Children's Physical Activity during Primary School Break Times and Physical Education: Ecologically Framed Interventions

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Abstract

Introduction: Physical education (PE) and break times have been identified as opportunities in which children can be physically active. Interventions in these areas of the primary school day are relatively new areas of research. Thus, the thesis' significant contribution to knowledge is the implementation of ecologically framed interventions applied to these two segments of the school day. Aim: The aim was to design, implement and evaluate primary school-based interventions to increase children's moderate to vigorous physical activity (MVPA) during break times and PE. Methods: Through a mixed-method design, two exploratory studies and two intervention studies were employed. The PA behaviour of 412 children (aged 5-10 years) across 8 schools was measured using pedometers and/or systematic observation. A total of 40 interviews were conducted to explore children's and teachers' perceptions and experiences of children's PA behaviour during break times or PE lessons. Specifically, 18 teacher interviews and 22 children's group interviews, including 120 children (aged 7-10 years), were conducted. **Results:** The break time intervention had positive short term effects (1-5 weeks) on both boys' and girls' MVPA (aged 5-9 years) and positive longer term effects (6-9 weeks) on boys' (aged 7-9 years) VPA. The qualitative data indicated that boys dominated the new playground space, while girls preferred to talk with friends. Inconsistencies in the implementation of the break time intervention negatively impacted upon its success. The PE intervention had positive effects on children's MVPA, evidencing a significant 30% point increase. The qualitative data indicated a pedagogical shift of teachers to focus on active learning time. Conclusion: The application of a unique combination of an ecological model, Self Determination Theory (SDT) and Behaviour Change Taxonomy (BCT) creates an effective framework for the design of primary schoolbased PA interventions. Further research is recommended involving the application of the framework in larger trials.

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Chapter 1 Introduction to the Thesis

Chapter 1 – Introduction to the Thesis

1.1 Background and Context

1.1.1 Setting the scene in England - why physical activity?

In England only 20-39% of children and youth (Tremblay *et al.*, 2014) are meeting the physical activity (PA) guidelines of at least 60 minutes and up to several hours of moderate to vigorous intensity PA (MVPA) everyday (Department of Health [DH], 2011). When considering the sex differences in England, it has been reported that only 21% of boys and 16% of girls (aged 5 -15 years) achieved the daily PA targets (Health Social Care Information Centre [HSCIC], 2013). A recent global comparison of children's PA levels comparing 15 countries, described various indicators of PA across the nations (Tremblay *et al.*, 2014). For children's overall PA, England received a D+ grade, which did evidence greater PA levels than other developed countries such as Finland, Canada, the US, Australia and Ireland. However, Tremblay *et al.*'s (2014) report highlights the complex nature of PA correlates, with no country as of yet being able to solve the problem of children's declining PA levels (DH, 2015).

England's House of Common's Health Committee (2015) affirmed that PA is a crucial health priority in its own right (rather than just a method for reducing obesity), with compelling evidence that the benefits of PA are independent of a person's weight (DH, 2015). In England it has been reported that physical inactivity directly relates to one in six deaths (Lee *et al.*, 2012), with the estimated associated costs for the UK being \pounds 7.4 billion (Public Health England [PHE], 2014a). Worldwide physical inactivity is the fourth leading risk factor for mortality accounting for 6% of deaths, following that of high blood pressure (13%), tobacco (9%) and high blood glucose (6%) (Kohl *et al.*, 2012). The health benefits of regular PA contribute towards the prevention and control of over 20 chronic health

conditions including: several types of cancers, obesity, musculoskeletal conditions, type two diabetes, stroke, and coronary heart disease (CHD) (Lee et al., 2012). There are multiple health benefits of PA for children and young people, with doseresponse relationships being observed, indicating the higher the dose the higher the benefits of PA (Janssen and LeBlanc, 2010; Frussenich et al., 2016). There is also consistent evidence which suggests that PA in childhood is one of the most powerful strategies for optimal bone structure and in the possible prevention of osteoporosis in older age (Gunter, Almstedt and Janz, 2012). England's national PA framework 'Everybody Active, Everyday' launched in 2014, highlighted the need for PA to be integrated into daily life, making it an easy and cost-effective choice for communities across England and enabling us to provide children with the greatest start in life (PHE, 2014a). Being physically active in childhood builds a strong foundation for living an active life as an adult (PHE, 2014a). For children, the school environment is integral to their daily routine, however a recent study reported that 83% of junior and high school children's weekday waking time is spent being sedentary (Sandercock, Alibrahim and Bellamy, 2016). Thus, it is important to target the school setting in the development of effective PA

interventions for children (PHE, 2014a).

1.1.2 Key windows of opportunity for physical activity: school break times and physical education

Almost two decades ago physical education (PE) and school break times were identified as two primary opportunities in which children could be physically active (Sarkin, McKenzie and Sallis, 1997). In a more recent study the same messages were reinforced, with break times and PE being found to provide the greatest opportunities for children to accumulate their daily MVPA across the segmented school day (Brusseau *et al.*, 2011); indicating that similar recommendations continue to be made. In England, PE is a statutory subject area within the primary National Curriculum (Department for Education [DfE], 2013a) and plays an important role in providing PA for all children irrespective of inequalities (Sarkin

McKenzie and Sallis, 1997). Gender differences in children's PA levels have been well documented (Armstrong and Van Mechelen, 1998; NHS, 2013). PE however is the one segment of the school day in which both boys and girls can accumulate similar levels of PA (Sarkin, McKenzie and Sallis, 1997; Fairclough and Stratton, 2006; Brusseau *et al.*, 2011). In addition, PE is often the only venue in which some children experience PA at a higher intensity (McKenzie and Lounsbery, 2014). Disappointingly children's MVPA in primary PE lessons are often very low (Simons-Morton *et al.*, 1993; Fairclough and Stratton, 2006; Hollis *et al.*, 2016), with reported levels frequently being below the recommended >50% MVPA target (Institute of Medicine [IOM], 2013; Association of Physical Education [AfPE] 2015). School-based interventions have demonstrated that children's MVPA in PE can be significantly increased, with a review of PE interventions indicating that MVPA on average is increased by 24% (Lonsdale *et al.*, 2013). However, the majority of PE interventions to date have been in the US, with a current paucity of primary school PE interventions to increase MVPA in England (Lonsdale *et al.*, 2013).

School break times are also considered to be a key window of opportunity as they are a mandatory part of the primary school day in England (DfE, 2014). As stated in the Education Regulations (1999), every school must have two teaching sessions separated by a break, with the length of the break being determined by the school's Governing Body. In England, the majority of primary schools have at least two breaks for all children (morning and lunch), and often three breaks for younger children (5-8 years) (morning, lunch and afternoon); indicating that some children are engaging in up to 600 school break periods per year (Stratton, 2000) and 25% of the school day (Ridgers, Fairclough and Stratton, 2010a). Additionally, as break times do not interfere with daily lessons, it makes them an ideal context for targeted interventions to increase children's MVPA (Erwin *et al.*, 2014). It has been suggested that a target of 40% MVPA during break time would be equivalent

to children engaging in 30 minutes of their recommended daily MVPA (Ridgers and Stratton, 2005). A growing body of research into children's PA at break times has accumulated over the past 20 years, with the majority of interventions making a physical change to the break time environment such as playground markings (Stratton, 2000; Stratton and Mullen, 2005), the introduction of portable equipment (Verstraete et al., 2006) or both (Ridgers et al., 2007; Ridgers, Fairclough and Stratton, 2010). These interventions have evidenced positive effects on children's PA, however sustaining these positive increases has not yet been demonstrated. Furthermore, in a systematic review of break time interventions to increase children's PA it was highlighted that only one study had a low risk of bias (Parrish et al., 2013). Thus, indicating that future research is required with high methodological quality. Moreover, it has been advocated that there are still gaps in the knowledge base, with an emerging need to focus on the effect of children's social behaviours on their PA levels during break times (Ridgers et al., 2011). Social behaviours have been identified as important variables to assess alongside PA, as they are potentially modifiable, and can therefore play an essential role in the development of effective break time interventions (Ridgers et al., 2012); with past research indicating that children's social behaviours can have either a positive (Smith and McDonough, 2008) or negative impact (Buhs and Ladd, 2001) on daily MVPA.

1.1.3 Intervention evidence: primary physical education and break times

Observations from intervention studies of children's PA during primary school break times over the past decade have been effective in increasing children's MVPA; such as in the work of Stratton and Mullen (2005) through the implementation of multicolour playground markings, and Hyndman *et al.* (2014) in their employment of recycled materials. However, findings from a recent systematic review of break time intervention studies, suggested there is insufficient evidence to establish conclusive intervention effects due to the methodological quality of studies (Parrish

et al., 2013). Moreover, a meta-analysis of worldwide intervention effects indicated that there is currently limited evidence to suggest that school break time interventions can increase children's MVPA (Erwin et al., 2014). As highlighted in Erwin et al.'s (2014) meta-analysis school break time intervention work is still a relatively new area of research with a small number of published studies targeting this specific context (Stratton, 2000; Stratton and Mullen, 2005; Verstraete et al., 2006; Alhassan et al., 2007; Hannon and Brown, 2008; Ridgers et al., 2007; Bundy et al., 2009; Cardon et al., 2009; Loucaides et al., 2009; Duncan and Staples, 2010). Some intervention studies have reported negative effects on children's VPA during break times, as in the case of an intervention study that used the multiple strategies of playground markings, a walking club and organised activities (Elder et al., 2011), which reported a declining effect for boys' MVPA over a 12 month period. Therefore, an important consideration for future break time intervention studies is to target population sub-groups, such as boys and girls (Ridgers et al., 2012; Parrish *et al.*, 2013). In addition it has been advised that a one size fits all approach should be avoided, taking into consideration the different playground environments and policy components of schools internationally (Erwin et al., 2014).

With regards to PE, the first systematic review of interventions designed to increase children's MVPA was only recently published (Lonsdale *et al.*, 2013), indicating that evaluating the effectiveness of such interventions is still a relatively new area of research. The review identified that there are currently a small number of intervention studies, warranting caution over the strength of the available evidence to date. The majority of PE intervention studies internationally fall into two categories, those targeting teaching strategies and those focusing on fitness (Lonsdale *et al.*, 2013). The teaching strategy interventions have shown improvements in %MVPA during PE for instance, results from the Child and

Adolescent Trial for Cardiovascular Health (CATCH) intervention increased MVPA from 37.4% at baseline to 51.9% post-intervention (McKenzie *et al.*, 1996). Yet, it is the fitness interventions that have reported greater increases in %MVPA (Quinn and Strand, 1995; Scantling *et al.*, 1998; Ignico, Corson and Vidoni, 2006; Eather, Morgan and Lubans, 2013). The success of the fitness interventions is not surprising, due to the specific focus on VPA intensity and type of activities such as resistance training. Even though it has been argued that PE should be placed in a public health context (Sallis *et al.*, 2012), this needs to be facilitated through a focus on active learning time which will increase opportunities for children to develop in other areas of a PE lesson, such as their physical, social and cognitive skills (DfE, 2013a; McKenzie and Lounsbery, 2014).

Intervention evidence for increasing children's MVPA in primary PE in England is limited (Lonsdale *et al.*, 2013), with only one study conducting a PE specific intervention (Rowlands *et al.*, 2008). The intervention termed 'Motive8' focused on both MVPA and children's motor skills, evidencing statistically significant differences in children's activity levels when their PE lessons were taught by a Motive8 instructor. To date and to the author's knowledge, there has been no primary PE intervention in England implemented to increase children's MVPA when taught by both specialist and non-specialist teachers. At this point in time, internationally there is a need for effective PE interventions to increase children's MVPA (Webber *et al.*, 2008; Sallis *et al.*, 2012), which focus on teacher pedagogy and behaviour in order to increase active learning time rather than solely fitness based approaches (Londsdale *et al.*, 2013).

1.1.4 Summary and significance of thesis

This thesis focuses on two components of the primary school day that have been researched over the past 20 - 30 years; however, the intervention work within these components of PE and break times are still considered relatively new areas

of research (Lonsdale et al., 2013: Erwin et al., 2014). No country as of yet has solved the declining PA levels of children (DH, 2015). Physical activity still needs to be integrated into daily life as an easy choice, across developed nations including England (PHE, 2014a). Through targeting the primary school environment, PA interventions can become integrated into children's daily life (PHE, 2014a), with England's All Party Commission on PA (APC-PA) (2014) advising that key components of a school day should be targeted in the development of effective PA interventions. Physical education is the one area of the primary school day in which both boys and girls can achieve similar levels of PA (Sarkin, McKenzie and Sallis, 1997; Fairclough and Stratton, 2006; Brusseau et al., 2011), and often the only venue in which some children will experience VPA (McKenzie and Lounsbery, 2014). The majority of primary PE intervention studies to increase children's MVPA have been implemented in the US (McKenzie *et al.*, 1996; Sallis *et al.*, 1997), with only a small number of primary PE interventions in England (Lonsdale *et al.*, 2013). To the author's knowledge there are no primary PE interventions to increase children's MVPA in England which have created teaching strategies that can be implemented by both specialist and non-specialist primary PE teachers. Therefore, the significance of the thesis is situated in the design and implementation of a PE intervention to increase MVPA, which focuses on developing pedagogical strategies for use by both specialists and non-specialist teachers.

With regards to primary school break times, current levels of evidence for intervention effects are insufficient in this area (Parrish *et al.*, 2013: Erwin *et al.*, 2014), with a need for interventions to focus on the social behaviours of primary school break times (Parrish *et al.*, 2013). Ridgers *et al.* (2012) advised that it is critical for future research to identify the modifiable variables that differ amongst girls and boys in the development of PA promotion strategies during break times. Parrish *et al.* (2013) confirmed this, recommending that future research is needed

to identify effective interventions for sub-groups of children such as boys and girls and children from different socioeconomic backgrounds. Therefore, the significance of the break time research in this thesis is the assessment of children's social determinants to inform the design and implementation of a break time intervention to increase children's MVPA.

A further original contribution is through the employment of a 'Multiphase mixed methods design' (Creswell and Piano-Clark, 2011) allowing for the assessment of both physical and social variables during these two key segments of the primary school day. The adoption of this methodology will contribute towards the understanding of these specific contexts in the school setting (Castelli, Carson and Kulinna, 2014). Therefore, the following research aims and objectives were designed to address the identified original contributions to knowledge, in the specific areas of primary school break times and PE.

1.2 Aims, Objectives and Research Questions

Overall aim of thesis

The overall aim of this thesis was to design, implement and evaluate primary school-based interventions to increase children's moderate to vigorous physical activity (MVPA) levels during break times and physical education.

The specific primary and secondary research objectives for each study were:

Study 1: Primary school break times (Chapter 4)

Primary objective

• To assess children's PA and social behaviours to identify any modifiable variables in order to inform the design of an outdoor break time intervention to increase children's MVPA.

Secondary objectives

• To assess children's PA levels, social group size, activity type and social interactions during outdoor morning and lunch break times.

• To explore primary school children's perceptions and experiences of their playground environment during outdoor morning and lunch break times.

Study 2: Primary school break time intervention to increase children's MVPA (Chapter 5)

Primary objective

• To implement and evaluate the effectiveness of an outdoor primary school break time intervention to increase the children's MVPA.

Secondary objectives

- To assess children's step count during morning and lunch break times at baseline, post-intervention and follow-up.
- To assess children's PA levels, social group size, activity type and social interactions during outdoor morning and lunch break times at baseline, post-intervention and follow-up.
- To assess children's weight status through the collection of BMI data (to enter into the pedometers for accurate data collection).
- To evaluate the effectiveness of the implementation of the walking track through exploring the PE Co-ordinator's perceptions and experiences.

Study 3: Children's physical activity during primary school physical education (Chapter 6)

Primary objective

 To assess children's PA during primary PE and determine the related physical and social determinants in order to design a primary school PE intervention to increase children's MVPA.

Secondary objectives

- To assess children's MVPA, lesson context and teacher promotion of PA during primary school PE lessons.
- To explore teachers' and children's perceptions of primary school PE lessons.

Study 4: Primary Physical Education intervention to increase children's MVPA (Chapter 7)

Primary objective

 To implement and evaluate the effectiveness of a one-year teaching strategy intervention, targeting both specialist and non-specialist teachers, to increase children's MVPA during primary school PE.

Secondary objectives

- To assess children's MVPA, lesson context and teacher promotion of PA during primary school PE lessons at baseline and post intervention.
- To evaluate the effectiveness of the primary school PE intervention through exploring teacher's perceptions and experiences in the intervention school.

1.3 Ontological, Epistemological and Methodological Assumptions

Table 1.1 provides an overview of the thesis' research design, highlighting the related philosophical and methodological assumptions which will be critically evaluated in Chapter 3 'Methodology'. Figure 1.1 provides a chronological overview of the thesis' studies, in the order in which they were conducted, along with methods employed and outcomes.

Table 1.1 Overview of the Research Design

PHILOSOPHICAL V	ILOSOPHICAL WORLDVIEW Pragmatism				
THEORETICAL FRAMEWORK Social Ecological Model of Health Promotion					
METHODOLOGY	N	Iultiphase Mixed Methods Des	ign		
		DESIGN, METHODS	AND DATA ANALYSIS		
	Design	Quantitative Methods	Quantitative Analysis	Qualitative Methods	Qualitative Analysis
Chapter 4 (Study 1) Break times exploratory study	Convergent mixed methods – QUAN + QUAL (Cross sectional)	Systematic Observation: SOCARP (Ridgers, Stratton and McKenzie, 2010)	Descriptives Two-way ANOVA Correlations (Pearson's and Spearman) Multiple Linear Regression	Children's group interviews	Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009)
Chapter 5 (Study 2) Break time intervention 'Walking track'	Explanatory sequential mixed methods QUAN → qual (One group time series)	Pedometers (Yamax Digi Walkers) Systematic Observation: SOCARP (Ridgers, Stratton and McKenzie, 2010) BMI data and stride length	Descriptives Two way ANOVA Three-way ANOVA	Individual teacher interview	Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009)
Chapter 6 (Study 3) Physical Education exploratory study	Convergent mixed methods – QUAN + QUAL (Cross sectional)	Systematic Observation: SOFIT (McKenzie, 2012; 2015)	Descriptives Pearson's Correlations Multiple Linear Regression	Children's group interviews Teacher individual interviews	Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009)
Chapter 7 (Study 4) Physical Education intervention 'SHARP Principles Model'	Explanatory sequential mixed methods – QUAN → qual (Quasi experimental)	Systematic Observation: SOFIT (McKenzie, 2012; 2015)	Descriptives A two-way ANOVA	Teacher individual interviews	Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009)

	Year 1 of PhD study	/ear 2 of PhD study	Year 3 of PhD study	Year 4 of PhD study
Study 1 Break time Exploratory Study	Methods: SOCARP, Children's group interviews			
Study 2 Break time Intervention Study		4ethods: SOCARP, Pedometers, Teacher ind	dividual interviews	Initial discussions began in the 2 nd year for study 2, but the intervention was delayed. Thus, data collection began in 4 th year of study.
Study 3 Physical education Exploratory Study		Methods: SOFIT, Children's group interviews, Teacher individual interviews		
Study 4 Physical education Intervention Study			Methods: SOFIT, Teacher individua interviews	

Figure 1.1 A thesis map to illustrate the chronology of the studies conducted and the methods of studies 1, 2, 3 and 4.

Exploratory studies

Intervention studies

1.4Publications and Conference Proceedings

The following peer reviewed journal articles and conference presentations originate

from the data presented in the thesis.

1.4.1 Peer reviewed journal articles

Powell, E., Woodfield, L.A. and Nevill, A.M. (2015) 'Children's physical activity levels during primary school break times: a quantitative and qualitative research design', *European Physical Education Review*, DOI: 10.1177/1356336X15591135 http://epe.sagepub.com/content/early/2015/06/24/1356336X15591135.abstract

Powell, E., Woodfield, L.A. and Nevill, A.M. (2016) 'Increasing children's physical activity during primary physical education: the SHARP Principles Model', *Preventive Medicine Reports,* DOI: 10.1016/j.pmedr.2015.11.007 http://www.sciencedirect.com/science/article/pii/S2211335515001643

The data from the above papers can be found in Study 1 and Study 4 of the thesis.

1.4.2 Conference papers

Powell, E., Woodfield, L.A. and Nevill, A.M. (2015) The Role of the Primary School Day in the Promotion of Children's Physical Activity Levels. *ISBNPA*, Edinburgh, UK, 3-6th June. Poster Presentation.

Powell, E., Woodfield, L.A., Nevill, A.M. and Powell, A.J. (2016) Increasing Physical Activity Levels in Primary School Physical Education: the SHARP Principles Model. 21st Congress European College of Sports Science, Vienna, Austria, 6-9th July. Oral Presentation.

The data from the above papers can be found in Study 1 and Study 4 of the thesis.

1.5 Definition of Key Terms

Active play: Diverse range of unstructured, spontaneous physical activities and behaviour that children engage in (Pellegrini, 2009).

Adults' perception of break time play: Adults tend to 'value neat and orderly landscapes', whereas, for children they seek play spaces and the ability to manipulate materials in new and creative ways (Chancellor and Hyndman, 2017).

Body Mass Index (BMI): A common global form of measurement for weight, with a range of 25 -29.9kg/m² being classified as overweight and a BMI of 30kg/m² or above classifies a person as obese (NHS, 2010). BMI in children should be adjusted for age and gender and then compared against growth reference charts. Child weight status can be categorised according to the Extended International Obesity Task Force (IOTF) Body Mass Index Cut-Offs for Thinness, Overweight and Obesity in Children (Cole and Lobstein, 2012).

Break Times: 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 (Ridgers, Stratton and Fairclough, 2006; Parrish *et al.*, 2013).

Convergent Mixed Method Design: the collection and analysis of both quantitative and qualitative data during the same phase of the research process, the results of which are then merged into an overall interpretation (Cresswell and Piano-Clark, 2011).

Energy Expenditure: Trost (2007: p299) highlights the distinction between PA and energy expenditure, as 'physical activity refers to body movement, whereas energy expenditure results from body movement'.

Exercise: Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness (Caspersen, Powell and Christenson, 1985: p.126).

Explanatory Sequential Mixed Methods Design: Occurs in two distinct interactive phases; the first phase of quantitative data collection has priority and then is followed by the qualitative data collection. The second phase (qualitative) is designed so that it follows on from the first (Creswell and Piano-Clark, 2011).

Inactive: Sedentary Behaviour Research Network (SBRN) suggested that the term 'inactive' should be described as 'those who are performing insufficient amounts of MVPA (i.e. not meeting the specified physical activity guidelines' (Cart, 2012).

Metabolic Equivalent (MET): One MET is approximately 1kcal kg⁻¹ hr⁻¹ of energy expenditure per 60kg person (Thomas, Nelson and Silverman, 2015). The absolute intensity of activities can be defined according to their MET value: light intensity <3METs; MPA as 3-<6 METs; and VPA as $6.0 \ge$ METs (ACSM, 2014).

Moderate to Vigorous Physical Activity: Any activity above 3 METs (ACSM, 2014); and engaging in categories of '4' (walking/moderate) and '5' (when movement requires more energy than an ordinary walk) on the SOFIT and SOCARP observation tools (Ridgers, Stratton and McKenzie, 2010; McKenzie, 2015).

Multiphase Mixed Methods Design: A multiphase design occurs when a researcher examines a topic through a combination of quantitative and qualitative studies that are sequentially aligned, with each new approach building upon what has been learnt previously to address a central programme objective (Cresswell and Piano-Clark, 2011: p.100).

Non-Specialist Teacher of Primary Physical Education: a teacher who has not followed a PE specialist route in becoming a teacher of primary education i.e., someone who has followed a generalist programme (Burgess and Goulding, 2009).

Obesity (2 - 18 years of age): Haslam, Sattar and Lean (2006: p.640) define obesity as 'excess body fat accumulation with multiple organ-specific pathological consequences'. The term obesity usually refers to an increased weight for height, with excess body fat (National Health Service (NHS), 2014). For children a BMI >30 is classified as obese according to the Extended International Obesity Task Force (IOTF) Body Mass Index Cut-Offs for Thinness, Overweight and Obesity in Children (Cole and Lobstein, 2012).

Overweight (2 – 18 years of age): The term overweight usually refers to an increased weight for height, with excess body fat (NHS, 2014). For children a BMI >25 is classified as overweight according to the Extended International Obesity Task Force (IOTF) Body Mass Index Cut-Offs for Thinness, Overweight and Obesity in Children (Cole and Lobstein, 2012).

Pedometer: 'is a feasible measurement tool for use in large-scale epidemiological and surveillance studies, where total volume of ambulatory activity is a desired outcome' (Clemes and Biddle, 2013: p.259).

Physical Activity: 'is any bodily movement produced by skeletal muscle that results in energy expenditure' (Caspersen, Powell and Christenson, 1985: p.126). For children aged 5 – 17 years, PA has been defined to include activities such as 'play, games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school and community activities' (WHO, 2010: p7).

Physical Fitness: 'is a set of attributes that are either health- or skill-related. The degree to which people have these attributes can be measured with specific tests' (Caspersen, Powell and Christenson, 1985: p.126).

Physical Education: 'is the planned, progressive learning that takes place in school curriculum timetabled time and which is delivered to all pupils. This involves both 'learning to move' (i.e. becoming more physically competent) and 'moving to learn' (e.g. learning through movement, a range of skills and understandings beyond physical activity, such as co-operating with others). The context for the learning is physical activity, with children experiencing a broad range of activities, including sport and dance' (AfPE, 2015: p.3).

Sedentary Behaviour: 'any waking behaviour characterized by an energy expenditure \leq 1.5 METs while in a sitting or reclining posture' (Cart, 2012, p.540). Using the SOCARP and SOFIT tools, the physical activity categories of `1' (lying), `2' (sitting) and `3' (standing) are classified as sedentary behaviour (Ridgers, Stratton and McKenzie, 2010; McKenzie, 2015). The British Heart Foundation (BHF) (2015: p.11) in their PA statistics report, defined sedentary behaviour as `a cluster of individual behaviours in which sitting or lying is the dominant mode of posture and energy expenditure is very low'.

Specialist Teacher of Primary Physical Education: teachers who have followed a subject specialist route in primary physical education (Burgess and Goulding, 2009).

Systematic Observation: 'Is a method by which a trained observer classifies children's free-living physical activity by objectively recording their activity behaviour for a predetermined length of time' (Loprinzi and Cardinal, 2011: p.20).

Vigorous Physical Activity (VPA): Anything \geq 6 METs (ACSM, 2014). According to the SOCARP and SOFIT tools the activity category of '5' is classed as VPA (Ridgers, Stratton and McKenzie, 2010; McKenzie, 2015), and is when the child's movement requires expending more energy than he/she would during ordinary walking.

1.6 List of Abbreviations

- ACSP American College of Sports Medicine
- AfPE Association for Physical Education
- AGDH Australian Government Department of Health
- AMRC Academy of Medical Research Colleges
- APC-PA All Party Commission on Physical Activity (England)
- BCT Behaviour Change Taxonomy
- **BHF** British Heart Foundation
- BMI Body Mass Index
- CATCH Child and adolescent trial for cardiovascular health
- **CCVR** Composite-Cardiovascular Risk
- CHD Coronary Heart Disease
- **CVD** Cardiovascular Disease
- **CSEP** Canadian Society for Exercise Physiology
- **CSPAP** Comprehensive School Physical Activity Programme
- DfE Department for Education
- DH Department of Health
- **DLW** Doubly Labelled Water
- **EE** Energy Expenditure
- HHR Hear Rate Reserve
- HR Heart Rate
- HSCIC Health and Social Care Information Centre
- HSE Health Survey England
- **IMD** Index of Multiple Deprivation
- **IOM** Institute of Medicine (United States)
- IOTF International Obesity Task Force
- IPA Interpretative Phenomenological Analysis
- **METs** Metabolic Equivalents

- MPA Moderate Physical Activity
- MVPA Moderate to Vigorous Physical Activity
- NCD Non-Communicable Disease
- **NHS** National Health Service
- NCMP National Child Measurement Programme
- Ofsted Office for Standards in Education
- **PA** Physical Activity
- PAQ-C Physical Activity Questionnaire for Children
- **PE** Physical Education
- PHE Public Health England
- **RCPCH** Royal College of Paediatrics and Child Health
- RCT Randomized Control Trial
- RE-AIM Reach, Efficacy/Effectiveness, Adoption, Implementation and

Maintenance (RE-AIM) evaluation framework.

- **SBRN** Sedentary Behaviour Research Network
- **SDT** Self-Determination Theory
- **SEM** Social Ecological Model
- SOCARP System for Observing Children's Activity and Relationships during Play
- **SOFIT** System for Observing Fitness and Instruction Time
- SPARK Sports, Play and Active Recreation for Kids
- **UN** United Nations
- **USDHHS** United States Department of Health and Human Services
- **VO₂** Oxygen Consumption
- VO₂R Oxygen uptake Reserve
- **VPA** Vigorous Physical Activity
- **WHO** World Health Organisation

Chapter 2 Literature Review
Chapter 2 – Literature Review

Following the initial introductory chapter, the literature review provides a critical analysis of the research to date. It will begin with the concept of PA and its related principles (section 2.1), moving onto PA in the primary school setting (section 2.2) with a specific focus on break times and PE, and finally a critical analysis of school-based interventions in reference to theories and models of behaviour change (section 2.3).

2.1 The Concept of Physical Activity and its Related Principles

2.1.1 Health benefits of physical activity during childhood and throughout the life course

In the mid-1900s a substantial contribution was made to the field of PA when Professor Morris and colleagues began to investigate the relationship between sedentary jobs and CHD (Morris *et al.*, 1953). This modern day narrative began after World War II in 1949, when Morris *et al.* (1953) noticed apparent protection against CHD from active bus conductors compared with their sedentary drivers of London's double decker buses. The hypothesis derived from these observations was that men in physically active jobs suffered less CHD compared to men in sedentary jobs (Morris *et al.*, 1953). Despite the large amount of scepticism from medical scientists, Morris and colleagues continued to test their hypothesis further and subsequent studies confirmed the cause and effect relationship between exercise and the postponement of cardiovascular disease (Hardman and Stensel, 2009). With this relationship established, it soon became evident that PA would have to be undertaken outside of the work place through exercise in leisure time (Paffenbarger, Blair and Lee, 2001). The notion of physical inactivity as a risk factor for children's health began in the 1960s (Armstrong *et al.*, 1990).

For children and young people the health benefits of PA are fundamental for their physical and social development (WHO, 2011). In children the recommended levels of PA can contribute to their development of musculoskeletal tissues,

cardiovascular system, neuromuscular awareness and maintaining a healthy body weight (WHO, 2011). Physical activity also provides opportunities for children to build their self-confidence, self-expression, social interaction and integration (WHO, 2011). In 2010, Janssen and Le Blanc conducted a systematic review of the health benefits of PA in school-aged children and youth. From the accumulated evidence of 86 studies, they concluded that a dose-response relationship exists, suggesting that the more PA children engage in the greater the health benefits. These health related benefits included: reductions in blood pressure, positive changes in adiposity, bone health and improvements in mental health, such as depression. The review also concluded that even modest amounts of PA (e.g. 10 minutes of MVPA repeated 2-3 times a week) can have substantial benefits for children and youth who are in high risk groups such as those who are obese and/or have high blood pressure (Janssen and LeBlanc, 2010).

Research has indicated that the benefits of childhood PA can positively influence adult health and includes positive outcomes such as adult bone health and maintaining a healthy body weight (Loprinzi and Cardinal, 2011). Additionally, a large tracking study in Australia, indicated modest associations between childhood and adult PA that varied by domain, age and sex (Cleland, Dwyer and Venn, 2012). The study concluded with recommendations to promote a range of physical activities to children of all ages is vital). Furthermore, Soric *et al.* (2014) demonstrated a low-to-moderate (r=.30, P=.03) association between the tracking of peak oxygen uptake from adolescence to middle adulthood. In the UK, the DH (2015) emphasized the importance of PA across the whole life span; as PA has been established as an effective way to protect against the development of a number of diseases, all of which are common in modern society (*Lee et al.*, 2012). For example: CHD (Paffenbarger, Blair and Lee, 2001), stroke (Kohl and McKenzie, 1994), hypertension (Tipton, 1994), obesity (Swinburn *et al.*, 2011), type II diabetes (Paffenbarger, Lee and Kampert, 1997) and several types of cancer, specifically breast and bowel cancers (Wang *et al.*, 2011). In the US, studies have also estimated that inactive people who become active after the age of 50 can gain up to 3.7 years of life (Franco *et al.*, 2005). Other studies have estimated up to a 4.2 years gain for those who are inactive and become active from the age of 30 in Asian populations (Taiwan) (Wen *et al.*, 2011). Physical inactivity has a detrimental health effect worldwide, accounting for 6-10% of deaths from all non-communicable diseases (Lee *et al.*, 2012).

2.1.2 Obesity, weight status and body mass index

The international rise in obesity began in the 1970s and 1980s first developing in most high income countries, however many middle and low income countries have now joined the obesity pandemic (Sassi *et al.*, 2009). Obesity rates continue to be high with maintained projections of 11 million more obese adults in the UK by the year 2030 (Wang et al., 2011). In 2008 an estimated 170 million children worldwide were classified as overweight or obese, producing an estimated figure of 25% of children globally (Swinburn *et al.*, 2011). In England, the National Child Measurement Programme (NCMP) reported a third of children aged 10 - 11 years (Year 6) and a fifth of children aged 4 - 5 years (Reception class) were either overweight or obese from 2015/16 data (National Health Service [NHS], 2016). The results indicated an increase in the prevalence of obesity from the 2014/15 NCMP data in both reception and year 6 children; in Reception it increased from 9.1% to 9.3% and in Year 6 it increased from 19.1% to 19.8% (NHS, 2016). The data also highlighted regional differences across England, with the West Midlands, London and the North East having higher obesity prevalence in both Reception Class data and Year 6 data, specifically, in the West Midlands the prevalence of obesity was 10.4% in Reception and 22.1% in Y6 children (NHS, 2016).

Haslam, Sattar and Lean (2006: p.640) define obesity as 'excess body fat accumulation with multiple organ-specific pathological consequences'. The terms overweight and obesity usually refer to an increased weight for height, with excess body fat (NHS, 2014). In adults the common global form of measurement is the Body Mass Index (BMI), with a range of 25-29.9kg/m² being classified as overweight and a BMI of 30kg/m² or above classifies a person as obese (NHS, 2014). In children, BMI categories vary according to age and sex and are compared against growth reference charts (Cole and Lobstein, 2012). Although BMI has its shortcomings, it tends to be the most commonly used method for assessing childhood adiposity due to its non-invasive nature and ease of data collection. In addition, the common BMI measurements allow for comparisons of weight data across nations (NHS, 2014).

The health burden of obesity is a major concern for both adults and children; it is accompanied with increased risks of diabetes (type two), cardiovascular diseases and several types of cancer (Swinburn *et al.*, 2011). One important variable associated to CHD is physical inactivity; and there is expansive evidence to support that individuals who are active reduce their risk of developing CHD (Lee *et al.*, 2012). Although the simplistic view of obesity is an energy imbalance, the causes of obesity go far beyond this and are complex and multifaceted (Gortmaker *et al.*, 2011). A driver of obesity can be classified as a factor which has substantially changed over the past 40 years, coinciding with the obesity epidemic and has occurred globally (Swinburn *et al.*, 2011). Research points to a range of complex determinants interacting with one another to produce obesogenic outcomes; Swinburn *et al.* (2011) classified these under the categories of physiological, behavioural and environmental drivers. Harnack and Schmitz (2010) believe the causes of obesity are a result of behavioural and environmental factors, which in effect encourage energy intake and reduce energy expenditure. The Measuring Up

Obesity Report (Academy of Medical Research Colleges (AMRC), 2013) advocated immediate action; affirming that populations need to change the way they eat and increase their PA to prevent and/or reverse the health implications of obesity. After 60 years of scientific research no country in the world has a comprehensive and sustainable strategy to address the obesity epidemic (Gortmaker *et al.*, 2011). This is a challenge that should not be taken lightly; lessons can be learned from past epidemiological studies including those of nutrition, tobacco and alcohol control; however physical inactivity should be treated as a unique public health issue (Hallal *et al.*, 2012).

2.1.3 Characterising physical activity and sedentary behaviours

Physical activity is a multifaceted concept and can be described in a variety of ways. For this reason, a collective construct is necessary to aid consistency of measurement; a broad definition of PA and the most widely accepted is 'any bodily movement produced by skeletal muscle that results in energy expenditure' (Caspersen, Powell and Christenson, 1985: p.126). Along with this early definition, Caspersen, Powell and Christenson, (1985: p.126), highlighted the importance of distinguishing between the concepts of 'physical activity', 'exercise' and 'physical fitness'. They defined exercise as 'a subset of PA that is planned, structured, and repetitive and has as a final or immediate objective the improvement or maintenance of physical fitness'. Physical fitness, therefore is 'a set of attributes that are either health or skill related' (Caspersen, Powell and Christenson, 1985: p.126). Trost (2007) reinforced the importance of distinguishing between the concept of PA and exercise, expressing that only a small percentage of children will engage in PA for the sole purpose of improving fitness. In addition, Trost (2007: p.299) highlighted the distinction between PA and energy expenditure (EE), as 'physical activity refers to body movement, whereas energy expenditure results from body movement'.

Working within the construct of Casperson, Powell and Christenson's (1985), PA can be classified as all types of activity, from walking, gardening and housework to playing active games and competitive sports, active transport and occupational related activity (DH, 2011). For children aged 5 – 17, PA has been defined to include activities such as 'play, games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school and community activities' (WHO, 2010: p.7). Physical activity is a complex behaviour and is variable from day to day, making accurate measurement of PA patterns extremely difficult (Winsley and Armstrong, 2005). Physical activity can be placed on a continuum from minimal to maximum movement and involves the key dimensions: frequency (number of times repeated), intensity (magnitude of physical effort), duration (length of time), mode (type of activity); and domain (context or setting in which the activity takes place) (Dugdill, Crone and Murphy, 2009).

When considering the concept of PA, there are a variety of intensities which can be quantified using various methods including: oxygen uptake reserve (VO₂R), HR reserve (HHR), oxygen consumption (VO₂), HR, and metabolic equivalents (METs) (American College of Sports Medicine [ACSM], 2014). The intensity of PA is generally referred to as light, moderate (MPA) or vigorous (VPA) and can be articulated under the expressions of 'relative' or 'absolute' (Thomas, Nelson and Silverman, 2015: p.326). When describing the absolute intensity, METs have been considered an appropriate measurement (ACSM, 2014), with one MET being approximately 1kcal kg-¹ hr-¹ of energy expenditure per 60kg person (Thomas, Nelson and Silverman, 2015). The absolute intensity of activities can be defined according to their MET value: light intensity <3METs, MPA as 3-<6 METs, and VPA as $6.0 \ge$ METs (ACSM, 2014). When classifying the relative intensity of activities: 40 – <60% VO₂R can be defined as moderate, and 60 – <85% VO₂R can be categorised as VPA (ACSM, 2014). However, to simplify these terms, guidelines

have been produced to better communicate the concept of relative intensity related to effort levels on a scale of 1–10. For instance, relative MPA as a level of effort is 5-6 on a scale of 1–10, where 0 is sitting and 10 is maximal effort (Nelson *et al.*, 2007). Despite the clear definitions and categories of absolute and relative intensity for PA, guidelines produced in METs, % maximum HR and %VO₂ max may not be easily understood by the general public and policy makers. Therefore, guidelines that express PA in units of minutes are more appropriate and accessible (Nelson *et al.*, 2007).

For decades the focus of PA studies has been placed upon MVPA. However since the 1990's, there has been a shift in focus for research to include measures of sedentary and light activity intensity in addition to MPA and VPA (Pate, O'Neill and Lobelo, 2008). Sedentary behaviour involves very low EE and usually takes the mode of lying or sitting, some examples of sedentary behaviour include: TV viewing; travelling by car, bus or train; sitting reading; and using various forms of technology such as computers and video gaming (DH, 2011). This relatively new focus upon sedentary behaviour initiated fresh debates; at the heart of these discussions was the definition of sedentary behaviour (Pate, O'Neill and Lobelo, 2008). Specifically researchers were considering whether sedentary behaviour should be classified in terms of low EE activities or whether posture should become the measured construct (sitting and lying versus upright posture as in standing) (Hamilton et al., 2008). More recently, the BHF (2015: p.11) in their PA statistics report, defined sedentary behaviour as 'a cluster of individual behaviours in which sitting or lying is the dominant mode of posture and energy expenditure is very low'. The recommended definition of sedentary behaviour refers to both EE and posture and is stated as 'any waking behaviour characterized by an energy expenditure < 1.5 METs while in a sitting or reclining posture' (Cart, 2012: p.540). Not to be confused with sedentary behaviour, the Sedentary Behaviour Research

Network (SBRN) suggested that the term 'inactive' should be described as 'those who are performing insufficient amounts of MVPA (i.e. not meeting the specified physical activity guidelines' [Cart, 2012: p.540]).

2.1.4 Physical activity guidelines

The accumulated PA research since the ground breaking work of Morris *et al.* (1953) led to the development of national PA guidelines in several countries including the UK (DH, 2011), Australia (Australian Government Department of Health (AGDH), 2014), Canada (Canadian Society for Exercise Physiology (CSEP), 2012) and the US (US Department of Health and Human Services (USDHHS), 2008). Through the creation of the PA guidelines and recommendations, these countries have adopted leadership roles by advocating PA as a public health priority (Kohl and Murray, 2012). These PA guidelines are an important way of communicating the scientific knowledge base to the general public, as they offer a clear interpretation of how PA can be integrated into daily life (Bouchard, Blair and Haskell, 2012). The guidelines as they are published today have been through a history of adaptations, as a result of the rapid increase in PA research since the mid-20th century.

Initially recommendations were based on the work of Finnish physiologist Marti Karvonen in 1957, from his research investigating the effects of exercise training (running) on endurance fitness in adults (Bouchard, Blair and Haskell, 2012). From his research he concluded that in order for gains in cardio respiratory fitness, 60% of the HR range was required (maximum HR minus resting HR). Despite his research being based on a limited number of participants, it became a very powerful and influential piece of research on public health practice (Bouchard, Blair and Haskell, 2012). Two decades later, in 1978 the first public recommendations were issued from the ACSM outlining the quantity and quality of exercise required for developing and maintaining fitness. They stated that in order to develop and

maintain fitness, adults needed to exercise for 15-60 minutes, three to five days per week, and at an intensity of 60-90% of maximum HR (ACSM, 1978). The ACSM guidelines have been updated and published over the years to the present day, and the main changes can be seen with regard to the intensity of the exercise recommended. Early recommendations were based on VPA (ACSM, 1978) with latest recommendations advising MPA to VPA; and recommending light to MPA in individuals who are deconditioned, with a gradual increase in intensity, frequency and duration (ACSM, 2014).

In early recommendations for children it was advised that they should do the same amount of PA as adults, however, research from expert panels and health organisations encouraged the advancement of age specific guidelines (Marshall, Welk and Smith, 2008). The UK's PA guidelines published from the DH in July, 2011 'Start Active Stay Active' provided a fully updated platform for research and practice in the field of PA and health (Davis *et al.*, 2011). It was the first time the UK's DH has produced specific PA guidelines across the entire life course including the early years (0-5years) and older adults (65+). The guidelines set are relevant to all and are irrespective of gender, race or socio-economic status (DH, 2011). For children and young people the guidelines are that they should take part in at least 60 minutes and up to several hours of MVPA a day; in addition, VPA which strengthens muscle and bone should be included at least three days a week (DH, 2011). There was also an emerging focus on reducing sitting time, with the UK's guidelines highlighting the risks of excessive sedentary behaviour; they advise that all children and young people should minimise their sitting time for extended periods (DH, 2011).

The country specific PA guidelines are also reinforced by the WHO (2010) who published global recommendations on PA for health. For children and young people

(5-17 years), they advise the accumulation of 60 minutes daily MPA to VPA. The WHO's (2010) recommendations state that any PA above the daily 60 minutes will provide additional health benefits, therefore highlighting the importance of the dose-response relationship between PA and health (Bouchard *et al.*, 2012). Their third recommendation highlights the need for aerobic activities, including those that strengthen muscle and bone at least three times a week. This recommendation is a newer addition to the guidelines, due to the increasing evidence base on health outcomes of children's PA (Bouchard *et al.*, 2012; Gunter, Almstedt and Janz, 2012). As children's patterns of PA are usually in short bursts and sporadic, the recommended 60 minutes can be accumulated from shorter periods of activity throughout the day (WHO, 2010).

Any differences amongst countries PA guidelines may be related to their publication date which demonstrates the importance of regular updates; with current gaps in the guidelines including specific age groups, ethnic groups and those with disabilities (Bouchard et al., 2012). Fussenich et al. (2016) highlighted that little is still known with regards to gender differences and children's PA recommendations. In their recent study, they investigated whether achieving the current WHO's (2010) PA recommendations reduced children's compositecardiovascular risk score (CCVR). The study by Fussenich et al. (2016) involved 182 children aged 9-11 years old in the North West of England, and their PA levels were assessed using accelerometers over a seven day period. The findings indicated that achievement of current guidelines of 60 min MVPA for children had positive effects on body composition and cardio respiratory fitness. However, they also reported that no differences were found between CCVR of children who undertook 60 min of MVPA per day and those who did not; suggesting that the current recommendations of 60 min MVPA per day (WHO, 2010) may be an underestimation of the PA required to reduce clustered cardiovascular disease (CVD) risk in children (Fussenich *et al.*, 2016). In addition, they further advised that daily VPA should be recommended as their data suggested that 17 min VPA each day may provide CVD risk reductions. Nonetheless, the UK's PA guidelines do state that children should engage in a minimum of 60 minutes of daily MVPA (DH, 2011), and the WHO's (2010) recommendations highlight that anything above the daily 60 minutes will provide additional health benefits. However, maybe this needs to be made clearer to those interpreting the recommendations, in order to advocate additional health benefits for children.

2.1.5 Measuring physical activity and sedentary behaviour

Research on the promotion of PA behaviours requires the application of measures that are valid and reliable when applied to their related age group and context (Pate, O'Neill and Mitchell, 2010). Unfortunately, there is no one perfect measurement tool for PA, therefore, researchers must be fully aware of the limitations and strengths of the methods they employ (Loprinzi and Cardinal, 2011). There are many measures of PA. Accurate measurement of children's PA is a difficult task due to the sporadic nature and short bursts of activity (Rowlands and Eston, 2007). The type of PA is also variable from one day to the next, therefore, researchers have acknowledged the importance of measuring over multiple days to capture the true essence of habitual PA. Research suggests that 3-4 consecutive days of monitoring are required to assess PA regardless of which method is selected (Hart et al., 2011). Currently there is a wide selection of objective methods available to measure children's PA, including: HR monitors, pedometers, accelerometers, direct observation, self-report and doubly-labelled water (Loprinzi and Cardinal, 2011). However, there are a number of factors that will influence the method selected. For instance the sample size, participant burden, research time frame, practicality, cost and data management (Dollman et *al.*, 2009). The following subsections will provide an evaluation of several methods for assessing children's PA in relation to their validity and reliability, with a specific focus on the methods of direction observation, pedometers and self-report.

2.1.5.1 Direct observation

The method of direct observation has been considered the gold standard for measuring PA in terms of intensity, frequency and type (Hay, 2013). It has a number of advantages over other PA measures (Loprinzi and Cardinal, 2011), as it is able to collect contextually rich data, providing information across a number of variables including the type of activity and when, where and with whom it occurs (McKenzie, 2010). There is also little participant burden, as the researchers do not interact with the participants (McKenzie, 2010), thus, it is an ideal method to use with children. As with any method, direct observation also has its limitations, as substantial time and effort are required by the researchers in terms of training and data collection (McKenzie, 2010), which can limit the number of samples taken and therefore can induce questions regarding the generalisability of the data (Loprinzi and Cardinal, 2011). Direct observation also presents challenges with regards to participant reactivity and for that reason the Hawthorne Effect must be a factor of consideration (Hay, 2013).

Several direct observation systems have been developed for specific settings to measure children's PA including PE lessons (McKenzie, 2012; 2015) and school break times (Ridgers, Stratton and McKenzie, 2010). Of which, validation studies have been conducted, as in the case of the System for Observing Children's Activity and Relationships during Play (SOCARP) (Ridgers, Stratton and McKenzie, 2010), which evidences a moderately, significant correlation between estimated EE scores (2.5 ± 0.5) and mean accelerometer counts (154.5 ± 74.1 CPE; r=.67; *P*<.01). Furthermore, the contextual advantage of direct observation allows the researcher to identify potentially modifiable physical and social variables which can

be applied to the design and implementation of children's PA interventions (McKenzie, 2010; Ridgers, Stratton and McKenzie, 2010).

2.1.5.2 Pedometers

Evidence suggests that primary school children can accumulate the recommended 60 minutes MVPA (DH, 2011) through a total volume step count of 13,000 to 15,000 steps for boys and 11,000 to 12,000 steps for girls (Tudor-Locke et al., 2011). The pedometer is considered a valid and reliable measurement tool for assessing children's (>5 years) total volume of ambulatory (walking) PA (Clemes and Biddle, 2013). It has been considered a relative low cost PA measurement tool for estimating the total number of steps taken over a given period (Loprinzi and Cardinal, 2011), with one of its main advantages being the low burden on both the participants and the researcher (Clemes and Biddles, 2013). It has been considered user friendly (Clemes and Biddle, 2013), objective (Clemes and Biddle, 2013), valid (McNamara, Hudson and Taylor, 2010), reliable (Rowe *et al.*, 2004) and useful for documenting changes in children's PA (Trost, 2001). However, there are several areas of concern when using pedometers as a research tool for measuring children's PA such as: reactivity, wear time, days of monitoring and compliance (Clemes and Biddle, 2013; Ling and King, 2015). In addition, pedometers are insensitive to certain forms of activity such as cycling and swimming, yet they are useful in providing a measurement of children's overall activity (Loprinzi and Cardinal, 2011).

As with the method of direct observation, one of the areas for concern when using the pedometer is participant reactivity, which can result in an increase or decrease in children's PA (Prewitt, Hannon, Brusseau, 2013) and thus can affect the validity of the measurement tool. To date, there is conflicting data with regard to wearing pedometers and reactivity in children (Clemes and Biddle, 2013), with several studies reporting no evidence of reactivity in children wearing unsealed pedometers. For instance, Rowe *et al.* (2004) collected unsealed pedometer data from children aged 10-14 years and concluded that there was no evidence of reactivity; as did Prewitt, Hannon and Brusseau (2013), who found no statistically significant differences in step counts between sealed and unsealed pedometers in children aged 9-11 years. A more recent study (Ling and King, 2015), provided further support for the validity of pedometers, highlighting no evidence of reactivity in the use of unsealed pedometers in children with a mean age of 9.2 years in a sample of 133 children across ten school settings. However, a criticism of studies reporting no reactivity when children are wearing sealed versus unsealed pedometers is that the children are still aware that they are wearing a pedometer and thus may cause some reactivity (Clemes and Biddle, 2013). Only through covert monitoring can a reliable indication of reactivity be shown (Beets, 2006). Another factor to take into consideration is the relatively short time period applied, such as in the Ling and King (2015) study, who recommend a longer monitoring period for future studies investigating pedometer reactivity.

When considering wear time, Clemes and Biddle (2013) highlighted that there is currently no accepted criterion for how much wear time is needed for a valid day of pedometer measurement in children. They also advised for future studies to exclude pedometer data from a day when it has been reported that the pedometer has been removed for more than an hour. It has been recently suggested that placing extended time periods for both wear time and days of monitoring can affect the available sample, indicating that certain criterion can be difficult to achieve (Laurson, Welk and Eisenmann, 2015). Due to the sporadic nature of children's PA and day to day variability there is currently no consistent evidence on how many days are needed to produce a reliable representation of children's habitual PA (Clemes and Biddle, 2013). However, it is vital to ensure a balance is maintained between reliable data without unnecessary burden upon the participants (Clemes and Biddle, 2013; Laurson, Welk and Eisenmann, 2015). The suggested timeframe for reliable data ranges from 2 – 7 days of monitoring (Ling and King, 2015). For instance Clemes and Biddle (2013) suggested the most common time frame to be 7 consecutive days, however a recent study advised that four consecutive days of wearing pedometers is sufficient to collect reliable data of children's PA (Ling and King, 2015). Although, it must be noted that these recommendations are for measuring free-living PA and advice for measuring children's step count during key windows of the school day is scant with researchers adopting different procedures (Tudor-Locke *et al.*, 2006; Stellino *et al.*, 2010).

2.1.5.3 Alternative measures of PA

Self-report measures were an early measure of PA behaviours until the development of monitors such as pedometers and accelerometers (Biddle *et al.*, 2011), and include instruments such as self-administered recalls (e.g. questionnaires and surveys), interview recalls and diary logs (Biddle *et al.*, 2011; Loprinzi and Cardinal, 2011;). Proxy reports are an alternative of self-report measures and are often used to estimate PA behaviours of children under 10, who are considered too young to provide reliable answers in a self-report measure, and therefore the measures are usually administered by a parent or teacher (Loprinzi and Cardinal, 2011). One example of a self-report measure for children aged 8-14 years is the Physical Activity Questionnaire for Children (PAQ-C) (Kowalski, Crocker and Donen, 2004), which requests children's seven day recall on frequency of PA and domain. However, measurement error still remains a concern when using self-report tools with young people due to issues of accurate recall, for instance young people may not recall all types of PA due to their sporadic bursts of PA (Biddle *et al.*, 2011).

Despite measurement concerns, self-report measures do offer advantages, as highlighted in an early review of self-report instruments (Sallis and Saelens, 2000) in which it was concluded that when used in combination with objective measures, they can offer additional information in the form of the domain and type of PA. Other advantages of self-report include ease of administration and relatively low cost (Trost, 2007). Biddle et al. (2011) advocated the use of self-report measures to assist in the development of effective PA interventions, as it is important to understand what PA behaviours occur as well as their frequency. More recently, Tannehill *et al.*, (2015) expressed the importance of listening to young people's voices in order to gain information on their perceptions of PA, why they choose to participate or any barriers they face. Over the past decade there has been a growing use of qualitative methods used alongside objective measures to provide researchers with a realistic understanding of why certain PA behaviours occur in order to design effective PA interventions (Tannehill et al., 2015). The use of mixed methods will therefore be explored further in the methodology chapter of this thesis.

HR monitors are considered an attractive approach to measuring children's PA due to the direct relationship between HR and EE (Trost, 2007), allowing the objective measurement of frequency, intensity and duration of PA (Loprinzi and Cardinal, 2011). They can be the method of choice when measuring non-ambulatory activities that cannot be measured by monitors such as pedometers and accelerometers (Ainsworth *et al.*, 2015). However, several limitations of HR monitors exist in their use with children, for instance HR response is momentarily delayed post movement and can remain raised after movement, therefore HR recordings may not reflect the sporadic nature of children's PA (Trost, 2007; Loprinzi and Cardinal, 2011; Ainsworth *et al.*, 2015). Accelerometers are another type of wearable monitor that have been considered an ideal tool for assessing

children's PA due to their extended battery life and memory capacity to record short epoch data (5 seconds) for up to several weeks (Loprinzi and Cardinal, 2011). They provide data on the frequency, duration and intensity of PA from the vertical movement of the trunk or other body segments at specified time intervals (Trost, 2007). Accelerometers provide less of a burden than that of HR monitors and they are capable of detecting short bursts of PA in children (Trost, 2007). Even though accelerometers have been considered the most promising tool for use in measuring children's PA (Trost, 2007), they still are limited with regard to the types of activity they can measure, for instance children need to remove them before taking part in water based activities.

Doubly-labelled water (DLW) is consider one of the criterion measures used to assess children's PA and is a method that provides total EE over a period of two weeks through measuring carbon dioxide production (Loprinzi and Cardinal, 2011). This method requires the participant to ingest a 'heavy water' which contains two stable isotopes; the difference between the elimination rates of the two isotopes from the body is then measured and the results are directly related to EE (Loprinzi and Cardinal, 2011: p.20). This technique has been validated in both adults and children with indirect calorimetry, evidencing the technique to be accurate within 5-10% (Goran, 1994). The major limitations of this measurement of EE are the cost and its inability to measure patterns of PA such as the intensity (Trost, 2007).

