237 (.07)	−.42	<.001
Games				.42 (.13)	.76	<.001	.35 (.15)	.56	.03	−.13 (.05)	−.32	.01
Sport	−.30 (.06)	−.75	<.001	.57 (.12)	1.50	<.001	.62 (.14)	1.49	<.001			
Adjusted R^2		**.32**			**.45**			**.41**			**.24**	

Outcome variables: standing, walking, MVPA, VPA. Covariates: Locomotion, games, sport.
β: beta value, indicates a positive or negative predictor; *B* (SE): unstandardised coefficients (standard error); MVPA: moderate to vigorous physical activity; VPA: vigorous physical activity.

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Table 3. Group size as a predictor of boys' ($n = 49$) and girls' ($n = 33$) activity levels (standing, walking, MVPA and VPA) during outdoor break times.

Predictors	Standing B (SE)	ß	P	Walking B (SE)	ß	P	VPA B (SE)	ß	P
Constant									
Small				.17 (.07)	.304	.03			
Medium							.146 (.07)	.28	.06
Large							.10 (.04)	.35	.02
Adjusted R^2					**.07**			**.09**	
Predictors	**B (SE)**	**ß**	**P**	**B (SE)**	**ß**	**P**	**B (SE)**	**ß**	**P**
Constant							43.54 (9.95)		<.001
Small	.42 (.23)	.57	.07				−.28 (.12)	−.597	.026
Medium	.57 (.24)	.72	.02				−.407 (.13)	−.80	.004
Large									
Adjusted R^2		**.17**						**.19**	

Outcome variables: standing, walking, VPA. Covariates: small, medium, large groups.
Lying, sitting and MVPA were included in the analysis but no significant predictors were identified.
ß: beta value, indicates a positive or negative predictor; B (SE): unstandardised coefficients (standard error);
MVPA: moderate to vigorous physical activity; VPA: vigorous physical activity.

Table 4. Social interactions as a predictor of girls' ($n = 33$) activity levels (standing, walking, MVPA and VPA) during break times.

Predictors	Walking *Girls* B (SE)	ß	P	VPA *Girls* B (SE)	ß	P
Constant	42.87 (2.95)		<.001	14.77 (2.31)		<.001
Anti-verbal	−4.69 (1.67)	−.45	<.001			
Anti-physical				2.70 (1.04)	.42	.01
Adjusted R^2		.17			.15	
Constant	−83.86 (60.70)		.178	156.58 (43.09)		<.001
Pro-verbal	1.48 (.64)	1.27	.029	−1.39 (.44)	−1.60	<.001
Pro-physical	1.21 (.62)	1.07	.062	−1.58 (.45)	−1.77	<.001
Adjusted R^2		.11			.24	

Outcome variables: walking and VPA. Covariates: anti-verbal, anti-physical, pro-verbal and pro-physical.
For boys, social interactions were not significant predictors of activity levels. Lying, sitting, standing and MVPA were included in the analysis but no significant predictors were identified.
ß: beta value, indicates a positive or negative predictor; B (SE): unstandardised coefficients (standard error);
MVPA: moderate to vigorous physical activity; VPA: vigorous physical activity.

tyres ... we always play on the tyres' (male, school 5). Other popular pieces of fixed equipment included the trim trails (e.g. a children's assault course including balance beams, stepping stones, ropes and pull up bars), climbing frames (e.g. climbing rope nets), outside gyms (e.g. air walkers,

cross riders and body twists) and the use of football cages (in which children played football games). For instance: 'I like using the gym because it keeps you active and you can get warm' (male, school 1); 'I like the trim trail because it's different stuff, at first you've got to hang on and then you give your arms a break and you're balancing and it's all sorts of different things' (male, school 1); 'I like to go on the monkey bars' (female, school 2) and 'I like the one where it's like a bridge and there are loads of pieces of wood on it and you walk across and they're wobbly' (male, school 5). One of the schools did not have any fixed or portable equipment, which the children stated was because of health and safety reasons. The common pieces of portable equipment the children enjoyed using included skipping ropes, basketballs and soccer balls. Some schools had playground rotas for the use of fixed and portable equipment, which enabled a fair system and gave children the opportunity to take part in a range of activities/sports. However, fixed and portable equipment in some schools encouraged sedentary behaviour (e.g. sand pits, water pits and reading areas). In addition, it was noted that some children were queuing for a turn to use portable equipment such as scooters if only limited numbers were available. In regards to sex differences in the physical environment, boys expressed a strong like for taking part in sports activities such as football: 'I like playing football with my friends' (male, school 3) and girls enjoyed using portable equipment such as the skipping ropes: 'When we got the new skipping ropes I was playing with them all the time' (female, school 1).

The social environment (emergent themes: adult input; boys and sport; and girls' walk and talk). It was evident that the children valued the adult input at break time; they enjoyed it when adults organised games for them or had equipment available. The children expressed a range of comments relating to adult input which included: 'at break times, I like playing with the football coach' (male, school 3) and 'the dinner ladies today they were doing this skipping thing and we were all playing together and making friends with other classes' (female, school 1). Ultimately, break time for the children revolved around friendships. The majority of the children enjoyed being active with their friends:

> I'm quite busy because even when you're talking with your friends you're like moving about, we don't really sit down when we're talking we're like standing about and walking around like the whole playground. We do like laps around the playground (female, school 1).