Each method of measuring PA has its strengths and limitations, therefore, to gain reliable and valid measures, Ridgers, Fairclough and Stratton (2010b) recommended the need to combine methods of measuring PA. Davison and Lawson (2006: p.14) made key recommendations regarding research into PA. They identified a need to move the body of research into the 'next phase', believing that this can be established through the design and implementation of more complex

research models. They also believe that the assessment of context-specific behaviours is essential to understand the associations between the physical environment and PA, incorporating research designs which link quantitative and qualitative data. Ainsworth *et al.* (2015) make recommendations in the selection of a research assessment tool for measuring PA. They suggested that in order to select an optimal assessment tool, the researcher must consider the likelihood of measurement error in relation to the population under study. Therefore, consideration of age, context and sex can assist in utilising the most valid and reliable measures of children's PA.

2.2 Physical Activity in the Primary School Setting

2.2.1 The importance of the primary school setting

In 2004, the WHO worked collaboratively with key health partners internationally to create a comprehensive global strategy to target diet, PA and health. Within this strategy, schools were identified as key settings in the promotion of children and young people's PA. This was further reinforced in their 2013-2020 global action plan, which outlined key measures in the prevention of Non-Communicable Diseases (NCDs) (WHO, 2013). A recent systematic review of PA in school-based settings concluded that the identification of effective approaches in increasing and sustaining the PA levels of children during school hours is crucial (Dobbins et al., 2013). The school setting is an ideal environment to target children's physical inactivity, as they spend a large proportion of their time in school during the first two decades of their life. Research has reported that children in British schools spend 40 - 45% of their waking hours during term time in the school setting, which includes travelling to and from school (Fox, 2004). In England, according to the Education (School Day and School Year) Regulations 1999, those children who are educated in a school setting are required to attend school for 190 days of the year, however, it is down to the head teacher and governors of the school to determine the length of the school day (DfE, 2014). England's All Party Commission on PA recommended schools as a prime environment to promote children's PA, affirming that active schools should be the norm, assisting children in creating lifelong habits for PA (APC-PA, 2014). In their report titled 'Tackling Physical Inactivity - A Co-ordinated Approach', they outlined the importance of targeting different segments of the school day through a whole school approach. They identified key parts of the school day to target: before and after school, high guality PE, active lessons across the curriculum and activity breaks. In addition, to children spending a large amount of their time at school, the school setting also provides an appropriate infrastructure for promoting children's PA, for instance through facilities, staffing and resources (Pate *et al.*, 2006). Schools are particularly important for children with disabilities, as it has been highlighted that opportunities for UK children with disabilities to be active are limited outside of the school setting (Downs et al., 2013). Furthermore, research also indicates that people in deprived areas are less likely than people who live in affluent areas to be physically active due to poorer perceived accessibility to greenspaces and poorer safety (Jones, Hillsdon and Coombes, 2009). Thus, the school setting can provide a safe location in which children can be physically active irrespective of their personal circumstances.

2.2.2 Opportunities for physical activity across the primary school day

2.2.2.1 Primary school break times

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, which includes morning break and lunchtime, has been defined as the non-curriculum time between lessons when children can freely engage in PA and leisure activities (Ridgers, Stratton and Fairclough, 2006; Parrish *et al.*, 2013). In the UK, daily break time is mandatory and can account for up to 25% of the school day

(Ridgers, Fairclough and Stratton, 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 MVPA (Ridgers and Stratton, 2005).

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 (Verstraete *et al.*, 2006; Barton *et al.*, 2015) equipment, 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 boys and girls (Ridgers *et al.*, 2012; Parrish *et al.*, 2013).

A systematic review of PA during break times supported previous research findings that boys are more active than girls (Ridgers *et al.*, 2012), with boys enjoying sports and competitive games, whilst girls are more likely to socialise with their peers (Blatchford, Baines and Pellegrini, 2003). A Ready for Recess intervention discovered differences in effects across the 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, with Ridgers et al. (2012) highlighting that few studies have investigated the social interactions amongst children and the composition of social groups during break times. In a recent gualitative study, Knowles et al. (2013) concluded that social interactions during break times amongst children aged 7-11 was the most commonly cited theme with 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, gualitative methods need to be employed to understand children's perceptions of this specific context. It has been suggested that the use of an ecological model 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 layers across a SEM (Ridgers et al., 2012), with the majority of variables being associated with the individual and the physical levels of the model.

Although the body of research investigating children's PA behaviours during break times has accumulated over the past 20 years and is growing, 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). Identification of children's social behaviours during primary school break times is important as it could highlight potential break time PA correlates, which in turn may assist in the development of future break time interventions. Therefore, in order to investigate children's social behaviours, both quantitative and qualitative methods have been recommended (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).

2.2.2.1.1 The physical environment of the school playground

Ecological models of health behaviours (Sallis, Bauman and Pratt, 1998; Glanz and Rimmer, 2008) emphasize that individual behaviour is a multifaceted concept, being influenced by factors such as individual, social, environmental and policy components. When considering the physical environment of the primary school playground, research has suggested both weak effects (Ridgers, Fairclough and Stratton, 2010b) and unclear associations (Cardon et al., 2008) between that of the playground's physical environment and the amount of PA children engage in at break times. However, the majority of prior research has demonstrated that interventions such as playground markings, portable equipment and physical structures do have a positive effect on children's MVPA and VPA (Stratton, 2000; Ridgers, Stratton and McKenzie, 2010; Anthamatten et al., 2011; Barton et al., 2015). Davison and Lawson (2006) conducted a review of the physical environment and children's PA levels; they discovered that children were more likely to be active during break times when there was a larger number of activityrelated equipment available to them. It has also been highlighted that children like to capitalize upon their surroundings and this has been a dominant characteristic reported amongst researchers (Darian-Smith, 2013). There is also a growing consensus that changes in the physical environment are required to increase the population's PA levels (Sallis *et al.*, 2012). However, it is still unclear as to whether changes in children's PA behaviours as a result of interventions targeting the physical environment are sustainable, as highlighted in the Anthamatten *et al.* (2011) study.

2.2.2.1.2 The social environment of the school playground

Several studies have investigated the social environment in relation to the primary school playground and children's PA levels, with research indicating that friendship

groups are key influences to children's PA behaviours (Salvy, et al., 2008; Jago, et al., 2009; Ridgers, Stratton and McKenzie, 2010), including the activities they engage in, how they interact with their physical environment and who and how they choose to interact. Previous research has highlighted that children's peers are of high importance during break times with the term 'peers' being defined as individuals who are of similar ages (Smith, 2007). Also supporting this is the work of Smith and McDonough (2008) who expressed that positive peer experiences can provide children with opportunities to be physically active. The opposite has been found to occur when negative peer relationships are displayed as Ladd (1999) suggested that children and young people often respond to negative peer treatment by disengaging from the social environment. Furthermore, the compounding effect of isolation and negative peer feedback can result in further isolation and a reduction in PA behaviours (Buhs and Ladd, 2001). Break time supervisors also form part of the playgrounds social environment, with mixed findings previously reported regarding associations between MVPA and the number of adult supervisors. Ridgers, Stratton and McKenzie (2010) suggested that the number of supervisors on the playground was not associated with children's %MVPA. Salvy (2008) suggested a need to move away from research that focuses upon the role of adults in governing PA behaviour, believing that the role of adults in the playground has little influence on children's PA.

2.2.2.1.3 The individual environment of the school playground

At the centre of the playground environment is the individual child, and a number of personal factors influence the child's PA behaviours, including age and gender. The school break time provides an environment where the child has to make a number of individual choices and, as a result, the child is able to construct their own playground environment. For instance, who they play with, the activity they engage in, the space they play in and who they interact with in their physical environment. There is evidence to suggest that sex differences exist relating to children's PA and social behaviours during school playtimes (Ridgers, Stratton and McKenzie, 2010; Roberts et al., 2012); boys prefer to engage in larger group sizes and choose more VPA than girls such as running and football, whereas girls enjoy spending time in smaller friendship groups. Factor (2004) suggests that children are flexible and resourceful when it comes to establishing a relationship between themselves and their playground environment, and a number of researchers also found children to be creative with their environment through the engagement in imaginative play (Dockett and Fleer, 1999; Sutton-Smith, 1999). Children's play behaviour is complex and goes beyond that of an adult's constructed view of the playground (Lester and Russell, 2010). A child engaging in an imaginary environment is supported by Mouritsen's (1998) theoretical work on children's play culture and the concept of development. Working within Mouritsen's (1998) conceptual framework, children's play culture refers to the expressions of culture that children produce through their own networks. It consists of a wealth of sporadic movement and expressive forms including locomotive activities such as Children can transform situations into special arenas for their walking. performance and creative play; hence the playground environment can be converted through their play culture. Drawing from previous research, it is evident that both the social and physical environment play important roles in children's PA behaviour. It would be suggested that the physical environment of the playground should be designed in a way to stimulate children's play. Children will play with real or invisible equipment; however PA levels could be increased through a well thought out playground design catering to the children's play culture and development. To gain an understanding of this, alongside objective PA measures, researchers also need to spend time in the playground environment observing children's break time behaviours and most importantly consult the children.

2.2.2.1.4 Children's perceptions of their school playground environment

Stanley, Boshoff and Dollman (2012) explored children's perceptions of their playground environment in relation to PA behaviours during break times; their results indicated a range of barriers and facilitators in association with both the social and physical playground environment. Barriers included a lack of access to space, programmes and equipment, and a lack of teacher/peer support and bullying; their perceived facilitators of PA included access to equipment, peer support and having the freedom to modify or make up their own games. They concluded their work proposing that future PA research needs to consult children as this will provide a unique opportunity to understand the factors that influence children's PA in the context of the school playground. They also advised that efforts should be made to promote PA in schools and address barriers to increase children's daily PA. Parrish et al. (2012) reported similar social and environmental barriers to children's PA at break times. One of the major determinants identified by the children, teachers and head teachers was bullying within the school playground. They perceived bullying to have negative effects on children's access to equipment and related PA levels. In the findings of Parrish et al. (2012) it was noted that even if physical environmental changes are made to the playground environment they could have little effect on PA levels if social determinants and policy variables of PA are not also considered.

2.2.2.1.5 The importance of play in the primary school environment

Santer and Griffiths (2007) classified free play as children being intrinsically motivated, and playing without adult supervision. Public health advocates have recently emphasized the importance of children's free play as a means to increase children's PA levels (Alexander, Frohlich and Fusco, 2014). Das and Horton (2012) consider the way forward in addressing public health is to change both the physical and social environment across various community settings. With that in mind, play provides opportunities for children to interact with their environment, and from this perspective, play can become a mechanism for developing newly acquired skills

which children will take with them into adult life (Lester and Russell, 2010). When children play they rearrange their worlds to make them less boring and less scary (Sutton-Smith, 1999). For example, in the school playground children can be physically active through the game 'chase' agreeing their own rules and boundaries, yet what they value most is the thrill of the chase (Lester and Russell, 2010). By the children establishing their own framework of rules to play in, children are providing their own safe place where emotions can be experienced without the consequences of the real world (Lester and Russell, 2010). In play, physical movement is exaggerated, unpredictable and fantastical, and rules of games are changed in order to allow them to continue; play for children is about creating a world in which they have control, they are free from rules and adult restrictions (Pellis and Pellis, 2013). Play offers children the opportunity to transform existing environments and cross borders, subverting adult cultural expectations of children (Thorne, 1993).

A range of academic fields acknowledge the benefits of play and the important role it has in children's life experiences (Cheng and Johnson, 2010). Researchers have argued that play is becoming an element of the past (Burdette and Whitaker, 2005) with one of the contributing reasons being parental fears regarding children's safety when playing outdoors unsupervised (Ginsburg, 2007). It is from these discussions that the benefits of play have entered public health agendas, focusing on increasing active play opportunities for children due to the widespread obesity epidemic and increases in sedentary living (Alexander, Frohlich and Fusco, 2014). It has also been cautioned that children's body weight may be associated with reduced opportunities for play (Harten, Olds and Dollman, 2008). As a result the promotion and regeneration of play spaces such as school playgrounds and community play spaces have been advocated to engage children in regular bouts of PA (Potwarka, Kaczynski and Flack, 2008) and perhaps schools provide safer places to play under adult supervision. Floyd *et al.* (2011) emphasized the importance of designing play spaces that are structured and tailored to promote PA amongst different age groups. However, if an environment is 'structured' then this suggests that an adult break time world is created rather than that of children's break time world, drawing upon imaginative play. Farley *et al.* (2008) stresses the importance of understanding the features of play spaces that are most effective in stimulating PA in children. For example, when considering a definition of an adult view of the break time environment, Chancellor and Hyndman (2017: p.38) state that adults tend to 'value neat and orderly landscapes', whereas, for children they seek play spaces and the ability to manipulate materials in new and creative ways.

2.2.2.2 Primary school physical education

Physical education occurs during curriculum time and has been recently defined as 'the planned, progressive learning that takes place in school curriculum timetabled time and which is delivered to all pupils' (AfPE, 2015: p.3). Involving the key concepts of 'learning to move' and 'moving to learn', with the context for learning being focused on PA through a range of experiences (AfPE, 2015). The current national curriculum (NC) programme of study for primary PE in England aims to ensure that all children are 'active for sustained periods of time', they 'develop the competence to excel in a broad range of physical activities and 'lead healthy, active lives' (DfE, 2013a). However, internationally there is a current lack of agreement on the aims and outcomes of primary PE and this issue has been highlighted since the 1980s until the present day (Doherty and Brennan, 2014).

The concept of 'effectiveness' in PE has been described as 'muddled' with the subject area lacking a curricular focus, with McKenzie and Lounsbery (2013: p.419) advocating that PE should be placed in a public health context. Dyson (2014) in his commentary on effective teaching in PE challenges the views of McKenzie and

Lounsbery (2013) and promotes a holistic approach towards PE with a focus on the affective domain, believing that PE is more than just PA. McKenzie and Lounsbery (2013) highlight that PA in PE is not just important for health gains but also for skill development, as children cannot become physically skilled if they are not engaged in PA. As highlighted by AfPE (2015), children need to move in order to learn physical skills thus, in a PE lesson if children are spending large amounts of time listening and observing the teacher then their opportunities to physically practice their skills is reduced.

In England, schools usually allocate at least two hours of PE weekly; however this was a target set through a previous government and has not been endorsed by the current government (AfPE, 2013; 2015). Greenfield et al. (2016) analysed national school level data on the provision of PE across both primary and secondary schools in England involving a total of 21,515 schools, encompassing 98% of all state schools in England. The results suggested that 90% of children in school years one to seven received 120 minutes of PE each week, with no apparent differences between males and females during the primary school years. Although a limitation of this data set, also noted by the authors, was that provision of PE in minutes does not necessarily match in terms of minutes of PA during PE, the accuracy of the data can be questioned due to the method of self-report. In addition, the results from England's report card on children and youth's PA reported that the favourable grade of 'A-' had been awarded to school provision, with one of the contributing components of that grade being the allocated two hours of PE provision (Tremblay *et al.*, 2014). Again, national data from the PE and Sport Survey 2003-2004 to 2009-2010 (Quick, Simon and Thorton, 2010) was used to inform the grade awarded, and the same limitation applies as stated by Standage et al. (2014: p.48) 'We do not know how active children are during the lessons. Future work on this issue is warranted'. Despite the national surveys

indicating that school provision was increasing, in 2013, the Office for Standards in Education (Ofsted) inspected 120 primary schools in relation to their PE provision, in England between 2008 and 2012. The report revealed that schools were allocating insufficient time to primary PE lessons, and common weaknesses were evident across inspected schools. One of the main limitations was long periods of inactivity during lesson time which was mainly related to teacher instruction time (Ofsted, 2013).

2.2.2.1 Facilitators and barriers of primary physical education

In the design of school-based health programmes it has been suggested that policy makers need to consider both the environment of the school (i.e. the physical environment) and the roles of school staff (i.e. the social environment) (Brown and Elliott, 2015). Lounsbery *et al.* (2011) advised that in the development of research based PE provision, an understanding of the facilitators and barriers to school PE would prove valuable. In their large scale study involving 134 schools across 34 US states, findings indicated that both teachers and head teachers expressed a range of barriers to school PE. These included: a lack of PE specialists, funding resources and time in the school day. The teachers also perceived additional barriers to PE: PE being a low priority subject area, large class sizes and limited district support for PE.

Christian *et al.* (2015) explored head teachers' perspectives of implementing health promotion interventions in 84 primary schools in Wales. One of the main barriers expressed by the head teachers was the current government priorities of literacy and numeracy lessons. The head teachers further expressed that until health based outcomes are measured in schools it will always be seen as secondary to academic achievement in literacy and numeracy. Another common theme reported amongst the head teachers was how integral their roles were in the implementation of interventions, regarding themselves as 'paramount in

influencing and engaging pupils as well as maintaining health based initiatives' (Christian *et al.*, 2015: p.5). Boyle, Jones and Walters (2008) investigated adolescents PA levels from the perspectives of head teachers and heads of PE in secondary schools in England. Despite this research being conducted in secondary schools, similar barriers were identified to the study of Christian *et al.* (2015), for instance time restraints, a restricted curriculum and schools undervaluing physical activities. Boyle, Jones and Walters (2008) concluded that children's activity must be built into a school through policy and practice in order to increase young people's PA.

Primary PE is generally delivered by non-specialist teachers and research from the past two decades has highlighted the difficulties teachers face in the delivery of PE lessons (Morgan and Hansen, 2008). A non-specialist teacher of primary PE has been defined as a teacher who has not followed a PE specialist route in becoming a teacher of primary education (Burgess and Goulding, 2009). Morgan and Hansen (2008) collected interview and questionnaire data from primary school teachers in Australia on their perceptions of teaching PE, from their research they identified two categories as to why PE provision was affected in schools. They classified these as either institutional (beyond the teacher's control) or teacher related (devising from their own behaviour). Institutional barriers highlighted included budgetary constraints, lack of resources, overcrowded curriculum and the absence of professional development. Teacher related barriers included low levels of confidence and subject knowledge, having negative personal experiences of PE and a lack of Initial Teacher Training (ITT) in PE. In addition research internationally indicates brevity in training allocated to non-specialist teachers in relation to primary PE (Curter-Smith, 2007). Fairclough and Stratton (2006) highlighted that primary school children are often taught PE by general classroom teachers and in the majority of cases they do not possess specialist PE knowledge or qualifications.

2.2.2.2.2 Pedagogical approaches and their impact on MVPA during PE

In 2006 Fairclough and Stratton conducted a review of children's PA levels during primary PE, they emphasized that in a typical primary PE lesson children are frequently stopped for a number of reasons. These included: to receive instructions, observe demonstrations, to organize resources and to arrange the children into groups. Therefore, increasing and maintaining high levels of MVPA during primary PE can prove a challenge for most teachers (Fairclough and Stratton, 2006). They also highlighted that simple pedagogical strategies can be put into place to maximize upon active learning time during primary PE lessons. Similar strategies were designed and implemented during the Sports, Play and Active Recreation for Kids (SPARK) intervention study, which indicated 50% MVPA in pupils when lessons were taught by non-specialists (McKenzie et al., 1997). Reflecting upon the pedagogy adopted in the SPARK programmes, to achieve higher levels of PA in PE lessons it was advocated that lessons should: ideally begin with VPA reviewing prior learning, subsequent lesson phases should include well-paced and differentiated activities that are enjoyable and underpinned by the principles of small group work or teams, efficient use of the available space and equipment, minimum teacher-talk time, and quick and efficient feedback which should be delivered to pupils whilst they remain on task (McKenzie et al., 1997; Fairclough and Stratton, 2006).

Logan *et al.* (2014) investigated the effects of two different instructional climates on children's (7-8 years) MVPA during primary PE. Their results indicated that children spent higher levels of MVPA during mastery (68% MVPA) and performance (67% MVPA) climates in comparison to their typical PE lessons (47% MVPA). In the typical PE lessons, the results indicated that 0% of the lesson time was allocated to general knowledge (using the SOFIT tool [McKenzie, 2012; 2015]); whereas the mastery and performance climates spent 16.5% and 16.2% of lesson time in general knowledge. They indicated that the higher levels of MVPA during mastery and performance climates could be as a result of the increased opportunities children had to put into practice what they had learnt.

2.2.2.3 The impact of sex, age and activity type on MVPA during PE

Differences in %MVPA have also been found with regards to age (school grade or year group), with evidence to suggest that the older year groups in primary schools have higher %MVPA in PE lessons (Fairclough and Stratton, 2006). Reasons for this are not quite clear but may be related to children's motor development; increased motor ability better enables children to engage successfully in PA which would lead to a more active participation in PE lessons (Malina, Bouchard and Bar-Or, 2004). Yet despite a positive relationship between age and PA in PE at a primary level, the opposite effect happens in the secondary school, with PA participation in the school setting declining with age and over time (Gilkey, 2007). In relation to sex and children's general habitual PA levels, boys have been consistently described as more active (Armstrong and Van Mechelen, 1998). However, in primary PE lessons the majority of research does not show any statistically significant differences (Sarkin, McKenzie and Sallis, 1997; Fairclough and Stratton, 2006; Brusseau et al., 2011), this could be attributed to girls and boys participating in mixed PE lessons, in which they will receive the same instruction and take part in the same activities as one another (Fairclough and Stratton, 2006).

Considering the breadth of activities within a PE curriculum, it would be expected that some activities would demand higher levels of MVPA. In most British primary schools, teachers are required to teach a range of activity areas and sports within the curriculum (Sloan, 2010). For instance in the primary PE curriculum in England, the suggestive breadth of study includes: gymnastics, dance, games, athletics, swimming and outdoor and adventure activities (DfE, 2013a). Conversely, there is limited evidence available to analyse the impact of activity type on children's MVPA (Hills et al., 2015), which may be down to issues such as pedagogical strategies employed in lessons and instruments applied to measure PA which might not gather contextual information such as lesson context (Fairclough and Stratton, 2006). However, a Belgium study compared children's MVPA during swimming and non-swimming lessons in children aged 8-12 years. Their results indicated that swimming lessons yielded higher MVPA (52% +9.9) than non-swimming lessons (40% +17) (Cardon *et al.*, 2004). Although a limitation of the study included no evaluation of the range of activities during the non-swimming lessons, they did conclude that increasing child involvement, by better use of space, including small sided games and avoiding team relays, are needed to increase PA levels of children during PE lessons. Despite the potential of PE to contribute towards children's daily PA recommendations (DH, 2011), a recent review reported low levels of MVPA during primary PE in England, still falling short of the recommended >50% MVPA (AfPE, 2015: Hollis et al., 2016). Hollis et al. (2016) concluded by recommending the need for interventions to increase children's MVPA during primary PE, advising researchers to report the activity type observed during the PE lesson.

2.3 Physical Activity Intervention Research

2.3.1 School-based physical activity interventions

PHE (2014a) reinforced suggestions that there is no quick fix to increasing PA in England's general population, as it is still not clear what works to address current levels of physical inactivity, especially in the case of large scale interventions (PHE, 2014b). Baker *et al.* (2015) has also expressed that it is still unclear which interventions are the most effective for increasing PA in adults, adolescents and children. Das and Horton (2012) believe that for too long the focus has been on encouraging the individual to be active and they instead promote population based approaches with an emphasis on the physical and social environments. PHE (2014a) have also placed importance on utilising the physical and social

environments to increase PA levels. In their framework 'Everybody active, everyday', they advocated a major change with regard to England's PA behaviours, and to help facilitate this they created four domains for action: 1) active society, 2) moving professionals, 3) active lives, and 4) moving at scale. In order to create an 'active society' they recommended a need for all sectors to work together including schools to allow PA to be integrated into children's daily lives. In addition, under 'moving professionals' they highlighted teachers as having a key role in the PA behaviours of children due to their daily contact with pupils. As highlighted by Chancellor and Hyndman (2017), teachers are the ones who make decisions about children's PA during the school day. The 'active lives' domain involves creating the right physical environment and 'moving at scale' focuses on encouraging action at every level and to everyone (PHE, 2014a). Therefore, PHE's four domains assist in highlighting further the current need for school-based interventions in order to promote and sustain children's PA behaviours (Dobbins *et al.*, 2013).

Numerous PA interventions have been implemented across different populations and tend to involve modifications of the social, environmental and cultural variables (Baker *et al.*, 2015). When an intervention aims to increase the PA levels of a population, it can be referred to as a community intervention which often involves multi-components over a sustained period of time (Baker *et al.*, 2015). The attractiveness of a community intervention can be found in the notion of improving a whole group or population of people with one intervention (Baker *et al.*, 2011). An example of a community intervention would be one that targets the school environment and therefore targets children and/or adolescents as the population. A comprehensive integrated approach is considered one type of a community intervention (Baker *et al.*, 2011), and an example of this in the school setting is a comprehensive school PA programme (CSPAP) (Russ *et al.*, 2015). This often involves targeting several components of a school day including: physical education, PA during the school day, PA before or after school, staff wellness, and family and community engagement (Russ *et al.*, 2015). Despite several countries having national recommendations for CSPAPs, intervention evidence relating to its effectiveness still remains unclear (Russ *et al.*, 2015).

Another example of a comprehensive school based PA model to increase children's activity during the school day is the 'Action Schools! BC Model' (Naylor et al., 2006). This is a comprehensive school based health model that is grounded in a social ecological framework (McKay et al., 2014). The model targets six action zones which include: the school environment, PE, extra-curricular, school spirit, family and community, and classroom action (Reed et al., 2008). An upscale study of the Action Schools! BC model based in Canada involved targeting 80,000 teachers, administrators and other key state holders and reached 500,000 children. This is one of the few comprehensive studies worldwide that has achieved up-scale of this size, with sustained impact (McKay et al., 2014). The Action Schools! BC model has provided greater increases in children's fitness levels (Reed et al., 2008), however even though the evidence indicated enhanced PA opportunities for children, the measureable effects were modest (Naylor et al., 2008). Furthermore, the authors highlighted limitations to sustaining the impact of the model which included frequent changes of school staff and administrators, recommending the need for ongoing training and support for the schools and teachers (McKay et al., 2014).

One example of a high quality PA intervention was the KISS study (Kriemler *et al.*, 2010). This study was a clustered randomized controlled trial that involved 504 children from 28 classes in 15 elementary schools in Switzerland. The intervention was a multi-component and included: structuring the three existing PE lessons each week and adding two additional lessons a week, daily short activity breaks,

and PA homework (Kriemler *et al.*, 2010). The results of the study, indicated improved PA, fitness and reduced adiposity in children. Meyer *et al.* (2014), also conducted a long-term follow up of the KISS study, in which 58% of the initial children participated. The long-term follow up data indicated that children in the intervention groups still had a significantly higher average of aerobic fitness than those in the control groups. However, the other beneficial effects which were seen after the initial one year intervention were not apparent at the three year follow up (Meyer *et al.*, 2014), thus, highlighting the need for long-term follow up data to judge the sustainability of school based interventions.

A systematic review of objectively measured, randomized controlled trials of PA during the school day, found that PA interventions typically have minimal increases in children's total PA volumes and small improvements in children's MVPA (Metcalf, Henley and Wilkin, 2012). However, interventions were more effective in increasing total activity amongst overweight and obese children (Metcalf, Henley and Wilkin, 2012). Another review focused on the potential mediators (e.g. social support, knowledge, enjoyment, and self-efficacy) of children's PA from interventions rather than the effectiveness of interventions to increase children's objectively measured PA (Brown et al., 2013). Kamath et al. (2008) conducted a review of 18 behavioural randomized control interventions to prevent childhood obesity (aged 2-18), and reported a minor but statistically significant pooled effect size on increase in PA. The review also reported stronger effect sizes for those interventions which used multi-cognitive approaches such as goal setting, problem solving and relapse prevention, and even stronger effect sizes for those interventions that provided behavioural reinforcement. Understanding the causal variables associated with effective intervention strategies is vital, and researchers can be guided by behaviour change theories and models as previously discussed.
One such approach is the Behaviour Change Taxonomy (BCT) (Michie *et al.*, 2011), which has been designed to assist with effective behaviour change through the application of specific taxonomy techniques such as goal setting, modelling behaviour and barrier identification (Michie et al., 2011). Furthermore, the application of a taxonomy to behaviour change interventions can assist researchers in the accurate reporting of interventions which helps to strengthen the scientific study of behaviour change and intervention development (Michie et al., 2011). As it has been highlighted that levels of reporting for interventions in published materials often fall short of the detail required for both use in systematic reviews and study replication (Michie et al., 2009). In addition the terminology used to describe the active ingredients of interventions has differed making it is hard to identify the specific intervention strategies applied (Michie et al., 2011). Brown et al. (2013) believed that the associated variables of effective interventions are not yet fully understood, although they also expressed that understanding the behaviour theories and models is difficult, especially when working with children due to their different rates of maturation and development within the same age groups, not to mention their sporadic and intermittent patterns of PA. Thus, the standardised definitions of techniques from the 40 item BCT for PA can assist in contributing to our knowledge of intervention effectiveness, accurate description of understanding of how interventions work, interventions, and effective implementation of interventions (Michie *et al.*, 2011).

In 2015, the UK Government released a document entitled 'What works in schools and colleges to increase physical activity?', within this document 8 principles of 'what works' are outlined (Gov, 2015). The 8 principles included: deliver multicomponent interventions; ensure a skilled workforce; engage student voice; create active environments; offer choice and variety; embed in curriculum, teaching and learning; promote active travel; and embed monitoring and active travel (Gov, 2015). However, the examples they provided to support these principles are based on self-reported increases in children and adolescents PA rather than objective measures. For instance, principle 1 'deliver multicomponent interventions' provides an example of a PA programme in which children kept log books to track their progress of PA.

Principle 2 'ensure a skilled workforce' draws upon the example of a primary school upskilling teachers' knowledge in PE through the PE Co-ordinator providing training on children's fundamental movement skills. The evidence drawn from this example was that teachers now reported children to be 'keener' to participate in PA (Gov, 2015). Furthermore, they stated that the school has now initiated a survey to track pupils' participation in PE. The problem with this evidence again, is that children's PA has been self-reported by the school and provides no objective measure of children's PA. For instance, research indicates that children's levels of MVPA in PE lessons are often below 50% (Hollis et al., 2016). In addition, as highlighted in section 2.2.2.2, although schools may state that there has been an increase in number of minutes of PE this does not necessarily match in terms of minutes of MVPA during PE (Greenfield et al., 2016). The government document does encourage the use of monitoring and evaluation of children's PA through the use of principle 8, suggesting objective measures such as pedometers (Gov, 2015). However, they do not take into consideration behaviour change theories to assist the schools in sustaining any positive impact. Nor do they consider individual components of the school day to assist in monitoring the impact of change.

2.3.1.1 Primary school break times: intervention design and evaluation

Parrish *et al.* (2013) conducted a systematic review on the effects of morning break and lunch time interventions on the PA levels of children and adolescents. Nine primary school break time studies were included in the review, with eight of those using randomized control trials (RCTs). Five of the studies reported positive

increases in children's PA and two of the studies reported statistically significant decreases in the children's PA levels. Parrish et al. (2013) advocated from their systematic review that there is a need for higher quality interventions, as their results indicated that there are currently insufficient levels of evidence to conclude the effects of break time interventions on children's PA levels, due to the methodological quality of the studies included. In the majority of the intervention studies implemented, most used a multi-component approach for their intervention such as in the study of Ridgers, Stratton and McKenzie (2010), who redesigned the school's playground environment using playground markings and physical structures. Parrish et al. (2013) highlighted in their review that using a multicomponent approach can make it difficult to determine the effects of each individual component. They also noted that the multi-component strategies which combined playground markings, playground coding (zoning) and non-fixed equipment resulted in the most statistically significant increases in children's PA levels during break times. Four studies identified in the review used single component interventions, two of these implemented playground markings (Stratton, 2000; Stratton and Mullen, 2005), one used playground equipment (Verstraete et al., 2006) and one study used video games (Duncan and Staples, 2010). The findings from the studies indicated that the single component use of playground markings and equipment were the most promising, with active video gaming having a negative effect on children's PA levels. The systematic review indicates that more research is needed using both multi-component approaches and single component approaches to determine the most effective intervention strategies (Parrish *et al.*, 2013).

Erwin *et al.* (2014) conducted a meta-analysis of the impact of primary school break time activity on children's PA levels. Twenty three studies were included in the review with children's ages ranging from three to eleven years. They

suggested that younger children's PA levels were affected more by interventions than older children and attributed this to the possible design of activities being more engaging for younger children, exemplified by Stratton and Mullen's (2005) intervention study which used playground markings, with results indicating that children's PA levels decreased with age. Thus, Erwin *et al.* (2014) suggested that more intervention studies need to be designed for specific age groups (Erwin *et al.*, 2014). Parrish *et al.* (2013) also highlighted the differences according to sex, suggesting that research needs to take into account the social validity of the break time interventions, indicating that interventions should be designed in a way that increases target children's PA levels without having a negative effect on other children's PA levels.

It has been recommended that future break time intervention studies to increase children's PA levels should consider using more than one measure of PA (Erwin et al., 2014). Intervention studies that used accelerometers and pedometers showed higher changes in children's PA levels than those intervention studies that used HR monitors and observation systems (Erwin *et al.*, 2014). Furthermore, studies have also been shown to differ with regard to the length of the intervention, with children's PA levels declining with the increased length of the intervention. This could be due to factors such as the children losing interest and playground markings wearing off over time. Parrish et al. (2013) outlined that most break time intervention studies only provided short term follow-up data and therefore results may only be evidencing novelty effects of an intervention. Thus, Erwin et al. (2014) highlighted the importance of long term follow-up to assess the extended impact of the intervention on children's PA levels, and a minimum period of at least six months has been advised for the duration of PA interventions (Van Sluijs, McMinn and Griffin, 2007). Other important considerations in the design and evaluation of an intervention study include the reporting of randomisation

procedure or power calculation, and any potential cofounders (Parrish *et al.*, 2013). There is an urgent need for high quality multi and single component break time interventions (Parrish *et al.*, 2013).

Hyndman (2015) discussed the direction of school break time interventions to encourage active play in children. He promoted the need for future studies to evaluate the transferability and feasibility of their interventions. McGoey et al. (2016) also expressed concern over the focus of systematic reviews of children's PA primarily being on the effectiveness of an intervention (internal validity) with regard to the causal relationship between intervention strategies and PA levels. This therefore limits the attempts made in relation to the generalisability of the intervention, which is essential for the application of research interventions into practice. There should instead be a balance struck between internal and external validity, which Glasgow, Vogt and Boles (1999) aimed to put into place through their design of the Reach, Efficacy/Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) evaluation framework. The framework aims to assess the efficacy of an intervention if placed in real world settings by people who are not part of the research (McGoey et al., 2016). The reach and adoption dimensions of the framework take into consideration the sample characteristics and the site features of the intervention, and whether it reflects the potential population (Glasgow Vogt and Boles, 1999). The remaining dimensions of implementation and maintenance jointly take into account the fidelity of the intervention such as the costs associated with its delivery (Glasgow, Vogt and Boles, 1999). McGoey et al. (2016) in their systematic review of RCTs in children's PA interventions via the use of the RE-AIM evaluation framework concluded that the relevance of research findings needs to be expanded to include elements of external validity.

2.3.1.2 Primary school physical education: intervention design and evaluation

Caution has been warranted over the evidence available on the effects of interventions to increase children's PA levels during primary PE lessons (Lonsdale et al., 2013). Only 14 studies were considered eligible for the inclusion in a systematic review (Lonsdale et al., 2013), even with no limitations being set regarding the duration and follow-up period of the interventions. Eligible studies were those that were experimental in design, therefore, cross sectional and cohort studies were excluded. Most of the studies included in the review were from the US (10), with two studies taking place in the UK, one from Belgium and one from Australia. The number of schools involved in each study ranged from one to 96; and seven of the studies were conducted in primary school settings. The effective intervention studies demonstrated a mean overall increase in children's MVPA of 24%, compared to usual practice of 10% more MVPA during lesson time with control groups. The most promising intervention strategies included teacher professional learning (which took into consideration class organisation, management and instruction), and fitness based lessons. However, a limitation of the review was the heterogeneity of the interventions including diversity in study design, length of the intervention and sample size. Thus, Lonsdale *et al.* (2013) recommended the need for high quality RCTs, in order to determine the effects of interventions.

In a recent review of children's MVPA during primary PE lessons a range of methodological inconsistencies were noted amongst the 14 studies reviewed, including variations in measurement tools and monitored length of a PE lesson (Hollis *et al.*, 2016). In relation to the monitored length of a PE lesson, the authors highlighted this can range from measuring the entire length of a lesson (Meyer *et al.*, 2013) to measurement commencing once 51% of the class had entered the working area (Chow, McKenzie and Louie, 2008). Hollis *et al.* (2016) believed that this inconsistency can prove difficult to make comparisons between studies. As in

the study of Chow, McKenzie and Louie (2008) which reported a mean of 50.7% MVPA using the criteria of 51% of the class entering the working area. However, if they had used the entire scheduled lesson time, then a mean of 36.4% MVPA would have been recorded. Although the lower figure of 36.4% MVPA would take into consideration children's changing time and travelling to and from their working space. Therefore, measuring using the 51% of the class entering the working space criteria would be considered more appropriate. Hollis *et al.* (2016) affirmed that there is a need to standardise the definition of 'PE lesson time' if comparisons are to be made between studies. Other measurement considerations for future interventions and reporting of children's MVPA during PE include: transparency on the reporting of the activities performed during the lesson and providing pre-intervention data (i.e. usual MVPA during PE lessons) (Hollis *et al.*, 2016).

Interventions based on a theoretical framework or behaviour change ingredients are thought to have greater effects than those based on atheoretical interventions (Lubans, Foster and Biddle, 2008; Michie *et al.*, 2013), with only a few studies identified in the review provided by Lonsdale *et al.* (2013) as being grounded in theory. McGoey *et al.* (2016) highlighted that intervention studies aimed to increase children's PA levels are less likely to be grounded in theory. Sallis, Prochaska and Taylor (2000) suggested that theoretical frameworks, which often rely on psychosocial measures such as self-report, are less likely to be used in children due to their developing cognitive abilities. Nonetheless, a recent systematic review of school-based PA interventions of the effectiveness of different theory in relation to behaviour change (Lai *et al.*, 2014). Researchers need to have a good understanding of behaviour change theories and models, as this will assist in their understanding of the factors involved to influence and moderate behaviour change (Salmon and King, 2010). Brown *et al.* (2013)

advocated that future interventions for children's PA need to provide a clear rationale for the theoretical framework and/or model applied; further recommending that the hypothesized mediators of change should match the approaches used, suggesting that targeted mediators should align with an ecological framework which focuses on the physical, social and policy environments. However, as previously discussed the BCT can also provide a means by which researchers can effectively communicate the key ingredients of their interventions (Michie *et al.*, 2011).

2.3.2 Theory and models of behaviour change

One of the key messages stated in NICE's (2015) updated guidelines for behaviour change is that behaviour is influenced by a number of factors including: socioeconomic, cultural, environmental, social, community and individual. In addition, they further advised the use of behaviour change techniques and grounding interventions in a theoretical construct (NICE, 2015) in order to create effective PA behaviour change. Thus, suggesting that a combination of theory/models and behaviour change techniques could be the key to creating and sustaining changes in PA behaviours. For instance, social ecological approaches can assist the researcher in identifying context specific behaviours via a multilevel perspective that conceptualises the interaction between the individual and their environment, as indicated in the meaning of the term ecological which describes the interconnections between organisms and their environment (Stokols, 1992). Thus, the advantage of working within an ecological framework is the identification of complex interactions that are taken into account between the individual, social, physical and policy environments that are specific to the setting under study (Giles-Corti *et al.*, 2005).

The setting with regard to an ecological approach is important because people will behave differently in different environments, for example the social and physical environmental components of children's PA at home or in the local community are likely to be different to their PA performed in school. It is believed that ecological models have the possibility of sustaining behaviour changes for population based research (Giles-Corti *et al.*, 2005; Salmon and King, 2010), and a social ecological perspective for studying human behaviour has been used in various disciplines such as tobacco smoking (Elder and Stern, 1986) and human development in cognitive functioning (Bronfenbrenner, 1979).

McLeroy et al. (1988) were the first researchers to apply a social ecological perspective to the field of health in order to understand the role of human behaviour in relation to chronic diseases and lifestyle choices (Figure 2.1), although it must also be noted that the ecological approach has roots in several disciplines dating back to more than a century (Green, Richard and Potvin, 1996). The multilevel approach has been claimed to have assisted with the major reductions in tobacco control and as such the social ecological approach has since been applied to many health problems (Sallis, Owen and Fisher, 2008). Ecological approaches are based on the following core principles: 1) multiple influences on health behaviours including the intrapersonal, interpersonal, organisations, community and public policy; 2) the influences on how behaviours interact across the different levels; and 3) ecological approaches should be behaviour specific, identifying the most effective change in behaviour (Sallis, Owen and Fisher, 2008). In the systematic review of interventions to increase children's MVPA during PE lessons (Lonsdale *et al.*, 2013), few studies applied a social ecological approach. Similarly a systematic review of break time interventions highlighted that most interventions targeted the individual and physical correlates of a social ecological model and failed to consider the social, community and public policy factors (Ridgers et al., 2012). However, French (2010) believed that no single intervention can address all levels of a social ecological model, noting that most health based interventions focus on two aspects of the model. Through exploratory work, researchers can identify the most influential levels within a school environment in order to target the most influential layers of children's PA behaviours.

As well as understanding the specific contextual behaviours of PA which can be achieved through the application of a social ecological model, it is also important to understand what motivates individuals to change their behaviour (NICE, 2015). An example of a motivational theory in order to create PA behaviour change in a community intervention, is Self-Determination Theory (SDT) which can offer an approach to human motivation that highlights human's inner resources for behavioural self-regulation (Ryan, Kuhl and Deci, 1997). SDT is grounded in the belief that for individuals to be optimally motivated they need to experience the following three psychological needs: competence, autonomy and relatedness (Ryan *et al.*, 2009). SDT has frequently become a theory applied to health and PA interventions, and it is believed that addressing these three inner psychological needs can assist in maintaining behaviour changes (Ryan *et al.*, 2008).

The need for competence is based on the premise that in order for an individual to act upon a particular behaviour they need to believe that they are effective and competent in their knowledge (Ryan *et al.*, 2009). This can be achieved through not only skill development and knowledge but also social feedback from those around them, such as a teacher receiving positive feedback from a PE lesson observation. The need for autonomy relates to self-regulation of oneself (Ryan *et al.*, 2009) with their behaviour being described as self-organised and initiated. An autonomous approach helps people to identify and achieve self-recognised goals (Ryan *et al.*, 2009). The need for relatedness fulfils an individual's basic need of belonging and connection with those around them. Relatedness brings a sense of wellness, care and involvement with others (Ryan *et al.*, 2009).



Figure 2.1 Ecological model for health promotion (McLeroy *et al.*, 1988) (adapted version in terms of formatting)

In the domain of PA interventions all three needs of the SDT are required in order to change and maintain behaviour; if needs are threatened or diminished then individuals are less likely to maintain their behaviour (Ryan *et al.*, 2009). Thus, when applying SDT to an intervention to increase children's PA levels, the motivational theory may be needed to target the head teacher and/or teachers in order to change their behaviours rather than the children. This therefore, highlights the need for the initial application of a social ecological model to reveal the layers in a school setting that may be impacting negatively upon children's school based PA behaviour.

When taking into consideration the advice provided by NICE (2015), alongside working within an ecological perspective and the application of theory to motivate

individuals to change their behaviour, it is also important to understand the 'active ingredients' of interventions. Active ingredients are designed to change behaviour and an example of such ingredients is the BCT (Michie *et al.*, 2011), as previously discussed. The application of these active ingredients involves specific techniques of behaviour change, for instance, social support, providing instruction and prompt practice (Michie *et al.*, 2011). The use of the active ingredients allows researchers to create effective and replicable interventions and creates a common language across intervention studies. Accordingly, it is suggested that the application of an ecological approach, whilst applying the motivation theory of SDT and the BCT could provide the platform for an effective PA intervention.

2.4 Summary

Chapter 2 outlined the importance of PA, and in particular the multiple health benefits for children who are physically active (Janssen and LeBlanc, 2010). The literature search has highlighted the necessity for children to be provided with the greatest start in life, by helping them to become physically active and to build strong foundations for a physically active life as an adult (PHE, 2014a). As discussed in section 2.2, the primary school setting can be an optimal environment to increase children's PA levels and this can be achieved through the effective design and implementation of school-based interventions (PHE, 2014a). Opportunities for school-based PA were discussed in section 2.2.2, and break times and PE were identified as prospective segments within the school day where children can accumulate their daily PA guidelines. However, as indicated in section 2.3, recent reviews have reported that intervention work in primary PE and school break times is still a relatively new area of research, especially in the UK (Lonsdale *et al.*, 2013; Erwin *et al.*, 2014; Hollis *et al.*, 2016).

In the future design of PA interventions for these specific components of the school day, it has been recommended (sections 2.3.1.1, 2.3.1.2) that a number of

key methodological issues should be taken into consideration (Parris et al., 2013; Erwin et al., 2014; Hollis et al., 2016). Specifically, a focus on sub groups (i.e. sex, age, disabilities, social backgrounds) and the social environment for break time research has been suggested as the next steps forward (Riders et al., 2012; Parrish et al., 2013), which the current thesis aims to address in terms of the sub group of sex and the social environment. In the consideration of intervention research to increase children's MVPA in primary PE lessons, section 2.3.1.2 evaluated the available evidence to date and concluded that intervention research in England is limited, particularly with regard to teaching strategy interventions (Lonsdale *et al.*, 2013). Therefore, the thesis also aims to design, implement and evaluate a teaching strategy intervention within a primary school in England. Further, it was highlighted that the employment of both qualitative and quantitative methods will allow for the assessment of physical and social variables in the school environment and could contribute significantly to our understanding of behaviour change (Castelli, Carson and Kulinna, 2014), therefore, an additional aim of the current thesis was to use a mixed method design (Creswell and Piano-Clark, 2011). Finally, the literature reviewed in section 2.3.2 indicated that for interventions to produce sustained changes in behaviour, theoretical frameworks should be considered in the design and implementation of PA interventions (Brown et al., 2013). Specifically, the application of an ecological approach, alongside motivation theory and taxonomy ingredients have been adovated (NICE, 2015). Thus, the current thesis aimed to create primary school PA interventions which are ecologically framed, grounded in SDT (Ryan et al., 2009) and have integrated active ingredients from the BCT (Michie *et al.*, 2011).

Chapter 3 Methodology

Chapter 3 – Methodology

This chapter will provide a justification of the methodological decisions and assumptions in which the multiple studies of the thesis are situated. Initially the ontological and epistemological position will be clarified (3.1), followed by a rationale for both the mixed method methodology (3.2) and the theoretical lens (ecological framework) (3.3) applied. The sampling strategies employed throughout the four studies will be argued for, along with the validity and reliability required in the quantitative methods and the trustworthiness sought in the qualitative methods (3.4). Finally, the ethical considerations relating to the overall research design and thesis will be discussed (3.5). The specific data collection methods and analysis will be critically discussed within each study chapter (Chapters 4-7).

3.1 Ontological and Epistemological Position

One of the initial considerations which must be clarified in any piece of research is one's ontological stance, which relates to how the researcher understands the nature of reality and how things work within this (Denzin and Lincoln, 1998). It is believed that this can be considered by asking the question 'what is the form and nature of the social world?' (Waring, 2012: p.16). Through the consideration of this question, I believe that this thesis sits within the notion that an extremist view on the nature of reality (for instance either extreme relativism or extreme realism) is not productive or realistic when conducting school-based PA interventions. Therefore, in order to conduct school-based PA interventions my ontological stance would be that reality is situated in the practical effects of ideas; taking into consideration what is required to be known in order to successfully design, employ and evaluate school-based PA interventions. My ontological view in which the thesis is based links to the following quote from Powell (2001: p. 884) 'the mandate of science is not to find truth or reality, the existence of which are perpetually in dispute, but to facilitate human problem solving'. Hence, this thesis does not subscribe to only one way of conducting research, for example through either a purely quantitative or qualitative research design, and instead, both approaches have been utilised in relation to what works at that point in time, in order to best answer the research question. The overall view is that the research in this thesis has set out to change practice and solve problems (Rorty, 1983), rather than answer questions regarding reality and the laws of nature (Cherryholmes, 1992).

From the acknowledgement of my ontological stance the epistemological questions can then be considered, which allows the researcher to ask 'how can what is assumed to exist be known? (Waring, 2012: p.16). This is very much associated with my own experience and interpretations of a primary school setting, which stems from previously working as a primary school teacher and a continuing involvement in school settings through my current role in teacher training. Being in a school setting is very much about the practical effects of ideas in the design, employment and evaluation of school-based PA interventions. Therefore, the epistemological stance of this thesis is to conduct research using any design and method that leads to practical solutions. Thus, this stance provided a pragmatic platform to draw upon multiple data collection techniques and analysis (Creswell, 2014).

Pragmatism is the philosophical position that best encapsulates my ontological and epistemological stance, as well as my inclination towards practical solutions over universal truths. A pragmatic 'philosophical worldview' best allows me to answer the type of research questions the thesis asks. It also encourages the use of multiple methods, using whichever method best answers a particular research question (Tashakkori and Teddlie, 2010; Punch and Oancea, 2014). This was also underpinned by my wish to be practical in relation to research in a school-based

setting. There are many versions of pragmatism, all of which have the common characteristics of using a multi-method approach and places an emphasis on the practical implications of the research (Creswell, 2013). My own views of pragmatism and how it sits within this thesis relate to the views of Johnson and Onwuegbuzie (2004). Consequently, my reasons for placing the thesis in a pragmatic paradigm are aligned with the characteristics of: rejecting the traditional dualisms; endorsing pluralism of conflicting theories; and believing that both observation and experiments can prove valuable in understanding children's PA within a primary school setting. Thus, the pragmatic stance in this thesis is concerned with the practical implications and in deciding which step to take next in order to gain a greater understanding of children's PA in primary school settings. Furthermore, this view links to the work of early pragmatists, such as Dewey (1920; 1929), who also believed that current truths and knowledge can change over time.

As this thesis is concerned with gaining a greater understanding of children's PA in the primary school setting, the chosen philosophical stance opened the door to involve both teachers and children in the design process of the interventions. Therefore, the participants are not viewed as independent entities but rather collaborative partners. Hence, the use of interviews as a research tool enables this to take place. It is also important to acknowledge the hermeneutic nature of my involvement in the interviews due to my own knowledge and values of a primary school setting. As a result, it was decided that Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009) would be used, which allows me to place an emphasis on my own interpretations of the teachers' and children's perceptions of PA in both PE lessons and break times. This IPA element in the thesis assimilates with pragmatism; through endorsing pluralism of conflicting worldviews believing that both quantitative and qualitative data can provide valuable insights to understanding real world phenomenon. Further discussion of the application of IPA across all four studies will be provided in the relevant chapters (i.e. chapters 4, 5, 6 and 7).

3.2 Mixed Methods: Multiphase Mixed Methods Design

In keeping with the pragmatic stance taken across the thesis, all of the studies draw upon both quantitative and qualitative methods. A mixed method approach was considered the most appropriate design to utilise as it attempts to take into consideration 'multiple viewpoints, perspectives, positions, and standpoints' (Johnson, Onwuegbuzie and Turner, 2007: p113). A mixed methods approach has been defined as going beyond the mixing of quantitative and qualitative research but also the mixing of worldviews (Tashakkori and Teddlie, 1998). Thus, a mixed method approach aligns with my ontological and epistemological stances discussed in section 3.1 of the methodology.

In relation to PA research, embracing a pluralistic approach is still a relatively new area (Thomas, Nelson and Silverman, 2015). Yet, a number of research studies are beginning to appear, drawing upon both qualitative and quantitative methods to gain a greater understanding of the research problem. For instance, an example of a large mixed methods study can be found in the work of Willenberg *et al.* (2010), who sought to increase their understanding of children's playground PA across 23 schools in Melbourne, Australia. Adoption of a mixed method approach allowed the researchers to effectively examine and report on the relationship between children's attitudes towards their playground activity behaviours and their PA levels. The adoption of a pluralistic approach was also reinforced in a special issue in the Journal of Teaching in Physical Education (JTPE), in which the editors welcomed the submission of mixed methods research, calling for the 'acceptance of this methodology' in the hope that it will contribute further to knowledge and understanding of children's PA behaviour in a school setting (Castelli, Carson and

Kulinna, 2014: p.435). This approach is something that has been strived for throughout this thesis.

As this thesis has four individual studies nested within the overall aim of 'to design, implement and evaluate primary school-based interventions to increase children's MVPA during break times and physical education', a multiphase mixed method design (Creswell and Piano-Clark, 2011) was adopted. This multiphase design supported the development of the four studies in the thesis which draws upon both a convergent design (Studies 1 and 3) and an explanatory sequential design (Studies 2 and 4) (Figure 3.1). The specific mixed method design is identified by a number of considerations including: interaction between the two types of data, the priority, the timing and the procedures for mixing (Creswell and Piano-Clark, 2011). The selection of a specific design provides a clear framework to guide the thesis' four studies and thus increases the rigour and quality of the overall research (Creswell and Piano-Clark, 2011).



Figure 3.1 Multiphase mixed method design of the thesis

Studies 1 and 3 draw upon a convergent mixed methods design as the quantitative and qualitative data collection have independent levels of interaction, meaning that the two strands of data are distinct at every stage of the design until the interpretation of the results (Creswell and Piano-Clark, 2011; Creswell, 2014). In addition, the priority given to each type of data is equally important (QUAN + QUAL) with concurrent timing of data collection; whereas, in studies 2 and 4 priority is given to the quantitative data and the qualitative data acts in a secondary role (QUAN->qual). This is referred to as an explanatory sequential mixed methods design in which the researcher collects, analyses and interprets the quantitative results and then uses this to design the qualitative method (Creswell, 2014). In studies 2 and 4, the design of the qualitative method (interview questions) is influenced by the quantitative findings; therefore, there is a level of interaction in the design phase and they are also sequential in their timing. The individual designs employed for each study will be discussed further in their respective thesis chapters (see chapters 4, 5, 6 and 7).

3.3 Theoretical Lens: Ecological Model for Health Promotion (McLeroy *et al.*, 1988)

The studies throughout this thesis are grounded in the theoretical lens of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988). The application of this allows for an 'a priori framework' to guide the research questions and objectives (Creswell, 2014: p.69). By using this lens as a guide it assists in understanding the multiple layers of influence within a primary school setting (Sallis, Owen and Fisher, 2008). Something also advocated by Salmon and King (2010) who expressed that an ecological framework is needed, as this framework allows the researcher to acknowledge the multifaceted constructs of children's PA. For instance, the ecological framework in this thesis assists in the design of the interview questions for both children and teachers. It also reveals the various levels of data that can be collected, for example children's PA levels as well as their

social behaviours. Secondly, in the design of the interventions the various complexities of a school environment have been targeted through the application of this theoretical framework; in a primary school setting there are many factors that can impact upon a child's PA behaviour such as teachers, peers, policy and physical structures.

In each study of the thesis, an ecological framework (McLeroy *et al.*, 1988) was applied which took into consideration: intrapersonal factors (characteristics of the individual such as attitude, behaviour and knowledge), interpersonal factors (social networks and support systems), institutional factors (rules, regulations and physical structures), community factors (networks beyond the school setting), and public policy (national policy such as the PE and school sport funding and the primary school National Curriculum). In studies 1 (chapter 4) and 3 (chapter 6) the framework is applied to the design of interview questions and the method of direct observation allows for collection across both individual and interpersonal factors. Therefore, the framework promotes the collection of data across the multiple levels of influence within the primary school environment. This knowledge is then used in the design of study 2 'break time' intervention (Chapter 5) and of study 4 'PE intervention' (Chapter 7).

Despite the benefits of using an ecological model in the thesis, it also presents some methodological challenges. For instance, when working in this framework for the intervention elements of the thesis (chapters 5 and 7), it is impossible to isolate separate levels of the intervention to measure their effectiveness. This methodological issue is something that has also been recognised by Parrish *et al.* (2013) in their systematic review of children's break time PA behaviour, as they expressed that using a multi-component approach can make it difficult to determine the effects of each individual component. Yet, isolating one of the layers from its contexts contradicts the conceptual understanding of 'multiple layers of influence' (Sallis, Owen and Fisher, 2008). Thus, the application of an ecological framework assists in the design, application and evaluation of the break time and PE interventions in the thesis.

3.4 Sampling

Whilst working within the worldview of pragmatism a mixed method sampling approach is used, whereby each study in the thesis draws upon multiple sampling strategies (Figure 3.2). Specifically, a multilevel mixed method sampling procedure is employed, which is the strategy of choice as multiple studies are nested within a larger research project. This is a sampling method that has been defined as involving both probability and purposive sampling (Teddlie and Yu, 2007). This is an appropriate and practical sampling strategy to use when working within a pragmatic paradigm due to the alignment with my ontological and epistemological views.

This multilevel sampling approach also reflects the complex nature of the mixed method design, for instance in Study 1 'Break Times' (Chapter 4), a concurrent mixed method sampling approach is implemented. This involves a convenience and purposeful sample to select the units of 'schools' and 'classes', followed by stratified and purposeful sampling of children to be part of the quantitative and qualitative phases of the data collection. Differing from this, Study 4 'PE Intervention' (Chapter 7) draws upon a sequential mixed method design in which the first stage involves a convenience and purposeful sample of the school and classes, followed by a purposeful and stratified sample of the children (quantitative data). After the intervention has been implemented, a purposeful sample of four teachers are selected to be interviewed on their perceptions and experiences of the intervention. The sampling strategies in each individual study will be discussed

in further detail in each of the relevant thesis chapters (see chapters 4, 5, 6 and 7).

Study 1 – Break Times (Concurrent MM sampling design)	Study 2 – Break Time Intervention (Sequential MM sampling)		
Step 1: Convenience and purposeful sampling to select schools and classes. Step 2: Stratified and purposeful sampling to select children in the schools for both QUAN and QUAL data collection.	 Step 1: Purposeful and convenience sampling to select school. Step 2: Purposeful and stratified sampling to select the children (QUAN). Step 3: Purposeful sampling (PE Co-ordinator) (qual) 		
Study 3 – Physical Education (Concurrent MM sampling design)	Study 4 - Physical Education Intervention (Sequential MM sampling design)		
Step 1: Convenience and purposeful sampling to select schools, classes and children (QUAN). Step 3: Stratified and purposeful sampling to select children for the group interviews (QUAL). Step 4: Purposeful sampling to select teachers to be interviewed (QUAL).	 Step 1: Convenience and purposeful sampling to select schools and classes. Step 2: Purposeful and stratified sampling to select children in each class (QUAN). Step 3: Purposeful (4 teachers interviewed from the intervention school) (qual). 		

Figure 3.2 Multilevel mixed method sampling strategy of the thesis.

The mixed method sampling procedure applied in the thesis can additionally be justified as it links to the ontological and epistemological position that the practical effects of ideas leads to practical solutions, with the aim to draw generalisations from the studies. The choice of this sampling procedure is further supported by Teddlie and Yu (2007), who highlighted that a mixed method sampling strategy can allow the researcher to draw clear inferences about the findings of the research. Therefore, in relation to sample size, I am working to the notion of 'good enough for purpose' (Krusakal and Mosteller, 1979: p.259). This concept allows me to generalise the findings in this research for which the sample is sufficiently representative (Thomas, Nelson and Silverman, 2015).

Sample size and type will always depend upon the ontological and epistemological positions of the researcher, and from this, one must argue whether generalisations can and should be applied. The extreme realist would argue for true experimental research that draws upon a probably sample (Creswell and Piano-Clark, 2011), and uses mathematical equations to determine sample size. Whereas the extreme relativist would argue for purposive sampling, disputing that generalisability in qualitative research is neither desirable nor possible (Draper, 2004); thus, making sample size irrelevant as no general laws can be made beyond the individual. Therefore, in the thesis I have created multiple quality criterion checklists for each of the different types of data (quantitative and qualitative) and methods. Accordingly, in the thesis validity and reliability will be sought in relation to the quantitative aspects along with trustworthiness for the qualitative methods. This also allows me to apply the notion of 'good enough for purpose' (Krusakal and Mosteller, 1979: p.259) which is contextualised within the question of 'what is required to be known in order to create effective school-based PA interventions?'

3.5 Validity and Reliability of the Quantitative Data

Each study of the thesis uses one or more quantitative methods in order to measure children's PA levels. Therefore, by setting fundamental criteria it allows me to justify the rigour of the quantitative methods in relation to both the internal and external validity, and also the reliability of the data. It has been stated that there are two main branches of internal validity, which are content validity and criterion validity (Atkinson, 2012). Taking into account the content validity of the methods involves considering whether a measure adequately samples what it was designed to measure (Thomas, Nelson and Silverman, 2015). In relation to criterion validity, the researcher will consider predictions about how well the measure performs based on comparable research studies (Atkinson, 2012). The concept of external validity is considered as the extent to which the results of a study can be generalised to other situations and people (Cohen, Manion and

Morrison, 2011). In addition, the concept of reliability relates to consistency and stability of a research tool (Kumar, 2014). Therefore, the rigour in the thesis will be justified in relation to these concepts when applied to the methods of systematic observation (SOCARP and SOFIT tools) and pedometers, and the sampling procedures that are drawn upon. Thus, adopting the advice of Cohen, Manion and Morrison (2011) the rigour of the quantitative data throughout the thesis can be defended through the application of the following checks for validity and reliability (which will be justified further for each individual study in chapters 4, 5, 6 and 7):

- Ensuring a high degree of content and criterion validity in relation to the individual methods used, including establishing observer reliability for the method of systematic observation;
- Appropriate sampling strategies and sample size (established through priori power tests or justified according to the statistical analysis applied);
- 3) Awareness of (and if possible avoidance of) internal and external threats including: instrument reactivity and selection bias; and
- 4) Being faithful to the assumptions underpinning the statistics used.

3.6 Trustworthiness of the Qualitative Data

All four of the thesis' studies (chapters 4, 5, 6 and 7) draw upon one or more qualitative methods including individual teacher interviews and children's group interviews. As my ontological and epistemological assumptions aim to solve human problems, the goal is to make inferences from the qualitative data. Consequently, a criterion checklist is also required for the qualitative data in the thesis and instead of considering the concepts of validity and reliability; the trustworthiness of the qualitative data is sought. According to Guba and Lincoln (1994) trustworthiness in qualitative data is determined by the concepts of credibility, transferability, dependability and confirmability. Trustworthiness is an appropriate

measure to judge the quality and transference of the thesis as it holds with the position that I cannot separate myself in the search for objectivity (Savin-Baden and Major, 2013). Thus, following the advice of Shenton (2004), the trustworthiness of the qualitative data in this thesis can be justified through the application of the criterion checklist below (further discussion of which will be provided in more detail in the respective thesis chapters 4, 5, 6 and 7):

- 1) Credibility: Ensuring that the qualitative methods adopted are suitable for the concept being studied; developing an early familiarity with the organisation under study (e.g. preliminary visits to the schools); triangulation of data with other methods (quantitative or qualitative methods); using tactics to encourage participants to be honest in their answers such as clarifying at the start of an interview that there are no right or wrong answers and that they have the right to withdraw from the interview; frequent debriefing sessions with critical colleagues; member checking during the interview process; and thick description of the phenomenon under study;
- Transferability: Providing detailed contextual information regarding the environment under study; and clearly communicating the boundaries of the study;
- Dependability: Reporting thoroughly the details of the study including the research design, how the methods were employed and a reflective appraisal of the study; and
- 4) Confirmability: Bracketing of initial ideas and predispositions to ensure as far as possible that the findings are a true reflection of the participants' experiences and ideas.

3.4 Ethical Considerations

The ethical considerations in this thesis are also situated within my ontological and epistemological stance of being practical to facilitate human problem solving. Whilst working within a pragmatic worldview, I consider ethics to be the study of practice and habits that respond to human problems (Dewey, 1929). Thus, throughout the thesis the concepts of habit and deliberation are considered in relation to the ethical decisions made (Serra, 2010). As a result, the actions taken are a result of my consideration of habitual practice within school-based PA research; as well as, consulting the research ethical guidelines of my place of study (Newman University) along with guidance from the British Educational Research Association (BERA) (2011) and the United Nations (UN) (2011) convention on the rights of the child. From taking all of the guidelines into consideration the process of deliberation then takes place to consider the best course of ethical practice. Included in this is the application to and gaining of ethical approval from Newman University Ethics Committee.

When considering the notion of habit (Serra, 2010), in relation to PA epidemiology and ethics, the approach taken usually involves observing naturally occurring events in a population; as it is considered unethical to conduct a true experiment on PA behaviours, such as forcing half of a population group to be inactive (Thomas, Nelson and Silverman, 2015). Accordingly, the four studies in the thesis involve observing the PA behaviours of children in the specific settings of school break times or PE lessons in order to identify any modifiable variables to inform the design and implementation of effective PA interventions. Hence, the participants in the thesis studies includes: teachers and children.

In accordance with BERA's (2011) ethical guidelines, all participants are treated fairly and with dignity, free from any prejudice. To achieve this, the following main principles apply throughout the thesis: openness and disclosure, the right to

withdraw, informed consent, and the right to confidentiality. At all stages of the thesis, confidentiality and rights to privacy are clearly communicated to the participants. This involves ensuring that any identifiable data is only seen by the researcher and supervisory team. All individual data is kept anonymous; for example, children are given participant identification numbers when collecting the BMI and pedometer data. No individual participant's data is discussed with schools, other teachers or parents. However, schools receive a written report of the findings (which is designed specifically so that they can easily access the results); yet individual data are kept anonymous. All data collected is stored securely on password protected devises, to further ensure the confidentially of the data.

In relation to openness, disclosure and informed consent, each school is fully informed of their involvement through initial meetings with the school (either head teacher or PE Co-ordinator) in which information booklets are used as a framework to discuss all aspects of the research. Teachers and children's guardians are provided with participant information forms and the children are given an information leaflet in child friendly language to assist them in making the decision as to whether to take part or not in the research (Clark *et al.*, 2014). This practice adheres to BERA's (2011) guidance in which all participants should be treated fairly and also the UN Convention (2011) on the rights of the child, who state in Article 12 that children have the right to express their views, feelings and wishes in all matters affecting them. The class teachers and guardians are also encouraged to explain the research to the children. Informed consent is central to every research project in the thesis, however, written informed consent can be particularly difficult with children due to their level of literacy and cognitive skills (Alderson, 2014). Due to the complex nature of this, children are asked to provide verbal consent to be part of the research project. In addition, before data collection, conversations take place with the children regarding their understanding of the research, their involvement and their right to withdraw. As it is the responsibility of the researcher to remind the children of their right to withdraw from the research project (O'Reilly, Dogra and Ronzoni, 2013). An enhanced focus is placed on this prior to any height and weight data collection, and also during the group interviews. However, ongoing consent was not sought for the observations of children's PA during break times and PE lessons as it was important that they did not know they were being observed so that they did not alter their PA behaviour.

All of the studies in the thesis involve prolonged engagement in some of the school settings, particularly in relation to the systematic observation, interviews and intervention work. Therefore, another important ethical consideration is to respect the school site, with minimal disruption to the children's learning and teachers' work patterns (Creswell, 2014). In addition, ethical considerations are taken in relation to data analysis, reporting and sharing of the findings. Hence, the methodologies in the individual studies aim to be explicit, ensuring that a true representation of the findings are discussed without suppressing, falsifying or inventing results (Creswell, 2014). The ethical issues of each study will be critically discussed in relation to their specific design, methods and findings in chapters 4, 5, 6 and 7.

Chapter 4

Study 1: Children's Physical Activity during Primary School Break Times: a Mixed Method Design

Chapter 4 – (Study 1) Children's Physical Activity during Primary School Break Times: a Mixed Method Design

4.1 Study Overview

The primary objective of this chapter (Study 1) was to assess children's PA and social behaviours and identify any modifiable variables, in order to inform the design of an outdoor break time intervention to increase children's MVPA during primary school break times (Chapter 5, Study 2). To achieve this, the secondary objectives were: 1) to assess children's PA levels, social group size, activity type and social interactions during morning and lunch break times; and 2) to explore children's perceptions and experiences of their playground environment during outdoor morning and lunch break times. Through a convergent mixed method design, data were obtained from children aged 7-10 years across five primary schools in the West Midlands, England. Data were collected during the English winter months of November 2013 to January 2014 and involved two distinct phases. In the quantitative phase (n=82), children's PA behaviours were directly observed at break time using the SOCARP tool. Observers coded 820 minutes of school break times across the categories of: PA, 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' 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. The findings from this study were used to design the break time intervention in Chapter 5 (Study 2), which was based on the implementation of a walking track to increase children's MVPA during outdoor break times.

	Year 1 of PhD study	Year 2 of PhD study	Year 3 of PhD study	Year 4 of PhD study
Study 1 Break time Exploratory Study	Methods: SOCARP, Children's group interviews Outcomes: Boys engage in more MVPA and dominate playground space in large groups Girls enjoy socializing with their friends in small groups Boys and girls engage in imaginary play			
Study 2		Methods: SOCARP, Pedometers, Teacher ind	dividual interview	
Break time Intervention Study				Initial discussions began in the 2 nd year for study 2, but the intervention was delayed. Thus, data collection began in 4 th year of study.
Study 3 Physical education Exploratory Study		Methods: SOFIT, Children's group interviews, Teacher individual interviews		
Study 4 Physical education Intervention Study			Methods: SOFIT, Teacher individua interviews	1

Figure 4.1 A thesis map to illustrate the chronology of the studies conducted and the methods and outcomes of study 1.

Exploratory studies

Intervention studies

4.2 Introduction

It seems likely that many children are not engaging in sufficient PA to secure the associated short and long term health benefits. As highlighted in Chapter 1, only 21% of boys and 16% of girls in England are reported to be meeting their daily MVPA target of at least 60 minutes (HSCIC, 2013). Given that the school environment is integral to children's daily routines, schools are ideal settings for developing effective PA interventions for children (PHE, 2014a). Certainly, schools have now been placed at the forefront of preventative public health as a key community setting to increase children's PA levels (Hyndman et al., 2014). School break times seem particularly pertinent in this. For the past two decades, school break times have been identified as a crucial component within the school day to target children's PA levels (Sarkin, McKenzie and Sallis, 1997; Brusseau et al., 2011). In England, break times are mandatory (DfE, 2014), with the majority of primary schools having both morning and lunchtime breaks (Stratton, 2000). An additional asset of break times is that they do not interfere with daily lessons, making them an ideal context to target children's PA levels (Erwin *et al.*, 2014). Therefore, a real world rationale for targeting primary school break times to increase children's PA would be that they happen every day and they do not interfere with curriculum lessons, thus it is hoped that schools will be more open to interventions taking place at this specific time and interventions will have greater impact on children's daily and weekly PA.

Even though an extensive body of research has investigated children's PA levels during primary school break times, there are still gaps in the knowledge base with an emerging need to focus on children's social behaviours (Ridgers *et al.*, 2011). Identifying differences in social behaviours of various sub groups such as boys and girls has also been advocated as an important line of enquiry, as this too could prove necessary in the design of interventions (Ridgers *et al.*, 2012; Parrish *et al.*,

2013). There is evidence to suggest that sex differences exist relating to children's break time behaviour, suggesting that boys are more active (Ridgers, Stratton and McKenzie, 2010). As discussed in Chapter 2 (section 2.2.2.1.3), the school break time creates an environment in which the individual child has to make a number of choices, for instance, who they play with, the activity they engage in, the space they play in and how they interact with their physical environment.

The use of mixed method research designs have been found to be an effective way of gathering information regarding children's break time PA behaviours, including their social interactions (Knowles et al., 2013). In particular the use of children's voices can assist in understanding break times from a child's perspective (Knowles et al., 2013). A mixed method approach is considered more advantageous, as it draws upon both quantitative and qualitative methods which are both important and useful approaches to use (Johnson and Onwuebuzie, 2004). For instance, Roberts *et al.* (2012) conducted a break time study using the quantitative method of SOCARP (an objective measure to collect data on children's PA behaviours). Therefore, this delivered the 'what' and 'how' of children's PA behaviours but it did not provide the 'why'. If they had employed a mixed method approach and collected some qualitative data as well as employing the objective method of SOCARP, they would have discovered the 'what', 'how' and 'why' of their participants' PA behaviours, which can be particular useful in the design of PA interventions. Similarly, Stanley, Boshoff and Dollman (2012) conducted a study in which they explored the barriers and facilitators of children's play behaviours during lunchtimes. They drew upon a qualitative design in which they conducted focus groups and collected field notes. This approach provided them with insights into children's perceptions and experiences of their play behaviour at lunch times. Yet, although the researchers also made field notes, the employment of quantitative methods alongside their qualitative methods would have provided

them with an objective measure to compare the qualitative findings with e.g., they would get both depth (qualitative methods) and breadth (quantitative methods) from the research findings. The depth would be provided through in-depth qualitative research exploring the participants' perceptions and experiences, but most often with a smaller sample size than quantitative measures; whereas the breadth of the data would be provided through a large sample size applied to quantitative measures.

Additionally, using ecological models as frameworks has been promoted as an effective way to understand the multiple levels of influence on children's PA levels (Salmon and King, 2010) and has been advocated by NICE (2015) in their guidelines on behaviour change. This will assist in identifying any possible influences on children's PA behaviour during primary school break times. Thus, both quantitative and qualitative research methods should be drawn upon to investigate children's PA levels and social behaviours during primary school break times. In the quantitative phase of the current study the objective was: to assess children's PA levels, social group size, activity type and social interactions during outdoor morning and lunch break times; and in the qualitative phase the objective was: to explore children's perceptions and experiences of their playground environment during morning and lunch outdoor break times. It is important to note, that although the data were collected in the English winter months, the study's purpose was not to investigate any seasonal effects on children's PA. However, the effects of seasonal variation on children's PA during break times is still unknown as indicated in Ridgers et al.'s (2012) systematic review, thus this study will contribute to knowledge of children's break time PA during primary school break times in the English winter months.

4.3 Pilot Study

A pilot study was conducted in order to assess the feasibility of using the System for Observing Children's Activity and Relationships during Play (SOCARP) systematic observation tool (Ridgers, Stratton and McKenzie, 2010), and of conducting children's group interviews. Twenty six children aged 7 - 9 years (n=12 boys, n=14 girls) in one primary school in the West Midlands took part. For the purpose of the pilot study, convenience and purposive sampling (Cohen, Manion and Morrison, 2011) were used to select the primary school and the participants. Children's PA was systematically observed during break times and the same children were involved in the group interviews (a total of 4 interviews). An important aspect of the pilot study was to create training videos for the SOCARP tool (Ridgers, Stratton and McKenzie, 2010). Due to the recent development of this tool, as of yet, no published training DVDs have been produced. Therefore, the pilot study created the opportunity to record children's PA behaviours within the context of the primary school playground. This video footage was then used to devise training videos in preparation for Study 1) data collection, in order to establish intra and inter-observer reliability (Appendix 1).

4.4 Methods

Using a pragmatic platform, described in the previous chapter, enabled the employment of a convergent mixed method design (Creswell, 2014) in order to gain a deeper understanding of children's PA behaviours during break times. This specific mixed method design allowed the data to be distinct at every stage of the study until the integration and interpretation of the results, thus both quantitative and qualitative data were given equal precedence (QUAN+QUAL). Hence, both types of data were collected concurrently throughout the study. In addition, the study described in this chapter (Study 1) was grounded in the Ecological Model for Health Promotion (McLeroy *et al.*, 1988), which assisted in identifying children's social behaviours alongside their PA levels through adopting a multi-layered perspective (NICE, 2015). The SOCARP tool enabled the collection of data across
the various ecological layers, for instance: the intrapersonal layer (children's PA behaviours), the interpersonal layer (group size, social interactions and activity type) and the institutional layer (contextual variables such as number of adults and equipment available). Alongside the SOCARP tool, the children's group interviews were designed to collect data across the following four layers: intrapersonal, interpersonal, institutional and community. In both the qualitative and quantitative methods, sex differences were investigated to ascertain any differences amongst sub groups in relation to the children's PA behaviours.

4.4.1 Participants and sampling procedures

Participants were selected from five mixed sex primary schools, located in in one of England's major cities in the West Midlands. Schools were selected through a concurrent mixed method sampling design (Chapter 3, section 3.4). Initially 50 schools from across the West Midlands were selected via systematic sampling (Thomas, Nelson and Silverman, 2015). However due to a poor response rate, with only one school agreeing to take part, a further four schools were recruited via convenience and purposive sampling (Cohen, Manion and Morrison, 2011), to ensure a range of school contexts and demographics were included in the sample. All children aged 7-10 years in each of the five schools were provided with information regarding the study. Purposeful and stratified sampling was then applied to a list of children who returned their written informed consent. As a result, schools differed in the number of participants (ranging from 10 – 25 in each school). The criteria of the stratified sampling included: children who speak English, represent diversity in activity level and were 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. Data were collected during the English winter months of November 2013 to January 2014 and involved two distinct phases.

In the quantitative phase 82 children took part (49 boys, 33 girls), and from this sample 80 children (47 boys and 33 girls) participated 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 (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 researcher aimed to recruit 84 participants, and received full consent from 82 children.

4.4.2 Research setting

The mean playground size for all five schools was $1795m^2$ (+627), with a mean morning break time of 16 minutes (\pm 2.2) and lunchtime of 36 minutes (\pm 6.5) (excluding 15 minutes when children are eating lunch inside the school). The individual characteristics of the participant schools are highlighted in table 4.1. 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. For the purpose of this study a school was considered poorly resourced if it had less than less than 3 outdoor resources, which could be fixed or portable. Schools were considered well-resourced if they had 5 or more fixed or portable resources. All schools had teachers supervising morning break times; at lunchtimes all playgrounds had between three to 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 (soccer), basketballs and skipping ropes.

The study's protocol was reviewed and approved by the Research Ethics Committee at Newman University. Written informed consent was gained from the head teachers (Appendix 2) and the children's legal guardians (Appendix 3). In addition, information leaflets (Appendix 4) 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 or the Disclosure and Baring Service and were experienced in working with children within a school setting.

4.4.3 Quantitative data collection: systematic observation SOCARP

Observational data were collected using the SOCARP tool (Ridgers, Stratton and McKenzie, 2010) (Appendix 5), 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, Stratton and McKenzie, 2010), sedentary behaviour was defined by combining the lying, sitting and standing activity posture codes, MVPA was calculated through the sum of the MPA and VPA categories and VPA. 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 his or herself self), 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 is a modification of a sport with or without its official structure [e.g. rules or numbers of players] such as: football [soccer], 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 is 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 none (e.g. no interactions), physical social (e.g. holding hands, hugging and high five), verbal social (e.g. praising others, giving encouragement, positive conversations and clapping), physical conflict (e.g. hitting, kicking, punching and pushing), verbal conflict (name calling and teasing) and ignore (if any conflict is aimed at the target child and they ignore the behaviour).

On each observation day, five trained observers arrived at the school before morning break time and were present during both the morning and lunchtime break times. Each child was observed for one ten minute observation period. Within this timeframe, the researcher observes a child's behaviour for ten seconds and then has ten seconds to record their behaviour against the four categories. Activity levels, group size and activity type are all coded according to the behaviour displayed on the tenth second of the observe period (momentary time sampling), whereas the researcher recorded all social behaviours observed across the ten second observation period for the social interactions category (partial time sampling). This process was repeated for 30 observed intervals for each child. Data collection took place over a two day period in each school and temperatures ranged from 2-10°C. To keep the consistency of the observation intervals, a pacer was used through an MP3 player. All 82 children were directly observed for a ten minute period each, totalling 2460 observed intervals and 820 minutes of coded observation.

Table 4.1 C	haracteristics	of the	participant	schools
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School	Size of the	Demographics	Type of	Adult	Equipment available (fixed and
		T 11: 1 Cil 11 Milit	SCHOOL	supervisors	
School 1	236 children	I wo-thirds of the pupils are white	Mixed sex	Morning	l'rim trail (obstacle course)
	on roll	British, the remainder coming from a	Roman	break time –	Climbing frame
	The school	range of other ethnic heritages.	Catholic	2 Teachers	Rubber tyres
	is an	I ne proportion of pupils who speak		LUNCH Dreak	Basketball posts
	average-	English as an additional language is		– 4 iunchtime	Outside gym (a range of weight
	Sized	Delow average.		supervisors	Daring equipment)
	primary	Pupil's eligible for pupil premium is		and a sports	Seating areas
Cohool 2	SCHOOL	Delow the national average.	Mixed	Coach	
School 2	393 Children	Pupils come from a number of	Mixed Sex	Morning brook time	Climbing frame
		Minority ethnic Dackgrounds with Dakistani, Bangladashi and Plask	Community	Dreak line –	Climbing Irane
	in larger	African numile being the largest		Z Teduleis	Rubber lyres Backethall pacts
	is idiyel	around			Daskelball posis
		groups. Dupil's aligible for pupil promium is			caged area for children to play
	average-	twice the national average (additional		supervisors	Sports
	Sizeu primary	funding from central government for			Portable equipment
	school	nunils known to be eligible for free			
	SCHOOL	school meals, children who are looked			
		after by the local authority or who			
		have a parent in the armed forces)			
School 3	236 children	Almost all nunils are from minority	Mived sev	Morning	Trim trail (obstacle course)
501001 5	on roll	ethnic backgrounds and most nunils	Community	hreak time –	Climbing frame
		sneak English as an additional	Community	2 Teachers	Rubber tyres
	The school	language		Lunch break	Baskethall nosts
	is an	The proportion of disadvantaged		– 4 lunchtime	Caged area for children to play
	average-	nunils eligible for the pupil premium		supervisors	sports
	sized	funding is well above average		and a sports	Seating areas
	primary			coach	Portable equipment
	school.				· ······· • • • • • • • • •

Table 4.1 continued.

School 4	143 children on roll Smaller than average primary school	Pupils come from a diverse range of ethnic backgrounds and about one third of them speak English as an additional language, a high proportion. Pupil's eligible for pupil premium is twice the national average.	Mixed sex Roman Catholic	Morning break time – 2 Teachers Lunch break – 3 lunchtime supervisors and a sports coach	Basketball posts Seating areas
School 5	400 children on roll Larger than average primary	Nearly two thirds speak English as an additional language with the main home languages being Urdu, Punjabi and Bengali. This is very high. A high proportion of pupils are eligible for the pupil premium.	Mixed sex Community	Morning break time – 2 Teachers Lunch break – 4 lunchtime supervisors and a sports coach	Trim trail (obstacle course) Climbing frame Rubber tyres Basketball posts Seating areas Portable equipment

Data sourced from School Level Classes Data (Gov, 2013), the Department for Communities and Local Government (2015) and from observational data.

4.4.3.1 SOCARP validity and reliability (quality criteria checks)

The SOCARP tool has a positive degree of concurrent validity through its validation against other PA measures such as uni-axial accelerometers and pedometers, with correlation coefficients revealing moderate concurrent validity between EE scores (2.5+0.5) and mean accelerometer counts (154.5+74.1 CPE; r = .67; P < .01)(Ridgers, Stratton and McKenzie, 2010). The training and use of five observers to collect the SOCARP data reduced the threat of observer bias. Consequently, intra and inter-observer reliability was established prior to data collection, with an advised inter-observer agreement of >80% for each of the SOCARP categories (Ridgers, Stratton and McKenzie, 2010). Observer training included becoming familiar with the study protocols, memorising categories and codes and practising using video recorded examples. The inter-observer reliability checks which took place before and after data collection involved observer's coding video recorded examples against the lead observer, using training videos that had been established from pilot study data (Appendix 1). 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 observation for the field reliability check was selected randomly. The field reliability scores recorded were: activity level 90%; group size 85%; activity type 95%; and social interactions 95%.

4.4.3.2 Quantitative data analysis (Including aspects of quality criteria checks) 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 frequency 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.

Descriptive statistics were applied to describe the final sample, a two-way ANOVA was then used to determine any main effects for 'sex' and 'school' on the SOCARP variables; Cohen's d was used to help explore practically significant differences (i.e., the size of the effect), thus, the interpretation of the interaction effect size was calculated using partial eta squared (n_p^2) (small [0.01], medium [0.06] and large [0.14]) (Cohen, 1988). The statistical assumptions for a factorial ANOVA were adhered to which included: using Levene's test to check for equality of variances of all data points of the dependent variable; and ensuring normality of residuals through the use of a QQ Plot (Cohen, Manion and Morrison, 2011; Pardoe, 2012). 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, moderate, MVPA and VPA) and the predictor variables of group size (alone, small, medium and large), activity type (sport, active games, sedentary, locomotion) and social interactions (none, pro physical, pro verbal, anti-physical, anti-verbal, none). As the SOCARP tool produces a number of predictor variables, the backwards selection enabled the model to be refined sufficiently and thus was the most efficient way of identifying predictor

variables. Predictor variables were retained if they significantly predicted the outcome variables. To enable trustworthy conclusions from the data, the following assumptions for multiple regression were checked for each model: a) homoscedasticity of errors through plotting standardised residuals against the predicted values of Y; b) multicollinearity through the presence of correlations between the predictor variables; c) outliers from the application of Cook's distance diagnostic; and d) linearity of the predictor and outcomes variables (Williams, Grajales and Kurkiewicz, 2013). All statistical analyses was conducted using the Statistical Package for the Social Sciences v.23 and the alpha level was set at P<.05.

4.4.4 Qualitative data collection: children's group interviews

Group interviews were employed to gain an understanding of children's break time PA behaviours and have been considered ideal to use in a mixed method design as they can add a further insight to the phenomenon under study (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). As opposed to a focus group which can be considered more of a discussion between the participants, with a key feature of this approach being the interaction between the participants. As highlighted by Arthur *et al.* (2012), the main distinguisher of a focus group is the interactive nature between the participants; whereas a group interview is when a participant group is guided into dialog by the researcher's list of questions, with the aim to elicit information on a certain points of enquiry (Menter *et al.*, 2011).

In the current study, two group interviews in each school took place and consisted of eight children in each group (i.e., 10 groups of 8 children) (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. The group interviews

(Appendix 6) were based on four of the layers from the Ecological Model for Health Promotion (intrapersonal, interpersonal, institutional and community) (McLeroy *et al.*, 1988) and included questions such as 'What do you enjoy/not enjoy doing during break times?', 'How active/busy do you think you are at break times?' and 'What did you do at break time today?' At the start of the group interviews, the children were asked to draw themselves at break times and these drawings were then used to engage children in conversation and to clarify the main concepts of the interview (Appendix 7). This was not conducted as a write and draw participatory method, as used in previously PA research exploring children's views of their break time environment (e.g. Knowles *et al.*, 2013). Instead it was used to engage the children at the start of the group interview and to encourage them to think about their break time behaviour. Each group interview lasted for approximately 30 minutes and was recorded using a Dictaphone to capture the verbal interactions of the participants.

4.4.4.1 Trustworthiness of the qualitative data (quality criteria checks)

The transferability and dependability of the group interview data can be reflected in terms of the structured approach adopted and the verbatim extracts, ensuring the participant's voice had not been lost, which enabled the reader to check the interpretations made. The credibility 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). The credibility of the data was increased further due to member checking, where the researcher's interpretation of the answers given were clarified with the children involved. The children were also informed that there were no right or wrong answers and that they did not have to take part in the interview. Such strategies contribute to the credibility of the interview data (Shenton, 2004).

4.4.4.2 Qualitative Data Analysis: interpretative phenomenological analysis

The group interviews were analysed using IPA (Smith, 1997), which 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, idiography and hermeneutics (Smith, Flowers and Larkin, 2009). It is phenomenological as it is concerned with the human experience and it is considered double hermeneutic because it involves the participant's interpretation and communication of the experience, and the researcher's interpretation and communication of each case (Smith, Flowers and Larkin, 2009).

An IPA approach was adopted because it was consistent with the epistemological position of the qualitative research objective, with regards to placing a focus on the children's perceptions and experiences of their playground environment (Smith, Flowers and Larkin, 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 Ecological Model of Health Promotion (McLeroy *et al.*, 1988). 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 it did not screen the participants' experiences (Smith, Flowers and Larkin, 2009).

A systematic analysis of each transcript took place (Appendix 8) in which the first step involved reading and re-reading the transcripts; at this stage of the analysis initial notes were recorded. Smith, Flowers and Larkin (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, Flowers and Larkin, 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 ten interviews. Further information on the use of IPA can be found elsewhere (Smith, Flowers and Larkin, 2009).

4.5 Results

4.5.1 SOCARP results

Table 4.2 provides the mean (M±SD) percentage of break time children spent in the SOCARP variables of: activity level, group size, activity type and social interactions during outdoor morning and lunch break times. The mean percentage of time children spent engaged in MVPA during break times was 64.7% (equivalent to 33.6 minutes), and VPA was 21.3% (equivalent to 11.1 minutes). However, a statistically significant difference was found between boys' and girls' MVPA, indicating a medium effect size (F(1,80)=9.89, P<.01, $n_p^2=.110$). Evidencing boys (70%MVPA, equivalent to 36.4 minutes) were more active than girls (56.8%MVPA, equivalent to 29.5 minutes) during primary school break times (equating to a difference of 6.9 minutes of MVPA). Furthermore, large effect sizes for differences in sex for large (F(1,80)=29.04, P<.01, $n_p^2=.266$) and small groups (F(1,80)=21.23, P<.01, $n_p^2=.210$) were evident from the data analysis. With boys spending more time engaged in large groups and girls spent more time engaged in small groups (Table 4.2). Other large effect sizes for differences in sex included time spent in sports (F(1,80)=24.55, P<.01, $n_p^2=.235$) and sedentary activities

(*F*(1,80)=21.99, *P*<.01, η_p^2 =.216). With boys spending more time taking part in sports activities and girls spending more time engaged in sedentary activities (Table 4.2).

Correlational analyses were conducted separately for girls (Table 4.3) and boys (Table 4.4). For boys, playing sport was weakly related to their break time MVPA, $(r (47) = .392, P < .01, r^2 = .152, 95\%$ CI [.122, .662]) and moderately related to VPA ($r (47) = .512, P < 0.01, r^2 = .262, 95\%$ CI [.260, .764]), sharing 15.2% and 26% of the variance respectively. There was a significant association between boys' MVPA and the contextual variable of equipment ($r(47) = .317, P = .03, r^2 = .100, 95\%$ CI [.033,.553]).

Further analysis using Multiple Regression Models 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 4.5), accounting for 9% of the variance. For girls, a significant relationship between MVPA and locomotive activities (r (31) =.478, P<.005, r^2 =.228, 95% CI [.156, .800]) (Table 4.6) was found, along with girls spending the largest % of time in MPA (39.5%) (Table 4.2). Small and medium groups (F(2,30)=4.915,P<0.05, r^2 =.247, $R^2adjusted$ = .197), along with prophysical and pro-verbal predictors (F(2,30)= 6.113, P<0.05, r^2 =.290, $r^2adjusted$ = .242) were negatively associated with girls' VPA (Tables 4.5 and 4.7).

	Boys (<i>n</i> =49)	Girls (<i>n</i> =33)	р	η _p ²	Boys and Girls (<i>n</i> =82)
Activity Level Lying down (%)	.00 ± .00	.10 ±.6	.22	.018	0 ± .4
Sitting (%)	2.4 ± 6.4	9.2 ± 11.1	<.01*	.132	5.2 ± 9.2
Standing (%)	27.3 ± 17.2	33.4 ± 20.7	.15	.026	29.8 ± 18.8
MPA (%)	46.1 ± 16	39.5 ± 17.1	.08	.038	43.4 ± 16.6
VPA (%)	23.9 ± 11.6	17.3 ± 13.1	<.01*	.069	21.3 ± 12.6
Sedentary (%)	29.8 ± 17.5	42.7 ± 20.3	<.01*	.106	35 ± 19.6
MVPA (%)	70 ± 17.7	56.8 ± 20.1	<.01*	.110	64.7 ± 19.7
Group Size Alone (%)	13±18.2	13±15.3	.99	.000	13±17
Small (%)	30.3±28.1	59.3±27.8	<.01*	.210	42 ± 31.3
Medium (%)	14.2±22.3	23.5±25.8	.08	.036	18±24.1
Large (%)	42.2±39.4	4.2±10.9	<.01*	.266	26.9±36.3
Activity Type Sports	42.1 <u>+</u> 42	4.6 <u>+</u> 13.2	<.01*	.235	27 <u>+</u> 38.1
Games	21.3 <u>+</u> 28.5	26.8+24.9	.37	.010	23.5 <u>+</u> 27.1
Sedentary	15.2 <u>+</u> 15.8	34.1 <u>+</u> 20.6	<.01*	.216	22.8 <u>+</u> 20.1
Locomotion	21.4 <u>+</u> 20.9	34.5 <u>+</u> 18.4	<.01*	.097	26.7 <u>+</u> 20.9
Social Interactions Pro-physical	16.6+14.7	21.1+14.6	.18	.022	18.4 <u>+</u> 14.7
Pro-verbal	74.5+17.2	76+15.1	.67	.002	75.1 <u>+</u> 16.3
Anti-physical	5+6.6	.9+2	<.01*	.126	3.3 <u>+</u> 5.6
Anti-verbal	2.5+4.5	.7+1.6	.03	.054	1.8 <u>+</u> 3.7

Table 4.2. The mean (M±SD) percentage of time children spent in the SOCARP variables of: activity level, group size, activity type and social interactions during outdoor morning and lunch break times

Descriptive statistics were used to find the mean values for girls and boys across the four variables. A two-way ANOVA was employed to determine any main effects for sex. Cohen's d was used to determine the effect sizes (η_p^2) .

Table 4.3 Correlation matrix re	presenting girls' (<i>n</i> =33) SOFIT	outcome variables of: ly	ing, sitting, moderate, MVPA,
VPA; and predictor variables of:	alone, games, locomotion, ve	brbal conflict, physical cor	nflict and equipment.

	Outcome variables					
Predictor variables		Sitting	Standing	MPA	MVPA	VPA
Alone	r	.27	.35*	10	.15	.37*
	p	.12	.05	.56	.38	.03
Games	r	16	02	18	.09	.39*
	р	.36	.89	.30	.58	.02
Locomotion	r	04	43	.61**	.48**	05
	р	.81	.01	<.01	.01	.74
Verbal conflict	r	14	.17	45**	17	.32
	р	.42	.32	.01	.33	.07
Physical Conflict	r	01	04	39*	05	.42*
	р	.92	.80	.03	.76	.02
Equipment	r	.39*	09	01	18	07
	р	.03	.61	.98	.31	.69

*.Correlation is significant at the 0.05 level (2-tailed), **. Correlation is significant at the 0.01 level (2-tailed)

	Outcome variables	S* 44 *	G4			7704
Predictor variables		Sitting	Standing	MPA	MVPA	VPA
Alone	r	.57**	13	.09	07	24
	p	<.01	.35	.50	.62	.09
Small group	r	.02	05	.30*	.06	33*
	р	.86	.70	.03	.67	.02
Large group	r	23	.16	29*	09	.24
	р	.11	.25	.04	.50	.08
Sport	r	24	32*	.06	.39**	.51**
	p	.08	.03	.67	.01	<.01
Games	r	.02	.46**	29*	46**	30*
	p	.87	<.01	.04	<.01	.04
Locomotion	r	.18	17	.42**	.11	43**
	р	.19	.22	<.01	.42	<.01
Equipment	r	373**	15	.24	.31*	.20
	р	.01	.28	.08	.03	.16

Table 4.4 Correlation matrix representing boys' (*n*=49) SOFIT outcome variables of: lying, sitting, moderate, MVPA, VPA; and predictor variables of: alone, small group, large group, sport, games, and locomotion.

*.Correlation is significant at the 0.05 level (2-tailed), **. Correlation is significant at the 0.01 level (2-tailed)

Outcomes		Standing	g		MPA			VPA	
Boys									
Predictors	B (SE)	ß	Р	B (SE)	ß	Р	<i>B</i> (SE)	ß	Р
Constant				40.81(3.24	-)	<.01	17.40(2.96)		<.01
Small				.17(.07)	.304	.03			
Medium							.146 (.07)	.28	.06
Large							.10 (.04)	.35	.02
Adjusted R ²		.00			.07			.09	
Girls									
Predictors	B (SE)	ß	Р	<i>B</i> (SE)	ß	Р	B (SE)	ß	Р
Constant	95(16.54)		.95				43.54 (9.95)		<.01
Small	.42 (.23)	.57	.07				28 (.12)	597	.026
Medium	.57 (.24)	.72	.02				407 (.13)	80	.004
Large									
Adjusted R ²		.17						.19	

Table 4.5 Group size as a predictor of boy's (*n*=49) and girl's (*n*=33) activity levels (standing, MPA, MVPA and VPA) during outdoor morning and lunch break times

Outcome variables: standing, MPA, VPA. Predictor variables: small, medium, large groups. Notes. Lying, sitting and MVPA were included in the analysis but no significant predictors were identified. **B** = Beta value, indicates a positive or negative predictor **B** (SE) = Unstandardised coefficients (St. Error)

	Stand	ing		MPA			M۱	/PA		VF	PA	
Boys												
Predictors	B (SE)	ß	Р	B (SE)	ß	Р	<i>В</i> (SE)	ß	Р	<i>В</i> (SE)	ß	Р
Constant	52.03(5.3)		<.01	-10.67(11.92)		.38	15.95(13.65)		.25	31.83(2.37)		<.01
Locomotion	54(.12)	66	<.01	1.104(.19)	1.44	<.01	.94(.21)	1.12	<.01	237(.07)	42	<.01
Games				.42(.13)	.76	<.01	.35(.15)	.56	.03	13(.05)	32	.01
Sport	30(.06)	75	<.01	.57(.12)	1.50	<.01	.62(.14)	1.49	<.01			
Adjusted R ²		.32			.45			.41			.24	
Girls												
Predictors	B (SE)	ß	Р	<i>B</i> (SE)	ß	Р	B (SE)	ß	Р	B (SE)	ß	Р
Constant	79.95(11.07)		<.01	73(7.65)		.92	69(8.34)		.93	11.72(3.15)		<.01
Locomotion	91(.20)	81	<.01	.85(.14)	.92	<.01	1.08 (.15)	.99	<.01			
Games	46(.15)	56	<.01	.30(.10)	.43	<.01	.62 (.11)	.76	<.01	.207 (.08)	.39	.024
Sport	52(.23)	33	.03	.56(.163)	.43	<.01	.70 (.17)	.46	<.01			
Adjusted R ²		.41			.54			.61			.12	

Table 4.6 Activity type as a predictor of boys' (n=49) and girls' (n=33) activity levels (standing, MPA, MVPA and VPA) during outdoor morning and lunch break times

Outcome variables: standing, moderate, MVPA, VPA. Predictor variables: Locomotion, games, sport. Notes. Lying and sitting were included in the analysis but no significant predictors were identified. **B** = Beta value, indicates a positive or negative predictor **B** (SE) = Unstandardised coefficients (St. Error)

Outcomes		MPA				
Girls						
Predictors	B (SE)	ß	Р	B (SE)	ß	Р
Constant	42.87 (2.95)		<.01	14.77 (2.31)		<.01
Anti-Verbal	-4.69 (1.67)	45	<.01			
Anti-Physical				2.70 (1.04)	.42	.01
Adjusted R ²		.17			.15	
Constant				156.58 (43.09)		<.01
Pro-Verbal				-1.39 (.44)	-1.60	<.01
Pro-Physical				-1.58 (.45)	-1.77	<.01
Adjusted R ²		.00			.24	

Table 4.7 Social interactions as a predictor of girl's (*n*=33) activity levels (standing, MPA, MVPA and VPA) during outdoor morning and lunch break times

Outcome variables: MPA and VPA. Predictor variables: anti-verbal, anti-physical, pro verbal and pro physical

Notes. 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. B = Beta value, indicates a positive or negative predictor B(SE) = Unstandardised coefficients (St. Error)

4.5.2 Children's group interview findings

In the qualitative findings three main themes emerged in the data set: the physical environment of break times (well-resourced versus poorly resourced schools; boys' football dominance; and girls' skipping); the social environment of break times (adult input; boys and sport; and girls walk and talk); and children's individual break time environment (imaginary role play; power hierarchy; manipulation of fixed equipment; and challenge and competition) (Table 4.8).

Table 4.8 Children's perceptions and experiences of their outdoor morning and lunch break times: 1st and 2nd order themes

1 st Order Themes	2 nd Order Themes
Intr	rapersonal
Children's individual break time environment	- Imaginary role play
	- Power hierarchies
	- Manipulation of fixed equipment
	- Challenge and competition
Inte	erpersonal
The social environment of break times	- Adult input
	- Boys and sport
	- Girls' walk and talk
Ins	titutional
The physical environment of break times	- Well-resourced versus poorly resources schools
	- Boys' football dominance
	- Girls' skipping

The physical environment of break times (emergent themes: wellresourced versus poorly resourced schools; boys' soccer dominance; and girls' skipping). The children expressed that they enjoyed using the fixed and portable equipment. A dominant theme across three of the 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 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). 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 footballs. 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 also noted that some children were queuing for a turn to use portable equipment such as scooters if only limited numbers were available. With regards to sex differences in the physical environment, boys in four of the schools expressed a strong liking for taking part in sports activities such as football 'I like playing football with my friends' (Male, School 3) and girls in four of the schools 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 of break times (emergent themes: adult input; boys and sport; and girls' walk and talk). It was evident that the children valued the adult input at break times, 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 times 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) and '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, such as boys in four of the five schools preferred to engage in larger groups playing sports 'What I like doing at playtime is playing football with all my friends' (Male, School 5) and girls across all five schools enjoyed talking with their friends in smaller groups 'I like to mainly just walk around with my friends making each other laugh' (Female, School 1).

The individual environment of break times (emergent themes: Imaginary role play; power hierarchies; 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 engaged 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. For example, '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). 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) and 'I play tig and tag on the monkey bars' (Female, School 2).

All children expressed how they thrived in a competitive environment; however this behaviour was expressed more in 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 past 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).

4.6 Discussion

The current study's qualitative findings provide insights into the three main environments that children engaged in during outdoor break time (the physical environment, the social environment, and the children's individual break time environment) supporting both previous findings and helping to address the knowledge gap with regards to the social environment of break times (Ridgers *et al.*, 2012; Parrish *et al.*, 2013). In addition, the quantitative findings evidence differences in the sub groups of boys and girls in determining predictors of children's PA during break time. The mixed method design assisted in method triangulation, from which both the qualitative and quantitative data highlighted differences in boys' and girls' social environments. The quantitative findings identified that boys spent 42.2% of their break times engaged in large groups and, 42.1% playing sport. Engaging in large groups was also a positive, although weak predictor of boys' VPA (9% variance); however, this was also supported by the qualitative findings.

Whereas for girls one of the strongest statistical relationships from the SOCARP data was between locomotion and MVPA, although this still only represented 23% of the variance in girls' break time behaviour. However, the qualitative data provided further insights as girls' walking and talking was a 2nd order theme. Interestingly, the pro-verbal and pro-physical variables from the SOCARP data were negative predictors of girls' VPA. If the girls were engaged in conversation then it would be hard for them to increase their activity level from MPA to VPA. 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 from the qualitative data 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 suggested 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' VPA 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, Fairclough and Stratton, 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. However, the 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) recommended future studies to research the role of adults to increase girls' PA during break time. In relation to this chapter's findings, an implication for future research would be to establish the efficacy of interventions to increase PA through adult promotion of walking whilst talking.

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, 1998) indicated 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 boys and girls concurrently through providing stimuli for children's imaginative role play. Previous research has suggested that children are flexible and resourceful when it

comes to establishing a relationship between themselves and their playground environment through the engagement in imaginative play (Darian-Smith, 2013; Knowles *et al.*, 2013) and the findings of the current study support this.

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 football, however they also found older girls to participate in imaginary role play. Building upon those findings, this study highlights from the children's group interviews 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 the school policies such as playground rotas, adult supervision 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 time. 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 through the employment of qualitative methods. 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 (Stratton and Mullan, 2005; Arthamatten *et al.*, 2011; Ridgers *et al.*, 2011).

However, both the quantitative and qualitative 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 % of time. This was the second highest figure out of all of the five schools, although the two-way ANOVA evidences no statistically significant differences for the main effect of 'school' on children's %MVPA. The high level of MVPA and locomotion as an activity type, indicated from the SOCARP data, 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. However, even with limited playground resources the children in School 4 discussed in the group interviews their imaginary playground games and chasing games such as stuck in the mud. 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.

4.6.1 Strengths and limitations

The use of direct observation allowed for 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). This therefore allows for the identification of variables that could be targeted in the design of break time interventions, in order to increase children's break time PA. A limitation of the study would be the collection of data within one regional area of England 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). The consistency of the findings across the five schools suggests that the results could be similar at other schools with comparable characteristics. It is also acknowledged that the presence of the researchers during break times could have influenced the children's PA behaviours. However, the study aimed to address this by reducing the effect of observer reactivity through researchers positioning themselves on the edge of the playground and avoiding any interaction with the children. Further limitations of the study would include an omission of the following confounding variables: children with disabilities, seasonal effects and Indices of Multiple Deprivation (IMD) data. An additional consideration to the study's findings would be the positive correlations between boys' and girls' time spent being alone whilst engaged in sedentary activities e.g. sitting or standing (Table 4.3 and 4.4). Therefore, a future recommendation would be to take into consideration those children that spend break times alone in sedentary activities and the reasons behind this.

4.7 Conclusion

The findings from this chapter (Study 1) highlight the importance of a mixed method approach and its contribution to understanding children's social behaviours during school break times. As not only does the current study use an objective measure of children's PA through the quantitative data, the qualitative data also provides insights to the children's perceptions and experiences of their PA behaviours. Several predictors of children's activity have been identified through both the qualitative and quantitative data, with significant differences between 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. A

behaviour which many girls who participated in the study identified as something they enjoyed doing at break times. However, the routes need to be designed in such a way that does not impact negatively upon the activity levels of boys, ensuring that boys still have space and portable equipment to play sports; a behaviour that was identified by the boys in both the quantitative and qualitative data. In addition, imaginary play was prevalent in both boys' and girls' gualitative data 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 by playground markings and additional resources. Consequently, these conclusions from this chapter have been used to inform Chapter 5 (Study 2) which aimed to: design, implement and evaluate the effectiveness of an outdoor primary school break time intervention to increase children's MVPA. Specifically, the break time intervention design was informed by the quantitative findings of girls' positive relationship between MVPA and locomotive activities (Table 4.6) and their pro-verbal and pro-physical behaviours being negative predictors of their VPA (Table 4.7). For boys, the specific quantitative results informing the break time intervention included: sport as a positive predictor of their MVPA (Table 4.6) and large and medium groups as a positive predictor of their VPA (Table 4.5). Furthermore, the qualitative sub themes of 'boys and sport' and 'girls walk and talk' (Table 4.8) were used to inform the design of a walking track to encourage girls to 'walk and talk' whilst leaving the space for boys to play sport in medium and large groups.

Chapter 5

Study 2: Primary school break time intervention to increase children's MVPA: The Walking Track Intervention Model

Chapter 5 – (Study 2) Primary School Break Time Intervention to Increase Children's MVPA: The Walking Track Intervention Model

5.1 Study Overview

The primary research objective of this chapter (Study 2) was to design, implement and evaluate the effectiveness of an outdoor primary school morning break time intervention to increase children's MVPA. The secondary research objectives were: 1) to assess children's step count during morning break times; 2) to assess children's PA levels, social group size, activity type and social interactions during morning break times; 3) to assess children's weight status through the collection of BMI data; and 4) to evaluate the effectiveness of the implementation of the walking tack through exploring the PE Co-ordinator's perceptions and experiences.

The intervention involved the installation of a walking track for use by children during their morning break times. The design and development of this walking track was informed by drawing upon both the quantitative and qualitative findings from Chapter 4. The quantitative data which directly informed the break time intervention included girls' positive relationship between MVPA and locomotive activities (Table 4.5), along with their pro-verbal and pro-physical behaviours being negative predictors of their VPA (Table 4.6). For boys, the quantitative results that informed the break time intervention included: sport as a positive predictor of their MVPA (Table 4.5) and large and medium groups as a positive predictor of their VPA (Table 4.4). Furthermore, the qualitative sub themes of 'boys and sport' and 'girls walk and talk' (Table 4.7) were used to inform the design of a walking track to encourage girls to 'walk and talk' whilst leaving the space for boys to play sport in medium and large groups.

The intervention design was a one-group time series, involving one experimental group which drew upon multiple points of measurements (baseline, post-

intervention [1-5 weeks] and follow-up [6-9 weeks]). Children (n=81, boys =43, girls=38) (aged 5 to 9 years) wore a pedometer during morning break times and the SOCARP tool was also used to provide further insights into Y3 and Y4 children's break time PA behaviour. Following guidelines produced by NICE (2015), the walking track intervention was grounded in aspects of the Ecological Model for Health Promotion (McLeroy et al., 1988), the Self Determination Theory (SDT) (Ryan and Deci, 2000), and key ingredients from the Behaviour Change Taxonomy (BCT) (Michie et al., 2011). Post-intervention, an individual teacher interview was conducted with the PE Co-ordinator to evaluate the implementation of the walking track. The results from factorial ANOVA conducted on the pedometer data revealed a main effect for 'point of data collection', with statistically significant increases in children's (Y1 to Y4) step count from baseline (M=1176.43) to post-intervention (M=1412.95). However, there was a significant decrease in step count at follow-up (M=1182.91). The two-way ANOVA results for the SOCARP data evidences a statistically significant main effect for 'point of data collection' on Y3 and Y4 children's VPA with a statistically significant increase from baseline (17.423%) to post-intervention (32.78%), which continued to increase at follow-up data collection for boys (34.90%). Thus, it is suggested that the implementation of a walking track in the grounds of a primary school can have positive short term effects on boys' and girls' MVPA and positive longer term effects on boys' VPA, which could contribute to children achieving their daily PA recommendations of at least 60 minutes MVPA. The gualitative data revealed the two main themes of 'boys dominating the walking track' by playing racing games and 'conflicting visions' of school staff', highlighting inconsistencies from school staff in the use of the track. Thus, a future recommendation would be to test the effectiveness of the Walking Track Intervention Model which has integrated the additional BCT ingredient of 'provide instruction' (Michie *et al.*, 2011) through the creation and communication of a set of 'how to' principles devised by researchers and provided to the intervention schools to discuss and employ alongside the changes to the school playground.

	Year 1 of PhD study	Year 2 of PhD study	Year 3 of PhD study	Year 4 of PhD study
Study 1 Break time Exploratory Study	Methods: SOCARP, Children's group interviews Outcomes: Boys engage in more MVPA and dominate playground space in large groups Girls enjoy socializing with their friends in small groups Boys and girls engage in imaginary play			
Study 2 Break time Intervention Study		Methods: SOCARP, Pedometers, Teacher ind Outcomes: Positive short term effects on boys' and girls' Longer term positive effect on boys' VPA Boys dominated the walking track, girls partie Inconsistencies in the implementation of the A set of 'how to principles are recommended	dividual interview step count and MVPA cipated in sedentary activities intervention from school staff	Initial discussions began in the 2 nd year for study 2, but the intervention was delayed. Thus, data collection began in 4 th year of study.
Study 3 Physical education Exploratory Study		Methods: SOFIT, Children's group interviews, Teacher individual interviews		
Study 4 Physical education Intervention Study			Methods: SOFIT, Teacher individua interviews	1

Figure 5.1 A thesis map to illustrate the chronology of the studies conducted and the methods and outcomes of studies 1, and 2.

Exploratory studies

Intervention studies

5.2 Introduction

As discussed in Chapter 1 (section 1.1.3) and Chapter 2 (section 2.3.1.1), there is a current need for effective primary school break time interventions to increase children's MVPA (Ridgers *et al.*, 2012; Parrish *et al.*, 2013; Erwin *et al.*, 2014). This recommendation has risen from the current lack of evidence on the efficacy of break time interventions, as few studies have reported statistically significant increases in children's break time PA (Parrish *et al.*, 2013). Alongside this scientific research based rationale, it is also important to consider the real world rationale for creating effective and sustainable break time interventions to increase children's PA. As previously stated in Chapter 4 (section 4.1), it is important to target children's PA during break times as most children in England will engage in at least two break times a day, every day. Furthermore, break times do not interfere with curriculum teaching or daily schedules; hence schools may be more inclined to implement break time interventions as they do not add to a teacher's workload.

In Parrish *et al.*'s (2013) systematic review of break time PA interventions it was highlighted that previous interventions have either drawn upon single or multicomponent strategies. The majority of single component interventions in their review targeted the physical environment, such as playground equipment (Verstraete *et al.*, 2006) and playground markings (Stratton, 2000; Stratton and Mullen, 2005), which, when using a single component intervention, were deemed to be the most effective (Parrish *et al.*, 2013). The multi-component interventions drew upon a range of strategies, making it difficult to determine the best single-component approach; with recommendations for a variety of multi-component intervention *et al.*, 2013). A multi-component approach could target both the physical and the social environment, as most interventions to date have only targeted the physical environment, with few targeting the social or policy variables (Ridgers *et al.*, 2012; Parrish *et al.*, 2013).

A recent example of a multiple component approach utilising both physical and policy strategies was that of Parrish *et al.* (2016) in which, they provided mixed portable equipment to the intervention schools along with several policy changes including maximum sitting periods during break times. At follow-up the intervention revealed a 13.6% increase in children's MVPA from baseline, although they did report inconsistencies in the implementation of the policy changes from individual teachers in the intervention schools. Parrish *et al.* (2016) also reported observed differences in girls' and boys' break time behaviour, stating that the policy change of implementing maximum sitting periods removed girls' inclination to sit and talk during break times. In addition, boys' PA levels did not change during lunch times as a result of Parrish *et al.*'s (2016) intervention from which it was concluded that this could be due to their normal PA break time behaviour of playing sports such as football (soccer).