> I talk and have races and talk about the future and we kick trees (female, school 2).

There were evident sex differences in relation to the social environment of break times. For example boys preferred to engaged in larger groups playing sports: 'What I like doing at playtime is playing football with all my friends' (male, school 5) and girls enjoyed talking with their friends in smaller groups: 'I like to mainly just walk around with my friends and making each other laugh' (female, school 1).

The individual environment (emergent themes: imaginary role play; power hierarchy; manipulation of fixed equipment; and challenge and competition). It was expressed by most children that they liked to engage in imaginary games during break times. They were able to describe in detail the rules of their games and how they engage in them and with whom. They all shared an apparent understanding of each other's imaginary games. The children were able to transform their playground environment into their own imaginary world: 'At playtime I play with my friends and we play Power Rangers . . . Saving the world' (male, school 3); 'I like to play zombie games. One of us would be lying on the bench then we move and we wake up and then they all chase us' (male,

school 1) and 'I like to make plays for the class' (female, school 5). Children also discussed how they applied their own rules and boundaries to their playground environment. If any other children tried to interfere with these rules they perceived this as being a threat to their system and said it was behaviour that that they did not like. The children also manipulated the fixed equipment, for instance they would play chasing games on climbing frames and other pieces of fixed equipment such as tyres and trim trails: 'I enjoy playing on the spider climbing frame playing tig' (male, school 3); 'I play tig and tag on the monkey bars' (female, school 2) and 'I don't like when people come up to me and they say let's play a different game and they take me away and they say let's play this game instead' (male, school 3).

All children expressed how they thrived in a competitive environment; however, this behaviour was expressed more by boys than girls. They liked to engage in games and activities that challenged them. They also enjoyed being competitive with their friends, for instance through chasing games and races: 'I like to climb on the climbing frame because it's so high and I like to race down with my friends' (male, school 3); 'When someone's in the middle and you're there and you have to try and run passed them but if they tig you then you're on with them' (male, school 4) and 'We race down and we race back up again' (female, school 5). In schools that had a range of fixed equipment, both boys and girls described how they would adapt the equipment to make it more challenging: 'I like playing on the trim trail because we try and play this game and we hop all the way across' (female, school 1).

Discussion

The study's findings provide insights into the three main environments that children engaged in during outdoor break times (physical, individual and social), supporting both previous findings and helping to address the knowledge gap in regard to the social environment of break time (Parrish et al., 2013; Ridgers et al., 2012b). In addition, the findings evidenced differences in the sub-groups of boys and girls in determining predictors of children's PA during break times, providing further rationale for future research to focus on male and female specific break time interventions (Parrish et al., 2013; Ridgers et al., 2012b).

The mixed method approach assisted in method triangulation, from which both sets of data highlighted differences in boys' and girls' social environments. The quantitative findings identified that boys spent most of their time engaged in large groups, playing sport utilising the portable equipment available such as footballs and basketballs. Engaging in large groups was also a positive predictor of boys' VPA, which was supported by the qualitative findings (e.g. male: 'I think I'm always quite busy in the playground because like when I play football you're always like moving around and looking for the ball and then you go in for dinner I usually play football again'). In contrast, for girls the significant relationship between locomotion and MVPA, along with the pro-verbal and pro-physical variables as positive predictors of their walking activity, indicated that girls spent the largest amount of their time engaged in walking (39.5%) and talking in small friendship groups. This also emerged as a sub-theme within the interview data (e.g. female: 'I like to mainly just walk around with my friends, making each other laugh'). Interestingly, the pro-verbal and pro-physical variables, along with small and medium group variables, were negative predictors of girls' VPA. If the girls are engaged in conversation then it would be hard for them to increase their activity level from moderate to vigorous. This supports previous research (Knowles et al., 2013; Renold, 1997), with boys dominating playground space in large groups playing sports and girls being situated on the periphery in small groups. However, the qualitative research

highlights that girls viewed break time as a socialising opportunity in which they could talk with their friends. Unlike previous research (Renold, 1997), there were no findings to suggest that the girls were excluded from larger sports games by the boys. Future research interventions that encourage walking and talking opportunities for girls are needed to determine the impact of this on their activity levels. However, the walking routes need to be designed in a way that does not impact negatively upon boys' activity levels, ensuring that they still have the space they need to play sports in large groups (Parrish et al., 2013).

Mixed findings have previously been reported between adult input and children's MVPA (Ridgers et al., 2010a). In the group interviews, the children stated that they valued the input from the adult play leaders and coaches; they viewed them as positive role models and enjoyed the activities they organised. There are recommendations to move away from research that focuses upon the role of adults in governing PA behaviour (Salvy et al., 2009); however, this study evidenced that there is a place for adults in the promotion of playground PA. In the qualitative findings, children placed a greater focus on adult supervisors such as the play leaders and coaches rather than teachers and lunchtime supervisors. Pawlowski et al. (2014) recommend future studies to research the role of adults in increasing girls' PA during break times. In relation to this study's findings, an implication for future research could be for adults to encourage girls to walk and talk during break times and to provide boys with the space and portable equipment they need to engage in sports. More research is needed into the use of adults as organisers versus facilitators in relation to children's physical activity during break time.