Another example of a primary school lunchtime intervention aimed to determine whether the use of portable sports equipment or the implementation of naturebased orienteering activities was more effective in increasing children's PA (Barton *et al.*, 2015). Each intervention lasted a week, with the portable sports equipment including bats, balls, skipping and Frisbees; whereas the orienteering intervention consisted of providing children with maps of the school grounds, with courses changing daily. The results indicated that the provision of sports equipment had the greater increase in children's PA, however Barton *et al.* (2015) also concluded that the orienteering intervention was more inclusive than the sports equipment intervention, and recommended that nature-based interventions can be used as a strategy to engage children of all fitness levels.
Reporting on a meta-analysis of break time interventions on children's PA, Erwin et al. (2014) advocated the use of multiple measurement tools to record children's PA, as different measures seemed to impact upon the reported effect sizes. It was noted that intervention studies using pedometers and accelerometers reported higher effect sizes than those which used HR monitors and observation systems (Erwin et al., 2014). As a result, the break time intervention described in this chapter (Study 2) uses both pedometers and systematic observation to measure children's PA at baseline, post-intervention and follow-up. Additionally, Parrish et al. (2013) stated that there are several considerations that need to be taken into account in the design of primary school break time interventions, including the differences in boys' and girls' PA break time behaviours. Thus, in consideration of this recommendation, the results presented in the previous chapter (Study 1) assisted in identifying the possible sex differences in children's PA break time behaviours. Both the quantitative and qualitative data from the study (section 4.4) indicated that boys and girls engaged in different activities during outdoor break times. With boys spending most of their break times playing sports in large groups, whilst girls spent most of their break time walking and talking in small friendship groups. As a result, this chapter (Study 2), will focus on designing, implementing and evaluating a break time intervention that targets girls' MVPA through the use of a walking track, yet the aim is to design this in such a way that it does not impact negatively on boys' PA levels ensuring that they have the space to continue to participate in the types of activities that they enjoy such as sports.

As well as drawing upon both pedometers and systematic observation to measure the quantitative differences in children break time PA from baseline to post intervention, study 2 will also use qualitative data in the form of an interview to evaluate the process measures of the intervention. The benefits of adopting a mixed method approach have been previously highlighted (see Section 3.2). For example, the intervention study conducted by Hyndman *et al.* (2014) drew upon both pedometers and systematic observation to measure the effects of their break time intervention. Although this intervention was successful and recommendations were made with regards to its application in other schools, a limitation of the study was the omission of any qualitative methods to assist as process measures of the intervention. If qualitative methods had been employed such as interviews with the teachers involved, this would have provided further insights and guidance into the implementation of the intervention, which would have been useful when applied to other settings. Thus, both quantitative and qualitative methods will be used in study 2.

The primary research objective described in this chapter (Study 2) was to design, implement and evaluate the effectiveness of an outdoor primary school morning break time intervention to increase girls' and boys' MVPA. In order to evaluate the effectiveness of the intervention, the secondary research objectives were: 1) to assess children's step count during morning break times at baseline, post-intervention and follow-up; 2) to assess children's PA levels, social group size, activity type and social interactions during morning break times at baseline, post-intervention and follow-up; 3) to assess children's weight status through the collection of BMI data (to enter into the pedometers for accurate data collection); and 4) to evaluate the effectiveness of the implementation of the walking track through exploring the PE Co-ordinator's perceptions and experiences.

5.3 Methods

5.3.1 Research design

The design of this research study was underpinned by the pragmatic approach outlined previously (Johnson and Onwuegbuzie, 2004), in which the mixed method design employed was that of an explanatory framework (Creswell, 2014). As a result, priority was given to the quantitative data, which was used to measure the changes in children's MVPA from baseline to post-intervention. Once all the quantitative data had been collected the findings were used to inform the design of the interview questions which were posed to the PE Co-ordinator to evaluate the overall effectiveness of the intervention. Thus, the two types of data were sequential in their timing with the precedence given to the quantitative data (QUAN ->qual).

The intervention design was a one-group time series, involving one experimental group which drew upon multiple points of measurements (baseline, post-intervention [1-5 weeks] and follow-up [6-9 weeks]) (Cohen, Manion and Morrison, 2011). Although a control group has not been used, the multiple points of measurement 'enables the participants to become their own controls', which can assist in reducing any reactivity and thus increases the reliability of the data (Cohen, Manion and Morrison, 2011: p323).

5.3.2 Participants, sampling procedures and setting

In March, 2014 one school was selected through convenience and purposive sampling as the school expressed their aim to improve their children's PA behaviours. The school was located in the West Midlands, England with approximately 275 children on role. According to the English Indices of Deprivation (Department for Communities and Local Government, 2015), the Local Authority District in which the school is located is ranked 138 in terms of income and 103 in relation to health, where 1 is the most deprived and 326 is the least deprived. In January 2016, a total of 81 children (boys = 43; girls = 38) were initially selected via purposeful and stratified sampling across year groups 1, 2, 3 and 4 (aged 5 to 9 years). The stratified sampling included the criteria of diversity in activity levels and ensuring that both boys and girls were included in each year group sample. In February 2016, BMI data and stride length were initially collected from all 81

children, these data were then used to personalise the pedometers to each individual child to increase the validity of the step count.

In March 2016, the pedometer data were collected from the children across year groups 1, 2, 3 and 4 (5 to 9 years) at baseline, post-intervention of the walking track and at follow-up data collection points as outlined in table 5.1. Furthermore, the SOCARP tool was used to provide further insights into children's break time PA behaviour at baseline, post-intervention and follow-up data collection points with 23 children from Y3 and Y4 (boys = 12; girls = 11). Post intervention, the PE Co-ordinator was purposefully selected to be individually interviewed to explore their perceptions and experiences of the implementation of the intervention.

The break time setting included two tarmac playgrounds, one for Y1 and Y2 (846.68m²) and one for the Y3 and Y4 children (1311.19m²) (Figure 5.1). Each playground had various faded line markings such as hop scotch and snakes. The Y3 and Y4 playground included rubber tyres, a trim trail, basketball rings, seating huts and the children had access to a range of portable equipment including balls, scooters and skipping ropes. The Y1 and Y2 children had access to various portable equipment, some fixed wooden climbing equipment and seating areas. Each playground was supervised during morning break times by at least two members of staff and the morning break time was approximately 15 minutes for all year groups.

	Baseline	e (<i>n</i> =81)	Pos	st-	Follow-u	p (<i>n</i> =68)
			interventio	on(<i>n</i> =75)		
	Boys	Girls	Boys	Girls	Boys	Girls
Y1	<i>n</i> =9	<i>n</i> =7	<i>n</i> =9	<i>n</i> =6	<i>n</i> = 8	<i>n</i> =4
Y2	<i>n</i> =11	<i>n</i> =9	<i>n</i> =11	<i>n</i> =9	<i>n</i> =11	<i>n</i> =8
Y3	<i>n</i> =12	<i>n</i> =8	<i>n</i> =10	<i>n</i> =10	<i>n</i> =12	<i>n</i> =8
Y4	<i>n</i> =13	<i>n</i> =11	<i>n</i> =10	<i>n</i> =10	<i>n</i> =9	<i>n</i> =8

Table 5.1 Pedometer data sample at baseline, post-intervention and follow-up data collection points

The study was reviewed and approved by Newman University's Research Ethics Committee, which was then followed by gaining written informed consent from the head teacher and PE Co-ordinator (Appendix 9), and guardians of the children involved (Appendix 10). Verbal informed consent was also sought from the children. All researchers who visited the school were cleared by the Criminal Records Bureau or the Disclosure Baring Service and were experienced working with young children. All data collection took place between February and July 2016, however, the planning of the project and intervention began in March 2014.

5.3.3 Walking track intervention

The main element of the break time intervention involved the implementation of a 250m long and 1m wide walking track around the edge of the school field (Figure 5.2), costing approximately £14,000 (Figure 5.3). The intention being that all children could access this during morning break times. The implementation of this physical change to the school field was grounded in the development of 'The Walking Track Intervention Model' (Figure 5.4). This model combines an ecological approach (McLeroy et al., 1988), SDT (Ryan *et al.*, 2009) and ingredients from the BCT (Michie et al., 2011), as advocated by NICE (2015) in their behaviour change guidelines. The triangular model also reflects the importance of the head teacher's support at the base of the triangle, as without their support it was anticipated that

the intervention would not be successfully implemented. This was then followed by the role of the PE Co-ordinator and then the roles of other school staff, the children and their parents. To interlink these various roles within a primary school setting, SDT (Ryan and Deci, 2000) was applied (Table 5.2). The application of this theory assisted in developing the school's confidence to make decisions through the collection of baseline data and discussions between the school and the researcher. In addition, children were encouraged to be autonomous in their decision making with regards to whether they walked around the track or not at break times. The aim was to provide children with a choice, thus during morning break times all children could access the track if they wished. The relatedness component involved raising awareness and use of the walking track amongst staff, children and parents. For instance, parents were invited to the opening of the track to walk around with their children. Furthermore, the staff were involved in planning meetings regarding the track and contributed to the formal rules of the track. The PE Co-ordinator's competence was developed through meetings with the researcher discussing the findings from the previous study (Chapter 4), the baseline results from this study and possible strategies for the intervention. The sharing of the baseline data raised the PE-Cordinator's awareness of children's current PA levels which enabled them to make an informed decision. Furthermore, the meetings that took place between the researcher and PE-Co-ordinator involved discussing a variety of intervention strategies and the benefits and cost implications of each approach. These meetings assisted in developing the awareness, competence and confidence of the PE Co-ordinator in relation to increasing children's PA during primary PE lessons.



Figure 5.2 Intervention school outside setting pre intervention

Along with SDT, the implementation of the physical change (walking track) was grounded in four levels of the Ecological Health Promotion Model (McLeroy *et al.*, 1988) including: intrapersonal, interpersonal, institutional and community (Table 5.2). At the intrapersonal level the track was targeting girls specifically, informed by the findings outlined in Chapter 4 (Study 1). The aim was to encourage girls to 'walk and talk' during morning break times, with the objective that it would not impede upon boys' playground space in which they took part in sporting activities. The interpersonal element targeted the school staff, through ensuring that all staff were aware of and would encourage children (especially the girls) to use the walking track at break times. The institutional layer reflected the physical change in the environment from implementing the walking track and at the community level, the school held an official opening of the track in which children's parents were invited to come and walk around the track with their children. Furthermore,

three active ingredients from the BCT (Michie *et al.*, 2011) were applied which included 'Barrier Identification/Problem Solving' (e.g. collection of baseline data), 'Action Planning' (e.g. creating a detailed plan with the PE Co-ordinator), and 'Model/Demonstrate the Behaviour' (e.g. parents and teachers modelling walking around the walking track during the official opening) (Table 5.2).



Figure 5.3 Walking track intervention around the edge of the school field

5.3.4 Anthropometric measurements and stride length

As in accordance with the Yamax Digi-Walker CW700 manual (Yamax Inc., Tokyo, Japan), participants' stride length was determined by each child walking 10 steps. The distance of the 10 steps (toe to toe) was then measured and divided by 10 to produce their mean average stride length. In addition, participants' body weight was measured to the nearest 100grams using Seca weight scales (Seca, Ltd.,

Hamburg, Germany). Participants were weighed barefooted and without excess clothing, such as cardigans and jumpers. To ensure measurement accuracy, the scales were checked for a zero recording before each weighing. Children's height was also measured to the nearest 0.5centimetre using a Seca portable height measure (Seca Ltd., Hamburg, Germany). Stride length, weight and height measures were taken within two weeks of the baseline pedometer data being collected. BMI was classified according to the equation: BMI = body mass (kg) / height² (m²). Child weight status was categorised according to the Extended International Obesity Task Force (IOTF) Body Mass Index Cut-Offs for Thinness, Overweight and Obesity in Children (Cole and Lobstein, 2012). The UK's National Obesity Observatory, highlighted that the IOTF cut-offs are commonly used for international comparisons and presenting child weight status data in academic journals (Dinsdale, Ridler and Ells, 2011).

5.3.5 Pedometers

All participants were asked to wear a sealed Yamax Digi-Walker CW700 (Yamax Inc., Tokyo, Japan) pedometer on the right side of their hip for 4 consecutive morning break times at baseline, post-intervention and follow-up. Prior to use, pedometers were checked for battery life and each participant's stride length and weight measures were entered into their personalised pedometer. The class teachers were then given a class list with each child's name and their corresponding pedometer number. All participants were provided with a pedometer step recording form (Appendix 11), on which their class teacher or teaching assistant recorded the number of steps on the pedometer immediately before and after morning break times. The sum of the pedometer data over the course of the four days was calculated and then divided by the number of break times worn, thus providing a mean average morning break time pedometer step count for each child. Break times were excluded if there was a note indicating that the child had stayed indoors during morning break time or was absent from school.

5.3.5.1 Pedometer validity and reliability (quality criteria checks)

In relation to both content and criterion validity, pedometers are considered to be an accurate tool when measuring children's ambulatory (walking) PA (Clemes and Biddle, 2013). Specifically, the Yamax Digi-Walker 700/701 pedometer has been stated as being accurate and reliable in measuring step counts (Coffman et al., 2016). Pedometers are also user friendly (Clemes and Biddle, 2013), reliable (Rowe *et al.*, 2004) and have been highlighted as a useful tool for measuring changes in children's PA (Trost, 2001), and is particularly appropriate for measuring the activity of children during break times which is primarily ambulatory in nature. The design of the Yamax Digi-Walker 700/701 also provides a sealed casing that is difficult for the children to open themselves, which may decrease some participant reactivity. In addition, the children wore the pedometers for four consecutive morning break times which is consistent with recommended wear periods (Ling and King, 2015). Some children, particularly girls with summer school dresses attached their pedometers to belts provided, as it has been suggested that the use of a belt to attach the pedometer could minimise errors associated with pedometer tilt (Clemes and Biddle, 2013).

5.3.6 Systematic observation SOCARP

The SOCARP tool was employed (as described in Chapter 4: section 4.3.3) to provide an additional insight into the PA behaviours of the children at morning break times. The use of this tool also assisted in identifying whether the children were using the walking track during morning break and if so, how it affected their PA behaviour. Thus, the SOCARP form was adapted by adding the additional variable of 'Track' (T) to the activity category column for the post-test and follow-up observations (Appendix 12). A small sample from the 81 children wearing pedometers were each systematically observed for a ten minute period at morning break time. This was a stratified sample, with the criterion of a mixture of boys and girls, and who represented diversity in activity behaviours. This sample included children from Y3 and Y4 (aged 7 to 9 years) and data was collected at

baseline (n=10, boys = 5; girls = 5), post-intervention (n=15, boys = 6; girls = 9), and follow-up (n=14, boys = 7; girls = 7). Observations took place over a 4 day period when the children were wearing the pedometers. On each observation day, 2 to 3 trained observers arrived at the school prior to morning break time. Children were asked to wear a coloured band so that the observers could easily identify them. Observations totalled 100 minutes (300 observed intervals) at pre-test, 150 minutes (450 intervals) at post-test, and 140 minutes (420 observed intervals) at follow-up. Full details of the SOCARP tool can be found elsewhere (Ridgers, Stratton and McKenzie, 2010).

5.3.6.1 SOCARP protocols, validity and reliability (quality criteria checks)

As justified in Chapter 4 (section 4.3.3.1) SOCARP has a positive degree of content validity (Ridgers, Stratton and McKenzie, 2010). In addition, the use of three observers assisted in reducing the threat of observer bias. The content validity was also increased through establishing acceptable inter-observer reliability scores of >80% for each of the SOCARP categories (Ridgers, Stratton and McKenzie, 2010). Training took between 10 - 22 hours for each observer and included: becoming familiar / revising the SOCARP protocols, codes and categories; and practicing using video examples (to set intra and inter-observer reliability). In addition, a field inter-observer reliability check took place with one of the observers coding against the lead observer (which was randomly selected), the field reliability scores were >80% for each category. To reduce the threat of observer reactivity, all observers positioned themselves on the edge of the school playground and avoided any interaction with children or members of staff.



Figure 5.4 The Walking Track Intervention Model to increase children's physical activity during break time

5.3.7 Quantitative data analysis

Descriptive statistics (M+SD) were calculated to describe the anthropometric characteristics of the children. Participants' mean daily morning break time step count and the SOCARP categories were calculated and then scores were separately analysed. For the two sets of data, factorial ANOVAs were employed which allowed the researcher to determine whether an interaction effect exists between the independent variables (Tokunaga, 2016). Specifically, an independent factorial design was used for both the pedometer and SOCARP data sets, as each data had two or more independent variables thus, children were treated as different participants (despite the majority of the same children being observed at each data point, some children choose not to take part or were absent for the follow-up observations). For the pedometer data, a three-way ANOVA was selected as it takes into account the three independent variables (fixed factors) which were: 'time', 'sex', and 'year group'. This enabled the researcher to establish the effect of the three independent variables on the dependent variable of 'mean daily morning break time step count'. For the SOCARP data, a two-way ANOVA was used to determine the effect of the two independent variables ('time' and 'sex') on the dependent variable of '%MVPA during morning break time'. The interpretation of the interaction effect size was calculated using partial eta squared $({\eta_{\scriptscriptstyle D}}^2)$ (small [0.01], medium [0.06] and large [0.14]) (Cohen, 1988). All statistical analyses were conducted using the Statistical Package for the Social Sciences v.23, with the alpha level being set at P < .05. In accordance with the quality checks stated in Chapter 3 (section 3.5), the statistical assumptions for a factorial ANOVA were adhered to which included: using Levene's test to check for equality of variances of all data points of the dependent variable and ensuring normality of residuals through the use of a QQ Plot (Cohen, Manion and Morrison, 2011; Pardoe, 2012).

Social Ecological Components (McLeroy <i>et al.</i> , 1988)	Behaviour Change Taxonomy (Michie <i>et al.</i> , 2011)	Self Determination Theory (Ryan and Deci, 2000)
Intrapersonal	Barrier Identification/Problem Solving	Competence
 The track was aimed at encouraging girls to 'walk and talk' during morning break times, without impeding upon the playground space of boys' sporting activities such as football. 	 An initial decision to target children's PA behaviour from the PE Co-ordinator and head teacher. Collection of baseline data provided an understanding of children's current PA levels during break times. Baseline data included children's pedometer step counts and SOCARP data. Meetings between the researcher and PE Co-ordinator to identify possible ways to address low levels of MVPA during break times, especially in relation to girls' PA behaviour. Discussions included implementing a walking track on the school field. 	• The PE Co-ordinator s competence developed through awareness and discussion of the findings from study 1, along with discussions of possible intervention strategies with the researcher. Thus, they were able to successfully lead the implementation of the walking route on the school field.
Interpersonal	Action Planning	Relatedness
 Children's use of the track during morning break times was discussed in a staff meeting led by the PE Co- ordinator and head teacher. The teachers agreed the school rules of the track which included all children being able to access the track at morning break times if they wished to do so (Y1, Y2, Y3 and Y4). 	 Creation of a school action plan for increasing children's PA levels, within this included targets specific to school break times. Action planning included: 'target', 'rationale', 'action', timescale' and 'evidence/outcome'. Example of the targets were 'to increase children's PA levels during break times', 'to create a walk and talk route for girls during break times', and 'to collect post-intervention and follow-up data to measure the sustainability of the intervention'. 	• From the head teacher's and PE Co- ordinator 's support, staff, children and their parents were aware of and had walked around the track, thus creating relatedness and a sense of belonging. Staff were involved in planning meetings and the development of the formal rules of the track.
Institutional	Model/Demonstrate the Behaviour	Autonomy
• Implementation of a 250m long and 1m wide gravel walking track around the perimeter of the school field. This could be accessed from both the KS1 and KS2 playground.	• This involved both parents and teachers modelling the behaviour of walking around the track for the children, which took place during the opening celebration. In addition, during morning break times the head teacher would frequently walk around the track with the children.	 Children were in control of their own behaviour as they had a choice as to whether they walked around the track during morning break times. No set days were allocated for year groups, all children could access the
Community		track during morning break times.
Official opening of the track, with the children, their parents and teachers.		 Several ideas were discussed with the school in how to change the children's PA break time behaviour, the school decided to implement the walking track on the school field.

Table 5.2 The Walking Track Intervention's theoretical constructs

5.3.8 Qualitative data collection: individual interview

An individual interview was conducted with the PE Co-ordinator 6 months after the walking track had been implemented to evaluate the process measures of the intervention. The timescale of 6 months was selected in order to gain a longer term view of the implementation of the intervention and to allow enough time for the PE Co-ordinator to reflect upon the process. The interview questions were structured according to several layers of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) and were designed to explore the quantitative findings (Appendix 13). The interview lasted 30 minutes and a Dictaphone was used to record the verbal interactions of the PE Co-ordinator and the researcher. As a semi-structured interview guide was created in advance of the interview (informed by the quantitative results and accompanying field notes [Figure 5.5]), this allowed the researcher to adapt the questions in response to the answers provided which is one of the advantages of adopting such an approach (Menter *et al.*, 2011).

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Figure 5.5 Field notes written by researchers during SOCARP observations

5.3.8.1 Qualitative data analysis: interpretative phenomenological analysis

As in the previous chapter (Study 1) the interview data was analysed using IPA (Smith, Flowers and Larkin, 2009). A systematic analysis of the transcript took place (Appendix 14) in which the first step was to read and re-read the transcript, with initial notes being made. 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) (Smith, Flowers and Larkin, 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.

5.3.8.2 Trustworthiness of the qualitative data (quality criteria checks)

The credibility of the interview data was established by adhering to Shenton's (2004) guidance in relation to strategies to enhance the trustworthiness of the data (Chapter 3, section: 3.6). For instance, the interview took place in a quiet room, free from distraction and away from the head teacher's office. In addition, the PE Co-ordinator was reminded that there are no right or wrong answers and they have the right to withdraw at any time. The quality of the interview data was also increased through member checking during the interview process and the researcher discussed their assumptions with critical colleagues post interview (Norris, 2007). Before the interview took place, the researcher discussed and bracketed initial ideas of the intervention data, to aid in the trueness of the participant's experiences and ideas.

5.4 Results

5.4.1 Anthropometric measurements

Age and anthropometric data of the children are presented in table 5.3. From the whole school sample, 72.8% of participants were of a normal weight, with 16.0% of children being classified as overweight and 3.7% obese. In addition, 7.4% of children had a weight status of thinness, highlighting that more children were in the 'thinness' category than the 'obese' category. Further data analysis indicated that there were no statistically significant BMI differences between sex and year group (all P > .05).

5.4.2 Outcome measures: pedometers

Children's mean pedometer steps at baseline, post-intervention and follow-up data collection points are presented in table 5.4. The ANOVA results confirmed that there was a statistically significant interaction effect between the 'point of data collection' and 'year group', on the mean pedometer morning break time steps taken (F(6,215)=3.39, P=.003, $\eta_p^2=.087$). This indicates that the effect of 'point of data collection' on children's mean morning break time step count was different across the year groups (Y1, Y2, Y3, and Y4). Specifically, Y1, Y2 and Y4 retained a higher mean step count at follow-up when compared with baseline data. However, Y3 decreased in their mean step count from baseline to follow-up data collection points (Table 5.4). Thus, there was a significant main effect of 'year group' on the number of mean pedometer steps taken at morning break time (F(3,215)=11.08), P<.001, n_p^2 =.134) (Figure 5.4). The Bonferroni *post hoc* test revealed that Y3 had a significantly higher overall step count than years 1 (MD=162, P=.04, 95% CI [1, 323]), 2 (MD=277, P<.001, 95% CI [137, 417]) and 4 (MD=208, P=.001, 95% CI [65, 352]) (Figure 5.7). The factorial ANOVA results, also revealed a main effect of 'point of data collection' on the mean pedometer steps taken during morning break time (F(2,215)=16.22, P<.001, $\eta_p^2=.131$). The post hoc tests revealed that there was a significant increase in children's pedometer steps from baseline to postintervention (*MD*=236, *P*<.001, 95% CI [236, 351]). However, this was not sustained as there was also a significant decrease from post-intervention to follow-up data collection point (*MD*=-230, *P*<.001, 95% CI [-351, -108]). The results also indicated a main effect of 'sex' on the number of mean pedometer steps taken at morning break time (*F*(1,215)=21.57, *p*<.001, n_p^2 =.091), indicating that boys were more active than girls. This main effect of 'sex' was consistent throughout the data collection points (baseline, post- intervention and follow-up) (Figure 5.8), as there was no interaction effect for 'sex' on the 'point of data collection'.

5.4.3 Outcome measures: SOCARP

The mean ($M\pm SD$) percent of break time (%) that Y3 and Y4 children spent in the SOCARP activity variables at all three data collection points is presented in table 5.5 and table 5.6. The two-way ANOVA results for the SOCARP data indicated a statistically significant main effect of 'point of data collection' on Y3 and Y4's mean %MVPA (F(2,46)=3.88, P=.028, $n_p^2=.144$). The Bonferroni *post hoc* test revealed a statistically significant increase in MVPA from 63.49% (9.5 minutes) at baseline, to 78.08% (11.7 minutes) at post-intervention (MD=14.58, P=.019, 95% CI [1.89, 27.28]); however the *post hoc* test also indicated a slight decrease in MVPA from post-intervention (78.08%) to 72.37% (10.8 minutes) at follow-up observation, although this decrease was not statistically significant (Figure 5.9).

There were no statistically significant sex differences for Y3 and Y4 %MVPA at all three observations, including baseline, post-intervention and follow-up (Figure 5.9). VPA increased significantly from baseline (17.43%) (2.6 minutes) to post-intervention (32.79%) (4.9 minutes), and this was maintained at follow-up observation (31.52%) (4.7 minutes) (F(2,46)=6.00, p=.005, $n_p^2=.207$). Boys' %VPA continued to increase at both post-intervention (4.8 minutes) and follow-up observations (5.2 minutes), whereas, girls' %VPA increased from baseline (2.4 minutes) to post-intervention (4.9 minutes) but then decreased at follow-up

observation (4.2 minutes) (Figure 5.10). However, there were no statistically significant interaction effects for 'point of data collection' and 'sex', and for the main effect of 'sex'.

Time (%) spent using the walking track declined between post-intervention and follow-up data collection observations (*MD*=-34.90%, *P*=.002, 95% CI [-60.09, -9.70]), with a main effect for 'point of data collection' (*F*(2,46)=17.27, *p*=<.004, n_p^2 =.429). The results also highlighted a statistically significant interaction effect between 'point of data collection' and 'sex' on the time (%) children spent engaged in sports activities at morning break times (*F*(2,46)=5.48, *P*=.007, n_p^2 =.192). This signifies that the effect of 'point of data collection' on children's engagement in sports activities differed for boys and girls, with boys engaging in more sports activities than girls (Figure 5.12).

	Age (Years) (<i>M</i> <u>+</u> <i>SD</i>)	Body Mass (kg) (<i>M</i> <u>+</u> <i>SD</i>)	Stature (cm) (<i>M</i> <u>+</u> SD)	BMI (kg/m ²) (<i>M</i> + <i>SD</i>)	Body Mass Index Status (percentages)			
					Thinness	Normal Weight	Overweight	Obese
Whole school	7.6 <u>+</u> 1.2	26.2 <u>+</u> 6.8	125.3 <u>+</u> 8.7	16.5 <u>+</u> 2.6	7.4	72.8	16.0	3.7
(<i>n</i> =81)								
Boys (<i>n</i> =43)	7.5 <u>+</u> 1.2	26.0 <u>+</u> 5.7	125.1 <u>+</u> 8.1	16.1 <u>+</u> 1.6	7.0	74.4	14.0	4.6
Girls (<i>n</i> =38)	7.6 <u>+</u> 1.1	26.5 <u>+</u> 8.0	125.6 <u>+</u> 9.6	16.9 <u>+</u> 3.3	7.9	71.1	18.4	2.6
Y1 (<i>n</i> =16)	5.9 <u>+</u> 0.3	20.7 <u>+</u> 2.8	114.3 <u>+</u> 6.0	16.4 <u>+</u> 2.6	6.3	81.3	12.5	0.0
Y2 (<i>n</i> =21)	6.9 <u>+</u> 0.3	24.4 <u>+</u> 4.2	123.0 <u>+</u> 4.7	16.0 <u>+</u> 1.9	4.8	71.4	19.0	4.8
Y3 (<i>n</i> =20)	8.0 <u>+</u> 0.3	27.2 <u>+</u> 5.3	127.2 <u>+</u> 4.8	16.9 <u>+</u> 3.8	0.0	80.0	15.0	5.0
Y4 (<i>n</i> =24)	8.9 <u>+</u> 0.3	30.6 <u>+</u> 8.6	133.3 <u>+</u> 6.9	16.6 <u>+</u> 1.6	16.7	62.5	16.7	4.2

Table 5.3 Children's anthropometric data collected at baseline (*M*+*SD*)

-	Baseline	Post	Follow-up
	(<i>M<u>+</u>SD</i>) (<i>n</i> =81)	intervention	(<i>M<u>+</u>SD</i>) (<i>n</i> =68)
		(<i>M<u>+</u>SD</i>) (<i>n</i> =75)	(6-9 weeks)
		(1-5 weeks)	
Whole school	1176 <u>+</u> 366	1412 <u>+</u> 348	1182 <u>+</u> 306
Boys	1235 <u>+</u> 364	1495 <u>+</u> 368	1293 <u>+</u> 222
Girls	1096 <u>+</u> 358	1336 <u>+</u> 314	1050 <u>+</u> 342
Y1	1125 <u>+</u> 230	1437 <u>+</u> 393	1194 <u>+</u> 169
Y2	971 <u>+</u> 235	1238 <u>+</u> 283	1218 <u>+</u> 297
Y3	1480 <u>+</u> 354	1605 <u>+</u> 289	1137 <u>+</u> 337
Y4	1098 <u>+</u> 366	1305 <u>+</u> 290	1195 <u>+</u> 370

Table 5.4 Children's pedometer step count during morning break times: baseline, post-intervention and follow-up data collection points (M+SD)



Figure 5.6 Point of data collection and year group on children's mean pedometer morning break time step counts







Figure 5.8 Boys' and girls' mean daily step counts for morning break time at baseline, post-intervention and follow-up data collection points

	B	Baseline (<i>n</i> =23	8)	Post-interv	vention(<i>n</i> =15)	(1-2 weeks)	Follow-up (<i>n</i> =14)(6-7 weeks)			
	Воуs (<i>n</i> =12)	Girls (<i>n</i> =11)	Boys and Girls (<i>n</i> =23)	Boys (<i>n</i> =6)	Girls (<i>n</i> =9)	Boys and Girls (<i>n</i> =15)	Boys (<i>n</i> =7)	Girls (<i>n</i> =7)	Boys and Girls (<i>n</i> =14)	
Activity Lev	el									
Lying down	1.39±4.81	0.00 ± 0.00	0.72±3.48	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	1.43± 3.78	0.00 ± 0.00	0.71±2.67	
Sitting	3.97±5.91	4.09±7.94	4.03±6.79	4.39±7.27	0.37 ±1.11	1.98±4.87	6.95±11.18	5.07 ±12.00	6.01±11.19	
Standing	33.06±23.65	31.61±10.98	32.36±18.30	16.99±19.29	18.33±17.43	17.80±17.52	17.54±5.75	22.72±9.68	20.13±8.12	
MPA	42.79±16.52	49.53±11.93	46.01±14.60	45.49±20.78	44.94±18.45	45.16±18.68	37.63±11.92	44.06±14.46	40.84±13.16	
VPA	18.52±13.58	16.35±14.12	17.48±13.57	32.02±16.55	33.40±18.19	32.92±16.95	34.90±11.53	28.16±17.22	31.53±14.50	
Sedentary	38.42±22.75	35.70±9.67	37.12±17.41	21.38±17.91	18.70±17.26	19.78±16.66	25.92 ±14.35	27.78±11.87	26.85±12.69	
MVPA	61.30±22.44	65.89±6.58	63.49±16.64	77.69±17.03	78.33±16.57	78.08±16.14	72.53±13.46	72.22±11.87	72.37±12.19	
Activity Typ	e									
Track	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	56.02 <u>+</u> 48.06	51.61 <u>+</u> 40.85	53.37+42.23	22.47+27.66	14.48+28.15	18.48+27.13	
Sports	41.67 <u>+</u> 47.34	0.00+0.00	21.74 <u>+</u> 39.67	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	3.43 <u>+</u> 9.07	1.71 <u>+</u> 6.41	
Games	15.14 <u>+</u> 26.06	41.03 <u>+</u> 28.01	27.52 <u>+</u> 29.51	7.01 <u>+</u> 15.05	7.04 <u>+</u> 17.52	7.03 <u>+</u> 16.01	28.79 <u>+</u> 31.55	19.58 <u>+</u> 29.44	24.18 <u>+</u> 29.70	
Sedentary	27.62 <u>+</u> 31.23	31.85 <u>+</u> 16.77	29.64 <u>+</u> 24.90	22.25 <u>+</u> 18.71	13.98 <u>+</u> 17.71	17.29 <u>+</u> 17.94	18.45 <u>+</u> 5.18	24.83 <u>+</u> 12.02	21.64 <u>+</u> 9.49	
Locomotion	15.57 <u>+</u> 23.50	25.45 <u>+</u> 20.73	20.30 <u>+</u> 22.29	76.42 <u>+</u> 18.44	75.65 <u>+</u> 27.18	75.96 <u>+</u> 23.32	44.26 <u>+</u> 32.52	54.93 <u>+</u> 22.41	49.59 <u>+</u> 27.40	

Table 5.5 Changes in Y3 and Y4 mean (*M*±*SD*) percentage of morning break time (%) spent in the SOCARP activity variables of: `activity level' and `activity type' at baseline, post-intervention and follow-up data collection points

	B	Baseline (<i>n</i> =23	3)	Post-interv	vention(<i>n</i> =15)	(1-2 weeks)	Follow-up (<i>n</i> =14)(6-7 weeks)			
	Boys (<i>n</i> =12)	Girls (<i>n</i> =11)	Boys and Girls (<i>n</i> =23)	Boys (<i>n</i> =6)	Girls (<i>n</i> =9)	Boys and Girls (<i>n</i> =15)	Boys (<i>n</i> =7)	Girls (<i>n</i> =7)	Boys and Girls (<i>n</i> =14)	
Group Size										
Alone	9.20 <u>+</u> 11.65	12.20 <u>+</u> 14.19	10.63 <u>+</u> 12.72	47.20 <u>+</u> 21.58	20.83 <u>+</u> 18.07	31.38 <u>+</u> 23.06	19.51 <u>+</u> 17.77	8.80 <u>+</u> 7.27	14.16 <u>+</u> 14.18	
Small	47.58±38.48	69.03±26.62	57.84±34.39	43.77±28.89	56.76±27.27	51.56±27.69	64.00±32.59	76.41±30.25	70.21±30.89	
Medium	26.56±39.11	17.50±28.47	22.23±33.98	2.841±5.07	18.06±26.57	11.97±21.73	5.26±8.00	7.29±9.87	6.28±8.69	
Large	16.67±38.92	0.30 ± 1.01	8.84±28.77	7.64±18.71	1.39±4.17	3.89±12.04	10.71±28.35	10.56±27.94	10.64±27.04	
Social Interac	tions									
Pro-physical	29.27 <u>+</u> 27.75	20.06 <u>+</u> 23.37	24.86 <u>+</u> 25.60	9.52 <u>+</u> 23.33	12.88 <u>+</u> 13.24	11.54 <u>+</u> 17.25	13.20 <u>+</u> 8.82	17.74 <u>+</u> 17.00	15.47 <u>+</u> 13.22	
Pro-verbal	63.15 <u>+</u> 30.03	78.89 <u>+</u> 24.38	70.68 <u>+</u> 28.03	88.96 <u>+</u> 22.88	86.47 <u>+</u> 14.56	87.46 <u>+</u> 17.60	85.65 <u>+</u> 9.15	80.96 <u>+</u> 19.62	83.31 <u>+</u> 14.91	
Anti-physical	4.70 <u>+</u> 7.49	0.72 <u>+</u> 2.38	2.79 <u>+</u> 5.90	1.52 <u>+</u> 3.71	0.65 <u>+</u> 1.96	1.00 <u>+</u> 2.70	1.14 <u>+</u> 3.02	0.00 <u>+</u> 0.00	0.57 <u>+</u> 2.14	
Anti-verbal	0.48 <u>+</u> 1.12	0.00 <u>+</u> 0.00	0.25+0.83	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	0.00 <u>+</u> 0.00	

Table 5.6 Changes in Y3 and Y4 mean (*M*±*SD*) percentage of morning break time (%) spent in the SOCARP activity variables of: `group size' and `social interactions' at baseline, post-intervention and follow-up data collection points







Figure 5.10 Girls' and boys' mean %MVPA during morning break times at baseline, post-intervention and follow-up observations



Figure 5.11 Girls' and boys' mean %VPA during morning break times at baseline, post-intervention and follow-up observations



Figure 5.12 Girls' and boys' mean % of time engaged in sports activities during morning break times at baseline, post-intervention and follow-up observations

5.4.4 Process measures: individual interview

From analysis of the interview data, the following themes emerged, which were then grouped according to the Ecological Model for Health Promotion (McLeroy *et al.*, 1988): intrapersonal (boys' domination of walking track) and interpersonal (conflicting visions of school staff) (Table 5.7).

Table 5.7 PE Co-ordinators' perceptions and experiences of the break time intervention

1 st Order Themes	2 nd Order Themes		
Intrape	ersonal		
Boys domination of the walking track	-Racing games		
	-Imaginary play		
	-Girls sitting and talking		
Interp	ersonal		
Conflicting visions of school staff	-Lack of buy in from some staff		
	-Not every child wants to be active		

Boys' domination of the walking track (emergent themes: racing games; imaginary play; and girls sitting and talking). The interview data revealed that the boys' dominated the walking track during morning break times. The PE Co-ordinator reported that the boys 'bound on past the girls who are walking by, they might intimidate them a little bit but yeah the boys seem to access it more'. It was expressed that the boys enjoyed racing around the track, being timed by the teachers. The boys also engaged in imaginary play behaviour on the track, as highlighted in the interview 'boys like playing superheroes around the track and pretending they are superman'. The PE Co-ordinator described how the boys used the track more than the girls. Although the girls did use the track, the interview identified that the girls would often sit or stand chatting away from the walking

track, for instance, 'they [girls] go off by the huts and kind of lean on the huts and have a chat, they go on the benches and continue their chats on there'.

Conflicting visions of school staff (emergent themes: lack of buy in from school staff; and not every child wants to be active). During the interview the PE Co-ordinator revealed how some of the senior members of staff wanted to offer children the opportunity to write or draw during break times instead of walking around the track. As illustrated in the following guote 'it was felt that there was a lacking in [sig] creative things for the children who would like to be drawing and writing so the deputy head who was the Key Stage Two Leader thought it would be a good idea to take chalk out and that's how it came about really, so she kind of put it out there and we had to agree really so that's how it came about'. The PE Co-ordinator also discussed how the head teacher had placed benches around the track, but they did not understand the reasoning behind this decision. When asked to explain the PE Co-ordinator responded 'I can't really, the head teacher might be able to, I don't know why, I think they are an absolute... I think they are a massive deterrent to what we are trying to do personally'. It appeared that the head teacher was more concerned with the aesthetics of the track rather than its use. As indicated in the following quote 'he thought it would be nice as a scenic, you know, sitting and chatting space which isn't what we were aiming for really but I guess he's thinking for those that don't want to'.

5.5 Discussion

The primary aim of this chapter (Study 2) was to design, implement and evaluate the effectiveness of an outdoor primary school morning break time intervention to increase girls' and boys' MVPA. Prior to the intervention, children in Years 1 to 4 accumulated a combined mean step count of 1176.43<u>+</u>366.42 (78.4 steps per minute); with Y3 and Y4 children spending 63.49<u>+</u>16.64% (9.5 minutes) of their morning break times in MVPA. The results of the intervention indicated statistically

significant increases at the 1-5 week post-intervention data collection. The pedometer results revealed a medium effect size for increases in the step count of all participant school children, by a mean of 236.52 steps per morning break time, and an additional 1182.60 steps per week from morning break times (94.20 steps per minute). Additionally, the SOCARP results demonstrated a large effect size for increases in Y3 and Y4 children's time spent in %MVPA during morning break time, with a percentage point increase of 14.59% MVPA (2.2 minutes). However, this increase in PA was not sustained at the 6-9 week follow-up data collection point. The pedometer step count made a statistically significant decrease from post-intervention (1-5 weeks) to follow-up data collection (6-9 weeks), returning to a figure similar to baseline data. The SOCARP data also demonstrated a decline in Y3 and Y4 children's %MVPA from post-intervention (1-5 weeks) to follow-up (6-9 weeks), although this was not a statistically significant decrease and still remained 8.88% (1.3 minutes) higher than the baseline data.

Even though there was a statistically significant decrease in children's overall pedometer steps, the SOCARP data revealed a significant increase in both boys' and girls' VPA from baseline to post-intervention (1-5 weeks) and this was maintained at follow-up (6-9 weeks) for both boys and girls. When taking into consideration the independent variable of 'sex' from the SOCARP data, boys' VPA increased at post-intervention and then continued to increase at follow-up data collection points. Thus, at follow-up data collection point, boys accumulated an additional 16.38% point increase of VPA per morning break time which equates to them gaining a further 2.5 minutes of VPA, and would increase weekly overall VPA by 12.5 minutes. The SOCARP results suggest that the walking track could have encouraged Y3 and Y4 boys' to engage in VPA. This is also supported by the qualitative findings, which revealed that boys enjoyed racing around the track. The qualitative theme of 'boys dominating the walking track' highlighted that boys were

competitive and often engaged in imaginary play pretending that they were superman flying around the track.

When placing the results of the walking track intervention in comparison to other similar peer reviewed published break time studies (Table 5.8), the results are comparable to Hyndman *et al.*'s (2014) break time intervention study. Hyndman and colleagues' research, which was based upon a moveable/recycled materials intervention, reported a significant increase in children's pedometer steps in the intervention school at a 7 week data collection point, however they also reported a dip in children's step count at the 8 month follow-up. Additionally, Hyndman *et al.* (2014) reported significant increases in children's VPA from the observational data at both the 7 week and 8 month follow-up data collection points.

While in the UK there seems to be an increase in introducing the daily walk/run a mile, to the author's knowledge no study has measured the effects of the daily walk/run a mile as an intervention. However, another similar study that included a 'walking club' component was that of Elder *et al.* (2011) (Table 5.8), who investigated the effects of a multi-pronged intervention on children's activity levels during break times. The walking club involved children walking laps around a designated area on the school grounds. This study however, found no statistically significant increase in children's MVPA in the intervention schools; although it did find a statistically significant decrease in the intervention schools' boys' %MVPA at the 1 year follow-up data collection point. Therefore, the quantitative findings from this chapter (Study 2) are similar to that of Elder *et al.* (2011) in relation to longer term effects of children's MVPA, however they differ in terms of boys' activity levels, in particular their VPA.

Barton *et al.*'s (2015) study (Table 5.8) also included a walking element which involved a nature-based orienteering intervention. Their findings were also similar to the quantitative findings of the current walking track intervention, in respect to reported increases in children's PA, however they also reported that their sports equipment intervention had greater effects on children's PA. Furthermore, they suggested that the nature-based intervention may have been limited by the duration of the orienteering courses. This was similar to what was reported by the PE Co-ordinator in the evaluation interview in this chapter, who stated that the girls often walked around the track once and then they went off to other areas of the playground to chat with their friends. Thus, the girls may have seen the walking track as an activity to complete by walking around it once.

When considering research findings in relation to the effects of being in green spaces and PA, the evidence is mixed (Lachowycz and Jones, 2011). As indicated in Lachowycz and Jones' systematic review of green space and obesity, which also included the effects of green space on PA. Their data indicated that although the majority of results in the review (66%) were positive, only 40% of these found an association that appeared unequivocal (Lachowycz and Jones, 2011). Two of the studies highlighted in Lachowycz and Jones' (2011) systematic review stated that the direct relationship between access to green space and PA was statistically not significant (Hoehner *et al.*, 2005; Jones, Hillsdon and Coombes, 2009). When considering these research findings in comparison to the findings in this study (Study 2), the children already had access to the green space at baseline. The intervention was the addition of a walking track, which was a change to the physical environment but not an additional green space for them to use. Thus, the addition of the walking track may not have impacted upon their views in terms of the existing space available.

The walking track intervention did have positive results in relation to boys' VPA with a percentage point increase of 16.38% at the 6-9 weeks measurement; this was similar to the results of Hyndman *et al.* (2014) who also reported an increase in boys' and girls' VPA at their 7 week data collection point of 18.6%. This result of the walking track intervention did evidence a large effect size for 'point of data collection' on children's %MVPA from the SOCARP data. However, the quality of the walking track intervention study and risk of bias must also be taken into consideration. As concluded by Parrish *et al.*, (2013) in their systematic review on the effect of school break time interventions on children's PA, there is currently a lack of high quality research in this area. Thus, the methodological quality of the walking track intervention has been assessed using the guidelines employed in Parrish *et al.*'s (2013) systematic review.

In relation to the inclusion conditions (Parrish *et al.*, 2013), the walking track intervention would have been included in the review as it adheres to the following criteria: reporting findings of an intervention targeting PA levels of children/adolescents during school morning break time and/or lunchtime, has a measure of PA as an outcome variable, and participants were between the age of 5 and 18 years. Furthermore, when considering the assessment of methodological quality, the walking track intervention was scored against an adapted 8 point assessment scale that was used in the Parrish *et al.* (2013) review (Table 5.9). Using this methodological quality criteria the walking track intervention study has a moderate risk of bias, with a score of 3. The aspects of the study that increased its methodological quality included: using a validated measure of PA; accounting for potential cofounders such as baseline score, gender and age; and providing a summary for each group and its precision (95% CI). Aspects of the walking track intervention that decreased the methodological quality of the study included: no control group and therefore there was no randomization of groups, PA was not

assessed at a minimum of 6 months pre-test, and a power calculation was not applied to determine whether the study was adequately powered to detect relationships/effects/differences etc.

Study	Intervention type	Break time period access (morning/ lunchtime)	Study quality	Level of evidence	PA measure	Intervention res	sults	
Thesis' chapter 5, study 2	Walking track	Morning	3	Small (Time series design, one control	Pedometer (Yamax Digi- Walker 700/701)	Steps per min for boys (Y1-4)	1-5 weeks +17.33 steps from baseline 6-9 weeks +3.9 steps from baseline	A significant increase in children's pedometer steps from baseline to post- intervention (<i>P</i> <.001, 95% CI [236.52, 351.87]). However, this was not sustained
				school)		for girls (Y1-4)	baseline 6-9 weeks -3.04 steps from baseline	from post-intervention to follow-up data collection point (<i>P</i> <.001, 95% CI [-351.96, -108.11]).
					Direct observation SOCARP	Mean % of time spent in MVPA boys (Y3+4)	1-5 weeks +16.39% from baseline 6-9 weeks +11.23% from baseline	A significant increase in MVPA from baseline to post-intervention (<i>P</i> =.019, 95% CI [1.89, 27.28]); however there was also a slight decrease in MVPA from post-
						Mean % of time spent in MVPA girls (Y3+4)	1-5 weeks +12.44% 6-9 weeks +6.33% from baseline	intervention to follow-up, although this decrease was not statistically significant.
						Mean % of time spent in VPA boys (Y3+4)	1-5 weeks +13.5% increase from baseline 6-9 weeks +16.38% from baseline	Boys' %VPA increased at post-intervention and follow-up, whereas, girls' %VPA increased from baseline to post- intervention but then decreased at follow-
						Mean % of time spent in VPA girls (Y3+4)	1-5 weeks +17.05% from baseline 6-9 weeks +11.81% from baseline	up observation. However, there were no statistically significant interaction effects for 'point of data collection' and 'sex', and for the main effect of 'sex'.
Elder <i>et</i> <i>al.</i> (2011)	Playground markings, walking clubs,	Before school, morning,	3	Large RCT	Direct observation SOPLAY	Mean % of time spent in MVPA boys	1 year -5.8% from baseline	Significant decrease in Boys' MVPA after a year (p<0.05).
	organized activities	lunchtime				Mean % of time spent in MVPA girls	1 year -4.1% from baseline	
						Mean % of time spent in VPA boys	1 year -2.7% from baseline	
						Mean % of time spent in VPA girls	1 year +2.4% from baseline	

Table 5.8 A comparison of break time intervention studies' methodological quality and results

Hyndman <i>et al.</i> (2014)	Moveable/ recycled materials	Lunchtime	6	Large >250 participants (matched control trial, 1 control and 1 intervention school)	Pedometers Digi-Walker SW200 Direct Observation SOPLAY	Steps per min (boys and girls) Intervention group Mean % of time spent in MPA for boys and girls Mean % of time spent in VPA for boys and girls	7 weeks +13.08 steps from baseline 8 months +5.93 steps from baseline 7 weeks -0.7% from baseline 8 months +10.3% from baseline 7 weeks +18.6% from baseline 8 months +11.2% from baseline	Pedometer determined PA remained significantly elevated in the short-term, but to a lesser extent at 8-months. A significant treatment effect for the intervention school children's pedometer- determined mean steps per minute in comparison to the control school from baseline to the 7-week post-test (p <0.001, 95% CI [7.31-18.84]) and from baseline to the 8-month follow-up (p =0.045, 95% CI [0.14-11.72]). The mean proportion of children participating in %MPA was significantly higher in the intervention school at the 8- month follow-up compared to the control school (p = <0.001). VPA was significantly higher in the intervention school at 7- week (p = <0.01) and 8-month (p = 0.01).
Barton <i>et</i> <i>al.</i> (2015)	Playground equipment Nature-based orienteering	Lunchtime	3	Small <250 children (two intervention groups in two schools of contrasting locations – urban and rural)	Accelerometers	Mean mins spent in MVPA	Final day of a 5 day intervention: Sports equipment +3.07 mins from baseline Orienteering +2.15 mins from baseline	The Playground equipment intervention increased the time spent in MVPA more than the nature-based orienteering intervention and the urban school increased their time spent in MVPA to a greater extent than the rural school.

Table 5.8 continued

Table 5.9 Criteria for assessment of methodological quality for the break time intervention

Methodological quality criteria (Parrish <i>et al.</i> , 2013)	Score
	1=positive
	0=negative
Key baseline characteristics are presented separately for treatment groups (age and one relevant PA outcome) and for cluster randomized controlled trials and controlled trails, positive if baseline outcomes where statistically tested and results of tests were provided.	0
Randomization procedure clearly and explicitly described and adequately carried out (generation of allocation sequence, allocation concealment and implementation).	0
Validated measures of PA (validation in same age group reported and/or cited).	1
PA assessed a minimum of 6 months after pre-test.	0
Potential cofounders accounted for in the PA analysis (e.g. baseline score, group/cluster, age)	1
Summary results for each group + treatment effect (difference between groups) + its precision (e.g. 95% CI).	1
Power calculation reported, and the study was adequately powered to detect hypothesized relationships.	0
Timing of measures comparable between intervention and control groups (needs to describe explicitly).	0

Risk of bias score: 0-2 high risk, 3-5 moderate risk, 6-8 low risk.

When comparing the methodological quality of the walking track intervention against those reported in Parrish *et al.*'s (2013) systematic review and those reported in Table 5.8, the majority of the published studies have a moderate risk of bias (score of 3-5). For instance in Parrish *et al.*'s (2013) review, 5 studies have a moderate risk, 3 have a high risk and only 1 study has a low risk of bias. In relation to the studies in Table 5.8, Elder *et al.* (2011) and Barton *et al.* (2015) both have a moderate risk of bias with a score of 3, however Hyndman *et al.*'s (2014) study has a score of 6 which indicates a low risk of bias and therefore of
high methodological quality. Therefore, the results of the walking track intervention could be acknowledged as an effective intervention to increase boys' VPA when compared against published studies with similar risks of bias scores (i.e. moderate risk). However, it must also be taken into consideration that the pedometer results did not reflect this increase as the 6-9 week follow-up data returned to a similar step count as the baseline data.

As advocated by Erwin *et al.* (2014), different measures can also impact upon the reported effect sizes of intervention results. This was also reflected in the results of this chapter, with a medium effect size reported for 'point of data collection' on number of steps taken, and a large effect size reported for 'point of data collection' on children's %MVPA from the SOCARP data. However, the SOCARP data only included children from school Years 3 and 4. Nonetheless, both the study in this thesis chapter and Hyndman et al.'s (2014) study highlight that the application of multiple methods of measurement (e.g. pedometers and systematic observation) can produce different results, which may make it difficult for the researcher to form accurate conclusions. However, both methods have their advantages, pedometers allowed for the measurement of step count and the SOCARP tool provided data across a number of contextual variables along with information on children's PA intensity. Although other researchers (Graser et al., 2011) have reported mean steps per minute as thresholds to indicate MVPA and VPA, it was felt that the SOCARP tool employed in this study would provide a more accurate measurement of children's PA intensity due to the small epoch length of 10 seconds. This smaller time frame better captures the intermittent and sporadic nature of children's PA. Furthermore, as some of the break times varied slightly in length, using steps per minute as an indication of intensity would not provide an accurate and feasible measurement. Thus, it was an advantage to employ both pedometers and the SOCARP tool in this study.

As previously stated, although the walking track intervention indicated a positive short term effect on children's MVPA during morning break time, this was not maintained at the 6-9 week follow-up. These findings may be indicative of some of the inconsistencies and the practice of some school staff during the intervention; as highlighted in the qualitative data as some teachers were concerned that children needed other options at break times. From the field notes, which were taken during the employment of the SOCARP tool, researchers stated that benches had been placed around the edge of the walking track and some teachers had provided children with chalk, which seemed particularly popular with the girls during break times. The interview data revealed that the PE Co-ordinator did not agree with these inconsistencies as they did not align with the vision for increasing children's PA at break times. However, the qualitative data indicated that it was the head teacher and deputy head teacher who implemented these additional resources and activities, and that they had a higher level of authority than the PE Co-ordinator. Accordingly, the implementation of the benches and having chalk during break times encouraged some children to engage in sedentary and low intensity activity and therefore, may have impacted upon the 6-9 week follow-up quantitative data collection results (Table 5.4, Table 5.5). This also implies that the PE Co-ordinator had less autonomy with the intervention than had been hoped for.

Furthermore, at the time of the intervention the school introduced a 'walk a mile' activity during curriculum time for all year groups, as a result, children were increasing their PA levels at other times in the school day; which could have had a negative effect on their break time PA behaviour. There is limited research on children's PA compensation during the school day (Stylianou *et al.*, 2016), however it has been suggested that children will compensate for high amounts of PA participation by lowering EE at a later time (Gutin and Owens, 1999). The

implementation of the 'walk a mile a day', alongside resources that promoted sedentary behaviours amongst the children, were not advised by the researcher, who had no control over these additional playground features and curriculum time initiatives. These observations are consistent with other break time intervention studies which have reported inconsistencies from teachers in the implementation of interventions (Parrish *et al.*, 2016), and also from control schools who purchased additional playground equipment to encourage the children to be more active during the study (Elder *et al.*, 2011). The inconsistencies in the implementation and use of the walking track are something that needs to be taken into consideration in the design of break time PA interventions; which could be achieved through the careful selection of key ingredients from the BCT (Michie *et al.*, 2011). The qualitative data also indicates that there needs to be a 'buy in' from all staff for the intervention to be consistently implemented across the school.

The Walking Track Intervention Model (Figure 5.3), had integrated the SDT (Ryan and Deci, 2000), elements from the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) and three key ingredients from the BCT (Michie *et al.*, 2011). When taking into consideration the BCT ingredients and the inconsistencies in the implementation of the intervention from school staff, the additional BCT key ingredient of 'Provide instruction' could have been beneficial in overcoming this limitation, along with a 'buy in' from staff. Michie *et al.* (2011) describe this technique as instructing people in 'how to' do something rather than 'what to do'. Thus, in relation to the walking track model the intervention could benefit from the application of this key ingredient through devising together and sharing a set of principles for the school and teachers to follow during the implementation of the intervention.

Providing instruction can either be achieved through verbal or written communication. Michie et al. (2011) offer the example of providing tips on how to take action. Taking this into account, a suggested set of principles in relation to the walking track intervention are based are the acronym SPRIINT and include: Space for sports; Promotion of PA; Removing sedentary resources; Imaginary play stimuli; Include everyone; No gueues or spectators; and Talk and walk. The application of the 'SPRIINT' principles could also be integrated within the other theoretical components of the Walking Track Intervention Model. For instance, in the 'competence' component of the SDT (Ryan and Deci, 2000), these would be used to developed the teacher's knowledge of implementing the intervention successfully, through sharing knowledge of the principles. In addition, the principle could be integrated into the 'interpersonal' and the 'institutional' elements of the Ecological Model for Health Promotion (McLeroy et al., 1988), through agreeing 'rules' regarding the walking track and developing a sense of social cohesion. Consequently, recommendations for future break time PA interventions would be to devise and communicate a set of principles on 'how to' successfully implement the intervention. Thus, these inconsistencies in the implementation of the intervention and the school deciding to implement the walk/run a mile a day highlight some of the shortfalls in the formative work when planning and designing the intervention. Furthermore, consulting the children in the design of the set of rules on the use of the walking track may have assisted with the buy in from staff, helping to eliminate some of the inconsistencies.

Utilising the findings from the previous chapter (Study 1), the Walking Track Intervention Model (Figure 5.4) aimed to increase children's MVPA during morning break times by providing opportunities for girls to 'walk and talk' whilst also providing space for boys to continue to play sports. However, one of the main findings from this chapter (Study 2) was the increase in boys' VPA from baseline to post intervention, which then increased further at follow-up. From the interview findings, it could be suggested that boys' utilised the track in an imaginative way as highlighted in the findings from Study 1. As Sutton-Smith (1999) suggests children are resourceful with their environment and engage in imaginative play. Previous research (Renold, 1997; Knowles et al., 2013), the gualitative findings from the previous chapter (Study 1) (Table 4.7) and the findings from this chapter (Study 2) (Table 5.7) suggests that boys often dominate playground space. The SOCARP baseline data (Table 5.5) in this study suggests that boys initially dominated the playground playing sports, engaging in a mean of 40.67% in sports activities during morning break time. However, at post-intervention (1-5 weeks) and follow-up data collection (6-9 weeks), the SOCARP data indicated that none of the observed boys engaged in any sports activities. Furthermore, the qualitative data indicated that boys dominated the walking track playing racing games. Thus, the walking track had a more positive effect on boys' PA, but this negatively impacted upon the girls' PA due to the boys' domination of the track, which was not an intention of the intervention. Future intervention work could consider combining a walking track and imaginary stimuli which could be placed around the walking track.

5.5.1 Strengths and limitations

One of the main strengths of this study was the employment of multiple PA measures to measure any changes in children's break time PA behaviour as a result of the intervention. Additionally, the use of direct observation provides contextually rich data and can distinguish between children's PA intensity (McKenzie, 2010). The employment of pedometers is also a strength of the study due to their reliability (Coffman *et al.*, 2016), and they have been advocated as a useful tool for measuring changes in children's PA (Trost, 2001). In addition, the pedometers enabled the collection of data from a larger sample than would be

possible through the use of observation alone; and thus the use of this data assisted in establishing the efficacy of the intervention on children's PA during break times. Follow-up data collection points were also a strength, given they measure the sustainability of the intervention (Nguyen *et al.*, 2016).

A limitation of the study was no control group to compare intervention effects against. Nonetheless, the application of a time series design can allow the participants to act as their own control group (Cohen, Manion and Morrison, 2011), although, the data collection in one school does limit the external validity of the study's findings to other school contexts. A further limitation was the inconsistencies in the implementation of the intervention by the school staff such as, the implementation of the 'walk a mile' activity during curriculum time and the introduction of the use of chalk at break times, which is something that needs to be taken into consideration when interpreting the results. This consideration needs to be in relation to the effectiveness of the intervention, as previously discussed with regards to the 'walk a mile' children may compensate for high amounts of PA participation by lowing EE at a later time (Gutin and Owens, 1999). Furthermore, if children are provided with sedentary options such as sitting and drawing then this could compete with the walking track intervention.

Moreover, resource limitations led to a small sample being observed when employing the SOCARP tool. The intense nature of this tool is expensive in terms of researcher time. However, as it was employed alongside the pedometers, it did provide an additional insight into children's break time PA behaviour. It is also acknowledged that the presence of the researchers during break times could have influenced the children's PA behaviours (Menter *et al.*, 2011). Furthermore, the time between installation of the track and follow-up data collection point is a limitation. This was due to the timing of the track installation and school Summer holidays which meant that it would not be possible to collect data at a later time. An additional consideration would be the BMI data which was not included in the analysis as a confounding variable. As highlighted in section 5.4.1 more children were classified in the 'thinness' category than that of the 'obese' category, which may be an area for consideration in future research. Further limitations of the study would include an omission of the following confounding variables: children with disabilities and any possible seasonal effects between data collection points. Additionally, the school's existing motivation to take part in the intervention needs to be taken into account. Nonetheless, the majority of this motivation was from the PE Co-ordinator and as highlighted in the qualitative results and discussion, some members of staff had not bought into the intervention.

A final point to note would be the differences in the pedometer and the observational SOCARP data. As the pedometer data revealed initial increases and then a decrease to similar baseline figures at follow up; whereas, the SOCARP data revealed a longer term (6-9 weeks) increase for boys' VPA. These differences in results could be due to how the data is measured, for instance pedometers only measure ambulatory activity whereas the SOCARP tool is able to measure a range of PA behaviours that the pedometer would fail to measure. Another reason could be the difference in sample size, as the SOCARP tool was employed to a smaller sample due to the labor intense nature of the tool.

5.6 Conclusion

The Walking Track Intervention Model was designed to increase children's MVPA during outdoor primary school break times, with a particular focus on increasing girls' MVPA; the quantitative results evidence that the intervention did have positive short-term effects (1-5 weeks), in relation to both boys' and girls' step count and %MVPA and longer positive effects (6-9 week) in relation to Y3 and Y4 boys' %VPA. Thus, it is suggested that the implementation of a walking track in

the grounds of a primary school can have positive short term effects on boys' and girls' MVPA and positive longer term effects on boys' VPA. However, these short term increases could offer little benefit to children's MVPA and therefore offer poor value for money in relation to the cost of implementing the walking track. Yet, the inconsistencies in the implementation and use of the track identified from the qualitative results are something that needs to be taken into consideration as these impacted upon the results of the study. Thus, a future recommendation would be to test the effectiveness of the Walking Track Intervention Model which has integrated the additional BCT ingredient of 'provide instruction' (Michie *et al.*, 2011) through the creation and communication of a set of 'how to' principles.

The following chapter, study 3 was the second study to be conducted chronologically (Table 6.1) due to the delay in the installation of the walking track intervention. Chapter 6 is an explanatory study to explore children's PA levels during primary PE lessons, which is another component of the primary school day in which children's PA levels can be targeted and increased, and it has often been targeted in comprehensive and multicomponent interventions to increase children's PA during the school day. For instance PE lessons have been targeted in the following studies, as previously discussed in section 2.3: Action Schools! BC (Naylor *et al.*, 2006), KISS (Kriemler *et al.*, 2010; Meyer *et al.*, 2014), and CSPAPs (Russ *et al.*, 2015).

Chapter 6

Study 3: Exploring the Facilitators of and Barriers to Children's Physical Activity during Primary Physical Education: a Mixed Method Design

Chapter 6 – (Study 3) Exploring the Facilitators of and Barriers to Children's Physical Activity during Primary School Physical Education: a Mixed Method Design

6.1 Study Overview

Physical education is often targeted as a component of the primary school day in which children's PA levels can be increased, as highlighted in the literature review (Chapter 2) and in the conclusion of the previous study (Chapter 5) (Naylor et al., 2006; Kriemler et al., 2010; Meyer et al., 2014; Russ et al., 2015). However, further research is required to understand the reasons behind low levels of PA in primary PE. Thus, the primary aim of this chapter (Study 3) is to investigate children's PA during PE and determine the related physical and social determinants. Through a convergent mixed method design: 138 children were observed using the System for Observing Fitness and Instruction Time (SOFIT) tool, totalling 813 minutes of observed lesson time; 80 children participated in group interviews; and 13 teachers were individually interviewed, across three primary schools in the West Midlands, England. Findings indicated that children spent 42.4% of lesson time engaged in MVPA, with children standing and sitting for 34% and 21.7% of lesson time retrospectively. In terms of lesson context, the majority of class time was spent engaged in games activities (29.2%) followed by knowledge (20.7%). The lesson contexts of 'management', 'fitness', 'skills' and 'games' were positive predictors of children's MVPA during PE lessons. There were no statistically significant differences between boys' and girls' PA across any of the PA categories. The two qualitative themes drawn from both the teacher and children's interviews included 'putting the 'physical' back in PE' and 'further professional development for teachers'. The barriers to children's PA in PE comprised of: excessive teacher talk, organisation of lessons, and teachers' low confidence. The identified facilitators were: teachers' promotion of PA and developing social networks. Thus, the findings from study 3 informed the design of a PE intervention in Study 4 (Chapter 7), which was based on the development of a set of 'how to principles' to increase children's MVPA during primary PE lessons.

	Year 1 of PhD study	Year 2 of PhD study	Year 3 of PhD study	Year 4 of PhD study
Study 1 Break time Exploratory Study	Methods: SOCARP, Children's group interviews Outcomes: Boys engage in more MVPA and dominate playground space in large groups Girls enjoy socializing with their friends in small groups Boys and girls engage in imaginary play			
Study 2 Break time Intervention Study		Methods: SOCARP, Pedometers, Teacher inc Outcomes: Positive short term effects on boys' and girls' Longer term positive effect on boys' VPA Boys dominated the walking track, girls partic	lividual interview step count and MVPA cipated in sedentary activities	Initial discussions began in the 2 nd year for study 2, but the intervention was delayed. Thus, data collection began in 4 th year of study.
Study 3	-	A set of 'how to principles are recommended Methods: SOFIT. Children's group	Intervention from school staff	
Physical education Exploratory Study		interviews, Teacher individual interviews Outcomes: Boys and girls engage in <50% MVPA during PE Barriers to MVPA: excessive teacher talk, ineffective organisation, low confidence and subject knowledge Facilitators to MVPA: head teacher support, social networks, professional development of teachers		
Study 4 Physical education Intervention Study			Methods: SOFIT, Teacher individua interviews	

Figure 6.1 A thesis map to illustrate the chronology of the studies conducted and the methods and outcomes of studies 1, 2, and 3.

Exploratory studies

Intervention studies

6.2 Introduction

The National Curriculum programme of study for primary PE in England aims to ensure that all children 'are physically active for sustained periods of time', 'develop the competence to excel in a broad range of physical activities', and 'lead healthy, active lives' (DfE, 2013a). Internationally scholars often disagree on the overall aims and outcomes of primary PE (Doherty and Brennan, 2014), although there is a common ground in relation to the importance of active learning time during PE lessons. This importance has been highlighted by Ward (2013); if an educator teaching movement cannot exceed >50% MVPA in PE lessons, then their teaching could be considered as ineffective, something which is also advocated by McKenzie and Lounsbery (2013) who stated that PA levels in PE lessons are not just important for health gains but also for children's skill development. With children's MVPA lower than the recommended (Fairclough and Stratton, 2006; Hollis et al., 2016), it is important to understand the reasons behind the reported low levels of MVPA in primary PE lessons in England, in order to design effective interventions. When considering a real world rationale for investigating children's PA levels during PE lessons, one of the main reasons for targeting this area of the school day is that it is the only subject in the primary national curriculum (DfE, 2013) that promotes movement and the development of children's physical skills. However, as previously stated research has highlighted that children are often not active for over 50% of lesson time (Hollis et al., 2016). Thus, promoting and increasing children's PA within PE is important for children's physical skill development which will allow them to access PA outside of PE lessons. Additionally, PE should be at the core of a school's PA programme. Furthermore, PE is often the only occasion in which some children will experience VPA and during lessons boys and girls tend to achieve similar levels of MVPA (Sallis et al., 2012). Hence it is important to investigate these reported low levels of MVPA during PE lessons, in order to design effective interventions to increase children's MVPA during PE.

As outlined in Chapter 2 (see section: 2.2.2.2.1), a range of facilitators of and barriers to teacher effectiveness in PE were highlighted and evaluated through the research of Boyle, Jones and Walters (2008), Morgan and Hansen (2008), Lounsbery *et al.* (2011), and Christian *et al.* (2015). The findings of the above studies, informed by teachers and/or head teachers as participants, included the following key considerations: time constraints and a restricted curriculum (Boyle, Jones and Walters (2008); overcrowded curriculum, class size, budgetary constraints, lack of resources, the absence of professional development, low teacher confidence and low subject knowledge (Morgan and Hansen, 2008); PE as a low priority subject area, and a lack of PE specialists (Lounsbery *et al.*, 2011); priority subjects of English and mathematics, and the support of the head teacher (Christian *et al.*, 2015). Therefore, it is important to understand the factors that can impact upon teacher effectiveness in primary PE in order to inform the design of primary PE interventions.

Over a decade ago, it was highlighted that the perceptions of children are rarely taken into account with regards to PE (Dyson, 1995; 2006). Moving forward to 2016, there are still relatively few articles that take into consideration primary school children's perceptions of PE, and especially in relation to active learning time. One recent study investigated children's (6-10 years) perceptions of what it means to be physically active (Everley and Macfadyen, 2015). In this study, the children were asked to draw themselves being physically active with the findings revealing that none of the children drew pictures of themselves being active in a PE lesson. While Everley and Macfadyen (2015) expressed concerns over this finding, their interview data revealed children did consider PE to be instrumental in

improving their health and fitness. Accordingly, it may be suggested that further research is needed which takes into account not only the views of teachers but also the children's views. In addition, it has been highlighted that there are still research questions that need to be answered in relation to PA in primary PE and that can be achieved through drawing upon a range of methods (Castelli, Carson and Kulinna, 2014). For instance quantitative methods provide an objective measure of how active the children are during PE but this will not provide the reasons behind the children's MVPA. Thus, adding gualitative methods will add depth as well as breadth to the research and hopefully help to inform the design of an effective intervention. Therefore, in the present study, to assist with gaining a multilevel perspective the following secondary research objectives were employed. In the quantitative phase, the secondary objective was to assess children's MVPA, lesson context and teacher promotion of PA during primary school PE lessons; and in the qualitative phase, the secondary objective was to explore teachers' and children's perceptions and experiences of PA levels during primary school PE lessons.

6.3 Methods

6.3.1 Research design

This chapter is situated in the stance of pragmatism (Johnson and Onwuegbuzie, 2004) (Chapter 3, section: 3.1), in order to provide depth and breadth to understanding children's MVPA during primary school PE lessons. Thus, throughout this chapter the focus was on the practical effects of ideas, drawing upon both quantitative and qualitative methods to advance knowledge and understanding of children's school-based PA. Specifically, this study drew upon a convergent mixed methods design which allowed the two strands of data to be distinct at every stage until the interpretation of the results (Creswell and Piano-Clark, 2011; Creswell, 2014). In addition, equal priority was given to both the

quantitative and qualitative data (QUAN + QUAL), with concurrent timing of data collection.

Throughout this chapter (Study 3), McLeroy *et al.*'s (1988) Ecological Model for Health Promotion was used as a framework to assist in identifying the multiple layers of influence that could impact upon children's MVPA in primary school PE; following the NICE (2015) guidelines on behaviour change. As a result, the SOFIT tool (Appendix 15) used to measure the children's MVPA provided information across the intrapersonal layer (children's PA behaviour), interpersonal layer (teachers' promotion of PA), and institutional layer (lesson context). Furthermore, the children's group interviews and teacher interviews were designed to collect data across several layers of the ecological model.

6.3.2 Participants, sampling procedures and setting

A convenience and purposeful sample of 138 children (68 boys and 70 girls) across school years three and four (aged seven to nine years old) in three primary schools in the West Midlands, England were selected. The convenience sample was selected through existing relationships with the three primary schools. Following this an element of stratified sampling was applied to select 80 children (42 boys and 38 girls) for the semi-structured group interviews. The inclusion criteria for stratified sampling were: children who speak English, represent diversity in activity levels and are comfortable speaking in group situations. In addition, 13 teachers (three males and ten females) were purposefully selected and individually interviewed, as they were the class teachers of the children participating in the study and therefore would be observed teaching PE.

In the quantitative phase, 23 pre-determined PE lessons were observed (ranging from seven to nine lessons in each school); totalling 813 minutes of observed lesson time and 2439 observed intervals. The PE lessons were taught through a

range of activity areas including: games (e.g. hockey, rounders, football [soccer] and basketball), fitness, dance, gymnastics, athletics and swimming. The observed lessons were selected according to the school's timetable (i.e. what they were teaching at the time of the observations), with the exclusion criteria of first and final lesson in an instructional sequence, as these are usually assessment lessons in primary PE lessons in England. In addition, researchers asked to observe at least two different activity areas (e.g. games and gymnastics) in each school and year group. Class sizes were constant across the observations, ranging from 26-30 children in each observed lesson. The lessons took place in a standard primary school hall or playground typical of English primary schools. The observed swimming observations took place in a small sectioned off area of a public 20m swimming pool. The characteristics of the participant schools are presented in table 6.1.

In the qualitative phase, a total of 10 children's semi-structured group interviews took place across the three schools, with 8 children in each group. In addition, 13 individual semi-structured teacher interviews took place (three males and 10 females). The study gained ethical approval from the Research Ethics Committee at Newman University and written informed consent was obtained from the head teachers of each school (Appendix 16), the class teachers (Appendix 17) and the children's legal guardians (Appendix 18). Verbal assent was also sought from all the children who took part in the study and they were provided with an information leaflet (Appendix 19). All researchers who visited the schools were experienced in working with children in a school setting. Data were collected during the months of April 2014 and December 2015.

 Table 6.1 Characteristics of participant schools

School ID	Size of the school	Demographics	Location	Type of school
School 1	275 pupils on roll	Most pupils are from a White British heritage.	West Midlands	Mixed sexed Community School
	The school is larger than the			
	average-sized primary school.	Over half of pupils are supported by the additional pupil premium funding. This proportion is well above the national average. The extra funding is for pupils known to be eligible for free school meals and those who are looked after.		
		Ranked 138 in terms of income and 103 in terms of health, where 1 is the most deprived and 326 is the least deprived.		
School 2	210 children on roll	Most pupils come from minority ethnic backgrounds, with few	West Midlands	Mixed sexed Roman Catholic
	The school is larger than the average-sized primary school.	who do not speak English as a first language.		
School 3	321 pupils on roll	The majority of pupils are White British, but the proportion from a	West Midlands	Mixed sexed Community
	The school is larger than the average-sized primary school.	range of minority ethnic groups is above the national average.		

Data sourced from School Level Classes Data (Gov, 2013) and the Department for Communities and Local Government (2015).

6.3.3 Quantitative data collection: systematic observation SOFIT

The System for Observing Fitness and Instruction Time (SOFIT) (McKenzie, 2012; 2015) was used to collect the quantitative data. SOFIT is a comprehensive tool for assessing PE classes, as it allows for the simultaneous collection of data across the three variables of: children's activity levels, lesson context and teacher promotion of PA. In accordance with the SOFIT protocols (McKenzie, 2012; 2015) sedentary activity was defined by combining the lying (1), sitting (2) and standing (3) activity posture codes, while MVPA was calculated through the sum of the MPA (4) and VPA (5) categories. The lesson context variable represented how the lesson was being delivered. The observers made the decision as to whether the lesson time was being allocated to one of five categories: management (M) (e.g. management, transitions and breaks), knowledge (K) (e.g. rules and strategy), fitness (F) (e.g. warm up, cool down and stretching), skill development (S) (e.g. the practice of skills), games (G) (e.g. application of skills in a game situation, gymnastic or dance sequence) or other (O) (e.g. demonstrating/sharing of work). The lesson context was decided according to the time allocated to the class as a whole (e.g. over 51%) of the children) (McKenzie, 2012; 2015). The teacher promotion of PA variable was defined through three elements: 1) teacher promotion of in class PA (e.g. 'you are trying really hard, keep going'); teacher promotion of out of class PA (e.g. 'remember to practice your passing skills at home'); and teacher does not promote in class or out of class PA.

Six children were observed during each PE lesson on a rotational basis (four minutes for each child until the end of the lesson). Thus, the SOFIT tool is a class level measure that provides a mean (%) total for the 6 observed children. The observation period began when 51% of the class arrived in the working area and the observation ended once 51% of the class had left the observation area (McKenzie, 2012; 2015). To maintain the consistency of the observations a pacer

was used on an MP3 player, from which the researchers were prompted to observe for a ten second period and then record the observed behaviour for a ten second period. Momentary time sampling was used for the PA and lesson context categories and partial time sampling was used for the teacher promotion of PA category. To reduce observer reactivity and to assist with children's safety, researchers positioned themselves on the edge of the working area during all lesson observations. Full details of the protocols can be found in the SOFIT manual (McKenzie, 2012; 2015).

6.3.3.1 SOFIT validity and reliability (quality criteria checks)

In relation to both content and criterion validity, the SOFIT tool has been validated in several ways and studies have shown that it can be used reliably in diverse instructional settings (McKenzie, Sallis and Nader, 1991; Rowe et al., 2004); and it has been used as a criterion for validating other PA measures (McClain et al., 2008). Systematic observation is a viable method to use when working within an ecological model, as it develops the researcher's understanding of PA with regards to both the physical and social influences (McKenzie, 2002). To increase the reliability of the data set and decrease the threat of observer bias, three additional observers were trained to use the SOFIT tool. Therefore, a total of four observers collected data, with intra and inter-observer agreement being set before data collection using percentage agreement (McKenzie, 2015). Furthermore, an infield inter-observer reliability check took place between two of the observers, in which the chosen observers were randomly selected. All reliability checks were >80% in each SOFIT category in accordance with the SOFIT manual (McKenzie, 2012; 2015). Total training time per observer took approximately 20 – 25 hours and involved the following five stages (McKenzie, 2012; 2015): 1) memorizing the protocols, codes, and categories; 2) practicing using the SOFIT video examples of children's PE behaviours; 3) practising in the field; 4) setting intra-observer

reliability agreement using the SOFIT videos; and 5) setting in field inter-observer reliability using one pacer, one set of ear phones and two observers.

6.3.3.2 Quantitative Data Analysis (including aspects of quality criteria checks)

The quantitative data was analysed using the Statistical Package for the Social Sciences v.23, with the alpha level being set at *P*<.05. The mean, range and standard deviation of the SOFIT variables were calculated. 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. Pearson product-moment correlations were then conducted to present preliminary examination of the association between SOFIT variables. To provide further analysis of the data, multiple regression was applied to the children's PA behaviours as the dependent variables. Specifically, each of the SOFIT activity variables (lying, sitting, standing, MPA, MVPA and VPA) were the outcome variables across six regression models, with each model including the predictor variables of: 'management', 'knowledge', 'fitness', 'skills', 'games', 'other', 'in class promotion of PA', and the confounding variables of 'school' and 'age'.

As the SOFIT tool produces a range of predictor variables, the backwards selection enabled the model to be refined sufficiently and thus was the most efficient way of identifying predictor variables. Non-significant variables that were least strongly associated with the outcome variable were removed. Variables were retained if they were statistically significant predictors of the outcome variables. As the SOFIT tool is a class level measure, each PE lesson observed was treated as a 'case' in the regression analysis (i.e. a case = one observed lesson); with 23 cases (i.e. lessons) being considered as an adequate sample size for the number of predictor variables applied to each linear regression model (Austin and Steyerberg, 2015). To enable trustworthy conclusions from the data, the following assumptions for multiple regression were checked for each model: a) homoscedasticity of errors through plotting standardised residuals against the predicted values of Y; b) multicollinearity through the presence of correlations between the predictor variables; c) outliers from the application of Cook's distance diagnostic; and d) linearity of the predictor and outcomes variables (Williams, Grajales and Kurkiewicz, 2013). As the SOFIT tool is designed as a class level measure (i.e. observations are made on 6 children at 20 second intervals which are then calculated into lesson totals), in order to examine sex differences in children's activity behaviours, the data were aggregated separately for boys and girls. A twoway ANOVA was then used to determine any main effects for 'sex' and 'school' on the activity categories of VPA, MVPA, MPA, standing, sitting and lying. The statistical assumptions for a factorial ANOVA were adhered to which included: using Levene's test to check for equality of variances of all data points of the dependent variable; and ensuring normality of residuals through the use of a QQ Plot (Cohen, Manion and Morrison, 2011; Pardoe, 2012).

The practical significance of the results were determined according to the percentage of time children spent engaged in %MVPA during PE lessons, using the IOM (2013) and AfPE's (2015) guidance of over 50% MVPA as an effective PE lesson in terms of PA. The predictor variables will be used to establish any meaningful determinants that could impact upon children's PA behaviour during their PE lessons.

6.3.4 Qualitative data collection: children's group interviews and individual teacher interviews

6.3.4.1 Children's group interviews

The children's group interviews were conducted in parallel with the SOFIT observations to explore the children's perceptions and experiences of their PA during primary PE lessons. The parallel collection of the quantitative and

qualitative data collection was due to timetable restrictions of the schools and thus the opportunities available to collect the data. All group interviews took place in a quiet room free from distraction, with 12 focus groups taking place and 6 to 7 children in each group. When using children as participants, the nature of a group interview enables them to feel more relaxed and therefore it has been suggested that the discourse may be richer than in a one-to-one situation (Flewitt, 2014), thereby increasing the credibility of the data set. The questions posed to the children (Appendix 20), were semi-structured, which offered a more flexible approach and thus, enabled the researchers to follow-up any emerging lines of enquiry (Flewitt, 2014). The interview questions were structured according to aspects of the Ecological Model for Health Promotion (McLeroy et al., 1988) and included questions such as: 'What do you think the phrase 'physical activity' means?', 'How active do you think you are in your PE lessons?', 'Why do you think you are active or not active during PE?' and 'What do your teacher's do during your PE lessons?' Each group interview lasted between 25 - 35 minutes (M=27) mins) and the discussions were recorded via a Dictaphone.

6.3.4.2 The individual teacher interviews

The individual teacher interviews were conducted in parallel with the SOFIT observations to investigate the teachers' perceptions of children's PA during primary PE (Appendix 21). Although a semi-structured approach was adopted, the interactive nature of the interview allowed the researcher to adapt their questions in order to elicit more information and therefore gained a greater insight into the teachers' actions and beliefs (Menter *et al.*, 2011). The interview questions were structured according to aspects of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) and included questions such as 'How active do you think the children are in PE lessons?' How would you describe PE and school sport in your school?' and 'How confident do you feel teaching PE?' Each interview lasted approximately 30-40 minutes (M=34.6 mins) and a Dictaphone was used to record

the verbal interactions of the teachers. All interviews took place on school site in a quiet room free from distraction.

6.3.4.3 Qualitative data analysis: interpretative phenomenological analysis

All qualitative data were analysed using Interpretive Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009). IPA is an approach which acknowledges that the results will always be influenced by the researcher's views and interpretations of the participant's experience; thus, such an approach accepts that it is not possible to gain direct access to the participants' world views (Willig, 2013). This element is referred to as the hermeneutic nature of an IPA approach, in which the researcher interprets the participant's interpretations. IPA is also grounded in the philosophical areas of phenomenology and idiography (Smith, Flowers and Larkin, 2009); the phenomenological element is the central focus on the human experience and the idiographic component is the researcher's committed detailed examination of each transcript (Smith, Flowers and Larkin, 2009).

A systematic analysis of each transcript took place for both the teachers' (Appendix 22) and the children's interviews (Appendix 23) in which the first step involved reading and re-reading the transcripts; at this stage of the analysis initial notes were recorded. Smith, Flowers and Larkin (2009) advised 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) (Smith, Flowers and Larkin, 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 each interview, which was followed by a comparison of themes across transcripts to produce two main themes that represented both the teachers' and children's perceptions and experiences of the phenomenon. Ultimately, an inductive approach was adopted, whereby the process of IPA assisted in facilitating the development of unanticipated themes within the data set through its flexible data collection and analysis techniques (Smith, 2004). Although IPA draws upon phenomenology, it was considered an appropriate data analysis approach as it sits within the pragmatic worldview of the thesis.

6.3.4.4 Trustworthiness of the qualitative data (quality criteria checks)

The credibility of the qualitative data set was increased by ensuring that the methods selected were appropriate, for instance, the group interviews were considered more appropriate than a one to one interview when working with children (Flewitt, 2014). In addition, engaging in critical discussions with colleagues and the bracketing of initial notes also increased the credibility and the confirmability of the interview data (Norris, 2007). Furthermore, the credibility of the children's group interviews was sought through ensuring the interview was conducted in child friendly language and that the children understood the main concept of the interview, i.e. physical activity. During the interview process, member checking (Shenton, 2004) took place to clarify any concepts that had been discussed with both the children and the teachers. Moreover, the credibility of the data was increased due to the systematic approach adopted and the verbatim extracts included in the results and discussion, which provides the reader with the opportunity to check the interpretations made.

6.4 Results

6.4.1 SOFIT results

Table 6.2 represents the means, standard deviations and range for the number of minutes and percentage of lesson time allocated to children's PA, lesson context and teacher promotion of PA. Of the lessons observed the mean average length of a lesson was 35.3 minutes, with lessons ranging from 24 to 52 minutes (Table 6.2). The mean percent of time children spent in MVPA during PE lessons was 42.4% equating to 15 minutes of lesson time and ranging from 22 to 62.5%. Out of the 23 lessons observed, seven met the recommended >50% MVPA. Children spent a mean of 34% of lesson time standing and 21.7% sitting. An average of 17% was spent in VPA, with a mean value of 5.8 minutes. In terms of lesson context, the majority of class time was spent engaged in the SOFIT category of 'games activities' (i.e. application of skills, for instance creating a sequence in gymnastics or a game of basketball) (29.2%) followed by 'knowledge' (20.7%). The least amount of class time was spent in 'other' (4.4%), which included demonstrations of children's work. In relation to teacher promotion of PA, 18.2% of class time was spent promoting in class PA, there was no promotion of out of class PA, and there was no promotion of PA for 86.5% of lesson time.

A positive correlation was found between sitting and the lesson context of 'knowledge' (r (23) = .696, p<.01, r^2 = .48, 95% CI [.398, .861]) (Table 6.3). Further results from applying multiple regression analysis (using children's activity behaviours as the outcome variables) indicated that the lesson contexts of 'management', 'fitness', 'skills' and 'games' were negative predictors of children's sitting behaviour but were positive predictors of children's MVPA during PE lessons (Table 6.4). Furthermore, lesson contexts of 'knowledge' and 'other', along with 'teachers in class promotion of PA' and the confounding variable of 'school' were negative predictors of children engaging in MPA.

Sorricategory	rereente	ige of and							
		time (<i>n</i> =	23)	ti	time (<i>n</i> =2				
Student Activity	M(%)	SD	Range	M (mins)	SD	Range			
Lying	0.9	1.7	0.0-6.9	.31	0.5	0.0-1.6			
Sitting	21.7	18.1	0.0-51.4	7.4	6.2	0.0-17.8			
Standing	34.0	13.0	11.8-53.4	12.2	5.6	3.0-24.0			
MPA	25.4	13.3	1.9-48.6	9.1	5.5	0.6 – 19.6			
VPA	17.0	10.0	1.7-40.0	5.8	3.4	0.6-14.8			
MVPA	42.4	12.3	22.05-62.5	15.0	5.7	7.0-30.0			
Lesson Context									
Management	17.8	9.5	3.9-35.4	6.2	3.2	1.3-11.3			
Knowledge	20.7	11.5	2.0-42.7	7.1	3.7	0.6-14.5			
Fitness	14.0	14.8	0.0-61.5	4.9	5.2	0.0-20.9			
Skills	13.8	14.1	0.0-42.8	4.8	4.9	0.0-15.2			
Games	29.2	18.9	0.0-78.2	10.6	8.8	0.0-40.6			
Other	4.4	7.8	0.0-23.7	1.5	2.8	0.0-8.0			
Teacher Behaviour									
In class promotion of PA	16.1	12.1	1.2-50.0	6.1	5.4	0.3-19.6			
Out of class promotion of	0.0	0.0	0.0-0.0	0.0	0.0	0.0-0.0			
РА									
No promotion of PA	82.9	12.3	50.0-100.0	29.0	5.6	17.3-38.0			
Length of lesson				35.3	7.0	24.0-52.0			

Table 6.2 PE lesson time (M, SD and the Range) according to children's activitylevels, lesson context and teacher promotion of physical activity**SOFIT CategoryPercentage of allocated lesson**Minutes of allocated lesson

In addition, the lesson context of 'other' and the confounding variable of age (year group) were negative predictors of children's % time spent standing during PE lessons.

No statistically significant 'sex' by 'school' interaction or 'sex' main effect was revealed for all SOFIT categories. Although there were no statistically significant differences across the three schools in relation to %MPVA (school 1 = 42.5%, school 2 =42.2%, school 3 = 42.5%), the ANOVA results revealed significant main effects of 'school' on children's %VPA (F(2,37)=3.76, P=.033, $\eta_p^2=.17$), and %MPA (F(2,37)=5.30, P=.009, $\eta_p^2=.22$). The observed children in school 3 spent more of their PE lesson time (%) engaged in VPA (22.9%) compared to school 1 (12.3%) and 2 (14.2%). However school 1 (30.2%) and 2 (28.1%) spent more time engaged in MPA than school 3 (19.7%).

6.4.2 Teachers' interviews and children's group interviews

Working within the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) to assist in gaining a full understanding of the teachers' and children's perceptions and experiences of PA levels, lesson context and teacher promotion of PA during primary PE, the teachers' and children's interview findings were contrasted and compared in order to produce collective themes. From which, the following two themes emerged from the data set: 1) putting the 'physical' back in primary PE (intrapersonal and interpersonal) and 2) further professional development for teachers in primary PE (intrapersonal, interpersonal, institutional and policy).

Putting the 'physical' back in primary PE. From both the children's group interviews and the teacher individual interviews all the teachers and children stated that PE lessons should be physically active; and the development of physical skills during PE lessons was important to both teachers and children. However, during the interviews children frequently commented upon aspects of their PE lessons that restricted their ability to practise their motor skills. For instance, across all of

Table 6.3 Correlations matrix for the SOFIT	variables of: lying,	sitting, moderate,	MVPA, VPA	, management,	other,
knowledge and no promotion of PA.					

	Outcome variables					
		Lying	Sitting	MPA	MVPA	VPA
Predictor variables						
Management	r	45*	41	.39	.47*	.05
	p	.03	.05	.06	.02	.81
Other	r	.75**	.44*	17	37	23
	p	<.01	.04	.44	.08	.29
Knowledge	r	.05	.70**	66**	61**	.13
	p	.81	<.01	.01	<.01	.54
No promotion of PA	r	07	.18	.05	31	-45*
	р	.76	.40	.82	.14	.03

*. Correlation is significant at the 0.05 level (2-tailed), **. Correlation is significant at the 0.01 level (2-tailed), n=23

				Citting			Chanding		MDA									
		Lying			Sitting		St	anding			MPA		r	1VPA			VPA	
Predictor variables	B (SE)	β	p	<i>B</i> (SE)	β	p	B (SE)	β	p	B (SE)	β	p	B (SE)	β	p	B (SE)	β	р
Constant	.20 (.29)		<.01	119.72 (12.99)		<.01	45.56 (4.50)		<.0 1	56.01 (5.83)		<.01	-10.70 (13.21)		.42	2.52 (3.22)		.44
Management				76 (.20)	40	<.01							.60 (.20)	.46	.01			
Knowledge										81 (.16)	67	<.01						
Fitness				-1.38 (.25)	-1.14	<.01							.76 (.26)	.92	.01			
Skills				-1.66 (.24)	-1.30	<.01							.76 (.24)	.88	.01			
Games				-1.42 (.21)	.21	<.01							.72 (.21)	1.11	<.0 1			
Other	.17 (.03)	.75	<.01				72 (.31)	44	.03	43 (.24)	25	.09						
In class promotion of PA										48 (.17)	.44	.01				.534 (.32)	.65	<.01
School 3										-10.60 (4.02)	40	.02				15.01 (3.22)	.74	<.01
Age (Year Group) Y4							-12.75	48	.02									
Adjusted R ²		.53			.74			.26			.59			.42			.53	

Table 6.4 Positive and negative predictors of children's activity behaviours during primary physical education from a backward selection multiple regression

the three schools, children discussed how if they misbehaved during their PE lessons they were asked to sit out, and sometimes this was for the rest of the lesson. This was also something that happened during the SOFIT observations across all three schools which was noted by the observers; as expressed by the children in the following quotes: 'Sometimes when you are silly you are told to sit on the orange spot or the bench', 'If you sit on the orange square more than once then you have to sit on the orange square for the rest of the PE lesson', and 'You have two warnings, then you have to sit there and watch people, then you miss your whole PE lesson'.

The children also discussed how the organisation and teaching strategies used in PE lessons impacted upon their ability to practise their motor skills. A common point discussed by the children was the amount of time teachers took to demonstrate skills at the start of the lessons, as highlighted in the following quotes, 'sometimes the teacher is demonstrating and they do it for ages' and 'for indoor PE you have to watch and see what she [the class teacher] is trying to show us and then you have to give it a go and you have to wait in a queue for like four people to have their turn'. Other comments some of the children made related to the organisation of groups, with teachers often organising the class into queues in which they would wait their turn to practise a skill, for example, 'in gymnastics we are not very active because the teacher demonstrates it but we only like jump off and do rolls, that is all we do, we have to wait in a queue for our turn quite a bit'.

Children in school 3 also suggested strategies that the teachers could use to enhance the learning experience, 'normally we are in a team and we have to wait for the other five people in front of us to have a go but if you are on your own you can do it quicker because you are not waiting for anyone else', 'so maybe the teacher could demonstrate quickly at the start and then just let us do it, so do it at the start and then we have the rest of the PE lesson to do what the teacher has demonstrated' and 'I think maybe for PE, if everyone had their own bit of the space then it wouldn't take as long and everyone could just do it over and over again and they would get more practice'. The children seemed to understand that their PE lessons could be organised more effectively in order to maximise upon their active learning time.

All teachers interviewed acknowledged that PE lessons should involve children engaging in PA to develop their motor skills. Teachers discussed how being 'physical' is the main purpose of a PE lesson and they contextualised this with comparisons to other subject areas such as Mathematics, stating that it would be unacceptable to not do maths in a maths lesson. Therefore, it should not be acceptable for children to do little PA during a PE lesson. As highlighted in the following quote from a recently qualified teacher, 'definitely over 50% (activity levels) is right otherwise there is no point in doing PE really is there, if they are all stood still watching' and 'I think that it is important that they are active because it is a PE lesson and if we were only doing maths for say 40% of a maths lesson then that wouldn't be good enough so I suppose it is the same thing in PE'. However, the teachers also discussed how elements of their pedagogical practice can often impact upon children's physical learning time during PE lessons, such as demonstration time. One experienced teacher acknowledged that teacher talk and demonstration time are parts of teaching and learning that can result in children sitting for long periods, for instance 'there is nothing worse than watching a PE lesson and the teacher is standing and doing all the talking and the children aren't doing anything they are just sitting there'.

Like the children, some teachers offered strategies for how they could adapt their teaching and learning to increase active learning time during PE lessons. One experienced teacher discussed strategies of stopping small groups of children to provide feedback rather than the whole class, 'I think it's a lot like getting them going as soon as possible and then going around and talking to them in their groups rather than getting the whole class to stop'. Thus, both teachers and children acknowledged that PE lessons could be more active and offered strategies to overcome this.

Further professional development for teachers in primary PE. The majority of teachers expressed that their confidence levels were low in one or more areas of primary PE and how this can impact upon the way they organise the lesson. As illustrated by one teacher 'It is the one that I worry about the most and I feel less confident doing it, it is the one that I view everyone else is so much better and knows so much more...it is the one that makes me panic'. In one of the schools even staff development courses did not improve their confidence 'I don't think anybody within the school is confident, even the people that have gone on courses'. There was also an uncertainty in their abilities, as teachers did not know whether they were effective or not at teaching PE and also some feared that the children would know more than them, 'I still don't know whether I am doing the right thing by questioning myself all the time', 'I was quite daunted by the prospect of it when I first came and I had a year five class so obviously it's a bit scary when they are older because I felt like they probably know more than me', and 'I think it is just the reassurance really, reassurance of what I am doing is on the right lines'.

This low confidence and subject knowledge from teachers did have an impact upon children's learning, as across all three schools the children commented upon their own lack of understanding and low confidence during their PE lessons. Some children expressed that their low confidence came from not knowing how to be good at a physical skill, which is a reflection of how the teachers described their knowledge and confidence in the subject of PE. The following quotes described how three of the children felt during their PE lessons 'I had no idea what to do and I am not that very good, every time I keep thinking about something I should be doing and I get muddled up', 'me and my friend had no idea what to do so we said to another child why don't you just lead us?', 'sometimes you are not that confident of how to be really good at it, like really good moves'. The children also described how they would learn the same things in lessons, as illustrated in the following quote 'we are good at swimming but every year we learn the same thing and we don't learn new things'.

One of the main barriers discussed by the teachers was the priority and time given to mathematics and English which impacted upon the time they had available for other subject areas such as PE. In some schools PE was expressed as a low priority subject area which was highlighted in the following quotes from two of the teachers: 'We meticulously plan all of our maths and English because we have to and they are the most important and we know that, and the afternoon lessons can tend to be a bit ad hoc, but you know, that's just what primary school teachers are like master of nothing' and 'You kind of focus so much on maths and English that you sort of rush through and sometimes I don't feel 100% prepared when I am teaching PE and that's quite daunting because it's like I'm not 100% sure what I'm doing'.

In one of the schools in particular, they had developed a range of supportive networks which included an element of autonomy for the staff, as expressed by a recently qualified teacher, 'teachers can volunteer themselves if you feel there is something you are not very confident with and you can say can I have some support with that'. There was effective leadership in PE across all three schools which often was developed through a 'PE team' and teachers frequently discussed the professional dialogue they engaged in. For instance 'I have other colleagues who are particularly good at PE and they have the specialist PE knowledge...there are plenty of people to speak to'. Across all schools the teachers acknowledged that a supportive social environment was an important element of a successful PE curriculum. A range of staff development opportunities where available across the schools and more so in school 3, as the teachers discussed how the training had developed their pedagogical knowledge. They reported finding it particularly useful observing the practice of others as highlighted by one of the teachers 'he is really helpful (PE Co-ordinator) for instance if you say I don't know what to do he will come and help you and he has team taught with me a couple of times'.

6.5 Discussion

The study highlights from the SOFIT data (Table 6.2) that children accumulated a mean average of 15 minutes MVPA (equivalent to 42.4% of lesson time) during PE lessons which were an average length of 35.3 minutes. These results are slightly higher than those previously reported in a review by Fairclough and Stratton (2006) (34.2%) but are similar to the results of recent meta-analysis (44.8%) (Hollis *et al.*, 2016) which identified a slight increase upon the levels of MVPA during primary PE reported in previous studies. Despite this higher percentage, the study's quantitative findings still fall below the recommended 50-80% guidelines of children actively moving during primary PE lessons (AfPE, 2015). Therefore, it is important to understand the possible facilitators and barriers behind effective pedagogical approaches to increase children's MVPA during primary PE through a focus on active learning time. This highlights the advantage of using a mixed methods approach, which assisted in providing the 'why' behind the quantitative data. Both the children's group interviews and the teachers' individual interviews

assisted in gaining a deeper understanding of the reasons behind low levels of MVPA in primary PE lessons, which will be discussed in the following sections.

6.5.1 Barriers to PA in primary PE

One of the main findings from the observational SOFIT data (Table 6.4) was the lesson contexts of 'knowledge' (i.e. teacher transfer of knowledge and demonstration time) and 'other' (i.e. children demonstrating work), along with teachers' 'in class promotion of PA' and the confounding variable of 'school' being statistically significant negative predictors of children engaging in MPA during their PE lessons. Although, 'teacher promotion of PA' and 'school' are indicated as negative predictors of PA the data also evidences that children in school 3 spent a statistically significantly higher % of time engaged in VPA; however school 3 also spent significantly less time engaged in MPA than school 1 and 2. Thus, all three schools produced similar levels of MVPA. The quantitative data also revealed 'teacher's promotion of PA' as a positive predictor of children's VPA during PE lessons for children in School 3. Therefore, the lesson context of 'knowledge' and 'other' can be identified as barriers to children engaging in MPA.

The SOFIT results also showed that 20.7% of lesson time was spent engaged in the lesson context of 'knowledge'. Transfer of knowledge and modelling through effective communication are important aspects of high quality teaching as illustrated in England's Teaching Standards (DfE, 2013b). However, what needs to be considered is how teachers can communicate effectively without excessive teacher talk, which can impact negatively upon children's active learning time in PE. This was also highlighted in an inspection report of primary PE in England, which suggested that long periods of inactivity in lessons were often due to the length of instruction time from teachers (Ofsted, 2013). Previous pedagogical interventions to increase children's MVPA in PE (Sallis *et al.*, 1997) have advised teachers to focus on delivering precise and efficient feedback to maximise upon
the lesson time available. For instance, often the teacher does not need to stop the whole class and instead they can focus on small group feedback which also assists with differentiated learning. The negative impact of teacher talk was also highlighted in the qualitative theme of 'putting the 'physical' back in PE', in which both teachers and children commented that teachers often spend too long talking and demonstrating skills at the start of PE lessons. Efficient teacher feedback is an important factor that must be considered in future interventions to increase children's MVPA in PE, with the concept of 'moving to learn' (DfE, 2013a) being discussed and promoted with teachers. Both the quantitative and qualitative findings therefore reinforce the need for a conscious break from traditional teaching methods previously highlighted (Hollis *et al.*, 2016), which includes all of the children being stopped to listen to instructions and observe demonstrations.

AfPE (2015, p3) reinforced the importance of the concept of 'moving to learn' in PE, and although a mindless approach to PA in PE is not to be advocated, children themselves as young as 7 to 9 years old commented upon their lack of skill practice during their PE lessons and are able to suggest ways that the lesson can be adapted. This qualitative finding highlights further the importance of listening to children in relation to their perceptions and experiences of PE lessons (Dyson, 1995; 2006). The knowledge that the children have in terms of organisation and increasing active learning time also supports the work of McKenzie *et al.* (1997) who promoted small group work in PE lessons through their comprehensive Sports, Play and Active Recreation for Kids (SPARK) intervention study. Reflecting upon the pedagogy employed in the SPARK programmes, to achieve higher levels of MVPA, small group work and more efficient use of space and equipment was advocated (McKenzie *et al.*, 1997).

Some barriers of active learning time identified from the interview theme of 'further professional development for teachers in primary PE' can be related to the institutional layer of the Ecological Model for Health Promotion (McLeroy et al., 1988). These included the time teachers had available to plan for PE lessons and priority subjects such as mathematics and English being the school's main focus. This was also reflected in the comments from the children, who discussed a lack of understanding in their PE lessons which could be a reflection of teacher's limited subject knowledge. One way teachers could improve their subject knowledge could be by giving them more time to plan PE lessons. This could impact upon their motivation to produce quality teaching and learning opportunities for children, and subsequently further their subject knowledge. However, these barriers of 'time' and 'priority' have also been previously reported through qualitative studies and are not new problems (Boyle, Jones and Walters, 2008; Morgan and Hansen, 2008; Christian et al., 2015), suggesting that until health based outcomes are measured in primary schools then head teachers will have other priorities (Christian *et al.*, 2015). When considering the intrapersonal layer of McLeroy *et* al.'s (1988) ecological model, low confidence and subject knowledge were apparent barriers across all three schools, highlighted from the qualitative results, supporting previous research which has investigated teachers' perceptions of PE (Morgan and Hansen, 2008). Even if teachers felt confident in some areas of the PE curriculum, they often expressed a lack of confidence with sports/areas of the curriculum in which they had negative secondary school experiences. Low confidence and subject knowledge are therefore not new problems, but additional qualitative data from this research provides further insights into how teachers can be supported and where supported can be targeted in order to develop their subject knowledge and confidence in primary PE in order to increase active learning time for children.

6.5.2 Facilitators to increasing PA in primary PE

The interview theme of 'further professional development for teachers in primary PE' provided insights into the advantages of establishing social networks in schools in order to support teachers in their knowledge of and confidence in teaching primary PE. Often this was developed through professional dialogue with other staff which took place in passing or from seeking support from colleagues. These aspects can be placed in both the intrapersonal and interpersonal layers of the Ecological Model (McLeroy et al., 1988) and also relates to one aspect of the SDT (Ryan and Deci, 2000). The social support the teachers discussed in the interviews can be associated with the relatedness component of the SDT, which is thought to fulfil an individual's basic need for belonging and connection with those around them. Thus, in facilitating teachers to develop their confidence to increase active learning time in primary PE, it could be suggested that creating supportive social networks in their school environment could assist with some teacher related barriers such as low confidence and subject knowledge. This in turn could also have a positive impact upon children who also reported a lack of understanding in their PE lessons. From the interview data, school 3 reported more social support and professional development than the other two schools. School 3's children also spent a higher promotion of their time (%) engaged in VPA, with teachers' in class promotion of PA being a positive predictor of this. It is important to acknowledge that children engaging in higher amounts of VPA rather than MPA has additional health benefits, as indicated in Fussenich et al.'s (2016) study, as they recommended that an additional 17 mins of VPA a day can reduce CVD risks. Furthermore, the DH's (2011) PA recommendations, state that children should engage in vigorous activities which strengthen muscle and bone on at least three days a week. Thus, these results could highlight an important difference in School 3's results. If children are experiencing more VPA in PE lessons this can contribute towards children meeting the DH's (2011) recommendation of engaging in VPA on at least 3 days a week. Thus, this provides further support for the development of social networks and training in primary PE, which may help to increase children's VPA during PE lessons.

As demonstrated in the 'putting the 'physical' back in PE' interview theme, the teachers' knowledge of how to increase active learning time was beginning to develop through interpersonal support. This relates to the competence component of the SDT (Ryan and Deci, 2000). However, if teachers are to develop in their competence of pedagogical strategies to increase children's PA through meaningful learning experiences, then it could possibly compete with the time given to priority subjects of mathematics and English (Christian *et al.*, 2015). Therefore, the limited time teachers have available needs to be taken into account and simple pedagogical strategies could be put into place such as eliminating queues and reducing teacher talk which could be applied to any PE lesson.

In consideration of staff development to increase teachers' pedagogical skills, the interview data suggested that teachers valued training opportunities when they were given an element of choice. Therefore, implying that teachers should be given some autonomy in the design, implementation and monitoring of future interventions to increase PA and active learning time in PE. If teachers are involved in designing interventions then this may motivate them to change their behaviour, feeling that they had more of a choice in their own behaviour. As illustrated in the third component of the SDT (Ryan and Deci, 2000). The need for autonomy in the SDT relates to self-regulation of oneself, with behaviour being described as self-organised and initiated (Ryan *et al.*, 2009), indicating that teachers should be fully assenting to staff development in primary PE. As it is advocated that all three needs of the SDT (relatedness, competence and autonomy) are required in order to change and maintain behaviour (Ryan *et al.*, 2009), and it is recommended that they should be considered in future interventions to increase PA in PE.

6.5.3 Strengths and limitations

The interviews provided insights into both the barriers and facilitators of PA in PE lessons and the method of direct observation allowed the researchers to collect quantitative data but also reflect in the environment, providing contextually rich data (McKenzie, 2010). Furthermore, the credibility of the study was increased as the methods employed are directly related the overall philosophical stance of pragmatism. A limitation of the study would be the relatively small sample size of three primary schools in one regional area of England, however the labour intense nature of direct observation limits the number of samples that can be taken (McKenzie, 2010). However, the study did include 813 minutes of observed lesson time with 2439 observed intervals and the advantages of using such an approach adds to the existing research in the area by providing contextual information on a number of variables such as lesson context and teacher interactions. In addition, common gualitative themes were revealed across all three schools, which suggests that these themes may be relevant to other primary school settings. Further limitations of the study would include an omission of the following confounding variables: children with disabilities, seasonal effects and IMD.

6.6 Conclusion

The main aim of this chapter was to investigate children's PA during PE and determine the related physical and social determinants; in order to inform the design of a primary PE intervention to increase children's MVPA. The quantitative findings reflected previous research studies with regards to children's low level of MVPA during primary PE lessons and also the qualitative results revealed barriers such as: PE as a low priority subject area, teachers' low confidence, and limited subject knowledge. However, what this study adds is the knowledge of other barriers including excessive teacher talk and ineffective organisation of children during lessons, along with the knowledge of possible facilitators to increasing MVPA in primary PE which align with the intrapersonal, interpersonal and institutional layers of McLeroy *et al.*'s (1988) ecological model, along with the three

components of the SDT (Ryan and Deci, 2000). From utilising the multiple layers of data, primary PE interventions should be grounded in theoretical frameworks that can assist in changing teachers' behaviour. The main focus needs to be on teachers developing their confidence and competence which could be achieved through supportive networks and including the support of the head teacher. Additionally, in the design of school-based interventions researchers need to consider the barrier of teachers' time available for PE development, as it will always be competing against the many subjects taught in a primary school. Therefore, the findings from this study suggest simple strategies are required that can be applied to a range of PE lesson plans and contexts, which could be the first step towards increasing active learning time in primary PE in England and would not impact too much on a teacher's already existing busy schedule. Consequently, these findings have been used in the next chapter to inform the design of the primary PE intervention to increase children's MVPA. Specifically, the following results were used to develop a set of pedagogical principles which were employed as part of the intervention model in chapter 7: 1) the quantitative finding of 'knowledge' (SOFIT category) being a negative predictor of children's MPA (Table 6.4), 'teachers' promotion of PA' (SOFIT category) being a positive predictor of children's VPA (Table 6.4), and the qualitative findings of ineffective organisation in lessons which included children not being allowed to participate and children queuing and waiting for their turn to participate.

Chapter 7

Study 4: Increasing Physical Activity Levels in Primary School Physical Education: The SHARP Principles Model Intervention

Chapter 7 – (Study 4) Increasing Physical Activity Levels in Primary School Physical Education: The SHARP Principles Model Intervention

7.1 Study Overview

Using the knowledge gained in Chapter 6 (Study 3) as highlighted at the end of section 6.6, the primary aim of this study was: to implement and evaluate the effectiveness of a teaching strategy intervention, targeting both PE specialist and non-specialist teachers, to increase children's MVPA during primary school PE lessons. The intervention has embedded a set of pedagogical principles that were directly informed from the results of study 3 (Chapter 6). For instance, the quantitative result of 'knowledge' as a negative predictor of children's MVP (Table 6.3) was integrated as the 'R' principle in SHARP, standing for 'reducing teacher talk through efficient demonstrations and quick feedback'.

A quasi-experimental non-equivalent groups design was employed, involving four classes from two primary schools in the West Midlands, England. In March, 2014 schools were selected through purposive sampling to match schools in terms of size and demographics (baseline, n=111: post intervention, n=95); data were collected from children in school years 3 and 4 (aged 7 to 9 years). Working within the NICE's (2015) guidelines of behaviour change, the intervention involved developing teacher effectiveness through the creation of the SHARP Principles Model, which was grounded in aspects of the SDT, the Ecological Model for Health Promotion and three active ingredients from the BCT. However, the new taxonomy ingredient of 'providing instruction' has been added as a result of the conclusions from the break time intervention (Study 2). Children's MVPA was assessed at baseline and a four-week follow-up post intervention, using the System for Observing Fitness and Instruction Time (SOFIT). Four individual teacher interviews were conducted with the intervention school, to explore teachers' perceptions of the intervention. A two-way ANOVA indicated large interaction effect sizes for time

spent in MVPA (P < .01, $\eta_p^2 = .316$) and VPA (P < .01, $\eta_p^2 = .263$). Time spent in MVPA during PE lessons in the intervention school increased from 42.51% to 72.6% whereas in the control school MVPA remained relatively constant (42.24 to 45.32%) and VPA decreased. The qualitative findings revealed two main emergent themes: a paradigm shift and teachers' developing pedagogy. Recommendations based on this evaluation, would be for the SHARP Principles Model to be replicated and evaluated on a wider scale across a variety of contexts.