It has been suggested that children are flexible and resourceful when it comes to establishing a relationship between themselves and their playground environment through engagement in imaginative play (Darian-Smith, 2013; Knowles et al., 2013) and the findings of the current study support this. The data from the group interviews revealed that boys and girls (aged 7–10 years) engaged in imaginative role play across all five schools. The children were able to describe in detail their imaginary play behaviour, in which they had their own rules and boundaries. The findings from the group interviews support other work which also found children to be resourceful with their environment and engage in imaginative play (Sutton-Smith, 1999). Theoretical work on children's play culture and the concept of development (Mouristen, 1999) indicates that children are capable of creating their own expressions of culture within social networks, which can consist of sporadic movement, including locomotive activities. The findings from this research indicated that imaginary play was prevalent in both boys and girls across all of the five schools. Future interventions could target both sub-groups of boys and girls concurrently through providing stimuli for children's imaginative role play.

The work of Pellegrini (2009) indicated that older children enjoyed games that were governed by rules and boundaries, whilst younger children enjoyed imaginary play. Knowles et al. (2013) reported playground dominance through sports; however, they also found older girls participated in imaginary role play. Building upon those findings, this study highlights that both boys and girls applied set rules to organised sports and imaginary games, thus creating numerous power hierarchies within the break time environment. These hierarchies were affected by school policies such as playground rotas, adult supervisors and children's social interactions. In essence, children demonstrated a strong sense of morality through the qualitative findings. They understood right from wrong and often complained when they perceived an unfair playground rota during break times. This was further supported through the type of imaginary role play they played, which often had hero and villain characters. Future research could examine further the power hierarchies that exist within the specific context of outdoor break time and the effects of this on children's PA. In

addition, researchers should consider consulting the children in the design of interventions as to whether they perceive them to be fair.

One of the emergent themes from the qualitative findings in relation to the physical environment of break time was 'well resourced versus poorly resourced schools'. Previous intervention research indicates that fixed and portable equipment in the playground environment can increase children's PA levels (Anthamatten et al., 2011; Ridgers et al., 2011; Stratton and Mullan, 2005). However, the findings in the current study indicate that children can still be active in a poorly resourced environment. The quantitative findings provided information for the percentage of time children spent in MVPA during break time and indicated that the poorly resourced school (school 4) had a mean %MVPA of 64.35%, with children engaging in locomotive activity for the largest proportions of their observed period. This was the second highest figure out of all of the five schools. The high level of MVPA and locomotion as an activity type links with previous research that children are resourceful and creative and able to adapt to their surroundings (Sutton-Smith, 1999). The qualitative findings highlighted that the school was poorly resourced because of health and safety fears and a high number of accidents (e.g. female, school 4 'We used to have equipment where all that grass is, we used to have monkey bars and stuff like that but then they changed it into a grassy area because people kept on being silly on them'). Further research into the activity levels of children in well resourced versus poorly resourced schools could add to the knowledge base as the children in the poorly resourced school still had high levels of MVPA.

Strengths and limitations

The use of the mixed method design increased the trustworthiness and validity of the data through method triangulation. In addition, the use of direct observation allowed for the measurement of contextually rich data and is a method which is believed to exceed other PA measures (McKenzie, 2010). One of its major strengths is the ability not only to measure PA levels but also the identification of the type of activity, when, where and with whom it occurs (McKenzie, 2010). Direct observation has a high internal validity for measuring PA and has been used as a criterion for validating other PA measures (McClain et al., 2008).

A limitation of the study would be the collection of data within one regional area of the UK, which could affect the external validity of the study; however, the labour-intense nature of direct observation limits the number of samples that can be taken (McKenzie, 2010). Yet the consistency of the findings across the five schools suggests that the results could be prevalent to schools with similar demographics (high social and economic deprivation). It is also acknowledged that the presence of the researchers during break time could have influenced the children's PA behaviours; therefore, the study aimed to address this through method triangulation with the use of group interviews (Menter et al., 2011).

Conclusions

Findings from this research highlight the importance of a mixed method approach and its contribution to understanding children's social behaviours during school break times. Several key predictors of children's activity have been identified, with significant differences in the sub-groups of boys and girls. The findings suggest that future interventions could focus on creating walk and talk routes for girls, as this would provide them with the opportunity to accumulate MVPA whilst they are socialising in friendship groups. However, the routes need to be designed in such a way

that they do not impact negatively upon the activity levels of boys, ensuring that they still have space and portable equipment to play sports. In addition, imaginary play was prevalent in both boys and girls across all of the five schools, indicating that if future interventions aimed to target boys and girls concurrently this may be achieved through stimulating children's imagination during break times through playground markings.

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Conflict of Interest

None declared.

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