	Year 1 of PhD study	Year 2 of PhD study	Year 3 of PhD study	Year 4 of PhD study
Study 1 Break time Exploratory Study	Methods: SOCARP, Children's group interviews Outcomes: Boys engage in more MVPA and dominate playground space in large groups Girls enjoy socializing with their friends in small groups Boys and girls engage in imaginary play			
Study 2 Break time Intervention Study		Methods: SOCARP, Pedometers, Teacher in Outcomes: Positive short term effects on boys' and girls Longer term positive effect on boys' VPA Boys dominated the walking track, girls part Inconsistencies in the implementation of the A set of 'how to principles are recommended	dividual interview ' step count and MVPA icipated in sedentary activities intervention from school staff	Initial discussions began in the 2 nd year for study 2, but the intervention was delayed. Thus, data collection began in 4 th year of study.
Study 3 Physical education Exploratory Study		Methods: SOFIT, Children's group interviews, Teacher individual interviews Outcomes: Boys and girls engage in <50% MVPA during PE Barriers to MVPA: excessive teacher talk, ineffective organisation, low confidence and subject knowledge Facilitators to MVPA: head teacher support, social networks, professional development of teachers		
Study 4 Physical education Intervention Study			Methods: SOFIT, Teacher individua interviews Outcomes: Positive effect on both boys' and gir MVPA, increasing by a 30% point in The SHARP intervention has the pot to shift teachers' current thinking to on active learning time during PE	al Is' crease ential focus

Figure 7.1 A thesis map to illustrate the chronology of the studies conducted and the methods and outcomes of studies 1, 2, 3 and 4.

Exploratory studies

Intervention studies

7.2 Introduction

The design of the intervention in this chapter will be informed by the available evidence to date in relation to children's MVPA during primary PE lessons (Lonsdale *et al.*, 2013; Hollis *et al.*, 2016). This chapter will also take into account the findings and conclusions from Chapter 5 (Study 2) and 6 (Study 3). The knowledge gained from these chapters helped to develop a theoretical model in which a PE intervention can be framed; furthermore, sitting within this model will be a set of principles for school staff to follow in relation to increasing children's MVPA during primary PE lessons. The sections below will discuss the existing literature to date, followed by the knowledge gained from the previous studies in this thesis.

Existing research indicates that in England children are not currently achieving the recommended 50-80% MVPA during primary PE lessons (Hollis et al., 2016), highlighting the need for effective interventions to enable schools to meet this target. The majority of intervention work in this area has been conducted in the US, with a current paucity of interventions that target children's MVPA in primary PE in England (Lonsdale et al., 2013). In a review of interventions to increase MVPA in PE lessons, the combined evidence suggested an average increase of 24% MVPA compared to usual practice (Lonsdale et al., 2013). Despite this average increase, the authors did warrant caution over the available evidence due to the heterogeneity in terms of study design, duration of lesson and sample size. This suggests a need for high quality RCTs, in order to determine the effects of interventions, something also acknowledged by Lonsdale et al. (2013). This diversity in study design was also noted by Hollis et al. (2016) in their review of children's MVPA during primary PE lessons. With inconsistencies being discussed in the use of measurement tools and monitored length of PE lessons (see Chapter 2, section: 2.3.1.2). They also specified other measurement considerations for future interventions on reporting of children's MVPA during PE including: transparency on the reporting of the activities performed during the lesson and providing preintervention data (i.e. usual MVPA during PE lessons) (Hollis *et al.*, 2016).

As discussed previously (see Chapter 1, section: 1.2.3) although there is limited intervention evidence to date in relation to MVPA in primary PE, the studies that are available tend to fall into one of the following two categories: 1) fitness based interventions (Quinn and Strand, 1995; Scantling et al., 1998; Ignico, Corson and Vidoni, 2006; Fairclough et al., 2016) or 2) teaching strategy interventions (McKenzie et al., 1996: 2001; Sallis et al., 1997; McKenzie et al., 2010). Even though it is the fitness based interventions that have shown the greater increases in MVPA, the aims of the study in this chapter focus on teaching strategies rather than fitness based approaches, given they are situated within England's NC for primary PE (DfE, 2013a). In addition, given the findings of the previous chapter, the intervention will focus on developing teachers' confidence and competence through a support network, including the support of the head teacher (Christian *et* al., 2015). Furthermore, the intervention will apply pedagogical principles adopted in other areas of the curriculum, so that the PE approaches are not in conflict. In terms of a real world rationale for creating an intervention to target and increase children's MVPA during primary PE lessons, it can be argued that although PE does not take place every day, it should be at the core of any school PA programme. If children are not engaged in MVPA for sustained periods in PE lessons then they are not being provided with opportunities to develop the skills and fitness they need to access physical activities at other parts of their daily lives. Furthermore, PE is often the only venue in which some children will engage in VPA (Sallis et al., 2012).

In Chapter 6 (Study 3), the findings discussed linked to several layers of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) including the

intrapersonal, interpersonal and institutional layers, along with the components of the SDT (Ryan and Deci, 2000). Thus, as the application of theoretical frameworks is thought to have greater effects in increasing MVPA and sustaining behaviour change (Lubans, Foster and Biddle, 2008; Michie et al., 2013) these were taken into consideration in the design of the PE intervention in Study 4. Furthermore, the findings and conclusions from the break time intervention in Chapter 5 were also taken into account. For instance, it was concluded from the break time intervention that a set of 'how to principles' linking to the BCT (Michie *et al.*, 2011) ingredient of 'providing instruction' would be beneficial to assist with the implementation of the intervention. Hence, in the design of an intervention framework in this chapter a set of 'how to principles' will be devised based on the knowledge gained in Chapter 6. The application of theoretical frameworks is also an area in which PE interventions differ, as Lonsdale et al. (2013) indicated in their review that only a few studies were grounded in theory. Grounding PA interventions in theoretical frameworks is something that has been recommended by a number of researchers (Brown et al., 2013; Lai et al., 2014), with Salmon and King (2010) advocating that researchers need to have a good understanding of the behaviour change theories in order to create and implement successful and sustainable PA interventions.

PA intervention work within primary PE is still considered a relatively new area, especially so in England (Lonsdale *et al.*, 2013) and to the author's knowledge there are no primary PE interventions to increase children's MVPA in England, which have created teaching strategies that have been implemented by both specialist and non-specialist primary PE teachers. Therefore, the focus of this chapter is situated in the design and implementation of a PE intervention to increase MVPA, which focuses on developing pedagogical strategies for use by both specialists and non-specialist teachers. For that reason, the overall aim of this study was to design and evaluate a teaching strategy intervention, which

supported teachers in increasing children's MVPA during primary school PE lessons. The intervention has been informed by the previous thesis' study (Chapter 6) along with previous interventions such as CATCH (McKenzie et al., 1996; 2001) and SPARK (Sallis et al., 1997); and the facilitators of and barriers to children's MVPA identified in Chapter 6 have been taken into consideration. For instance, effective organisation of children during PE lessons needs to be addressed through teaching strategies that include all children practising their skills instead of waiting in a queue for their turn. One of the main barriers to children's active learning time during PE lessons identified in the previous chapter was excessive teacher talk and demonstration time, therefore this a barrier that needs to be addressed. Thus, using this knowledge, a set of teaching principles were developed which became the core element during the intervention. These were termed the 'SHARP Principles' and involved the following key pedagogical aspects: Stretching whilst moving; High repetition of motor skills; Accessibility through differentiation; Reducing sitting and standing; and Promoting in class physical activity. An overview and further explanation of each principle is provided in Table 7.1.

When conducting intervention work within primary PE, a mixed method approach can be advantageous, as was advocated in a recent special issue in Journal of Teaching Physical Education, in which Castelli, Carson and Kulinna (2014) called for more mixed method research designs to assist in gaining a fuller picture of research within PE. For instance, employing quantitative methods will provide an objective measurement of the impact of an intervention. However, to gain an understanding of the process measures of an intervention, employing qualitative methods alongside quantitative methods can be an important and useful research design.

7.3 Methods

7.3.1 Research design

As in previous chapters, the final study forming the basis for this chapter takes a pragmatic stance (Johnson and Onwuegbuzie, 2004) in which the mixed method design employed was that of an explanatory framework (Creswell, 2014). As a result, priority was given to the quantitative data, which was used to measure the changes in children's MVPA from baseline to post intervention. Once all the quantitative data had been collected the qualitative data then interacted with the quantitative data in order to design the interview questions which were posed to the teachers in the intervention school to evaluate the overall effectiveness of the intervention. Thus, the two types of data were sequential in their timing with the precedence given to the quantitative data (QUAN ->qual). In relation to the quantitative element, the intervention had a quasi-experimental design, involving one control school and one intervention school. Specifically, a pre-test-post-test non-equivalent group design was employed; with 'non-equivalent' indicating that the control and intervention schools were not selected via randomisation (Cohen, Manion and Morrison, 2011). However, the strength of the design was increased due to matching of the two groups.

7.3.2 Participants, sampling procedures and setting

Schools were selected through convenience and purposive sampling to match schools in terms of school size and demographics. Both schools were located in areas of high social deprivation, in the West Midlands, England; with similar numbers of children on role (intervention school = 275 children; control school = 210 children). At baseline (boys = 60; girls =51) and post-intervention (boys = 51; girls = 44), data were collected from children in school years 3 and 4 (aged 7 to 9 years) and their class teachers (baseline=9, post intervention=6). In studies with small or moderate numbers of participants, randomisation can lead to control and treatment groups being different in important respects thus, purposeful and

stratified sampling was used. The criteria included diversity in activity levels, ensuring that an equal number of boys and girls were observed each lesson. A total of 28 PE lessons were observed, seven lessons at baseline and seven lessons at post-intervention in each school. At baseline 28.6% of the lessons were taught by male teachers and 71.4% were taught by female teachers. The postintervention lessons were taught by 35.7% male teachers and 64.3% female teachers. The average class size was 30 (SD = 1) children. In both the control and intervention schools there was one specialist PE teacher, with the remaining teachers being non-PE specialists. The study was reviewed and approved by the Research Ethics Committee at Newman University. Written informed consent was provided by the head teacher (Appendix 24), teachers (Appendix 25) and guardians (Appendix 26) of the children involved. In addition verbal consent was also obtained from the children and they were provided with an information leaflet (Appendix 27). Children's PA levels were assessed at baseline and at a four-week follow-up post intervention, using the SOFIT tool (McKenzie, 2012; 2015). Four individual teacher interviews were also conducted with the intervention school to explore their perceptions of the intervention.

7.3.3 'The SHARP Principles Model' PE intervention

The intervention was based on the development and implementation of the 'SHARP Principles Model' (Figure 7.2). The triangular model reflects the important foundations required in order to increase active learning time in primary PE and follows guidance on creating effective behaviour change (NICE, 2015). The head teacher is at the base of the triangle, reflecting their supporting role in the intervention, followed by the PE Co-ordinator and the individual teachers. To interlink the roles of the head teacher, PE Co-ordinator and the individual teachers, the SDT (Ryan and Deci, 2000) was applied. The SDT holds the principle that self-determined behaviour will vary according to the extent to which the behaviour is autonomous or controlled. Thus the components of the intervention were

implemented through a supportive autonomous role (autonomy), along with developing teachers' social networks (relatedness) and knowledge (competency). In addition, the model was grounded in three key elements (intrapersonal, interpersonal and institutional) of the Ecological Model for Health Promotion (McLeroy et al., 1988). At the institutional level, initial support from the head teacher allowed for the development of a revised PE and PA school policy and the creation of a new curriculum map. At the interpersonal level, ongoing support was provided for the PE Co-ordinator from both the lead researcher and the head teacher. The intrapersonal level involved developing teachers' awareness and knowledge of children's PA in PE. Working alongside the SDT and the Ecological Model were three 'active ingredients' from the BCT (Michie *et al.*, 2011), which were: 'Barrier identification/problem solving' (collecting baseline data), 'Action planning' (creating a detailed plan with the PE Co-ordinator), and 'Provide instruction on how to perform the behaviour' (joint planning sessions with teachers, integrating the SHARP principles). An overview of the theoretical constructs has been provided in Table 7.2.

Table 7.1 SHARP Principles – Increasing active learning time in primary physical education

Stretching whilst moving	 During the warm up section of a PE lesson, activities are to include dynamic movements and stretches, replacing the traditional static stretching routines (Bukowsky, Faigenbaum and Myer, 2014). Dynamic movements should be designed to elevate and maintain a higher core body temperature, whilst also engaging children in a fun, active and purposeful warm up. A dynamic warm up includes various movements that engage the lower and upper body (Faigenbaum, McFarland and Nitka, 2007). A dynamic warm up assists in increasing children's MVPA and could therefore allow for greater explosive effort during subsequent activities (Sale, 2002). Examples of dynamic stretches include: side shuffles, jump and twist, high knees, heel flicks, jumping jacks and skipping (Faigenbaum, McFarland and Nitka, 2007). The teacher must ensure that the dynamic movements will prepare the children for the activities that will follow in the skill development and then application of those skills. 			
High repetition of motor skills	 This principle is based on the notion that children cannot become physically skilled if they are not engaged in active learning (McKenzie and Lounsbery, 2013). In order to increase active learning time, teachers must ensure that each child has the opportunity to engage in the task at hand. For instance: reducing/eliminating queues so that children are not waiting their turn; having small sided games or group work such as 3 v 3 (which will increase the amount of times children have to apply an acquired skill and help to eliminate children being on the peripheral of, or excluded from a game/activity); and increasing the amount of equipment available to the children and/or increasing the number of stations. 			
Accessibility through differentiation	 All children should be set tasks that are appropriate to their physical, cognitive and social development, which will enable them to engage in learning time. Teachers should ensure that they are familiar with the STEP framework (Space, Task, Equipment and People) for effective differentiation of a (Doherty and Brennan, 2014). An example of the acronym STEP for a gymnastics lesson would be: 			
-	Space	Working in their own space	Sharing multiple stations with others	
	Task	Deducing the number of elements to be included in a conjugate	Increasing the number of elements to be included in a conjugate	
	I dSK Equipmont	Reducing the number of elements to be included in a sequence	Increasing the number of elements to be included in a sequence	
	Equipment	Using the noor and mats	Using the hoor, mats and apparatus	
	People	Working with a partner	Working in a small group	
Reducing sitting and standing	 As PE is the only required curriculum subject to provide MVPA to all children (Sallis <i>et al.</i>, 2012); this principle aims to develop teachers' awareness of the amount of time children are sitting and standing during the lesson in relation to knowledge transfer, teacher feedback and organisation of equipment (similar to the SPARK PE programme which placed an emphasis on efficient teacher feedback, whilst the child remained on task [Sallis <i>et al.</i>, 1997]). Examples of this principle include: When a teacher is providing feedback or questioning learners, often they do not need to stop the whole class, instead they can just target and stop a group of learners or an individual child. Engaging children in activity as soon as possible at the start of the lesson through concise questioning and feedback. 			
	Ensuring	equipment is ready, organised and accessible at the start and throu	ghout the lesson.	
Promoting in class physical	 If teacher PE lesson This prince 	rs are to assist in the development of children's lifelong PA they must is promoting in class PA (Sallis <i>et al.</i> , 2012). ciple is also linked to the assessment of PA during PE lessons using t	st make a conscious effort to change their instruction behaviours during	
activity	promotio	n of in class PA includes `great team work, keep moving and looking	tor space'.	

7.3.4 Quantitative data collection: systematic observation SOFIT

SOFIT (McKenzie, 2012; 2015) was used as the primary method to assess the baseline and post-intervention PA levels of the children during primary PE (Appendix 15). As discussed in the previous chapter, SOFIT is a comprehensive tool for assessing PE as it allows for the simultaneous collection of data across the three variables of: children's activity levels (lying, sitting, standing, MPA or VPA), lesson context (management, knowledge, fitness, skills, games or other), and teacher promotion of PA (in class promotion of PA, out of class promotion of PA or no promotion of PA). At baseline and post-intervention 1610 observed intervals took place, totalling 9 hours of pre and post direct observation. The baseline and post-intervention observations involved a range of activities including: dance, swimming, athletics and games. Given it is only possible to generalize the results of observations to those circumstances that have been sampled, this enhanced the study's representative design (Brunswick, 1955), and in turn improved its external validity. Six children were observed during each PE lesson on a rotational basis (four minutes for each child until the end of the lesson). The observation period began when 51% of the class arrived in the working area and the observation ended once 51% of the class had left the observation area (McKenzie, 2012; 2015). Full details of the SOFIT protocols can be found elsewhere (McKenzie, 2012; 2015).

7.3.4.1 SOFIT validity and reliability (quality criteria checks)

As discussed in the previous chapter, direct observation has a high internal validity and has been used as a criterion for validating other PA measures (McClain *et al.*, 2008). In addition, the SOFIT tool has been verified as a valid and reliable method to assess children's MVPA during PE (McKenzie, Sallis and Nader, 1991; Rowe *et al.*, 2004). Furthermore, SOFIT has been frequently used to provide objective baseline data (McKenzie, 2012; 2015). Training took approximately 20 – 25 hours for each observer and involved the five stages as used in Study 3 (Chapter 6, section: 6.3.3.1). Observers set intra and inter-observer agreement criterion before baseline data were collected and before the post-intervention data were collected, and an infield inter-observer reliability check also took place. All reliability checks were above 92% in each SOFIT category. Moreover, during all observations, researchers positioned themselves on the edge of the working area and avoided interaction with children and teachers to assist in the reduction of observer reactivity/Hawthorne effect (Cohen, Manion and Morrison, 2011).

7.3.4.2 Quantitative Data Analysis (including aspects of quality criteria checks)

The mean percentages of the dependent variables (SOFIT categories) were calculated in each lesson and then these scores were analysed using a two-way ANOVA. A two-way ANOVA was selected as it takes into account more than one independent variable, enabling the researcher to estimate the effect of two independent variables on a single dependent variable (Tokunaga, 2016). Accordingly, 'group' (intervention and control) and 'time' (baseline and post intervention) were treated as fixed factors (independent variables); and the two independent variables were therefore nominal data and the dependent variable was continuous (SOFIT variables). Furthermore, the two-way ANOVA was considered an appropriate test to employ as the baseline and post-intervention data contained measures of different participants but these were from the same population group. The interpretation of the interaction effect size for changes in baseline and intervention data were calculated using partial eta squared (η_p^2) (small [0.01], medium [0.06] and large [0.14]) (Cohen, 1988). All statistical analyses were conducted using the Statistical Package for the Social Sciences v. 23, with the alpha level set at *P*<.05. In accordance with the quality checks stated in Chapter 3 (section: 3.5), the statistical assumptions for a two-way ANOVA were adhered to which included: using Levene's test to check for homogeneity of variance between the groups; and ensuring normality of residuals through the use of a QQ Plot (Cohen, Manion and Morrison, 2011; Pardoe, 2012).

7.3.4 Qualitative data collection: individual teacher interviews

Four individual teacher interviews were conducted with teachers in the intervention school (1 male, 3 females) after the intervention, to explore their perceptions and experiences of the intervention. The interview questions were designed around the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) and informed using the quantitative results from the intervention. As in the previous chapter, a semi-structured format was adopted, which allowed the researcher to adapt their questions accordingly and enabled member checking to take place during the interviews (Shenton, 2004). The interview included questions such as 'What is effective teaching in PE?' and 'Did you, or did you not change any elements of your practice?' (Appendix 28). A Dictaphone was used to capture the verbal interactions, and to maintain consistency all interviews were conducted, transcribed and analysed by the lead researcher.

7.3.4.1 Qualitative Data Analysis: Interpretative phenomenological analysis

As with the thesis' studies described in the previous chapters, a systematic and detailed analysis of the interview data was conducted using IPA (Smith, Flowers and Larkin, 2009) (Appendix 28). An IPA approach was adopted in this chapter as it aligned with the epistemological position of exploring teachers' perceptions and experiences of the intervention.

7.3.4.2 Trustworthiness of the qualitative data (quality criteria checks)

The credibility of the interview data was established by adhering to Shenton's (2004) guidance in relation to strategies to enhance the trustworthiness of the data (Chapter 3, section: 3.6). For instance, the interviews took place in a quiet room, free from distraction and away from the head teacher's office. In addition, all participants were reminded that there are no right or wrong answers and they have the right to withdraw at any time. The quality of the interview data was also increased through member checking during the interview process and the

SHARP Principles: Stretching whilst moving; High repetition of motor skills; Accessibility through differentiation; Reducing sitting and standing; and Promoting in class physical activity.



Figure 7.2 'The SHARP Principles Model' to increase active learning time during primary physical education

Table 7.2 The 'SHARP Principles Model' theoretical constructs

Social Ecological Components (McLeroy <i>et al.,</i> 1988)	Behaviour Change Taxonomy (Michie <i>et al.</i> , 2011)	Self Determination Theory (Ryan and Deci, 2000)		
 Intrapersonal Level Increasing teachers' awareness of children's PA levels in PE through the collection of baseline data. Developing teachers' knowledge and skills of PE through a joint planning session; SHARP 	 Barrier Identification/Problem Solving An initial decision to change behaviour from head teacher and PE Co-ordinator. Collection of baseline data provided understanding of the current behaviours in the school. Baseline data collection included: MVPA in primary physical education lessons (SOFIT tool) and teachers' perceptions of teaching physical education (individual interviews). Meeting between the researcher and PE Co-ordinator to discuss 	 Competence Teachers' competence developed through joint planning sessions and the SHARP Principles. PE Co-ordinator's and head teacher's competence developed through baseline data collection. 		
principles where integrated to increase active learning time.	barriers and identify possible ways of overcoming then. Including the implementation of the SHARP Principles.			
Interpersonal Level	Action Planning	Relatedness		
 Ongoing support for teachers from the lead researcher and the school's PE Co-ordinator. Ongoing support for the PE Co- ordinator through regular emails and meetings; action plan and progress were reviewed. Ongoing reference to the SHARP Principles. 	 Creation of detailed action plans with the PE Co-ordinator. Targets were set based on the information collected at baseline including children's MVPA during PE and teachers' and children's perceptions of PE. Action planning included: 'target', 'rationale', 'action', 'timescale' and 'evidence/outcome'. Examples of targets where: 'to increase teachers' subject knowledge, confidence, planning and assessment strategies in primary PE' and 'to increase the percentage of active learning time in primary PE to above 50% MVPA through implementation of the SHARP Principles. 	 Teachers sense of belonging; intervention was supported by the head teacher and PE Co-ordinator which provided an instant support network for the teachers involved. The joint planning meetings assisted in providing social belonging and support from the lead researcher and their supporting year group teacher. 		
Institutional Level	Provide Instruction on How to Perform the Behaviour	Autonomy		
 Ongoing support from the head teacher. Development of a PE and PA policy and action plan with the PE Co-ordinator, integrating SHARP Principles. Creation of a curriculum map, which was used as a starting point. 	 Providing instruction, involved 'telling' the teachers 'how' to perform the behaviour (Michie <i>et al.</i>, 2011). In this instance, joint planning sessions took place with year group teachers and the lead researcher. In the planning sessions there was a focus on the integration of the SHARP principles to increase children's active learning time to above 50% MVPA. 	• Teachers to be in control of their own behaviour. So although instruction was provided in relation to the SHARP principles, they chose the content of the lesson and were actively engaged in the planning stage of the lessons.		

researcher discussed their assumptions with critical colleagues post interview (Norris, 2007). Before the interviews took place, the researcher discussed and bracketed initial ideas of the intervention data, to aid in the trueness of the participants' experiences and ideas.

7.4 Results

7.4.1 Outcome measures (SOFIT)

Large 'time' effects for MVPA (F(3,27)=11.07, p=.003, $n_p^2=.316$), VPA (F(3,27)=8.557, p=.007, $n_p^2=.263$) and skill practice (F(3,27)=14.87, p=.001, $n_p^2=.383$) were evident between the intervention school and the control school. The amount (%) of time children were engaged in MVPA during PE lessons in the intervention school increased to a statistically significant extent between baseline (M=42.51% SD=12.41%) and post-intervention (M= 72.59%, SD=10.05%) (Figure 7.3). Teachers' promotion of PA in the intervention school also increased significantly from baseline to post intervention; whereas for the control school, MVPA remained relatively constant, and VPA and teachers' promotion of PA decreased (Table 7.3). Thus, in relation to the practical significance of the results the 30% point increase in MVPA meets AfPE's (2015) and the IOM's recommendations of >50% MVPA during PE lessons, equating to a mean of 72.59% MVPA.

7.4.2 Process measures: teachers' perceptions of the teaching strategy intervention (interviews)

The qualitative findings revealed two main themes: 1) a paradigm shift; and 2) developing pedagogy, as highlighted in Table 7.4.

A paradigm shift (emergent themes: rethinking their approach to primary PE, raising awareness, and a whole school approach). It was evident from the teacher interviews that the intervention assisted in raising **Table 7.3** Mean percentage of lesson time (%+SD) (and number of minutes+SD) representing children's activity levels, lesson context and teacher promotion of PA in intervention and control school during baseline and post intervention.

	Baseline		Post In	Post Intervention		Interaction	
	Mean percentage of lesson time % (SD)						
	Control School	Intervention	Control School	Intervention School	Р	ղ _տ ²	
SOFIT Category		School				-	
Physical activity							
Lying	0.34 <u>+</u> 0.89	0.86 <u>+</u> 1.08	0.00 <u>+</u> 0.00	1.66 <u>+</u> 2.02	.245	.056	
Sitting	16.62 <u>+</u> 13.86	23.69 <u>+</u> 14.96	6.06 <u>+</u> 7.33	1.69 <u>+</u> 3.75	.182	.073	
Standing	40.68 <u>+</u> 7.09	32.79 <u>+</u> 12.69	48.25 <u>+</u> 7.88	23.60 <u>+</u> 8.51	.025*	.192	
MPA	28.07 <u>+</u> 12.12	30.23 <u>+</u> 12.66	34.83 <u>+</u> 5.09	42.59 <u>+</u> 10.03	.483	.021	
VPA	14.17 <u>+</u> 5.50	12.28 <u>+</u> 12.71	10.49 <u>+</u> 4.36	30.00 <u>+</u> 12.79	.007*	.263	
MVPA ^a	42.23 <u>+</u> 13.58	42.51 <u>+</u> 12.41	45.32 <u>+</u> 4.66	72.60 <u>+</u> 10.05	.003*	.316	
Lesson Context							
Management	18.26 <u>+</u> 5.05	17.90 <u>+</u> 11.53	14.11 <u>+</u> 5.24	16.43 <u>+</u> 5.33	.635	.010	
Knowledge	21.29 <u>+</u> 7.41	17.30 <u>+</u> 8.71	22.30 <u>+</u> 7.89	18.38 <u>+</u> 6.84	.991	.000	
Fitness	10.43 <u>+</u> 5.13	26.36 <u>+</u> 21.66	13.18 <u>+</u> 6.75	10.47 <u>+</u> 7.60	.055	.145	
Skills	17.49 <u>+</u> 14.18	6.84 <u>+</u> 8.69	9.25 <u>+</u> 5.45	29.78 <u>+</u> 12.30	.001*	.383	
Games	32.48 <u>+</u> 24.76	23.84 <u>+</u> 19.61	40.88 <u>+</u> 13.29	23.23 <u>+</u> 15.87	.534	.016	
Other	0.00 <u>+</u> 0.00	7.66 <u>+</u> 10.04	0.63 <u>+</u> 1.17	1.88 <u>+</u> 4.69	.142	.088	
Teacher promotion of							
PA							
In class promotion	21.36 <u>+</u> 13.08	18.72 <u>+</u> 14.28	6.89 <u>+</u> 3.91	42.29 <u>+</u> 13.89	.000*	.420	
Out of class promotion	0.00 <u>+</u> 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00			
No promotion	78.47 <u>+</u> 13.09	81.28 <u>+</u> 14.28	92.86 <u>+</u> 3.42	57.60 <u>+</u> 13.84	.000*	.422	



Figure 7.3 Mean percentage of time children engaged in MVPA at baseline and post intervention for both intervention and control schools

Table 7.4 Teachers' perceptions and experiences of the SHARP Principles Model intervention

1 st Order Themes	2 nd Order Themes
Paradigm Shift	-Rethinking their approach to primary PE (Intrapersonal)
	-Raising awareness (Intrapersonal and institutional)
	-A whole school approach (Interpersonal and institutional)
Developing Pedagogy	-Planning is the foundation (Intrapersonal)
	-Being Comfortable in Chaos (Intrapersonal)
	-PA as the main aim of primary PE (Intrapersonal and Institutional)

teacher's awareness of children's PA levels in PE lessons and also developed the status of PE as a subject area in the school. For instance: 'Well it has definitely got a higher status than it did before, I don't remember there being a focus on PE'. The teacher's also expressed how the intervention had changed their thinking and approach towards primary PE with regards to active learning time and their organisation within the lesson, 'it taught me to rethink how I'm teaching those skills and to ensure that the activity levels are much higher than they were, I'd say much, much higher than they were before'. The teacher's also conveyed the importance of a whole school approach (relatedness) with regards to increasing children's PA levels in PE 'If it's not a shared kind of ethos and ideas then it's not going to work, everyone needs to be on board'.

Developing pedagogy (emergent themes: planning is the foundation, being comfortable in chaos, and PA as the main aim of primary PE). All of the teachers stated that planning was a key element to changing their practice and increasing children's PA levels. For example one teacher highlighted the importance of having structure in their approach to planning 'I think definitely having some structure in planning has 100% improved it'. The teachers also voiced that for them PA was a main priority in PE and that they constantly reflected upon children's active learning time throughout a lesson. For example 'I've changed all the lessons that I teach and how I teach them to be honest with you, as a result of the work that we have done...the activity now comes at the forefront of my mind when I'm planning and when I'm teaching, so I am always thinking what are the children doing, are they moving are they active, how could this be more active'. In addition, teachers reflected upon their organisation within lessons and how it increased children's activity levels, for instance, 'from the outset I try and get their heart rate going and not to reduce that' and 'for swimming, whereas before you might have them all on the side, watching how to do something, now you get

them all to do it, three times, instead of just the once, so that they are all moving all of the time'.

7.5 Discussion

The main aim of Study 4 was to implement and evaluate the effectiveness of a one year teaching strategy intervention, targeting both specialist and non-specialist teachers to increase children's MVPA during primary PE. Both the quantitative and qualitative results indicated that the intervention was effective, as the mean %MVPA of children in the intervention indicated a 30% absolute increase in %MVPA, meeting the MVPA guidelines (IOM, 2013; AfPE, 2015) and producing a mean MVPA of 72.6% of lesson time. The quantitative results indicated large effect sizes, and produced a greater percentage point increase in %MVPA (30%) than previous intervention studies that had a teaching strategy focus, such as CATCH (12% MVPA increase) (McKenzie *et al.*, 2001) and M-SPAN (18% MVPA increase) (McKenzie *et al.*, 2010). Furthermore, the results of the SHARP teaching strategy when placed in comparison with Lonsdale et al.'s (2013) systematic review is double that of any teaching strategy intervention study included in the review (Figure 7.4). However, this large percentage point increase in MVPA must be considered alongside the methodological quality of the SHARP teaching strategy intervention and the study's risk of bias. As Lonsdale et al. (2013) concluded from their systematic review that although evidence does suggest that interventions can increase children's %MVPA during PE, higher guality intervention studies are needed to establish the most effective and sustainable intervention strategies. Thus, the methodological quality of the SHARP teaching strategy and its risk of bias have been assessed using the inclusion criteria and risk of bias criteria included in Lonsdale et al.'s (2013) systematic review.



SHARP teaching strategy = 30% absolute difference in

Figure 7.4 A comparison of the SHARP teaching strategy' results against other published studies' results included in Lonsdale *et al.*'s (2013) systematic review.

In relation to the inclusion criteria, the SHARP teaching strategy intervention would have been included based on the following criteria identified in Lonsdale *et al.*'s (2013) review: the study sample is from primary PE classes, the intervention is a deliberate attempt to increase MVPA during PE lessons, the study is a quasi-experimental design, the measure used provides a % of time from the PE lesson that children are engaged in MVPA. Furthermore, when considering the risk of bias the SHARP teaching strategy intervention has been scored against the criteria also

Risk of bias criteria (Lonsdale <i>et al.</i> , 2013)	Risk of blas score
	1=positive
	0=negative
Where groups comparable at baseline on key characteristics (positive if baseline characteristics were	1
presented for the proportion of MVPA during PE class,	
plus one other demographic detail such as age or gender)?	
Where baseline values accounted for in the analysis?	1
Where randomization procedure adequately described	0
and carried out (e.g. random number generating algorithm)?	
Did the authors report a power calculation, and was the	0
study adequately powered to detect MVPA changes during PE lessons?	
Did the study include measures of MVPA known to	1
produce reliable and valid scores (positive if reliability and	
validity evidence was reported or referred to in the	
article)?	
Where participant dropout rates described, and not more	0
than 20% for studies with follow-up of six months or	
shorter, and 30% for studies with follow up of more than	
six months?	
was the timing of measures comparable between	T
Merce automa and control conditions?	0
volere outcome assessments binded (positive if those responsible for accessing MVDA blinded to allocation)?	U
responsible for assessing MVPA blinded to allocation)?	

Table 7.5 Risk of bias score for the SHARP teaching strategy intervention

Risk of bias score: 0-2 high risk, 3-5 moderate risk, 6-8 low risk.

provided in Lonsdale *et al.*'s (2013) review as indicated in Table 7.5. Using this risk of bias criteria the SHARP teaching strategy intervention has a moderate risk of bias (Table 7.5) with a score of 4. The aspects of the SHARP study that reduced the risk of bias included: having comparable groups at baseline in terms of school size, demographics, age and gender; accounting for baseline values in the

analysis; using the measure of SOFIT as it is a reliable and valid tool; reporting the intra and inter observer reliability scores which were taken at baseline and prior to post intervention data collection along with an infield inter observer reliability check; and the timings of measures were comparable between control and intervention groups.

Aspects of the SHARP intervention study that increased the risk of bias included: not blinding the outcome assessments i.e. observers knew if they were observing a control or an intervention class; no follow up data was collected to assess the sustainability of the increase in %MVPA; omission of a power calculation to detect whether the sample size was adequate to detect MVPA changes during PE lessons; and non-randomization of the control and intervention groups. Thus, in judging the impact of the SHARP intervention it is important to note that although there is a large percentage point increase in children's MVPA during PE lessons (30%), there is a moderate risk of bias according to Lonsdale *et al.*'s (2013) criteria. However, when compared to the published intervention studies reported in Lonsdale et al.'s (2013) review, 5 studies were rated as having a high risk of bias, 8 studies had a moderate risk and only one study had a low risk of bias. The only comparable study in relation to similar increases in %MVPA was Ignico, Corson and Vidoni's (2006) intervention study which was a fitness based intervention and was the only study with a high risk of bias (Lonsdale et al., 2013). Therefore, the results of the SHARP teaching strategy intervention should be acknowledged as an effective teaching strategy intervention to increase children's %MVPA during PE lessons when compared against published studies with a similar risks of bias score (i.e. a moderate risk of bias), as the SHARP intervention's % point increase in MVPA was double that of any other study in Lonsdale *et al.*'s (2013) review. For that reason it is important to consider the theoretical components of the intervention which may have positively impacted upon changes in children's %MVPA.

The qualitative data provides further insights to assist in evaluating the effectiveness of the intervention, which highlighted a paradigm shift (Kuhn, 1962) with regards to the teachers' approaches to PE and also the advancement of their pedagogical development in terms of increasing active learning time. This paradigm shift in the teachers' thinking resulted in them changing their pedagogical behaviours during PE lessons. For instance, they now considered one of the main aims of PE to be a focus on increasing the about of time children are active and practicing their physical skills. Thus, teachers during lessons adapted their pedagogy to meet their new focus and the SHARP principles were applied to assist them with this. In order to create this paradigm shift and change their behaviour, the teaching strategy intervention used the unique combination of the SDT (Ryan and Deci, 2000), aspects of the Ecological Model for Health Promotion (McLeroy et al., 1988), the BCT (Michie et al., 2011), and the introduction of the SHARP Principles. Thus, teachers were provided with a new platform that raised awareness, provided a clear focus and re-directed their approach to teaching primary PE. It was evident from the qualitative data that teachers began to think about primary PE in a very different way, in short their approach to PE at baseline did not align with their new awareness of increasing active learning time at post intervention. Therefore, the application of the SHARP Principles could be seen as the first step towards improving pedagogical practice in PE when used with a curriculum focused school programme, thus having the potential to improve the quality of PE in primary schools in England. By placing PE within a public health context in the intervention school through the integration of PA in school policy and practice, this assisted in raising the status of PE as a subject area; which has been declining in importance since the 1970s (Puhse and Gerber, 2005). The evaluation of the intervention (qualitative data) highlighted that it is possible for primary teachers to think about PE in a very different way and thus change their pedagogical behaviour, offering considerable potential for major advances in the subject area through the re-direction of an entire field of practice. The consideration of a paradigm shift is based on a phenomenon that there is an abandonment of current ideas and the adoption of a new way of thinking (Kuhn, 1962), which in study 4 of the thesis resulted in the teachers changing their behaviour. Therefore, it is proposed that the SHARP Principles Model has the potential to shift current thinking and change pedagogical behaviour in primary PE towards a focus on increasing children's active learning time.

The SHARP Principles provided the teachers with key elements to focus on in both the planning stage and the delivery of their PE lessons. It could be considered that the intervention was effective as it was underpinned by generally accepted pedagogic practice, for example, effective lesson planning of lesson time to maximise upon learning (children would not queue in an English lesson to complete their work and lessons would be differentiated). One important factor was the introduction of dynamic stretches which the intervention teachers integrated into the warm up elements of their lessons. As advocated in previous research studies dynamic stretching can be more beneficial than traditional static stretching routines (Duncan and Woodfield, 2006; Bukowsky et al., 2014). Another important factor was the high repetition of motor skills which provided children with increased active learning time. The teachers in the intervention school became conscious of queues and children waiting for their turn, as a priority of the intervention was to increase the opportunities children had to practise their skills during PE lessons, as discussed by one of the teachers: We are always trying to teach skills but now it's teaching those skills in an active way'. The SHARP principles are unique as they can be applied to any activity area in PE such as swimming, dance and games activities; and they can be integrated into both traditional and teaching games for understanding teaching styles, which differs to

other teaching strategy interventions that are based on specific teaching styles such as game centred approaches (Miller *et al.*, 2015). Additionally, they can be applied by both specialists and non-specialist teachers. Developing an approach to teaching primary PE which increases children's active learning time, suggests that primary PE can make a valuable contribution towards minimum PA guidelines of 60 minutes MVPA (DH, 2011), on days when PE is timetabled. Both the quantitative and qualitative findings indicate that the SHARP Principles Model has been an effective intervention to increase active learning time in the intervention school's primary PE lessons, thus future interventions to test its effectiveness across different school contexts is recommended.

7.5.3 Strengths and limitations

One of the main advantages of the evaluation process was the mixed method approach to evaluate the effectiveness of the intervention, which increased the quality of the data through method triangulation. In addition, the intervention was grounded in theory (Deci and Ryan, 2000; McLeroy *et al.*, 1988) and elements of the BCT (Michie *et al.*, 2011), with the method of direct observation allowing the researchers to collect quantitative data but also reflect in the PE environment, providing contextually rich data (McKenzie, 2010). Given the importance of the teacher's role in PE interventions, the credibility of the design and evaluation of the intervention was increased by the researcher's understanding of a school setting, having experience teaching in primary schools and developing primary PE pedagogy modules in ITT.

However, limitations of this study include the small sample size of one control school and one intervention school, along with the non-randomised design. This therefore limits the generalisability of the findings to other school contexts. The design was also limited to one method for the assessment of children's MVPA during PE; a future recommendation would be to use accelerometers alongside the

SOFIT tool, as some may question an element of bias with an observational method to assess children's MVPA. However, the inter-observation reliability scores of >80% were set prior to any data collection for pre and post intervention data. Nonetheless, a possible method to reduce any observer bias would be for blind observations to take place e.g. observers would not know whether the lesson was at a control/intervention school; although, this may prove difficult due to the labour intensive nature of systematic observation. Furthermore follow-up data collection points were not taken therefore; the sustainability of the intervention cannot be inferred. Another limitation of study 4 would be the non-measurement of children's total school day PA, as it has been suggested that children will compensate for high amounts for PA participating by lowering EE at a later time (Gutin and Owens, 1999). With these limitations in mind, it is suggested that further research using the SHARP Principles Model is implemented on a wider scale taking into consideration the use of accelerometers and measuring children's total day PA.

7.6 Conclusion

Findings from this research highlight the importance of a mixed method approach and its contribution to understanding the effectiveness of school-based PA interventions. The intervention itself produced significant increases in children's MVPA during PE (Table 7.3) through re-directing teachers' approaches and thinking towards primary PE as a subject (Table 7.4). As a result, the SHARP Principles assisted both specialist and non-specialist teachers in utilising their role to effectively increase children's active learning time in PE. Recommendations based on this evaluation would be for the SHARP Principles Model to be replicated across a variety of contexts; and evaluated using both quantitative and qualitative measures.

Chapter 8 Discussion and Conclusion
Chapter 8 – Discussion and Conclusion

This chapter aims to bring together the research findings from the four studies in the thesis. Following a summary of the thesis and contribution to knowledge, the theoretical application will be discussed. Next, the implications of findings for both researchers and practitioners will be outlined before a discussion of recommendations for practice in relation to optimizing children's PA in the primary school break time and PE environments. Finally, conclusions of the thesis are presented.

8.1 Summary of Research Findings, Strengths and Contribution to Knowledge

The importance of the thesis' topic was situated in the notion that physical inactivity is the fourth leading risk factor for mortality worldwide (Kohl et al., 2012), and for children there are multiple health benefits of regular PA with doseresponse relationships being observed (Janssen and Blanc, 2010). In England, it has been reported that only 21% of boys and 16% of girls are meeting the recommended PA guidelines of at least 60 minutes and up to several hours of MVPA every day. Public Health England (2014a) advised that PA needs to be integrated into daily life for communities across England and that the school environment is a key setting which can assist in developing effective PA interventions for children. In this key setting of the primary school environment, PE lessons and school break times have been identified as two prime opportunities in which children's PA can be promoted (Sarkin, McKenzie and Sallis, 1997; Brusseau et al., 2011). Although these two areas have been well researched over the past 20 years, the intervention work within these is still considered a relatively new area of research (Erwin et al., 2013; Lonsdale et al., 2013). Hence, the research in this thesis sought to discover and recommend effective school-based interventions to increase children's PA in the key components of primary school break times and PE lessons, with the overall intention of creating an intervention framework that could be applied to primary school-based PA interventions. Thus, the main aim of this thesis was: to design, implement and evaluate primary school-based interventions to increase children's MVPA during break times and PE lessons.

To achieve this main aim a series of interconnected studies were conducted. In order to design effective interventions for both break times and PE lessons, it was considered essential to employ exploratory studies with the purpose of gaining a thorough understanding of those specific areas of the primary school setting. Gaining an insight into these areas helped to identify any variables that could be modified through the intervention work to target and increase children's PA levels. Chapter 4 (Study 1) provided an exploration of the primary school break time environment which was then used to inform the design of the break time PA intervention in Chapter 5 (Study 2). Following this, Chapter 6 (Study 3) provided an exploration of children's PA levels during primary school PE lessons; this information was then used to create a primary PE intervention to increase children's MVPA which was outlined in Chapter 7 (Study 4). Therefore, the boundaries for the research were set to these two specific areas of the school day, which enabled the intervention work to target all children.

The thesis was situated in the ontological stance of 'the practical effect of ideas', which was grounded in the notion that an extremist view on the nature of reality would not have been productive or realistic when conducting children's schoolbased PA research. Consequently, both quantitative and qualitative approaches to data collection were used, as the overall view in the thesis was to solve problems and change practice (Rorty, 1983). The philosophical stance of pragmatism provided a workable solution to the intervention work, creating the opportunity to gain both breadth and depth in answering the research questions. Working in the belief that both quantitative and qualitative data can prove valuable in understanding children's school-based PA behaviour, the participants became collaborative partners rather than independent entities. The multiphase mixed method design of this thesis created a platform from which to embrace a pluralistic approach, which is still considered a relatively new area in PA research (Thomas, Nelson and Silverman, 2015). To combine the four studies and to assist in gaining an understanding of the multiple layers of influence in a primary school setting, the theoretical lens of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) was applied as a framework. This ecological framework was also used in the design of the interventions (Study 2 and Study 4) and has been suggested for use in the recommended framework for school-based PA interventions produced from this thesis.

8.1.1 Summary of research findings: Chapter 4 (Study 1)

The primary research objective of Study 1 was: to assess children's social behaviours and identify any modifiable variables. In order to achieve this, the following secondary research objectives were employed:

- to assess children's PA levels, social group size, activity type and social interactions during outdoor break times; and
- to explore children's perceptions and experiences of their playground environment during outdoor break times.

These research objectives were addressed through a mixed method research design via the employment of quantitative and qualitative data, which provided a multi-layered perspective of children's PA behaviours during outdoor break times. The findings from Study 1 added to the existing literature by providing knowledge of children's social behaviours during primary school break times; a gap which both Ridgers *et al.* (2012) and Parrish *et al.* (2013) suggested to be addressed. Thus, the findings from Study 1 added to the existing knowledge through revealing

potentially modifiable social variables that could be targeted to increase children's break time PA behaviour.

In relation to the intrapersonal environment of break times, the findings from Study 1 were similar to previous research studies (Renold, 1997; Knowles *et al.*, 2013) which identified differences in boys' and girls' break time PA behaviours. The results suggested that boys enjoyed playing sports in large groups, whilst girls enjoyed talking with their friends in small groups. The intrapersonal layer however, also revealed an imaginary world at break times, wherein both boys and girls would engage in imaginative role play, and linked to Mouristen's (1998) theoretical work on children's play culture, illuminating children's sporadic and locomotive PA behaviours. These findings highlight further the strength of the methodology in Study 1 through the application of a mixed method design by the employment of both the SOCARP tool and the children's group interviews. Without the group interviews, the additional insights into the children's break time world would not have been possible. Study 1 provided several predictors of children's break time PA behaviour, which were then used to inform the design of the intervention in Study 2.

8.1.2 Summary of research findings: Chapter 5 (Study 2)

The primary research objective of Study 2 was: to implement and evaluate the effectiveness of an outdoor primary school break time intervention to increase children's MVPA. To achieve this primary objective, the quantitative methods of pedometers and systematic observation were employed, along with an individual interview with the PE Co-ordinator to evaluate the implementation of the intervention. Thus, the secondary research objectives of Study 2 were:

 to assess children's step count during morning break times at baseline, post-intervention and follow-up data collection points; and

- to assess children's PA levels, group size, activity type and social interactions during morning break times at baseline, post-intervention and follow-up data collection points;
- to assess children's weight status through the collection of BMI data (to enter into the pedometers for accurate data collection); and
- to evaluate the effectiveness of the implementation of the walking track through exploring the PE Co-ordinator's perceptions and experiences.

One of the main strengths and novelty of Study 2 was the design of an intervention that took into consideration the identified differences in boys' and girls' break time PA behaviour. Hence, the 'Walking Track Intervention Model' was created from using the knowledge of girls perceiving break times as an opportunity to socialise with their friends. The aim was to encourage girls to 'walk and talk' during break times rather than sit or stand and talk in small groups. In addition, it was intended that this would create more space for the boys to continue to play sports in large groups. Creating a break time intervention that targeted boys' and girls' break time PA behaviours separately is an original aspect of this thesis, and something previously identified as being important (Ridgers *et al.*, 2012; Parrish *et* al., 2013). Furthermore, the break time 'Walking Track Intervention Model' was novel due to its theoretical foundations in aspects of the Ecological Model for Health Promotion (McLeroy et al., 1988), SDT (Ryan and Deci, 2000) and key ingredients from the BCT (Michie et al., 2011), which will be discussed further in section 8.2. Moreover, the use of both pedometers and the SOCARP tool is an additional strength of Study 2, along with the qualitative insights from the evaluation interview. As recommended by Erwin et al. (2014) who suggested that break time intervention studies should use more than one measure of children's PA levels to allow a thorough evaluation of the effect of the intervention on children's PA levels.

The results from the playground intervention in Chapter 5 (Study 2) suggests that the implementation of the 'Walking Track Intervention Model' had positive short term effects on both boys' and girls' PA levels. However, this increase was not maintained at follow-up data collection point (6-9 weeks) in relation to children's MVPA, although it did have a positive longer term effect on boys' VPA. Along with the majority of studies in Parrish *et al.*'s (2013) systematic review, the walking track intervention study had a moderate risk of bias in relation to methodological quality. Therefore, the results of the walking track intervention could be acknowledged as an effective intervention to increase boys' VPA when compared against published studies with similar risks of bias scores (i.e. moderate risk). However, it must also be taken into consideration that the pedometer results did not reflect this increase as the 6-9 week follow data returned to a similar step count to the baseline data.

To the author's knowledge, few studies have evaluated the impact of integrating a walking track during break times on children's PA levels. Thus, the results from Chapter 5 make a further contribution to knowledge. The findings highlight that although the walking track was designed to encourage girls to 'walk and talk' at break times, the track had a positive effect on boys' VPA levels. The results also highlighted that boys' engagement in sports activities during break times declined from 41.67% at baseline to 0% at both post-intervention and follow-up. This implies that the boys were distracted from their usual sporting activities and exchanged this to race around the track as superheroes, as highlighted in the interview data. This reflects the notion of boys and their playground dominance in relation to space (Knowles *et al.*, 2013), and the results of Study 2 suggests that boys' domination of the walking track may have negatively impacted upon the girls' use of the walking track. In addition, the inconsistency in the implementation

of the track from school staff is a limitation of the study outlined in Chapter 5. From the interview data, this included the instalment of benches around the track and the use of chalk as a resource which encouraged girls to sit and talk or sit and draw on the playground, and ran counter to the original intention of the walking track (i.e., to promote PA amongst girls by increasing walking and talking). Furthermore, the school implemented the 'walk/run a mile a day' during timetabled lessons, however, the researcher was not made aware of this until postintervention data collection was taking place. Thus, it is considered that this could have had a negative impact upon the children's break time PA behaviour. As highlighted by Gutin and Owens (1999), children will compensate for high amounts of PA participation by lowing EE at a later time. These inconsistencies were similar to the findings of Parrish et al. (2016) and are something that needs to be taken into consideration in the design of school-based PA interventions. Thus, a further contribution of knowledge from Chapter 5 (Study 2) is the recommendation for a set of 'how to' principles to be provided alongside school-based interventions, which aligns with the BCT (Michie et al., 2011) key ingredient of providing instruction. In order to ensure a consistent and focused approach amongst staff in the implementation of future interventions. Hence, this knowledge was taken into consideration in the exploratory research of children's PA levels in primary PE lessons in Chapter 6 (Study 3), and in the design of the PE intervention in Chapter 7 (Study 4). This integration of a set of 'how to' principles would contribute to the UK Government's (2015) policy on 'What works in schools and colleges to increase physical activity?'. For instance, under their principles of 'deliver multiple component interventions' and 'ensure a skilled workforce', the integration of a set of 'how to' principles would assist schools in their successful implementation.

8.1.3 Summary of research findings: Chapter 6 (Study 3)

The primary research objective of Chapter 6 (Study 3) was: to assess children's PA during primary PE lessons and to determine the related physical and social determinants; in order to design an intervention to increase children's MVPA during primary PE lessons. To achieve this primary research objective a mixed method design was employed and included the use of the SOFIT tool to assess children's PA levels, and the qualitative methods of children's group interviews and teacher individual interviews. Thus, the secondary research objectives were:

- to assess children's PA levels, lesson context and teacher promotion of PA during primary school PE lessons; and
- to explore teachers' and children's perceptions and experiences of PA during primary PE lessons.

One of the main strengths from Chapter 6 was the employment of a mixed method design that allowed for the measurement of children's PA levels during PE lessons, but also provided insights into teachers' and children's perceptions of PA in PE. From the employment of the quantitative method of the SOFIT tool, data revealed that children were engaging in a mean of 42% MVPA during primary PE lessons, which is below the recommended >50% (IOM, 2013; AfPE, 2015). The reported figures are similar to a recent systematic review of children's MVPA during primary PE in England (Hollis *et al.*, 2016), which reported a mean MVPA of 44.8%. No sex differences were found during primary PE lessons, which provides further support for the notion that PE is one area of the school day in which both boys and girls can accumulate similar levels of MVPA (Sarkin, McKenzie and Sallis, 1997; Fairclough and Stratton, 2006; Brusseau *et al.*, 2011). A positive correlation was found between the lesson context of 'knowledge' (e.g. demonstration time and teacher transfer of knowledge) and the amount of time children spent 'sitting',

additionally the lesson contexts of 'knowledge' and 'other' (e.g. children asked to demonstrate their work) were also negative predictors of children's MPA.

The gualitative methods employed in Chapter 6 enabled the researcher to identify the facilitators of and barriers to children's MVPA during primary PE lessons. From the qualitative results, two main themes emerged: 'Putting the 'physical' back in PE' and 'Further professional development for teachers in primary PE'. Within these two main themes, children and teachers identified a number of barriers to children engaging in high levels of PA in primary PE lessons. These included: the negative impact of teacher talk and demonstration time, children gueuing, children being asked to sit out for behavioural reasons, PE not being a priority subject area, and teachers' low confidence and subject knowledge. What the study also adds to our knowledge gap, is an insight into the facilitators of children engaging in high levels of PA in primary PE lessons which comprised of: support networks for teachers, support from the head teacher, staff autonomy, staff training, knowledge of pedagogical strategies to increase active learning time, and teacher promotion of PA during the lesson. The identification of these barriers and facilitators assisted in the development of a set of 'how to' principles for the design of the PE intervention. The design of these principles was informed by the break time intervention study (Chapter 5), with the aim of instilling a consistent approach across school staff in the implementation of the intervention. The knowledge gained from Chapter 6 (Study 3) was then used to inform the design of the PE intervention in Chapter 7 (Study 4).

8.1.4 Summary of research findings: Chapter 7 (Study 4)

The primary research objective of Chapter 7 (Study 4) was: to design, implement and evaluate the effectiveness of a one-year teaching strategy intervention, targeting both specialist and non-specialist teachers, to increase children's MVPA during primary school PE. Study 4 also drew upon a mixed method design in order to evaluate any changes in children's MVPA during PE lessons using the SOFIT tool, and also teacher interviews were used to evaluate the teachers' perceptions and experiences of the intervention. Therefore, the following secondary research objectives were employed:

- to assess children's PA levels, lesson context and teacher promotion of PA at baseline and post intervention; and
- to evaluate the effectiveness of the PE intervention through exploring teachers' perceptions and experiences of the intervention.

The originality of this study and further contribution to knowledge was the design of a teaching strategy intervention that was delivered by both specialists and nonspecialists teachers of primary PE. Furthermore, the majority of primary PE interventions to increase children's MVPA have been conducted in the US (Lonsdale *et al.*, 2013) and to the researcher's knowledge there have been no PE interventions that have focused on teaching strategies that can be implemented by both specialist and non-specialist teachers of PE. Teaching strategy interventions are important as they align with the mandatory national curriculum for primary PE in England (DfE, 2013a) and will assist in developing children's motor skills, which could help in providing them with the necessary physical skills to engage in physical activities outside of PE lessons. As highlighted by Sallis *et al.* (2012), PE is often the venue in which children's PA can be promoted.

The results from Chapter 7 provided evidence that the 'SHARP Principles Intervention Model' was effective in increasing children's MVPA during PE lessons. A percentage point increase of 30% MVPA produced a mean of 72.6% MVPA during lesson time, and a greater percentage point increase in MVPA (>10%) than those previously reported for teaching focused interventions (McKenzie *et al.*,

2001; McKenzie *et al.*, 2010). Furthermore, the 'SHARP Principles Model' produced a greater percentage point increase (30%) than the average increase (10.4%) in MVPA reported in a recent systematic review of teaching strategy interventions (Lonsdale *et al.*, 2013). The SHARP teaching strategy intervention has been assessed as having a moderate risk of bias according to Lonsdale *et al.*'s (2013) criteria which is comparable with the majority of the studies reported in Lonsdale *et al.*'s (2013) review. The only comparable study in relation to increases in %MVPA was a fitness based intervention (Ignico, Corson and Vidoni, 2006) however, this was assessed as having a high risk of bias (Lonsdale *et al.*, 2013). Therefore, the results of the SHARP teaching strategy intervention should be acknowledged as an effective teaching strategy intervention to increase children's %MVPA during PE lessons when compared against published studies with a similar risks of bias score (i.e. a moderate risk of bias), as the SHARP intervention's increase in % point MVPA was double that of other published studies in Lonsdale *et al.*'s (2013) systematic review.

Taking into account the results of the SHARP intervention (i.e. almost double the % point increase in MVPA than other similar published studies); the implementation of the SHARP Principles Model could add to the UK Government's documents of 'What works in schools and colleges to increase physical activity?' (Gov, 2015). For example, within principle 6 'Embed in curriculum, teaching and learning', it encourages schools to increase the amount of time being active during PE and other lessons, stating that it can improve both physical development and educational outcomes (Gov, 2015). However, no practical advice in the document is provided on how this can be achieved. Thus, the addition of the SHARP Principle Model would provide not only a set of 'how to principles' for teachers to follow in their planning and delivery stages of their lessons, but it would also provide a theoretical framework to guide the school towards an effective and sustainable

intervention. As advocated by NICE (2015) in their guidelines on behaviour change, inclusion of an ecological framework, behaviour change taxonomies and motivational theory can prove effective in changing behaviour. All of these components are within the SHARP Principles Model and have objective results to support their impact on increasing children's PA during primary PE lessons.

The contribution to knowledge from Chapter 7 is the evidence of an effective teaching strategy intervention which increased children's MVPA in PE lessons by a 30% point increase. The need for interventions to increase MVPA in PE lessons was only recently reinforced in a systematic review and meta-analysis of MVPA in primary PE lessons in England (Hollis *et al.*, 2016), highlighting further the importance of the findings from Chapter 7.

The success of the intervention could be attributed to the combination of the SDT (Ryan and Deci, 2000), aspects of the Ecological Model for Health Promotion (McLeroy, 1988), and three key ingredients from the BCT (Michie *et al.*, 2011). However, the main difference between the break time intervention study in Chapter 5, and the PE intervention study in Chapter 7, was the introduction of a set of 'how to' principles which were termed the SHARP Principles, and aligned with the BCT ingredient of 'Providing Instruction'. The principles provided the teachers with a focus during their planning and teaching of PE lessons. An additional contribution of Chapter 7 to existing PE intervention research, was the application of the mixed method design through the employment of the individual teacher interviews. The interviews explored the teachers' perceptions and experiences of the intervention, the results of which enabled the researcher to evaluate the efficacy of the intervention. A further novel aspect and strength of the intervention was the application of the SHARP Principles to any aspect of the primary PE curriculum (DfE, 2013a). Moreover, they can be applied by both

specialist and non-specialist teachers of primary PE. To the researcher's knowledge no other PE interventions to increase children's MVPA have integrated all the above components.

8.2 Summary of Theoretical Application

The primary school-based interventions to increase children's PA during school break times and PE lessons applied in this thesis drew upon similar theoretical components and were based on guidance from NICE (2015) in relation to creating behaviour change. However, the PE intervention produced a greater effect on children's MVPA. This section will critically evaluate the application of these theoretical constructs in both interventions, with the intention of creating and recommending a theoretical framework that can be applied to future primary school-based interventions. As the whole thesis is grounded in the Ecological Model for Health Promotion (McLeroy *et al.*, 1988), the critical evaluation of the use of theory in the school-based interventions will be structured according to layers in this ecological model: intrapersonal, interpersonal, institutional and community.

8.2.1 Intrapersonal influence

The intrapersonal layer relates to the knowledge, attitudes, behaviour, self-concept and skills of the individual (McLeroy *et al.*, 1988). In the break time intervention, the intrapersonal layer of the model (Figure 5.3) involved targeting the different interests of boys and girls which had been identified in Chapter 4; whereas, in the PE intervention model (Figure 7.2), the intrapersonal layer involved developing teachers' confidence and competence in their planning and delivery of primary PE lessons. Other theoretical components that linked with this aspect of the intrapersonal layer included the psychological needs of 'competence' and 'autonomy' from the SDT (Ryan and Deci, 2000). However, in each intervention model (Figure 5.3; Figure 7.2), competence was targeted through two different approaches. In the break time intervention, the research aimed to develop the competence of the PE Co-ordinator through discussions of the baseline data results and possible strategies for intervention to increase children's break time PA levels. Despite these conversations taking place, no instructions were given to the school to implement any one specific intervention. The reason for this was due to financial implications, as the school was funding the break time intervention. In addition, according to the SDT (Ryan and Deci, 2000), for the school to be motivated in behaviour change then they needed to have an element of autonomy.

Initial discussions regarding a break time intervention took place in March 2014, two years later, the walking track was installed. The delay in the instalment of the walking track was due to both the school deciding upon their choice of intervention and following this the financial implications. Although, the school had autonomy in their decisions, the role of the researcher was on an advisory level rather than directly being involved. For instance, conversations would take place between the researcher and the PE Co-ordinator who would then relay those conversations to the head teacher and school staff. The researcher advised the school to implement imaginary play stimuli as a result of the findings from the children's interviews in Study 1, along with a walking route. However, the school chose to just focus on the walking route. These practical insights and reflections gained from the process of planning the break time intervention informed the planning of the PE intervention. Thus, in order to have some control over the implementation of the PE intervention, a set of 'how to' principles were devised. This was easier to do with the PE intervention as there were no financial implications for the school, instead, the researcher was providing input in terms of 'researcher time' through working with individual teachers during planning meetings. Hence, in the PE intervention individual teachers were targeted at the intrapersonal level through developing their confidence in joint planning sessions in which the SHARP Principles were discussed and integrated into the teacher's existing lesson plans.

This still provided the teachers with an element of autonomy through them being in control of their own planning, however the SHARP Principles provided a focus during the planning and teaching of the lessons. Therefore, it is important to address the needs at the intrapersonal layer, whilst also providing autonomy for the participants and integrating the 'how to' principles.

8.2.2 Interpersonal influence

The interpersonal layer of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) encompasses the formal and informal social networks and social systems which include the working relationships and friendship networks. In the break time intervention model, targeting the interpersonal component included discussions during staff meetings of the children's use of the track. In relation to the PE intervention, the interpersonal element involved the researcher providing ongoing support for both the individual teachers and the PE Co-ordinator. As a result, the main difference between the two models in terms of targeting the interpersonal layer was the involvement of the researcher. In the break time intervention, support was provided to the PE Co-ordinator and not the individual teachers, whereas in the PE intervention support was provided by the researcher to both the PE Co-ordinator and the individual teachers.

Other theoretical components that aligned to the interpersonal layer included relatedness from the SDT (Ryan and Deci, 2000) and the key ingredient of 'action planning' from the BCT (Michie *et al.*, 2011). In both intervention models 'action planning' took place with the PE Co-ordinator as the key lead in each intervention. One limitation of this in the break time intervention was that other staff were also leading on this, as the school had an outdoor area committee who the PE Co-ordinator needed to consult with regarding the break time intervention ideas. Whilst in relation to the subject of PE and the PE intervention, the PE Co-ordinator was the only lead.

According to Ryan *et al.* (2009) the need for relatedness, fulfils an individual's basic need of belonging and connection with those around them. If individual needs are threatened then individuals are less likely to maintain behaviour change. In both interventions relatedness amongst the school staff was sought through initially having the support of the head teacher; a key component that has been highlighted in previous PA research (Christian *et al.*, 2015). Other aspects of relatedness included: encouraging a supportive network within the school so that teachers could draw upon the support from the head teacher, PE Co-ordinator and each other. In the PE intervention support was also available from the researcher. Therefore, in the consideration of a primary school-based PA intervention framework, developing social support networks is an essential component; which was also highlighted as a facilitator to increasing children's PA levels in PE and developing teachers' confidence to teach PE.

8.2.3 Institutional influence

The institutional layer of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) relates to the formal and informal rules and regulations within an institution along with organisational characteristics. This includes the physical environment in an institution or setting. Both the break time and PE interventions targeted the institutional layer. However, there were differences between the two interventions. The break time intervention involved the physical change of the walking track, whereas the PE intervention involved changing the PE and PA policy, the integration of the SHARP Principles and the creation of a PE curriculum map. These aspects also linked to the BCT ingredients of 'barrier identification/problem solving' and 'action planning'. The findings from the break time intervention study highlighted the inconsistencies amongst school staff in the implementation of the intervention, even though the school had discussed the use of the walking track during staff meetings. This was a limitation of the break time intervention, as it

appeared there was a lack of understanding amongst school staff in terms of the use and purpose of the track; whereas, the PE intervention was grounded in policy change along with the BCT ingredient of 'providing instruction'.

The teachers in the PE intervention had an autonomous role however this was supported through the changes in school policy documents and the introduction of the SHARP Principles. In the break time intervention, the school still had an autonomous role however this was without any policy changes or 'how to principles'. Ryan et al. (2009) advocated that autonomy relates to self-regulation of oneself with behaviour being self-organised and initiative. However, it would appear that although autonomy was present, the missing components were competence and relatedness amongst all school staff which was evident through the inconsistencies that emerged throughout the break time intervention. Furthermore, in the break time intervention, as the school was not provided with any 'how to principles', they drew upon their own understanding of an effective break time intervention and how this should be implemented. As a result the school utilised their knowledge of an 'adult world' and did not consider the children's view of the playground, which was a finding from Chapter 4 (Study 1) and Chapter 5 (Study 2). The findings from Study 1 and Study 2 supported previous research which highlighted children's imaginary world (Sutton-Smith, 1999; Darian-Smith, 2013) and theoretical work on children's play culture (Mouristen, 1998). Initial discussions between the PE Co-ordinator and the researcher centered on the implementation of imaginary stimuli alongside a walking route, however as the school were investing a large amount of money (£14,000) then they were reluctant to release some of their autonomy. This reinforces the need for consistency in establishing formal and informal rules of an intervention through integrating the BCT ingredient of 'Providing instruction'. Thus, had the SPRIINT principles been developed from the outset this may have helped with the consistency of the implementation of the intervention from the teachers.

8.2.4 Community influence

The community layer of the Ecological Model for Health Promotion (McLeroy *et al.*, 1988) was targeted in the break time intervention but not in the PE intervention. According to McLeroy *et al.* (1988), the community layer involves the relationships amongst organisations, institutions and informal networks with defined boundaries. Thus, in the break time intervention the community layer was targeted through inviting the children's parents to the opening of the walking track. This also linked to the BCT ingredient of 'model/demonstrate the behaviour' (Michie *et al.*, 2011). As a result, children had the opportunity to walk around the track with their parents and would frequently observe the head teacher walking around the track at break times. However, this behaviour was not displayed by all school staff. Thus, for children to observe consistent modelling of behaviour the 'Providing Instruction' BCT ingredient (Michie *et al.*, 2011) would have also been beneficial.

8.2.5 Recommended framework for primary school-based PA interventions

Ecological theories are based on the premise that people behave differently in different settings and it is believed that an ecological approach has the possibility of sustaining behaviour change (Giles-Corti *et al.*, 2005; Salmon and King, 2010). However, few break time and PE interventions have targeted all five layers of an ecological model. As Ridgers *et al.* (2012) identified, most break time interventions targeted the individual and physical (i.e., institutional) correlates of the model. In addition, Lonsdale *et al.* (2013) highlighted in their systematic review that few PE interventions applied a social ecological approach. Thus, this further highlights the contribution to existing intervention research of the thesis in relation to the ecologically framed school-based PA interventions. Although the interventions do not cross all layers of an ecological model, French (2010) believed that no single intervention can address all levels and that most health based interventions focus

on two aspects of a model. As a result, the most effective components from the break time and PE intervention models will be identified in order to inform the design of a recommended framework for primary school-based interventions.

From the evaluation of the thesis intervention models, it can be concluded that the most effective three components from the Ecological Model for Health Promotion (McLeroy et al., 1988) were the institutional, the interpersonal and the intrapersonal layers. Within the institutional layer, it would be essential to target informal and formal regulations. For instance, school policy could be adapted when considering the formal regulations and it is recommended that a set of 'how to principles' should be used by the school staff as informal regulations; if a physical change is made to the environment, the 'how to principles' need to be aligned with this. These principles can be developed through utilising the key BCT ingredient of 'providing instruction' (Michie *et al.*, 2011) and will assist in developing school staff competence, which is a key component of SDT (Ryan and Deci, 2000). Thus, when considering previous school based interventions such as Action Schools! BC (McKay et al., 2014), what the thesis adds to this knowledge is the integration of BCT ingredients such as 'providing instruction' (Michie *et al.*, 2011). As highlighted by McKay et al. (2014) one of the limitations from the upscale results was the complex nature of schools and the consistent change of teachers. Thus, if the Action Schools! BC Model had integrated a set of 'how to principles' alongside the social ecological framework then this could assist in addressing the problem of the need for continuous training and support for changing staff roles.

At the interpersonal level, an important recommendation from the thesis is that the support of the head teacher is paramount; following this formal and/or informal social networks need to be encouraged amongst school staff which will assist in developing the relatedness component of the SDT (Ryan and Deci, 2000). This

should also involve developing a social support network with the researcher, which can initially commence through the researcher sharing the results of baseline data collection and discussing ways to increase children's PA levels; which links to the BCT ingredient of 'barrier identification/problem solving'. The BCT ingredient of 'action planning' can be used to create a formal outline of the targets for the interventions but also to outline how the teachers will be supported in their implementation of the intervention. It is recommended that the intrapersonal layer should target the key participants in the intervention, for instance, the PE intervention targeted the individual teachers through developing their knowledge and confidence in their delivery of primary PE. In the break time intervention model, the intrapersonal layer targeted children's interests and preferences in relation to their break time behaviour. Hence, when considering the intrapersonal layer it is recommended that participants' interests and needs are taken into consideration; this could include targeting children and/or teachers. The integration of the three theories follows and supports the NICE (2015) guidelines on effective behaviour change through the integration of an ecological framework, behaviour change taxonomies, and motivational theory. Consequently, the novel aspect of this thesis is the creation of a framework for primary school-based PA interventions (Figure 8.1), which is being recommended as a unique model that incorporates three key components of the Ecological Model for Health Promotion (McLeroy et al., 1988), three key ingredients from the BCT (Michie et al., 2011), and SDT (Ryan and Deci, 2000).

8.2.6 Conceptual conclusions

When considering the effectiveness of both the break time and PE intervention models the theoretical components of each model have been critically evaluated. As highlighted by Brown *et al.* (2013) and NICE (2015) it is important to understand the mediators of effective interventions as well as the increases in measures of PA. Thus, from the critical evaluation of the findings, it can be

concluded that a unique combination of theoretical concepts provide an effective framework from which to ground primary school-based PA interventions. These include:

- the intrapersonal, interpersonal and institutional layers from the Ecological Model for Health Promotion (McLeroy *et al.*, 1988);
- all three components from SDT (Ryan and Deci, 2000); and
- the BCT (Michie *et al.*, 2011) key ingredients of 'providing instruction', 'action planning' and 'barrier identification/problem solving'.

Although both interventions (Studies 3 and 4) drew upon very similar theoretical components, it was established that one of the key differences was the BCT key ingredient of 'providing instruction'. This element is considered essential due to the inconsistencies in the implementation of the break time intervention from school staff, and also from the success of the PE intervention which had the SHARP Principles embedded into the intervention model.

Informed by the thesis' studies and the efficacy of the PE intervention (and the less effective break time intervention), a recommended model/framework to underpin future school-based PA is proposed (Figure 8.1). Grounded in this framework is the support of the head teacher at the base of the triangle; without their support it is anticipated that interventions would be ineffective. The creation of an ecologically framed model for primary school-based PA interventions is a significant contribution to knowledge from the combined studies in this thesis. The application of this model in future intervention research has the potential to increase children's MVPA within the primary school setting. The model provides a framework that can be easily integrated into school life and as advised by PHE (2014a), interventions are required that are an easy and cost effective choice. Thus, it is recommended that this framework could be added to the UK

Government's document of 'What works in schools and colleges to increase physical activity? (Gov, 2015), to provide schools with practical guidance on the implementation of school based PA interventions. This would also provide a framework for Ofsted to consider when inspecting schools in relation to primary physical education, school sport and physical activity. Furthermore, the use of the SHARP principles would provide guidance for Ofsted inspectors in their evaluation of primary PE lessons.

The PE intervention which was termed the 'SHARP Principles Model', produced the greatest increases in children's MVPA during this key part of the school day, and although PE is not timetabled daily in English primary schools, it is one area of the school day in which both boys and girls can achieve similar levels of MVPA. As highlighted in Chapter 5, no significant sex differences were found in children's MVPA during PE lessons. In addition, PE is often the only venue in which some children will experience PA at a higher intensity. Furthermore, PE has been advocated as a key segment of the primary school day in which children's PA can be targeted (APC-PA, 2014). The SHARP Principles Model supported the teachers in placing a focus on active learning time during primary PE lessons, which could contribute to skill development and thus providing children with the physical skills and competence to engage in a range of physical activities (McKenzie and Lounsbery, 2013). As children spend 190 days of the year at school (DfE, 2014), it is important to develop an understanding of effective interventions of the segmented school day.

As break times are also a key segment of the school day in contributing towards children's recommended MVPA of at least 60 minutes (DH, 2011), it is important to understand the mediators of successful interventions (Brown *et al.*, 2013). The Walking Track Intervention Model assists in the understanding of effective and less

effective mediators, as the inconsistencies from school staff appeared to impact upon the success of the intervention.

8.3 Limitations of the Thesis

8.3.1 Measures of PA

In all four studies, the method of systematic observation was employed and although this is a tool that has been considered the gold standard for measuring PA (Hay, 2013), one of its limitations is the amount of time and effort required by the researcher in terms of training and data collection (McKenzie, 2010). This therefore, limited the sample size taken across all four studies. It is also acknowledged that the presence of a researcher during the quantitative observation data collection could have influenced the participants' PA behaviour across all four studies. As according to the Hawthorne effect, participants may alter their behaviour in the presence of the researcher (Cohen, Manion and Morrison, 2011). To try and reduce this effect, the observations were intended to be unobtrusive with the researchers positioning themselves on the edge of the working/play area and with the observations taking place in the participants' natural environment. Nonetheless, irrespective of the method used to measure children's PA there is always the potential for participation reactivity to PA measurements (Trost, 2007).

Although the use of the pedometer has been promoted as a valid and reliable measurement tool for assessing children's (>5 years) total ambulatory PA (Clemes and Biddle, 2013), they are insensitive to certain forms of activity and do not provide a measurement of intensity (Loprinzi and Cardinal, 2011). In addition, there are threats to validity with regards to reactivity and compliance (Clemes and Biddle, 2013; Ling and King, 2015). The teachers and teaching assistants were asked to record the children's number of steps before and after morning break times, as the Yamax Digi-Walker 700/701 only stores a daily step count then the

researcher was relying upon the compliance of the school staff to consistently follow the given protocols. Moreover, there may have been an element of reactivity from the children when wearing the pedometers, however, the design of the Yamax Digi-Walker provides a sealed casing that is difficult to open.

8.3.2 Break time Intervention research design

In chapter 5 (Study 2), a limitation of the study design was the lack of a control school, although the application of the time series design can allow the participants to act as their own control group (Cohen, Manion and Morrison, 2011). A further limitation of the break time intervention research design was the inconsistencies from the school staff in terms of its implementation; for instance, the school's instalment of benches around the walking track and the introduction of resources which encouraged sedentary behaviour such as the boxes of chalk. Furthermore, the introduction of the school's 'walk/run a mile' initiative was also introduced at the same time as children could use the walking track during morning outdoor break times. Thus, some of the children had walked around the track before morning break time which could have impacted upon the children's interest to use the track at break times. However, the knowledge gained from these inconsistencies from the school staff helped to inform the design of the SHARP Principles for the school staff to follow in the PE intervention in Chapter 7. A further limitation in the design of the break time intervention would be the omission of children's views with regards to the rules of the walking track. The children could have contributed to creating a set of rules that would link to the 'providing instruction' ingredient from the BCT (Michie *et al.*, 2011). This may have assisted with some of the inconsistencies outlined above, as staff may have been more reception to the children's views of the track. An additional limitation of study 2 would be the BMI data which was not included in the analysis as a confounding variable. As highlighted in section 5.4.1 more children were classified in the 'thinness' category than that of the 'obese' category, which may be an area

for consideration in future research in terms of a multi-component approach involving nutritional input as well as PA.

8.3.3 Sampling procedures

All of the participant schools in this thesis were located in one regional area of England, which is very likely to impact upon the generalizability of the findings from each of the four studies. However, in the exploratory studies used in Chapter 4 (Study 1) and Chapter 6 (Study 3), the schools were purposefully selected to ensure that a range of school contexts and demographics were included in the sample. Nonetheless, only one school was used in each of the intervention studies which is a limitation of Study 2 and 4, and could affect the generalizability of the intervention findings.

8.3.4 PE intervention follow-up data

The PE intervention in Study 4 (Chapter 7) involved only one data collection point after the SHARP intervention had been implemented, therefore, the longer term impact of the SHARP Principles Model cannot be inferred. However, as this was a year-long process, follow-up data collection was not possible due to changes of school staff within the intervention school, which would have made it impossible to collect reliable follow-up data, involving the same teachers and year groups.

8.3.5 Omission of some confounding variables: disability, IMD, seasonal effects

In Study 1 (Chapter 4) and Study 3 (Chapter 5), confounding variables such as disability and IMD data were not taken into account. Although this was not a focus of the thesis, it may have provided some useful/interesting results to advance the contribution of the knowledge from this thesis further. Furthermore, the thesis did not take into account any seasonal differences in any of the four studies and the possible impact upon children's PA.

8.4 Conclusions Drawn from the Research

The following conclusions were drawn from each of the four thesis' studies:

Study 1

- a) Girls accumulate a mean of 29.5 minutes and boys accumulate a mean of 36.4 minutes of their MVPA from primary school morning and lunch break times;
- b) Boys engage in significantly more (14%) MVPA than girls during morning and lunch break times, equating to a difference of 6.9 minutes;
- c) Boys dominate playground space playing sports in large groups;
- d) Girls view break times as a socializing opportunity in which they can talk with their friends; and
- e) Both boys and girls engage in imaginary play behaviour during break times.

Study 2

- a) A walking track intervention during break times has positive short term effects (1-5 weeks) on both boys' and girls' PA (aged 5-9 years) (236.52 steps and 2.2 minutes MVPA per morning break time); and positive longer term effects (6-7 weeks) on boys' (aged 7-9 years) VPA (2.5 minutes per morning break time);
- b) Boys dominated playground space racing around the walking track, whilst girls participated in sedentary activities such as sitting and drawing;
- c) Inconsistencies in the implementation of a break time PA intervention can impact negatively upon its success; and
- d) A set of 'how to principles' would assist in increasing children's MVPA during morning break times through aiding the consistency of the implementation of the intervention from school staff.

Study 3

a) Children are not meeting the recommended >50% MVPA during primary PE lessons;

- b) Boys and girls accumulate similar levels of MVPA during primary PE lessons;
- c) Barriers to children's MVPA during PE lessons include: excessive teacher talk, ineffective organisation of children during lessons, teachers' low confidence and limited subject knowledge, and PE as a low priority subject area; and
- d) Facilitators of children's MVPA during PE lessons include: support of the head teacher, supportive social networks and professional development for teachers.

Study 4

- a) The SHARP Principles Model has positive effects on children's MVPA during primary PE lessons and is able to produce a 30% point increase in MVPA;
- b) The application of the SHARP Principles Model could be seen as the first step towards improving pedagogical practice in primary PE by all teachers, irrespective of their subject specialism/expertise, when used with a curriculum focused school programme; and
- c) The SHARP Principles Model has the potential to shift current thinking and pedagogical behaviour of teachers in primary PE in England towards a focus on active learning time.

Overall conclusions

a) The primary school-based intervention framework (Figure 8.1) provides a unique combination of theoretical components that will support the increase in children's MVPA in the specific context of the primary school setting.

8.5 Future Directions for Research

Following the successful findings from the SHARP Principles Model Intervention, it is important that this work is continued to test its effectiveness across a variety of school settings. As advised by PHE (2014a) for major change to take place the following four domains need to be facilitated: 1) active society; 2) moving

professionals; 3) active lives; and 4) moving at scale. Taking these four domains into account, schools need to be encouraged to take action in which all teachers have a role in promoting children's PA behaviours due to their daily contact with children, including the head teacher. The SHARP Principles Model provides researchers and primary schools with a framework that will assist them in targeting the key mediators to create a change in PE practice in order to increase children's MVPA. Thus, with the intention of moving at scale, it is recommended that the external validity of the SHARP Principles Model needs to be assessed through a large scale study. This next phase of the SHARP Principles Model commenced in June 2016, in which the planning and recruitment of schools was initiated. Two phases of the study are planned through applying the SHARP Principles Model to two different groups of participants 1) An additional sample of primary school teachers (both specialist and non-specialist of primary PE); and 2) sports coaches who are employed to teach PE in primary schools. To build upon the strengths of the SHARP Principles Model Intervention study employed in this thesis, the upscale of the study will employ a randomised control trial in which the intervention and control groups will be randomly selected. In addition, resource cards will be created which clearly explains and communicates the SHARP principles for both the teachers and coaches. Hence, following the research findings from the SHARP Principles Model employed in this thesis the recommendations advised are to:

- Expand the SHARP Principles Model Intervention through randomised control trials across various primary school settings and age ranges (5-11 years); to include teachers and sports coaches; and
- 2. Develop a resource to support teachers' and coaches' understanding of the SHARP Principles.



Figure 8.1 Framework for primary school-based PA interventions

A recommendation and future direction of the break time Walking Track Intervention Model would be to address the inconsistencies from school staff in the implementation of the walking track. In order to achieve this, it is recommended that the BCT ingredient of 'Providing Instruction' (Michie *et al.*, 2011) be integrated into the theoretical model. Instead of the model employed in Chapter 5 (Study 2) of this thesis, it is therefore recommended that the Walking Track Intervention Model is grounded in the thesis' recommended framework for primary school-based PA interventions (Figure 8.1). Furthermore, when working within this recommended framework, researchers and schools need to take into consideration children's views of their break time environment which can be achieved through the intrapersonal layer of the model. Thus, following the break time intervention findings in this thesis, the recommendations for future practice are:

- A small scale randomised control trial of the walking track intervention model that is adapted according to the recommended framework for PA interventions, ensuring consistency from school staff through the creation of a set of 'How to principles'; and
- In the design and employment of break time interventions, studies are advised to take into consideration children's perceptions and experiences of their break time environment. For example, through integrating stimuli for imaginary play behaviour.

8.6 Recommendations for Practice

The primary school setting is an important environment in which children's PA can be promoted, therefore increasing and sustaining children's PA during school hours is essential (WHO, 2013; Dobbins *et al.*, 2013). As highlighted by PHE (2014a) targeting different segments of the school day is crucial. The findings from this thesis have identified some important implications for practitioners in relation to optimizing the specific components of primary school break times and PE lessons.

8.6.1 Optimizing the primary school break time environment

The primary school break time environment is an ideal segment of the school day in which to target children's MVPA, as they do not interfere with curriculum lessons (Erwin *et al.*, 2013). Furthermore, it has been stated that children can achieve 30 minutes of their daily MVPA guidelines during the school break time period (Ridgers and Stratton, 2005). The break time intervention in Chapter 5 (Study 2) suggested that the walking track intervention had positive short term effects (1-5 weeks) on children's MVPA, increasing by an average of 260 steps for boys and 240 steps for girls. However, this increase was not sustained at the follow-up data collection point (6-9 weeks). It was concluded that the increase in children's MVPA was not sustained due to a number of inconsistencies in the implementation of the intervention from school staff. Thus, as a result of the findings in this thesis the following recommendations are advised for practitioners:

- Play England/BHF: To develop a set of publishable resources to provide schools with advice on how to create an active break time environment. It is advised that these resources are based on the suggested 'SPRIINT Principles' (Space for sports, Promotion of PA, Removing sedentary resources, Include everyone, Imaginary play, No queues or spectators, and Talk and walk);
- Local Education Authorities/Academies/ITT: To provide training to schools on the importance of children's MVPA during break times and how to integrate the SPRIINT Principles integrated within the recommended framework for school-based PA interventions;
- 3. **Head teachers:** To place a focus on active learning time during break times, taking into consideration the SPRIINT principles and the implementation of the recommended framework for school-based PA interventions; and
- 4. **PE Co-ordinator / Break time lead:** To support and train staff on the use of the SPRIINT Principles in order to increase children's MVPA.

8.6.2 Optimizing the primary school PE lesson

In 2013, OFSTED identified from their inspection report that children in England were not participating in sufficient levels of PA during primary PE lessons. In 2015, AfPE advocated in their Health Position Paper that children should be engaged in MVPA for 50-80% of the lesson time. Nonetheless, neither OFSTED nor AfPE have suggested strategies that will help primary school teachers to increase children's PA levels during primary PE lessons. The contribution to practice therefore, is the development of a set of teaching principles (strategies) that can be implemented into the planning and delivery of primary PE lessons to increase children's active learning time in order to meet the recommended guidelines of >50% MVPA. Although primary PE is not timetabled daily, it is essential as it can provide children with the physical skills to participate in PA beyond this specific component of the school day. The thesis demonstrated that the SHARP Principles Model increased children's MVPA during primary PE lessons by a 30% point increase and produced an average of 72.6%. Thus, the following recommendations for practitioners are advised:

- 1. **OFSTED:** To evaluate the quality of primary PE through focusing upon active learning time during primary PE lessons through the use of the SHARP principles as a guide/framework, which are aligned with the primary National Curriculum for PE;
- 2. **AfPE:** To advocate the application of the SHARP Principles and the SHARP Principles Model to support schools and teachers in their delivery of primary PE, which will enable them to place a focus on active learning time;
- Local Education Authorities/Academies/ITT: To provide training to schools on the importance of active learning time during primary PE lessons and on the integration of the SHARP Principles Model;

- Head teachers: To place a focus on active learning time in primary PE lessons through supporting the implementation of the SHARP Principles Model;
- 5. **PE Co-ordinator:** To support and train staff on the use of the SHARP Principles in the delivery of lessons.
- 6. **Teachers:** To implement the SHARP Principles into the planning and delivery of PE lessons; and
- ITT: To integrate the importance of active learning time into the training of student teachers and educate them on the use of the SHARP Principles as effective strategies to increase children's MVPA during PE lessons.

8.7 Final Conclusions

This thesis has extended the work of previous studies through the creation of two ecologically framed primary school-based PA interventions, in the contexts of break times and PE lessons. Specifically, the significance of the primary school break time intervention was the assessment of children's social determinants in the design and implementation of a walking track intervention to increase children's MVPA. This thesis extended previous studies by targeting girls and boys separately for the break time intervention, encouraging girls to walk and talk whilst also providing enough space for boys to play sports. Findings from the break time intervention study revealed short term increases in girls' and boys' MVPA; however the results also suggested positive longer term effects for boys' VPA. Indicating the walk and talk route was dominated by boys racing around the track. Moreover, inconsistencies from the school staff in the implementation of the intervention encouraged girls to engage in sedentary activities. The significance of the PE research was the design and implementation of an intervention to increase children's MVPA that focused on a set of principles which were implemented by both specialists and nonspecialists. Findings from the PE intervention revealed practically and statistically significant increases in children's MVPA during PE lessons. Moreover, a recommended theoretical framework for school-based PA

interventions is advocated as a model for both researchers and practitioners to implement. In summary, the findings in this thesis highlight the importance of targeting break times and PE lessons through interventions that are grounded in the recommended theoretical framework for school-based PA interventions in order to increase and sustain children's MVPA.



Appendices

Appendix 1 – Study 1 SOCARP Training Video



https://www.youtube.com/watch?v=0hlC_yKthyY
Appendix 2 – Study 1 Head teacher consent form



Informed School Consent

Research Study: Children's physical activity levels and social behaviours in the primary school playground

It is my understanding that:

- Children's physical activity patterns will be tracked during break times using direct observation;
- ✓ Focus group discussions will take place with small groups;
- ✓ Height, weight and waist circumference measurements will be taken of the selected children. Extra care will be taken to ensure that the measurements are done sensitively and in private, and that each child's results will not be shared or seen by other children;
- ✓ The study will not cause children any physical or psychological harm;
- ✓ The study will not affect the children's learning in any way;
- ✓ This study is designed to further scientific knowledge and all procedures have been approved by Newman University's Research Ethics Committee;
- ✓ The school is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing;
- ✓ Procedures, benefits or risks of the research will be explained to the school;
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer;
- ✓ Results will be shared with the school, communicated in a format of our choice.

By signing and returning this form, I agree to the school participating in this study.

Your signature (Head teacher)

Date:

Appendix 3 – Study 1 Guardian consent form



Research Study: Children's physical activity levels and social behaviours in the primary school playground

Dear Parent / Carer,

Newman University would like to invite your child to participate in a short research project. We are interested in learning about the physical activity patterns of children during playtimes. The Department of Health (2011) recently published physical activity guidelines for children aged 5 – 17years, advising that children should be active for at least 60 minutes each day. School break times have been identified as a critical window in the school day for providing children with physical activity opportunities. Therefore your child's school has been invited to take part in the research study; we are only interested in working with schools that are keen to promote, generate and evidence healthy and sustainable school environments. The lead researcher is a qualified teacher and is currently a Senior Lecturer in Primary Education at Newman University. Other researchers may accompany the lead researcher, but in all cases visitors will hold CRB clearance forms and ID which will be checked by the school.

The school will be visited over the course of three to four days. The research has two parts, in part one your child will be observed during playtimes to track their physical activity patterns. Your child will only be observed for a ten minute period and the researchers will aim to position themselves on the perimeter of the playground to avoid any reactivity. The researchers will be completing observation forms and will have an MP3 player to pace the timings of the observations.

In the second part of the research we will be interested in recording the views and experiences of your child regarding their playtimes. The staff involved will be trained in conducting focus group discussions with children and they will aim to create a safe and calm environment. We will make it clear to your child that there are no right or wrong answers as they are not being tested, but rather that their own opinions and experiences count. Each focus group will consist of five children and two researchers.

The overall results of the study will be shared with the school which will enable them to reflect upon the physical activity opportunities it provides for their children. Individual results of your child can also be provided for you upon request. The overall results may also be shared with other schools and the wider research community to assist others in addressing children's physical activity levels. All information provided will be anonymous and kept confidential. Data will be stored securely at Newman University. Taking part in this study is voluntary and you may choose for your child to take part or not and they may leave the study at any time.

If you are happy for your child to go about their normal school day whilst researchers visit their playtimes and conduct focus group discussions then please read, sign and return the enclosed parental consent form to your child's school. Please note your child will also receive an information leaflet regarding the study, please take the time to read it through with them and discuss if they would like to take part.

Yours faithfully, Miss E. Morris Senior Lecturer in Primary Education

Informed Guardian Consent

Research Study: Children's physical activity levels and social behaviours in the primary school playground

It is my understanding that:

- My child's physical activity patterns will be tracked during break times using direct observation;
- \checkmark My child will be involved in a focus group discussion;
- ✓ The study will not cause my child any physical or psychological harm;
- ✓ The study will not affect my child's learning in any way;
- ✓ This study is designed to further scientific knowledge and all procedures have been approved by Newman University's Research Ethics Committee;
- ✓ My child is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing;
- Procedures, benefits or risks of the research have been explained to me and my child;
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer;
- $\checkmark\,$ Results will be shared with me for my child upon request.

By signing and returning this form, I agree to my child participating in this study.

Child's name:

Child's DOB Child's school class: Child's signature: Parent/guardian's signature:

Date: Date:

Appendix 4 – Study 1 Children's information leaflet



Research Study

Dear Children, My name is Miss Morris and I am a Lecturer in



Education at Newman University. I love to learn new things and really enjoy carrying out science investigations.

As you probably already know, keeping active is a really important part of maintaining a healthy heart. In a typical day, children should be active for at least 60 minutes.

I have spoken to your school and they are keen to find out how much and what types of physical activity you do at playtimes.

How will I be involved?

The investigation includes two parts:

Part one will involve monitoring your physical activity at playtimes. I am going to use observation forms to track how busy you have been, taking notes at morning breaks and lunch times. I will also use an MP3 player to time the observations I make. You don't need to do anything special, just enjoy your playtimes!

Part two will provide you with the opportunity to discuss your views of your playtimes. It is important for you to know that there are no right or wrong answers and you are not being tested. We just want to hear what you have to say.



What will happen to the

results?

I will write and talk about your playtimes and physical activity patterns to other people. This will help other children and schools to be more active. However, to protect your school and your identity I will keep all the your information top secret by using disguise names.

I will share the overall results of the study with your school and hopefully work to improve your activity levels during break times.

Do I have to take part?

If you're happy to carry on with your normal school day, and for me to visit your playground and PE lessons then I'll see you soon. If you have any worries please speak to your parents/corers.

Appendix 5 – Study 1 SOCARP record form

SOCARP Recording Form (System for Observing Children's Activity and Relationships during Play)

Date:	School:	Observer: Stud	y:
Recess Period: am lunch pm	Recess Time Start:	Recess Time End:	
Reliability: No Yes	Adult Supervisors: 0 1 2 3 4 5	Equipment: No Yes	
Child Time start:	Child Time End:		
Target Child Number: 1 2 3 4 5 6 7	Target child gender: Male Female	Page of	
Interval Activity	Group Act	ivity	
Level	Size Type		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	M L SP G S L M L SP G S L	N PS VS PC VC I N <t< td=""><td></td></t<>	
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Comments:

Appendix 6 - Study 1 Children's group interview questions

Children's Group Interview questions – break times

Intrapersonal

How active are you during break times? (Possible prompts: What do you think I mean by the word active? Do you think you are busy at break times? What types of things do you do?)

What is your favourite thing to do at break times? (Possible prompts: what do you like about break times? Do you enjoy break times? Is there anything else you like to do? What have you drawn for me in your picture?)

Is there anything that you do not like about break times? (Possible prompts: is there anything that you would change? Does this happen/take place every break time?)

What did you do at break times today? (Possible prompts: who did you play with? What did you do? Did you use any equipment? Where you active/busy at break times today?)

Interpersonal

Who do you play with at break times? (Possible prompts: what types of things did you do with your friends at break times? Do you always play with your friends? Do you always play with the same friends?)

What do your teachers /lunch time supervisors / coaches do during break times? (Possible prompts: do they organise activities? Do they play any games with you? Do they encourage you to take part in any activities?)

Institutional

Do you play with any equipment during break times? (**Possible prompts:** what equipment do you have in your playground? Would you have any additional playground equipment? If you could change any equipment what would it be?)

Are there any playground rules or rotas for break times? (Possible prompts: can you use all the equipment at all times? Are there are adults that organise activities for you? Can you join the activities every day?)

33 cket

Appendix 7 - Study 1 example of children's drawings of break times

Appendix 8 - St	tudy 1 example of	of an analysed intervie	w transcript from the	children's group interviews
		-	_	

Emergent themes	Original transcript	Exploratory Comments
	Initial questions were asked to encourage children to talk and to be able to recognize their names when transcribing.	
Value input from adults	 Interviewer: What do you like, what do you enjoy about breaktimes? Child male: Sometimes we have the football coach and when we go inside we play fun games. Interviewer: So you like it when the football coach comes and does he do lots of different 	Children like having the football coach with them during both outdoor and indoor play. <u>Children</u> value the contribution of the football coach, they have fun with him. 'We play fun games'
Physical activity opportunities at indoor play	 games in the playground with you outside? Child male: Sometimes he does it inside. Interviewer: and when does he do it inside? Child male: When it's raining. Interviewer: When it's raining and you come inside to play games in the hall? Child male: Yes 	Children still have the opportunity to 'play' indoo if it is wet play.
Value input from adults	 15 Interviewer: What else do you liek to do at 16 breaktimes? 17 Child male: At breaktimes. I like plaving with 	Children enjoy playing football with the football
Rules and boundaries	 18 the football coach. 19 Interviewer: You like playing with the football 	coach. Again they value the input of the football coach. What does he add for the children? Rules a sense of fairness, a role model?

	20 coach as well, and does he go outside in the
	21 playground?
	22 Children: Yes
	23 Interviewer: What types of things does he do
Physical activity	24 with you?
opportunities	25 Child male: He plays football and bench ball, There's always a backup plan if it rains, children
	26 inside he sometimes he plays different sports still get the opportunity to be active.
	27 when it's raining.
	28 Interviewer: so what does he do outside with
	29 YOU?
	30 Children: He plays football
	31 Interviewer: He plays football, does he organise
	32 any other sports with you or play any other
	33 dames?
	34 Children: Just football.
	35 Interviewer: and does everybody play football
	36 with the football coach?
	37 Child male: Inside he has to choose a small Not all children have the option if inside only a
Physical activity	38 amount of people but if you want to play select few. This is probably due to indoor space
opportunities	39 football you can. and health and safety reasons. The coach gives
	40 Child male: We have a timetable, on Monday the children options, values their opinion.
Value adult input	41 it's Y6, on Tuesday it's Y5, on Wednesday it's us
	42 (Y4), on Thursday it's Y6 and on Friday it's Y5 School has a timetable for various activities
Rules and boundaries	43 so we only have it on Wednesday. <u>Children view this as a fair system, but they do</u>
	44 Interviewer: and that's outside? realise that they have it less opportunity to play
	45 Children: Yeah, if it's raining we go inside in the football than Y5 and 6. We only have it on
	46 school hall.
	47 Interviewer: So what do you like to do at
Physical activity linked to	48 breaktimes?
challenge and competition	49 Child male: I like to climb on the climbing frame
Physical activity linked to	50 because it's so high and I like to race down
menusnips	51 with my friends.

	52 Interviewer: What do you like to do at adds an additional challenge; they like to add their
Rules and boundaries	53 breaktimes? own games to the fixed equipment.
	54 Child male: I like to play Star Wars with my
	55 friends. Children like to play Star Wars with their friends
Imaginary play	56 Interviewer: and what do you do when you're
	57 playing Star Wars? What types of things do you playground, making links between the home
Home and school	58 do? What would I see you doing if I came environment and that of the school environment.
environment	59 outside and you were playing Star Wars?
	60 Child male: We pretend we have light savers
	61 and there are the heroes and the villains and they are pretend we have light savers <u>Children know</u>
Imaginany play	62 the emperor is Darth Sidious and the master is
inaginary play	63 Darth Vader.
Morality – good and	64 Interviewer: and what do you do when you're the characters. They understand that there is
bad/right and wrong	65 playing those games, do you stay in one spot in good and bad
saanginanamong	66 the playground, do you move around – what do
	67 you do? Children move around when they are playing their
	68 Child male: yeah we move around, I'm Darth imaginary games Physical activity is a by-product
Physical activity promoted	69 Vader. of imaginary play.
through imaginary play	70 Child male: I like to play zombie games.
	71 Interviewer: You like to play zombie games and Children enjoy zombie games Imaginary play,
	72 what would I see you doing if you were playing involved in their own world, transforming the
Transforming the	73 your zombie games? playground into their own arena.
playground environment	74 Child male: One of us would be lying on the
	75 bench then we move and we wake up and then Children able to describe their games in detail,
	76 they all chase us and when they catch one of us they all know the rules to the game. Children form
Rules and boundaries	77 they put us on the bench and then they have to their rown rules and have a joint understanding of
Dhysical activity promoted	78 catch us.
through imaginany play	79 Child male: because they turn into the zombie chase element in the zomble games.
u nough i maginary piay	80 because the other zombie eats them and we're
	81 the doctors and we're trying to fix them.
	82 Interviewer: Do you chase each other when
	83 you're zombies?

	84 Child male: No the zombie chases us and he	Children are very specific about their rules of the
Rules and boundaries –	85 catches us and puts us on the bench and then	game. These games mean a lot to them, they
ownership	86 they move and have to chase us.	have created the rules with their friends, therefore
	87 Interviewer: What does anyone else like to do	there is a sense of ownership.
	88 at breaktimes?	
Imaginary play	89 Child male: Zombies	Most children engage in imaginary play
	90 Interviewer: You like to play the zombie games	
	91 as well?	
Adapt physical activity	92 Child male: I like to go in the wooded area and	Like to read in the wooded area – comics
behaviours according to	93 I like to read with my friends.	Children appreciate the welcoming environment.
zones	94 Interviewer: You like to go in the wooded area	<u>They acknowledge the various zones within the</u>
	95 and what do you read in the wooded area?	playground and change their physical activity
	96 Child male: comics	benaviours accordingly.
	97 Interviewer: and what do you do when you're	
	98 reading, do you sit down and read, is there a	
	99 place for you to sit down?	
	100 Children: ves there's a bench	
Imaginary play	101 Child male: Sometimes I like to play, I like to	Children like to play imaginary games with their
inaginary play	102 play Minium Rush with my firends.	friends There is a cross over between their online
Home and school	103 Interviewer: and what's that?	games and their playground games.
environment	104 Child male: Minium Rush is someone needs to	<u>a a p a a</u>
	105 be the minium and someone needs to be like	
Morality – good and	106 they want to choose which villain, they are	Villains and heroes in their imaginary play
bad/right and wrong	107 three types yeah and when the villain comes	Children understand the moral concepts of good
	108 they need to get the things that are safe back	and bad, they have to work together with their
	109 to us and then the villain loses.	friends to succeed. Developing their teamwork
Teamwork – friendships	110 Child male: Minium Rush you can download it	and social skills
	111 on your phone, it's a game.	
	112 Interviewer: Ok so has everybody told me what	Links between digital and real world
Home and school	113 they like about breaktimes?	
environment	114 Child male: I like playing the zombie games as	Enjoy imaginary play – zombie games – monsters
	115 well	

Imaginary play	116 Interviewer: You like playing the zombie	
	117 games? What do you do in the zombie games?	
	118 Child male: er, somebody chooses who is going	
	119 to be the zombie, then they lie down on the	Children understand the rules of their imaginary
Rules and boundaries	120 bench, then when we touch them they wake up	games Own rules within the bounded system of
	121 and they have to catch us	their friendship groups
	122 Child male. I like to play zombie games because	
Challenge and competition	122 child male. This to play 20mble games because	Children enjoy the element of the chase physical
	123 when they lie on the bench I like to tickle them	activity is a by-product of their imaginary play
Physical activity promoted	124 and they wake up and they rup to catch you do	
through imaginary play	125 Interviewer, and do they full to catch you do	
	126 (ney chase you?	
	127 Children. years, if they calch you, you have to	
	128 go on the bench and they have to be a zomble	
	129 and the game carries on and they run and	
	130 Catch us.	
	131 Child male: they tickle me.	
	132 Interviewer: Ok you told me what you like at	
	133 breaktimes, now I want you to tell me what you	
	134 don't like about breaktimes?	
Rules and boundaries –	135 Child male: I don't like it when people ruin my	Children don't like it when others interfere with
friendship groups	136 games.	their imaginary games <u>They have their own rules</u>
	137 Interviewer: You don't like it when people ruin	and systems which they value. Others outside of
	138 your games and what do they do to ruin your	their friendship groups don't understand the rules.
	139 games?	
	140 Child male: They choose another game	
Aronac of play, bounded	141 Interviewer: They choose another game, so	Almost a sense of fear of being brought back to
Arenas of play – bounded	142 they stop the game that you're playing?	reality, they like to be within their own arena and
system	143 Child male: Miss today we were playing Star	are unaware of others outside of their friendship
	144 Wars and he came and said to all of us let's	groups.
	145 play the zombie game and he ruined the game.	
	146 Child male: I didn't know you were playing any	
	147 game.	

		-
	 148 Interviewer: So why don't you like it when 149 people change your games then, because do 150 not still have fun playing the other games? 151 Child male: I don't like playing the zombie 152 game 153 Interviewer: and why don't you like that? 154 Child male: because my favourite game is Star 155 Wars. 156 Child male: I don't like it when people be mean 	Children don't like it when others stop their game
Arenas of play – Bounded systems	157 to me and just randomly because sometimes 158 me and my friends play a game someone 159 comes up and says no no no no no and I say 160 why you being mean to me and they say I 161 didn't do nothing, so they just annoy me 162 Interviewer: and how does that make you feel, 163 why do you think people are mean? 164 Child male: I don't know	or interfere in anyway. <u>They interpret this as being</u> <u>mean, however it appears that they don't like their</u> <u>own imaginary world to be interrupted.</u>
Arenas of play – bounded systems	 165 Child male: I don't like when people come up to 166 me and they say let's play a different game, 167 when I'm playing a game with someone and 168 they just come to me and they they take me 169 away from (Child's name) and they say let's 170 play this game instead of (child's name) game. 171 Interviewer: Ok but do you like to play different 172 games anyway? 173 Child male: Yeah I like to play some of my 174 games 	Friendship groups are linked to different games, a sense of belonging is created. Children make up their own rules which are specific to different friendship groups.
Morality – right and wrong/good and bad	175 Interviewer: What do you not like about 176 breaktimes? 177 Child male: I don't like it when people come to 178 and be mean and say nasty words 179 Child male: I don't like it when people call me	Children don't appreciate being spoken to in a nasty way <u>Children understand what is right and</u>

	180 names and they annoy me.	wrong.
	181 Interviewer: Is there anything else we don't like	
	182 about breaktimes?	
	183 Child male: I don't like it when someone comes	
	184 to me and annovs me loads of times	
	185 Child male: I don't like it when people come up	Children don't like anti physical behaviours and
	186 to me when I'm on the bouncy hoppers and	they don't enjoy being taken away from an
Arenas of play – bounded	187 they just push me off the bouncy hoppers and I	element of play <u>Children value their play, gives</u>
systems	188 want to play on the bouncy hoppers and they	them a sense of ownership and independence –
	189 just take me away.	hence they are not happy if this is taken from
	190 Interviewer: So you say that people are mean	them by other children and they just take me
	191 to you at breaktimes does this happen all the	away
	192 time or just sometimes?	
	193 Children: Sometimes	The negative verbal and physical behaviour is not
	194 Child male: All the time	a common occurrence in the playoround
	195 Child male: I don't like it when I kick the ball	73
Morality – right and wrong /	196 over and then people say that you kicked the	
good and bad	197 ball over and then (member of staff) say's that	Children don't like being told that they have done
	you are bad	something wrong if it was an accident Sense of
	198 Interviewer: Who's (member of staff)?	morality, right and wrong/good and bad.
	199 Child male: one of the dinner supervisors	
	200 Interviewer: One of the lunchtime supervisors?	
	201 Child male: He's not a dinner supervisor.	
	202 Interviewer: What does he do?	
	203 Child male: He just takes out toys and he's one	
	204 or the supervisors.	
	205 Interviewer: Next question: How active do you	
	206 UIIIIK YOU die di <u>DiedKumes</u> ? What door active moon?	
	2071 mean by active, what uses active means	
	208 China male. Ince il you re running and il you just	
	209 don't stop	

	211 you think you are, at playtimes do you run	
	212 around a lot do you get hot and sweaty or do	
	213 you like to sit down, what do you do? Or do you	
	214 do a mixture of things?	
Locomotive activity	215 Child male: I keep on running	Children are active at breaktimes, they like to run
behaviours	216 Interviewer: You run around a lot at	around Locomotive activity behaviours
	217 breaktimes? What does everybody else do?	
	219 Child male: I sometimes do assault courses with	They like to be active on the fixed equipment with
Physical activity promoted	210 me friends and it's really tiring	their friends Physical activity promoted through
through fixed equipment	219 me filler and it's really timig.	fixed equipment and friendship groups
and friendship groups	220 Child Hale. Sometimes 1 like playing withing	
	221 ITTERIUS UTAL KITOW UTE game Star Wars and it	Busy with friends through imaginary play physical
Physical activity promoted	222 really and when and when init i ying to thase	activity promoted through their own imaginations
through imaginary play	223 the vinan with the light saver, the pretend	 – links between home and school environment.
	224 ones, then when I get him that means hes	"I pretend" Children understand that their games
Home and school	225 ne s. defeated.	are not real – adopting the role of characters.
environment	226 Interviewer: So are you running around are you	
	227 really busy, are you very active?	
	228 Child male: Yep	
Physical activity promoted	229 Child male: I like it when we play racing games	Children enjoying playing chasing games with
through friendship groups	230 with my friends.	their friends. Friendships are an important
	231 Interviewer: Do you like to race around a lot?	element of physical activity.
Challenge and competition	232 Chid male: I like to run with my friend (Child's	
	233 name) and always we're the same speed at	Enjoy running with their friends, element of
	234 running.	competition
	235 Child male: Sometimes when I play with the	
Value input of adult staff	236 football coach I get really hot and I don't stop	Children are very active when they play football
	237 and when it's the end of dinner time I ask Miss	with the coach Aware of the affects of physical
High activity levels	238 (Teacher's name) if I can have a drink of water	activity e.g. hot, tired and needing a drink. Do
	239 and sometimes on the trim trail I do obstacle	they know the benefits of being active?
	240 courses with my friends and once we get to the	Children enjoy playing on the trip trail with the in
Challenge and competition	241 end I get really tired.	Children enjoy playing on the trim trail with their
Chanenge and competition	242 Interviewer: So you are all busy at playtimes	menus, unsis a chanenge for them, makes them

Physical activity promoted	243 then? You run around a lot?	tired. Physical activity promoted through the fixed
through fixed equipment	244 Children: Yeah	equipment and friendship groups.
	245 Interviewer: Ok then so you've already told me	
	246 a little bit about some of the activities you like	Children know that they are busy and active at
High activity levels	247 to do at <u>breaktimes</u> but do you use any	playtimes. This is linked to enjoyment and
Challenge and competition	248 equipment? So it might be that you have things	challenge.
Challenge and competition	249 in your playground like the climbing frame or	
Physical activity behaviours	250 somebody might bring out some equipment.	
promoted through fixed	251 What do you like to use and what do you use?	Children enjoy playing with the sand toys they
equipment	252 Child male: The sand toys	enjoy the sensory touch and having something to
equipment	253 Interviewer: You use the sand toys	do – this promotes standing.
Physical activity promoted	254 Child male: We use the moon hoppers	
through fixed and portable	255 Child male: Skipping ropes and this thing that	Children enjoy using a range of portable and fixed
equipment	256 you put on your foot and you have to swing it	equipment in the playground.
	257 around	
	258 Child male: I like going on the thing and you	
Rules and boundaries	259 have to hold it and you have to run across, you	
	260 have to hold the rope and there's like a rolling	Apply their own games/rule to the fixed
	261 thing at the bottom and you have to get across	equipment. Children like to have a sense of
	262 dilu il you idil uowil you die out of the game.	ownership e.g. implementing their own rules.
Physical activity promoted	263 Child Hale. Sometimes 1 like bring out the	
through sport's games	264 100 (Dali dhu pidy of sometimes from the boxes	Enjoy playing sports related games e.g. football
unough sport s games	205 Well get the basketball and play	and basketball
	200 Intel viewer. OK it sounds like you have lots of	
	260 Child male: Most of the time I play with the	
	260 sand toys	
	270 Interviewer: Only two more questions and they	
	271 you can go back to class, so you're doing really	
	272 well. OK then so now I want to know what you	
	273 did at breaktimes today? Where you outside for	
	274 breaktimes today?	

ГТ		r
Physical activity promoted through imaginary play, sports games, fixed equipment.	 275 Children: Yes 276 Interviewer: Ok so what did you do today 277 Child male: I played football with (Child's name) 278 Child male: I did the assault courses 279 Child male: I was playing football and I was 280 playing the zombie game 281 Child male: I played the zombie game too 282 Child male: I played football and I played on 283 the monkey bars 284 Child male: I played Star Wars 285 Child male: I played football Star Wars and the 286 zombie game 287 Child male: I played the zombie game as well. 288 Interviewer: Ok then last question now, If you 289 could change anything about breaktimes so 290 maybe if you wanted some different equipment, 291 what would you change about your breaktimes. 292 So if you could change anything what would it 293 be, have a little think. 294 Child male: I would change that we had erm, 295 like, it's like something they have, slides and 296 swings 297 Child male: the same 297 Child male: the same 	Children take part in imaginary games, sports specific games, and play on the fixed equipment. Children would like more fixed equipment <u>Do they</u> <u>like fixed equipment because it will always be</u> <u>there rather than portable equipment which can</u> <u>be taken away from them or damaged?</u>
	296 swings 297 Child male: the same 298 Child male: a zip wire 299 Child male: a zip wire 300 Child male: I would change like a pogo stick 301 Child male: Rollercoaster's 302 Children: wow! 303 Interviewer: Do you think we would be able to 304 do that? 305 Children: yeah, just a little one.	be taken away from them or damaged?

Appendix 9 – Study 2 Head teacher and PE Co-ordinator consent ethics form



Informed School Consent

Research Study: Measuring the impact of a walking track on children's PA levels during break time

It is my understanding that:

- ✓ A sample of children from Y1, Y2, Y3 and Y4 will wear a pedometer for 4 consecutive days at three time points (March, May and June, 2016) to measure the effect of the walking track on children's PA during break times.
- Direct observation will also be used to track Y3 and Y4 break time behaviours in March, May and June;
- ✓ Height, weight and waist circumference measurements will be taken of the selected children. Extra care will be taken to ensure that the measurements are done sensitively and in private, and that each child's results will not be shared or seen by other children;
- ✓ Staff will be interviewed post-intervention to evaluate the intervention;
- ✓ The study will not cause children any physical or psychological harm;
- \checkmark The study will not affect the children's learning in any way;
- This study is designed to further scientific knowledge and all procedures have been approved by Newman University's Research Ethics Committee;
- ✓ The school is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing;
- ✓ Procedures, benefits or risks of the research will be explained to the school;
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer;
- ✓ Results will be shared with the school, communicated in a format of our choice.

By signing and returning this form, I agree to the school participating in this study.

Signatures Head teacher: PE Co-ordinator:

Date: Date:

Appendix 10 – Study 2 Guardian consent form



Research Study: Walking track break time intervention

Dear Parents/ Carer,

Your child's school has been working hard to encourage children to be more active at break times. As you know, they have put into place a walking track and we would like to measure the impact of this on your child's activity levels. We would like to collect data in March, May and June, 2016. The data collected will help the school to measure and understand the impact of the work they have been doing so far. If your child is involved in the research, they will be asked to wear a pedometer for four consecutive days during March, May and June, 2016 (12 days in total). They may also be observed during their playtimes and will be asked to wear a coloured band or bib so that the observer can easily identify them. In order for the pedometer to collect accurate data, we will also need your child's height, weight and stride length measures. Staff will take care to ensure that the measurements are done sensitively, and that your child's results will not be shared or seen by other children. All information provided will be anonymous and kept confidential. Data will be stored securely at Newman University. Taking part in this study is voluntary and you may choose for your child to take part or not and they may leave the study at any time. If you are happy for your child to take part in the research, please can you sign the parental consent form. It is important that this is completed otherwise your child will not be able to take part in the study. If you have any questions or concerns about this research please speak to Miss _____and she will be happy to discuss it with you.

Yours faithfully,

Mrs. E. Powell Senior Lecturer in Primary Education



Informed Guardian Consent

Research Study: Challenging children to be more active during break times

It is my understanding that:

- \checkmark My child's physical activity patterns will be observed during break times
- ✓ My child will be asked to wear a pedometer for 4 consecutive days during school time on three separate occasions.
- ✓ Height, weight and stride length measurements will be taken of my child. Extra care will be taken to ensure that the measurements are done sensitively and that my child's results will not be shared or seen by other children
- ✓ The study will not cause my child any physical or psychological harm
- ✓ The study will not affect my child's learning in any way
- ✓ This study is designed to help the school understand how they can increase the physical activity levels of children and all procedures have been approved by Newman University's Research Ethics Committee
- ✓ My child is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing;
- Procedures, benefits or risks of the research have been explained to me and my child;
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer;
- $\checkmark\,$ Results will be shared with me for my child upon request.

By signing and returning this form, I agree to my child participating in this study.

Child's Name: Date of Birth: Class:

Parent/guardian's signature: Date:

Appendix 11 – Study 2 Pedometer recording form

Name:

Pedometer Number:

Class:

	Number of steps before break time	Number of steps after break time	Number of steps before lunch time	Number of steps after lunch time
Day 1				
Day 2				
Day 3				
Day 4				

Appendix 12 – Study 2 Adapted SOCARP recording form

Date:				(S	ystem	fo	r C) bs (S	ervii Scho	SOCA ng Chil ol:	AR dre	PR n's	Rec Acti	ord vity	ling 1 and	Forn Relat i	n ions Ob	ships serve	duri r:	ng Pl	ay)	Sí	tudy:
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Comments:

T = Track Circle track if the child is on the walking/running track on the record interval. Please also circle the activity type even if they are on the track.

Appendix 13 – Study 2 Break time evaluation interview questions

PE Co-ordinator Interview Questions – Evaluation of the Walking Track Intervention

Intrapersonal layer

How did the children respond to the walking track during morning break times? (Possible prompts: where all year groups using the track? Did both boys and girls use the track? Do you think boys or girls used it more? What kind of activities did you see the children engaging in when using the track? Are the children still using the track now at break times?)

The quantitative data revealed that Y3 and Y4 boys' VPA at both postintervention and at follow-up data collection points, why do you think this was in relation to anything you did as a school? (Possible prompts: was there any additional support you provided as a school to encourage boys to be more active? Why do you think this happened with the boys and not the girls?)

Why do you think the girls MPA initially increased and then returned to a similar figure to the baseline data? (Possible prompts: why do you think the girls stopped using the track? Did the school do anything to encourage the girls to not use the track?)

Interpersonal layer

How did the school staff respond to the implementation and use of the track? (Possible prompts: do you think all school staff supported the idea? Why? Why not? What encouraged or discouraged the staff in their support of the track at morning break times?)

During the observations of children during morning break times, some of the observers noted that children were sitting and drawing with chalk, can you share with my why the chalk was introduced? Was there staff consensus on its introduction? (Possible prompts: if there was staff consensus, were there any other alternative ideas proposed?)

Institutional layer

As a school what was the vision for the walking track? (Possible prompts: did you have different visions for its use at different times of the school day? How was this vision agreed/shared with school staff? What did you want to achieve from the walking track?)

As a school, where there any formal or informal polices for the use of the track? If so, how were these developed and implemented? If not, do you think that this could have helped with the implementation of the track? (Possible prompts: how were staff involved in the planning stage of the walking track? Were there any discussions on how the track should be used? Where there any health and safety concerns?)

After the implementation of the walking track, some benches were placed around the track, can you share with me the reason for this lease? (Possible prompts: did all staff agree, do you think it aligned with the vision for the track?)

As a school you introduced the 'walk/run a mile' during curriculum time, can you share with me why you introduced this as a school? (Possible prompts: how did staff respond to this? Do you think that this could have impacted upon children's morning break time physical activity?)

What would your advice be to other schools that are going to implement a walking track to increase children's break time physical activity? (Possible prompts: in the planning stage? Developing a vision? Formal and informal rules? Implementation stage? Measuring the impact?)

Community layer

Parents were invited to the opening of the track, do you think that this helped in anyway? (Possible prompts: what information did you give to the parents in relation to the schools' reasons for implementing the walking track?)

Appendix 14 – Study 2 Break time intervention evaluation interview analysis

Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009) Key – Descriptive comments (blue text), linguistic comments (<i>red italicised text</i>) and conceptual comments (<u>underlined</u>).					
Emergent themes	Original transcript	Exploratory Comments			
Initial buzz Health and safety concerns	 Interviewer: Ok then, my first question is how did the children respond to the walking track during morning break times? Teacher: initially it was new so everyone was really keen and there was a big buzz about it and on the website and the parents all knew and it was in the assembly I say that but even now they still really like going on it and there is a running club that happens at lunch time but because of staffing it's only a certain number of children but at playtime now, morning play we make sure that there is enough staff on there so that anyone can go on there at any time, but it's the same ones that go on. But the girls are 	An initial wow factor in relation to the walking track. Acknowledges an initial 'buzz' about the track and anticipated a decline in activity. Staff needed to man the track during break times School has health and safety concerns in relation to the track, this is mainly due to a mound at one place on the track that the teachers can't see the children if they go behind. Thus, the school has limitations in relation to when the children can use the track.			
Girls socialise at break times	 being encouraged more to waik and talk around there but they kind of do one lap and then they kind of go off and have a chat somewhere else so it is being used but maybe notyeah. Interviewer: So do you think the boys or girls are using the track more? Teacher: the boys definitely use it more than 	Girls only walking around the tack once and then going and chatting somewhere else in the playground. <u>Girls view playtime as an opportunity to socialise</u> with their friends			
Boys race around the track	22. the girls, the girls kind of don't sustain it as 23. much as the boys do. The boys are more	Boys use the track more than the <u>girls</u> , boys are competitive to see how many laps they can do around the track.			

Boys dominate the track	24. competitive going around, how many laps they 25. can do but as a general rule the girls come in	Boys dominating the track, especially if they are racing around the track this probably puts the
-	26 and just do one lap of talking and chatting and	girls off from using the track; they don't want to
	27. then they kind of an off somewhere else really	compete with the boys.
	27. Unen diev kind of go on somewhere else really.	
	28. Interviewer, so nom your observations then,	Girls walk and talk around the track
Girls sit and talk	29. When the girls go off what kind of things are	
	30. they doing?	Girls go to the buts and benches to sit and have
	31. Teacher: they go off by the huts and kind of	a chat with their friends girls are drawn to the
	32. lean on the huts and have a chat, they go on	a char with their mends gins are drawn to the
	33. the benches and continue their chats on there.	physical realures of the playground that
	34. Yeah kind of short bursts to different places	encourage sedemary behaviour. The honohoo
	35. really and 9 times out of 10 it's because we	sealing areas inside of them. The benches
	36. kind	girle to sit and shot. Also they were drawn to
Devia developate the	37. of said let's have a chat and a walk around so	gins to sit and chat. Also they were drawn to
Boys dominate the	38 they have to be encouraged more but we don't	spaces in the playground that were not
playground space	39 have to encourage the boys as much	dominated by the boys.
	40. Interviewer: so what kind of things are the hove	
	40. Interviewer, so what kind of unings are the boys	Giris were encouraged by statt to walk and talk
	41. doing them:	around the track, but boys dominated this space.
	42. Teacher: erm so, for example when I mout	
David and a survey stitle of	43. there I say to them right I am going to time	
Boys and competition -	44. You now long it will take to go around the track	Development of the second s
racing around the track	45. and they go. The girls do come but erm the	Boys enjoy competition and racing around the
	46. boys just like to see who is the quickest and	track boys utilise their playground environment
	47. who can take over who and who is the quickest	
	48. year 2 boy and the quickest year 1 boy so that's	
	49. how it tends to work really.	
	50. Interviewer: Which leads me onto my next	
	51. question, so the quantitative data revealed that	
	52. the year 3 and 4 boys VPA increased at post	
	53. intervention and then it continued to increase.	
	54. erm so you mentioned some things previously.	
	ss so what do you think you added as a school to	
	 48. year 2 boy and the quickest year 1 boy so that's 49. how it tends to work really. 50. Interviewer: Which leads me onto my next 51. question, so the quantitative data revealed that 52. the year 3 and 4 boys VPA increased at post 53. intervention and then it continued to increase, 54. erm so you mentioned some things previously, 55. so what do you think you added as a school to 	

	56. keep the boys going?	
	57. Teacher: yeah so we have incentives of timing,	
	58. erm, I think the boys just like the fact that they	
	59. are top of the school now and getting the	
	60. younger ones to come and join them. So it was	
	61. kind of staff saying well how far can you get	
	62. around in three minutes, how many laps can	
	63. you do, so lots of staff encouragement really	
Boys and imaginary play	64. but saying that the boys like playing	
	65. superheroes around the track and pretending	Boys played superneroes around the track and
	66. they are superman and different things like that	imitated their own games Boys engaged in
Child lod play	67. and yeah they kind of initiate their own games	maginary role play using the track as stimuli,
Critic led play	68. really as well as the staff supporting them. The	imposed playaround
	69. boys love it and you don't want to discourage	imposed playground.
	70. them but because they kind of bound on	'Boys loved it' boys really enjoyed the track staff
	71. passed the girls who are walking by they might	know they dominate but don't want to discourage
	72. intimidate them a little bit but yeah the boys	them from using the track. 'bound pass the girls'
Boys dominated the track	73. seem to access it more despite encouragement	intimidate the girls, dominate the space. Boys
-	74. from us. I think it's helped that when we do our	dominated the track, boys engaged in a higher
	75. run a mile as a class, they see us as role	intensity of PA than girls who were just walking
	76. models doing it with them. I think if you model	around the track. Girls were intimidated so were
Girls sitting and talking	77. it more they are more inclined to follow.	pushed to other areas of the playground and
	78. Interviewer: in terms of the girls then, their	resumed to their habitual behaviour of sitting and
	79. data showed an initial increase in their	talking in huts and on benches away from the
	80. moderate PA and then it dropped back down to	boys.
	81. baseline figures, do you think there are any	
	82. other reasons why the girls may have not been	
	83. that interested?	
	84. Teacher: I think, they were more inclined to do	Girls are also engaged in imaginary play
Girls and imaginary play	85. like skipping and the imaginary play, so from	teachers view them as more 'creative than
cine and imaginary play	86. when you walk out and about the girls are	physical' Teachers lack of understanding of
	87. playing mums and dads games, or dancing so	

Boys are more physical	88. then it seems more creative than physical if	physical activity, can they be creative and
	89. that makes sense.	active?
	90. Interviewer: so if we think about school staff	
	91. now, so how did they respond to the	
	92. implementation and use of the walking track?	
	93. Teacher: So when we did the PE audit if you	
	94. like, it was mentioned as an idea and everyone	All staff thought the walking track was a good
	95. was really keen and thought it was a really	idea in relation to children's health
Staff ann an ma	96. good idea because of the health of the children	a good idea but
Starr concerns	97. but there were questions raised relating to	starr agreed that the track was a good idea but
	98. inclusion, weather and time. So as a staff we all	discussing the use of the track during curriculum
	99. came together and collated all the worries I	talk for the 'walk a mile a day' This was their
Staff control	100.guess and thought of solutions and everyone	main focus probably because they had control
	101.seemed to take it on board and be really	over the 'walk a mile a day' instead of children
	102.involved in it and they all signed the PE policy	freely using it at break times.
	103.to say this is what we are going to be doing	
	104.and I think generally as a rule the staff thought	
	105.it was a really good idea and great use of space	
	106.and you can always see teachers out there, but	
	107 it is just making sure its regular because I think	Priority subjects of English and Maths,
Priority subjects	108. curriculum takes over and data takes over and	importance in primary schools will also be linked
	109. sometimes physical activity isn't as important	to these subjects.
	110.as getting your writing finished so	
Supportivo staff	111. I think once we launch	Supportivo staff, overvene thinks it's a good
Supportive start	112. this next initiate hopefully that will make it	idea, however its harder to put into practice
	113.more of a buzz then but everyone has been	primary school teachers have lots of pressures
Pressures and time	114. really supportive and thinks it's a great idea and	The school needs to move away from adult input
	115.that's including governors as well, they were	in the playground and have adults as facilitators
	116.really impressed and the use of the money.	rather than placing more work on them.
Staff control – adult view of	117.Interviewer: So how did you involve the	<u></u>
the playground	118.governors then?	
	119. Leacher: so I went to speak to them and I	

	120.showed them the data that we had collected	Physical activity is important, reporting back to
Physical activity is important	121.from the beginning and kind of the ideas that	the school governors; does the collection of data
	122.we had for this term with Woodrow winners	and use of measurement make it more
	123.and around the world. We were hoping to start	important? Links back to previous comments on
	124, the run a mile with parents as well so it's trying	use of data in schools.
Difficult to sustain PA	125.to keep things fresh I think because it is an	
increase	126.initial buzz and it has died down and we knew it	Difficult to sustain the initial increases in
	127. would anyway and with the constraints of staff	children's PA
	128.and time it's hard to keep it fresh and keep	
	129.everyone motivated by it, so it's trying to find	Constraints on staff time the school believes it
Staff control – adult view of	130. different ways.	has to be stattled, they need to consider a
the playground	131.Interviewer: and are the boys still using the	child s view of the playground.
	132.track did you say?	
	133. Teacher: yeah I would say the boys are still	Boys dominating the track girls are choosing
Boys domination of the	134.dominating the track really, it's more the girls	other options
track	135.that are choosing more creative options which	
	136.are more available at lunch times really rather	Boys dominate the playground space and the
	137. <mark>than morning break.</mark> The morning break	girls move into other available space.
	138.skipping is out for key stage two but for key	
	139.stage one there are not that many resources	
Staff control	140.out, maybe that is something that we need to	Again the school believe that children's PA
	141.consider. It's hard for staff because when they	should be adult led.
	142.have to go back in and they are thinking about	
	143. <mark>lessons that they are doing after playtime</mark> , its	
	144.had to give them a game to lead if you like	
Time constraints	145. because they haven't got time. It's just trying to	Wants to find an easy solution, with not too
	146. get a balance really (laughs).	much strain on staff resource and time. If this is
	147.Interviewer: do you think that there is any way	the case they need to move away from the 'adult
	148. that you could encourage the girls to walk	view of the playground .
	149.around the track?	
	150.Teacher: there might be, we could just say who	Girls need more encouragement to walk around
	151. wants to go for a walk, I don't know how you	Gins need note encouragement to walk alound

	152.would encourage that for them to do it on their	the track – this is probably not going to happen
	153.own I quess. Definitely that would be	with whilst the boys are dominating the track with
Boys dominate the track	154 something easier to do but it would be how we	their racing activities.
	155 could encourage that. I don't know what the	
	155.could checking chart i don't know what the	
	157 Interviewer: So during the observations, some	
	157. Interviewer. So during the observations, some	
	158. Of the observers noted that some of the	
	159. Children especially the girls were sitting and	
Not all children should be	160. drawing with chaik	From her body language she disagreed with this
active – lack of staff	161. Leacher: (laughs and shakes her head)	
agreement	162.Interviewer: can you share with me why the	
5	163.chalk was introduced and whether there was a	Teachers believe that they need a break and
	164.staff consensus for this?	don't have time to promote children's PA at
	165.Teacher: so erm laughs, it was in the KS2	break times, yet teachers are encouraging
	166.meeting and it was felt that there was a lacking	children to continue with their writing at break
Lack of 'buy in' from some	167. in arty, creative things for the children who	times. Don't children need a break too?
staff	168.would like to be drawing and writing so the	
	169.deputy head who would the ks2 leader thought	Not all of the staff have bought into the idea of
	170.it was a good idea to take the chalk out and	encouraging children to be physically active at
	171.that's how it came about really so she kind of	break times. Links back to the vision for the
	172.put it out there and we have to agree really so	walking track, staff needed to understand the
	173.that's how that came about.	importance of PA for children.
	174.Interviewer: and were there any alternative	
Importance of support from	175 ideas put forward?	'she put it out there and we have to agree really'
senior management	176 Teacher: yeah from that we have the scooters	highlights the importance of senior management
_	177 out on certain days and football and skipping so	support, if they have different priorities and
	178 different things are going on but she felt that	visions it can be detrimental to the work the PE
	179 there was something lacking for those who	coordinator was trying to achieve
	190 wished to not take part in that really yeah	
	101 (laughe)	
	101. (iaugiis).	
	182. Interviewer: so as a school then, what was the	
	183. Vision for the walking track?	1

	184. Teacher: I think definitely to raise the culture of	They had an agreed vision as a school e.g. 'to
School vision	185. physical activity erm get the children enjoying	raise the culture of physical activity'.
	186.moving and using it as much as we can across	
	187.lessons so I know nursey have gone around on	Their focus wasn't just on break times, they
	188.an autumn hunt and we have used it for	wanted children to be active across the
Staff control	189.phonics on different trails and things and we	curriculum, however this can clash with the
	190.have used it as much as we can across the	existing busy primary school day. Maybe they
	191.curriculum but generally it was to get the	overloaded the teachers and children during
	192.community involved and we have had two	curriculum time with the walk a mile a day.
	193.Olympians come in now and then we had one	
	194.of the local footballers came and official open	Olympians visiting the school to promote the
An outward projection	195.the track so we have had a couple of people	Domonstrates the importance of the track to the
	196.come around which is great for the kids so they	school - but was this just an outward projection
	197.can see that keeping healthy and keeping	of success rather than focusing on increasing
	198.focused is good and what you can achieve. Erm	and sustaining children's physical activity levels
	199. but as a school the vision is to raise the status	
	200.of it in school really and I think as a school	
	201.going forward I think we need to do more	
	202. about the healthy living generally not just	
	203.moving but nutrition and healthy eating and	
	204.things so that's in the pipe line I think for this	
	205. yeah but yeah that's where we are.	
	206. Interviewer: So do you think you have achieved	
Journey is just beginning	207. this vision now?	
	208. Teacher: I think its work in progress still, I think	Physical activity has risen across the school '
	209. its definitely risen across the school it feels	think it is more prominent' beginning of the
	210.more prominent but I think it is the beginning	journey as not all staff have bought into the idea
	211.really because it's only been 6 months hasn't	just yet.
	212 really so we have a long journey I guess. I	
	213 think there is a lot to build on which is good.	
	214.Interviewer: Ok so you kind of mentioned a	
	215.little bit about this before, about how you got	

Health and safety concerns – lack of focus on children's PA	 216.the staff to sign the policy so my next question 217. then is where there any formal or informal 218.policies the kind of dos and don'ts for the use of 219. the track? 220.Teacher: Yeah so as a staff we thought about 221.health and safety so about how you overtake at 222. certain points, that we don't push people out 223.the way and we agreed as a staff that we 	Some agreed principles but related to the health and safety of the track rather than increasing children's physical activity.
Staff control	224.would have certain people positioned around 225.the track. On the policy we agreed that we 226.would do it as much as we can within the 227.curriculum time erm, yeah. So then we had an 228.assembly about the dos and don'ts and shared 229. it with the children and then in class they 230.wrote class rules with how they would use it to 231.make sure they were safe and to make sure	<u>The children were told what they could and</u> <u>couldn't do, is this placing an adult view on the</u> <u>playground?</u>
	232.everyone's joining in and stuff really so yeah it 233.kind of funnelled down right to the children 234. <u>really</u> which was good. 235.Interviewer: so how were the staff then 236. <u>involved</u> in the planning stage? 237.Teacher: so initially I went to the head teacher 238.with the idea and then the idea was put onto a	A funnelled down approach <u>rather than starting</u> with the children.
Sense of autonomy	239.piece of paper that he drew and then basically 240.we got all the planning for the funding and 241.things and we knew it was coming, I put in the 242.staff room this is what's happening can you 243.write down any concerns that you have got and 244. then we came together in a staff meeting and 245.we discussed then, so instead of me kind of 246.saying this this and this, we discussed it 247.together and then in the key stage meetings we	Tried to provide staff with an element of autonomy – collected staff concerns – considered inclusion e.g. boy in a wheel chair.

-

	248. wrote down a list of all their concerns and they	However staff concerns were more related to the
	249. had to fond the solutions to them. So for	health and safety of the track rather than the
	250.example one of them was about a little boy and	children's physical activity levels.
Health and safety concerns	251. his wheel chair and how he would access that	
	252.and then we agreed that he wouldn't go on the	
	253. grass we would keep him on the track so that	
	254. he wouldn't get stuff on the grass. So that kind	
	255. of stuff was discussed and agreed really, so	
	256 instead of me saving x, y and z, everyone came	
	257 together and then I shared everyone's thoughts	
	258, and then we agreed a final protocol if you like	Staff agreed a protocol – but related to health
Health and safety concerns	259 and then we went from there.	and safety and the dos/don'ts of the track.
	260.Interviewer: So when the staff signed the	
	261.policy, what were they signing?	
	262. Teacher: they were signing to the ethos of PE	Staff didn't really sign up to the break time use of
Staff control	263. and what we are doing, so they signed to	the track it was more of a curriculum time initiate
Cian control	264 agreed that they would do the run a mile and	that was their focus. They wanted to utilise the
	265 they signed up to the kind of change of culture	track at other times of the day. However, does
	266. really that we are pushing for not just outside	this not add extra pressures onto staff time and
	267.but in lessons as well when they see team work	resource?
	268, or fairness and respect. So that's what the	
	269. policy was for and everyone signed to say that	
	270.they would do that.	
	271. Interviewer: After the implementation of the	
	272. walking track some benches were placed	
	273. around the track so can you share with me the	
Clash of visions	274.reasoning behind this?	
	275. Teacher: I can't really, the head teacher might	She couldn't explain what the reasoning behind
	276.be able to, I don't know why, I think they are	the benches was. This was the head teacher's
	277.an absolute yeah <mark>. I think they are a massive</mark>	idea. <u>The PE coordinator didn't believe in the</u>
	278.deterrent to what we are trying to do	benches, she described it as 'a massive
	279. <mark>personally.</mark> The head teacher thought in the	deterrent to what we are trying to do. The head

	280.summer it would be nice for them to have a	teacher was more concerned with the
Outward projection	281.walk around the track and then have a sit and a	appearance of the track rather than considering
	282. chat and then have another walk round. I think	the impact the benches would have on children's
	283. it's a massive deterrent to be honest, I think	physical activity.
	284.it's, I don't think it helps, but that's the head	
	285. <mark>teachers call.</mark> He thought it would be nice as a	The head teacher's call – the PE co-ordinator
Power dynamics	286.scenic you know sitting and chatting space	agree with the installation of the benches
	287.which isn't what we were aiming for really but I	however, the head teacher has the final say.
	288. guess he's thinking for those that don't want	Despite the PE co-ordinators knowledge the HT
	289. to.	doesn't seem to let her lead the subject.
	290.Interviewer: So do you think that links back to	Reinforces the need for the head teacher to
	291.the concerns that you have the staff to list?	support but also understand the key components
	292. Teacher: yeah, because some of the staff was	or an intervention.
	293.like it doesn't have to be run a mile it can be	
	294.walk a mile, so I think some of them thought	School staff lack of understanding of the concept
	295.that physical activity just means running which	of physical activity
	296.it doesn't. so maybe it is to encourage a walk	
	297.and a stop, a walk and a stop he never really	
	298.told me the reason behind it (laughs). I think	
	299.maybe he thought about the appearance of the	
Outward projection	300. track not necessarily how it is used. That's	PE coordinator doesn't agree, head teacher
Class of visions	301.what I think (laughs). It's a bit awkward to	more concern with the appearance of the track
	302.have that chat with the head teacher because	an outward reflection of the school rather than
	303.he made the decision so yeah that's my	focusing on the children's needs.
	304.feeling about it I told you I would be honest.	
	305.Interviewer: so as a school then you introduced	
	306. the walk/run a mile a day as well during	
	307.curriculum time, erm, so again what was the	
Staff control	308.reasoning behind introducing that?	The askesturents day find an economy of
Starr control	309. Teacher: I think it was easier thinking how we	tracking children's physical activity. They have
	310.are going to track how many steps they were	more control over it during curriculum time rather
	311.doing rather than at lunch time there could be	more control over it during curriculum time father

	312.so many going at once it would be hard to track 313.and I think teachers wanted to do it as kind of	than at break times, even though this impedes on their existing busy schedule.
	314.a brain break if you like to kind of refocus and if	
	316.choosing a child in each class who is an	
	317.average for that day and to say as a class they	
	318.have done three, so it's easier to record rather	
	319. <u>than</u> at break times.	
	320.Interviewer: what would your advice be to	
	321.other schools if they were thinking of	
	322.implementing a walking track?	
Boys and girls have	323. Leacher: I would say it's been really useful to	Believes it is important to target girls and boys
different activity preferences	325 of activity, erm and whether there are certain	separately, from her own observations realises
	326.sub groups that are accessing physical activity	that the girls are not as active as the boys.
	327.more than others and if they enjoy it because	
	328.like we said before the girls like more creative	
Staff control	329.stuff and that what they always go for whereas	
	330.the boys like the racing games and the cars, so	Sustainability is key – consulting the children is
Sustainability is key	331.they tend to access the track more so I think	important however it seems as though they still
	332.for us we know the track isn't being used as	want to place an adult view of the playground on
	333. much so we need to think of a way that we	the children.
	334. Can sustain it but also encourage those that	
	335. aren't likely to do it without being guided so it's	
	337.children and what interest them but making	
Outward projection	338.sure that you are not being complacent with it	
	339.and keeping it relevant and with people still	I he school invested a lot of money into the track
	340.using it and keep nagging people about the use	importance appearance of the school to the
	341.of it really because there is a lot of money	head teacher rather than children's physical
	342. Invested in it.	activity levels?
	343.Interview: because our initial conversations	
	344 when we first stated to consider break time	
----------------------	--	---
	and interventions we discussed kind of imaginary	
	345. Interventions we discussed kind of imaginary	
	346.stimuli as well as the waiking track. Do you	
	347. think that may have captured the girls interest?	Cirls and imaginany play to a charp links
	348. Teacher: definitely, the girls you can give them	Gins and imaginary play – <u>teachers links</u>
<u></u>	349.a piece of ribbon and they are away, they are	imaginary play to portable resources rather than
Girls imaginary play	350.well away but I think a lot of it as well sound	considering fixed equipment or playground
	351.daft its storage so a lot of the teachers haven't	markings and paintings of superheroes etc.
	352, got time to get the box of stuff get it out and	
	353 then put it all away, they haven't got time to	
	254 so there are different constraints. At morning	
	ass play it peode to be comething that is colf-	Staff have limited time
	sss.pidy it needs to be something that is sen-	
	356. Initiated of I don't know what that would be	PE coordinator started to consider that the
	357.0F what that would look like but it would be	children's PA needs to be facilitated rather than
	358.great to do something like that but I don't	led by adults.
	359. <mark>know really.</mark>	
	360.Interviewer: initially we discussed putting	
	361.imaginary characters of different things on the	
	362. playground, even having signs up around with	
	363. different characters around the track or mini	
	364 fairy doors around the playground.	
Class of visions	365 Teacher: yeah we had the ideas with the fairy	PE coordinator is restricted by what the head
	266 doors didn't we but yeah I spoke to some of	teacher wants, she knows they need to try and
	and the sine the other day when they were standing	target the girls physical activity
	367. the girls the other day when they were standing	algorato gino privoloaraoanty.
	368. by the wall having a chat and I said to them	
	369.1 m just interested you know, there is this going	
	370. on and that going on, I'm just interested you	
	371.know why you are standing here really, you are	
	372. not in trouble or anything, I am just interested.	
	373. They said well I kind of like dancing and	
	374.cheering leading and gymnastics and stuff like	
	375.that and I thought well I can't get the mats out	

Staff control – adult view of the playground	376. but maybe if we had some sort of music stereo 377. out there, its where we are going to put things 378.now I mean we have a table tennis table 379.coming that the head teacher has been banging 380.on about for ages but its where are we going to 381.put it. Key stage two have so much now and 382.Key stage one have hardly anything around 383.here. I mean we have those huts that are a 384.waste of space and we had those horrible 385.pencils that have all been taken off now but we 386.need something this side, we need to have a 387.think about it. 388. 389. 390.	<u>Head teacher trying to place his view of what the playground should look like – table tennis will only create sedentary spectators as not a lot of children will be able to access the resource at the same time.</u>

Appendix 15 – SOFIT systematic observation form

Date		School	Grade /Period	Teacher Teach	her Gen: M F SERIES
Time :	start	Observer	Rel obs	No girls boys	Location: <u>O I</u>
Time (end _	Lesson Length	No of obs	_ Page 1 2 3 4 of	
		Céculomé	Lassan		NOTES
		Student	Lesson		NOTES
Inter	val	Activity	Context	Interactions	
	1	12345	MKFSGO		
	2	12345	MKFSGO	TON	
~	3	12345	MKFSGO		
0	4	12345	MKESGO		
۱۱ ۵	6	12345	MKESGO		
c	7	12345	MKESGO		
m/f	8	12345	MKFSGO	ION	
	9	12345	MKFSGO	ION	
	10	12345	MKFSGO	ION	
	11	12345	MKFSGO	ION	
	12	12345	MKFSGO	ION	
	13	12345	MKFSGO	ION	
	14	12345	MKFSGO	ION	
	15	12345	MKFSGO	ION	
t	16	12345	MKFSGO	ION	
w	1/	12345	MKFSGO		
0	18	12345	MKFSGO		
	20	12343	MKESGO		
m/f	20	12345	MKESGO		
	22	12345	MKESGO		
	23	12345	MKFSGO	ION	
	24	12345	MKFSGO	ION	
	25	12345	MKFSGO	ION	
	26	12345	MKFSGO	ION	
	27	12345	MKFSGO	ION	
t	28	12345	MKFSGO	ION	
h	29	12345	MKFSGO		
r	30	12345	MKFSGO		
e	31	12345	MKFSGO		
e	32	12345	MKESGO		
m/f	34	12345	MKESGO		
	35	12345	MKESGO	ION	
	36	12345	MKFSGO	ION	
	37	12345	MKFSGO	ION	
	38	12345	MKFSGO	ION	
	39	12345	MKFSGO	ION	
f	40	12345	MKFSGO	ION	
0	41	12345	MKFSGO	ION	
u	42	12345	MKFSGO	ION	
r	43	12345	MKESGO		
	44 15	12343	MKEGGO		
m/f	45	12345	MKESGO		
	47	12345	MKESGO	LON	
	48	12345	MKFSGO	ION	

SOFIT RECORDING FORM

SUM

Appendix 16 – Study 3 Head teacher consent form



Informed School Consent – Head teacher

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- ✓ Researchers will be present in a selection of physical education lessons (Y3 and Y4) and will systematically observe physical activity levels, lesson context and teacher behaviour.
- \checkmark Group interviews will take place with children from years 3 and 4.
- \checkmark A selection of teaching staff will be interviewed.
- ✓ The study will not cause children any physical or psychological harm.
- ✓ The study will not affect the children's learning in any way.
- ✓ This study is designed to further our knowledge in the area of physical education and all procedures have been approved by Newman University's Research Ethics Committee.
- ✓ The school is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing.
- Procedures, benefits or risks of the research have been explained to the school through an information booklet and discussions with the physical education coordinator.
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer.
- Results will be shared with the school, communicated through an evidence report/pack.
- \checkmark

By signing and returning this form, I agree to the school participating in this study.

Head teacher's signature: Date:

Appendix 17 – Study 3 Class teacher consent form



Informed Teacher Consent (Class Teachers)

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- ✓ I will be observed teaching primary PE lessons at two different points in the school year.
- ✓ Individual children will be observed for four minutes during the observations, they will be asked to wear a coloured band so that they can be easily identified.
- ✓ The researcher/s will stand/sit on the edge of the working space, with a clipboard and MP3 player so that they can take time sampling observations (every 20 seconds).
- ✓ I will be involved in an individual interview regarding my perceptions of children's PA in PE lessons.
- ✓ The observations will contribute to providing a bigger picture of physical education/physical activity within my school setting and all procedures have been approved by Newman University's Research Ethics Committee.
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer.
- \checkmark No real names will be used in the write up of the study.
- \checkmark There will be an opportunity for feedback from the lesson observations.
- ✓ I am under no obligation to take part in the study and have the right to withdraw from the study at any stage for any reason, and I will not be required to explain my reasons for withdrawing.
- ✓ Procedures, benefits or risks of the research have been explained to me.
- Results will be shared with the school, communicated through an evidence report/pack.

By signing and returning this form, I agree to participate in this study. If you require any further information please email me on <u>e.powell@newman.ac.uk</u>.

Teacher's name: Teacher's signature:

Date:

Appendix 18– Study 3 Guardian consent form



Research Study: Children's physical activity levels during primary physical education

Dear Parent/Guardian,

Newman University would like to invite your child to participate in a short research study which will focus on how active your child is during their PE lessons. Physical activity is important for your child's muscle and bone development along with protection against a number of diseases. _____Primary School aims to ensure that your child receives the best possible PE lessons and the research project will help to monitor the provision it provides.

The school will be visited over the course of two to three weeks. During this time your child will be observed during PE lessons to track their physical activity levels. So that the researcher can identify them, they will be asked to wear a coloured band. Your child will only be observed for a four minute period and the researchers will aim to position themselves on the perimeter of the working space to avoid any interruptions to your child's learning. The lead researcher is a qualified teacher and is currently a Senior Lecturer in Primary Education at Newman University. Other researchers may accompany the lead researcher, but in all cases visitors will hold CRB/DBS clearance forms and ID which will be checked by the school.

The overall results of the study will be shared with the school which will enable them to reflect upon the PE opportunities it provides for all children. Individual results of your child can also be provided for you upon request. All information provided will be anonymous and kept confidential. Data will be stored securely at Newman University. Taking part in this study is voluntary and you may choose for your child to take part or not and they may leave the study at any time.

If you are happy for your child to take part in the research, please can you sign the parental consent form. It is important that this is completed otherwise your child will not be able to take part in the study. If you have any questions or concerns about the research please speak to ______ and s/he will be happy to discuss it with you.

Yours faithfully,

Mrs Emma Powell Senior Lecturer in Primary Physical Education



Informed Guardian Consent

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- My child's physical activity patterns will be tracked during physical education lessons using direct observation.
- ✓ My child will be asked to wear a coloured band, so that they can be easily identified by the observer.
- \checkmark My child will be involved in a small group interview.
- ✓ The study will not cause my child any physical or psychological harm.
- \checkmark The study will not affect my child's learning in any way.
- ✓ This study is designed to further our knowledge and contribute towards improving physical education in the school and the wider researcher community.
- ✓ All procedures have been approved by Newman University's Research Ethics Committee.
- ✓ My child is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing.
- Procedures, benefits or risks of the research have been explained to me through the attached letter.
- ✓ All individual results will remain confidential and will be stored securely on a password protected computer.
- $\checkmark\,$ Results will be shared with me for my child upon request.

By signing and returning this form, I agree to my child participating in this study.

Child's Name: Child's Date of Birth: Child's School Class:

Parent/Guardian's Signature:

Date:



Appendix 19 – Study 3 children's information leaflet

Dear Children,

My name is Emma and I am a Lecturer in Education at Newman University in Birmingham. I love to learn new things and really enjoy carrying out science investigations.

As you probably already know, keeping active is a really important part of maintaining a healthy heart. In a typical day, children should be active for at least 60 minutes, which is around 12,000 steps!

I have spoken to your teachers and they are keen to find out how active you are during your PE lessons.

How will I be involved? The

investigation will involve me or one of my work friends visiting your PE lessons at some point during the school year. We will use an observation form to track how busy you are, taking notes during the PE lesson. You may be asked to wear a coloured PE band during the lesson, so I can spot you easily. Just like in the picture below. You don't need to do anything special, just enjoy your PE lessons! If you decide at any point you don't want to wear the band or to be observed that's ok, just tell your teacher and we will stop.



What will happen to the results? I will share the overall results of the study with your school. I will also write and talk about how active you are during your PE lessons to some other people. This will help other children and schools to be more active during PE. However, to protect your school, your teachers and your identity I will keep the entire information top secret by using disguise names.

Do I have to take part? If you don't want to take part that's ok you may still see us in your PE lessons but we will not be watching you. If you do wish to take part then please talk to your parents about it, as they will have a letter too; and don't forget to return your permission slip to your teacher.



Appendix 20 – Study 3 Children's group interview questions

PA in Primary PE Group Interview Questions

1. Concept of 'physical activity': What do you think I mean by the word

active?

(Is it important to be active?How active do you think you are?What types of activities do you do?At school? At home?Do you think your teachers are active?Are you parent's active?)

2. <u>Physical Education:</u> Can you tell me what you have been learning to do in your PE lessons?

(Do you enjoy your PE lessons?
What do you like about your PE lessons?
What do your teachers do during your PE lessons?
Do you think your teachers like PE?
How active do you think you are in your PE lessons?
Do you think you could be more active in your PE lessons?
Is there anything you don't like about your PE lessons?
Can you share with me what you did in your last PE lesson?
Do you enjoy doing PE?
Do you think your PE lessons could be better? Why?).

- 3. <u>School Sport:</u> Do any of you attend any after school sports clubs? (Why do you/don't attend these clubs? Do you enjoy the clubs? What types of clubs would you attend after school or during lunch times?)
- 4. Do you think you could be more active/move more in a school day? How do you think you could be more active?

Appendix 21 – Study 3 Teachers' individual interview questions – guide

PA in primary PE Interview Questions - Teachers

Intrapersonal: Would you be able to share with me a particular memory of taking part in PE at primary or secondary school? (Possible prompts: Is this a positive or negative memory? Why do you think that is? Do you have mostly positive or negative memories of PE? Why do you think that is? What made them positive or negative experiences? How do you feel about exercise? Do you take part in any exercise at the moment? Why is that?)

Intrapersonal (understanding of key constructs): Within a primary school setting the terms 'Physical Education, Physical Activity and Sport' are used interchangeably. What do these concepts mean to you when applied to a primary school setting? (Possible prompts: Which part of the school day do they fit in to? Can you give me examples of each one when applied within your own school setting?)

Institutional and Policy: How would you describe Physical Education in your school (curriculum time)? (Possible prompts: How often is it taught? How do staff feel about teaching it? Are children active in PE lessons? Are children active in your PE lessons? How do you feel about having to teach PE? Why do we teach PE? How do you know what you should be teaching in the PE lessons? Do children enjoy PE? Do you feel children make progress in PE? How do you know? What advice would you give to other teachers to increase children's PA levels in PE lessons?)

Intrapersonal: How confident do you feel teaching PE? (Possible prompts: Where does this confidence/lack of confidence come from? Are there any facilitators/barriers to delivering PE? Are there any Facilitators/barriers to children being active in PE lessons? Do you have schemes of work to follow? Is there CPD available? What would make your job easier with regards to teaching PE?)

Policy: Can you share with me anything you know about the primary PE and school sport funding? (Possible prompts: What do you think the money should be spent on? Why do you think the government is providing this new funding? Do you think it will make a difference? What do you think needs to be done to improve physical education? To improve children's PA levels in PE?)

Policy: Do you feel prepared to teach to the new PE curriculum? (Possible prompts: are you aware of any changes?)

Institutional: What do you think your school needs to do in order to build upon its current PE curriculum?

Interpersonal: Do you feel you need any/ or would like any support in terms of your delivery and understanding of PE?

Emergent themes	Original transcript	Exploratory Comments
Mixture of positive and negative past experiences of PE	 Interviewer: If we can start with you thinking back to your own PE lessons when you were a child to a primary or secondary school and when you think back on those memories whether you think that they're positive, negative or a mixture really? Interviewee: I think I probably have a mixture, I think I have more positive at primary school and not negative when I was at secondary school but it didn't ever seem quite as fun, as when I was at primary school. I remember having to go outside in the freezing cold and we had to wear a netball skirt we were never allowed to wear trousers. So that was not a positive memory for me looking back on it now. 	A mixture of positive and negative experiences Positive primary school experiences – links to having fun and the subject of gymnastics Negative secondary school experiences – links to netball, gym kit and being outside in the cold.
Positive primary school experiences	 16. But when I was at primary school I remember 17. gymnastics on the apparatus and like running 18. around doing games and sports days and things 19. so positive when it comes to primary and not 20. so positive when it comes to secondary. I 21. suppose that's why I am a primary school 22. teacher. 23. Interviewer: So why do you think that they 	Own reflections on career choice - positive primary school experiences.

Appendix 22 – Study 3 example of an analysed interview transcript from the teacher interviews

	24. were more positive memories at primary	
	25. school?	
	26. Interviewee: I just think it was more fun, it just	
PE should be fun	27. seemed more fun and we just did things that	
	28. were a lot more fun to a child going on the	Fun primary school experiences – <u>PE should be</u>
	29. apparatus in the hall and sports days and things	fun and something to be enjoyed, not always the
	30. in the playground. I just remember those in a	case reflecting on secondary experiences when
	31. much more positive light than I do those at	they were more focused on games and rules.
	32. secondary school. I think it was just more fun	
	33. for me really and at secondary school it felt	
	34. more serious, it was more about learning	
	35. specific skills and things.	
Sport is not fun	36. Interviewer: So do you take part in any	
	37. exercise, physical activity or sport yourself now	
	38. Interviewee: No not really I go to an exercise	Exercises now but for health reasons – she
	39. class once a week, legs bums and tums, but I	doesn't really enjoy sport 'not a massive sports
	40. would say I do that because I enjoy the	fan'
	41. physical aspect of it, I just want to keep fit and	
	42. stuff. But that' sit really I have never been like	
	43. a massive sport's fan so	
Negative experiences of	44. Interviewer: Do you think that might be why	
invasion games –	45. you enjoyed primary school PE more?	
secondary school	46. Interviewee: I think it was, I think that was	
	47. more fun but when you were at secondary	Negative memories linked to invasion game
	48. school it's all learning like specific sports and I	experiences, particularly netball – this is probably
	49. hated, I just didn't like netball at all. <mark>I have</mark>	why she doesn't enjoy teaching invasion games
	50. really bad memories of being freezing cold on	and she identified it as an area for further training.
	51. the netball court. I just wanted to be anywhere	
	52. else but here at that moment.	
	53. Interviewer: So do you think if the netball was	
	54. indoors you would have still felt the same?	
	55. Interviewee: probably, just because everything	

	56 felt more serious at secondary school and you	PE should be enjoyable rather than serious sports
	57 had to learn things and there was more	with rules probably why she chooses fitness
PE should be fun – sport is	57. Inducto rearrainings and there was more	classes rather than sports now as an adult.
not fun	50. think from secondary school, it's kind of put me	
	60 off	
	61 Interviewer: Ok if we move onto the next	
	62 question. So how would you describe the status	
Values the PE coordinator	63 of PE in your school then?	
	⁶⁴ Interviewee: I think we do quite a lot of PE	Values the PE – coordinator – believes he has the
	65 here. I know that the PE coordinator is really	skills to complete the role.
	66 good and be does loads of sports and activities.	
	67. We make sure we do two PE lessons of PE each	
	68. week, we do one indoor and one outdoor so	
	69. they get guite a nice range as well. We make	
	70. sure we go out even when it's really cold as	
Broad range of activities	71, well. We make sure we get out there and do	Broad range of activities covered in PE lessons
taught in PF	72. our two lessons of PE and we cover a wide	broad range of activities covered in the lessons
	73. range of subjects. I think it's guite good here	
	74. and we have lots of training as well if we need	Her enjoyment and experiences of PE impacted
	75. it. I had training in my first year and because I	her teaching on PE as a subject, particularly in
Past experiences of PE	76. never enjoyed PE that much at secondary	relation to her confidence
impacted upon confidence	77. school I was like this is quite daunting now to	
	78. come and teach PE to 30 children but we have	
	79. a lot of training if we need it and that was	
	80. really helpful. You could have training in the	
	81. areas where you need instead of just saying	Sense of autonomy – choice in training they
Sense of autonomy	82. you are going to have training in this so yeah I	receive as staff
	83. think PE is really good here compared to some	
	84. schools that I've heard of, I think we do quite a	
Children come first	85. lot and we make sure we get it done as well	Putting the children first in terms of their health
	86. because I know the children need to have so	
	87. much time doing exercise a week and we try	

	as and establish an europeration and we haven't	
	88. and catch up on our exercise and we haven t	Aware of DLPs suidelines unstawite sure of the
	89. done it this year yet but I know we are going to	Aware of DH's guidelines – not quite sure of the
Awareness of benefits of PA	90. start. Like we did skipping every playtime and	exact guidance
	91. afternoon play when I was in Y5 so that was	
	92. quite good, so they are definitely getting that	
	93. amount of exercise that they are supposed to	
	94. have.	
	95. Interviewer: Ok thank you, so you have kind of	
	96. touched in this a little bit but how do you feel	
	97. then about teaching PE?	
	98. Interviewee: I was guite daunted by the	Balata ta basan ana ina ang KBE atawata t
Negative experiences of	99. prospect of it when I first came and I had a Y5	Relates to her own experiences of PE – daunted
Invasion games – linked to	100 class so obviously it's a bit scary when they are	by the prospect of teaching something she didn't
past memories	101. older because I felt like they probably knew	enjoy.
	102 more than I did when it came to specific rules	l an antidages in her sum shifts, humanna a
Law and Calance	102 for nethall and backethall. I thought ob gosh	Low confidence in ner own ability – nung up on
Low confidence	103.101 Hetball and basketball, I thought on gosh	knowing the rules of specific sports – comes from
	104. diey know more than 1 do about it so now and 1	secondary school experiences
	105. Going to teach their something new but	Cabaal training has increased has confidence
Cohool training	106. ODVIOUSIY ITOIT THE CLAINING THEE A TOUTHOLE	School training has increased her confidence
	107. Confident with it now. I feel like when I have	
opportunities – confidence	108 time to really prepare a lesson then I really	
	109. enjoyed doing it but I do feel honestly that PE	DE loss anissites and second of months and English
	110. sometimes is one of those things that because	PE low priority – pressures of maths and English
DE a lavo priarito autoiant	111. in the afternoon and it's the same with all	
PE a low priority subject	112. afternoon lessons you kind of focus so much on	
area	113.maths and English that you sort of rush through	Time can be a barrier to delivering offective
Importance of mathe and	114. and sometimes I don't feel 100% prepared	
English	115.when I am teaching PE and that's quite	lessons
English	116.daunting because it's like I'm not 100% sure at	
	117. wh <mark>at I'm going to do.</mark> So the times that I have	
Time is a barrier	118. took the time to really prepare a good lesson I	
	119. do really enjoy teaching it because I feel as	

	120.though it has gone really well and I can see the	Focus on learning during PE lessons e.g. 1 can
	121. children have made progress throughout the	see the children have made progress'
Focus on pupil progress	122. lesson and they have really enjoyed it so I love	
during PE	123. doing it when I know that I am prepared for it.	
	124. I find it a little bit more daunting when I	
	125. haven't really prepared for it that much and I've	
	126. just kind of got to go in and pick it up and go	
	127. with it and I can, I can and I do pick it up as I	
	128.go along and I can see what I need to do and	
	129. how I can move them on from that and I	Cohool training holes to develop staff, so there
DE is a priority in the acheal	130. definitely prefer doing it when I know I have	School training helps to develop start – so there
PE is a priority in the school	131. prepared for the lesson. I think the training has	time for training is this related to the sports
	132. helped me a lot because we did some training	premium funding?
	133. on how to move them on throughout the	premium runuing:
	134. lesson, so instead of having to keep stopping	
	135. them and saying ok we are going to do this	
	136. next, it was with Aspire, and they go around	
	137.and make sure that you can see the groups of	Developing pedagogical skills – considering
Developing pedagogical	138. children that need more support or moving on	different approaches - differentiation and working
skills	139. and then you just move that group on instead	with individual groups rather than stopping the
	140. of stopping the whole class, so they are getting	whole class.
	141. the exercise that they should be doing in the	
	142. lesson as well. I am definitely more confident	Indicate high PA levels in PE lessons She is
	143. than I was, which is good.	conscious of how active the children are during
High PA levels in PE	144. Interviewer: So what would you say are the	PE – are they achieving above 50%?
	145. facilitators and barriers to delivering a good PE	
	146. lesson in which you feel confident?	
	147. Interviewee: I think it's time, that's the biggest	Time is a barries to affective language
Time is a barrier	148. barrier, time and confidence. If it is something	I me is a parrier to effective lessons
	149. that I quite enjoy doing like I quite enjoy	The subjects she feels most confident in
	150. teaching gymnastics but if I was teaching	delivering are the ones that she enjoyed at
	151. netball I would be thinking I don't want to	derivering are the ones that she enjoyed at

	152. teach	primary school – they are also the ones that she
	153. netball, I don't know the rules myself and then	chose to have training in.
	154. you have to research and go away and if you	
	155. do have time to go away and have a good read	
	156. and find all the rules out then it's fine but for	
	157.me I think my biggest barrier is that I don't	Time is a barrier and subject knowledge in
Time is a barrier	158.know all the rules to the different games we	relation to rules of the games – primary PE is
	159. teach and we teach so many because it's	more than rules of the games and this
Cubic et la cude da comune	160. primary school then I'm not sure of them so I	demonstrates a lack of subject knowledge in
Subject knowledge – rules	161. have to go away and learn them so that's my	relation to children's maturation and development
orgames	162. biggest barrier it's just having time to prepare	
	163. so that I have the confidence in what I'm	
	164. teaching but I think once I've sorted that out I	
	165. will feel a lot better about it then.	
	166. Interviewer: So what do you think could help	
	167. with that then?	
	168. Interviewee: I think I mean obviously all the	
	169. training and I did get the chance to train in two	
	170. different subjects like volleyball and gymnastics	A supportive school – supportive networks
Supportive networks	171. so there is always the opportunity to train in	
	172. different things which really increases your	
	173. confidence and having somebody come in and	
	174. even things like learning walks and stuff, I	
	175. mean they are horrible to have but I had one	
	176. with the PE coordinator and the headteacher	
	177. last year and actually they both came out of it	
Developing and the set	178. and said that was really good, I would send	
Developing competence –	179. somebody to you if they were struggling to	Leadership team resitive feedback develops
environment	180. teach gymnastics and that was a big confidence	confidence she does have the skills and
environment	181. boost because obviously I thought you know	knowledge just her past pegative experiences
	182. that it might not have been brilliant but to hear	from secondary impact upon her confidence of
	183. that was really good. So the training definitely	nem cecondary impact apoint ner connucitor of

	184. works and I don't really know what else to say	teaching PE.
	185. because I think it's mainly just time to be able	
Time is a barrier	186. to prepare but you know we cannot magic time	Time is a barrier
	187. from nowhere (laughs) but obviously we get a	
	188. lot of support from the PE coordinator and I	Supportive networks – PE coordinator
Supportive networks	189. know we can just go and talk to him and say	
	190. I'm not quite sure how to teach this and he	
	191. would come up with some really good ideas as	
	192. well.	
	193. Interviewer: So are schemes in place then for	
Time is a barrier	194. you to deliver from?	
	195. Interviewee: Oh yeah there are lots of things	Lots of resources available – but time can be a
	196. like there are lots of resources on the internet	barrier to reading the resources – maths and
	197. and I know the PE coordinator has found a	English a priority
	198. website that we can get a lot of planning from	Englion a priority
	199. and that is really good and we have the TOPs	
	200. cards which talks about the differentiation and	
	201. there's loads of things we can use there are lots	
	202. of resources and stuff like lesson plans, it's	
	203. having the time to find them when you have	
	204.taught maths and English and you are trying to	
	205. get all your marking done sometimes you just	
	206. don't have that time.	
	207. Interviewer: So your next question relates to	
	208. something you were saying earlier relating to	
	209. your training with Aspire. So Afpe recently	
	210. release their health position paper and they	
	211. recommend that children should be active for	
	212.50-80% of a PE lesson. So I just want to know	
	213. your views on this really?	
	214. Interviewee: I think that definitely is, I'm sorry	
	215. I keep coming back to this training, but it was	

ildren's PA levels – developing
skills – through observation of
vorking alongside teachers.
the SHARP principles
ck of understanding in the teaching
of increasing PA levels in PE through
tegies.
<u>pedagogical awareness – various</u>
employ during PE lessons to
ildren's PA levels.

Focus on pupil progress	248. different situations. I know I keep coming back 249. to gymnastics but that's just because I am 250. teaching it at the moment. So for example if we 251. were doing rolling, and we were sort of 252. practising the skills of rolling and there was a 253. group that could clearly do more I would 254. probably get them to apply it and put it into a 255. sequence with things we had been learning	Opportunities are provided in PE for children to apply their skills and therefore make progress.
Limited ITE training	 256. about like a jump and balance and different 257. ways of travelling. I would do it that way and 258. try to get them to apply it to different 259. situations. 260. Interviewer: you mentioned with the Aspire 261. training, with your formal teacher training do 262. they provide you with any of those strategies? 263. Interviewee: I can honestly say that I don't 264. think that I have ever taught anything that I 265. learnt at university and I know that might 266. sound really bad. I did a B.Ed and we did days 267. on PE but I can't really remember it. I felt like 268. a lot of things you learn at university until you 269. actually start teaching, that all goes out the 	Limited training on PE during ITE
	 270. window and you start a fresh, so definitely 271. looking back for me I learnt a lot more from the 272. Aspire training than I did when I was at 273. University. I think you just forget about it all. 274. It's only when you are actually working with 275. children that you realise how to do it. 276. Interviewer: I was just wondering whether 277. Aspire was just refreshing things or whether it 278. js new knowledge. 279. Interviewee: I think for me anyway where I 	<i>Forget it all'</i> is this because they have limited opportunities to apply what they have learnt in ITE? And then they forget what they have been taught?

	200 went to Uni. I didn't learn the stuff about	
	281. making sure that they are all doing something	
	282. and running around and focusing on different	At university sne didn't focus on the pedagogical
	283. groups and moving different groups on and that	aspects of teaching PE – making just the
	284. was something that I had never seen. But	activity/sport content.
	285. that's just me, I'm not saying that every	
Supportive networks –	286 university is like that. The training for	Training from Aspire – really useful –
Aspire training – team	287 me was really useful probably more than I	opportunities provided by the school – CPD for
teaching	288 learnt at Uni	teachers.
	200 Interviewer: Ok so if we just finish off with then	
	209. Interviewer, OK so in we just milish on with then	
	290. In terms of needs, your individual needs and	
	291. training, what are your next steps?	
	292. Interviewee: Possibly some training in invasion	
	293. games, so I've done a lot of work on	
	294.gymnastics, but obviously I've already	
Low confidence – negative	295. mentioned about netball I don't enjoy netball,	Doesn't enjoy netball – links with her own past
past experiences	296. that probably those kinds of specific games	personal experiences.
	297. where you need to know rules to be able to do	
	298. it that's the kind of thing I would like training	
	299. in, because I feel I could probably apply things	
	300 that I have learnt in gymnastics to things like	
	301 dance and follow the same technique but when	Invasion games – areas of development – links to
	202 it comes to nethall baskethall or football when	past personal experiences of PE – knowing the
Subject knowledge – rules	202 there are specific rules to learn to be able to	rules of games – subject knowledge – lack of
of the games	and play a game. I think that is where my payt area	confidence
	304. play a game, I think that is where my next area	
	305. of development is. If it was possible because I	
	306. have already had PE training in like two	
	307. subjects.	
	308. Interviewer: and then as a school? What do you	
	309. think the next steps are as a school?	
	310. Interviewee: I think, I know that we are trying	
	311.to push on the social and creative side of PE	

Whole school vision for PE	312.now and I think we are quite good at teaching 313.the skills and things but especially with our 314.children it is about being able to play together 315.and work in teams nicely. Thinking of new ways 316.of doing things and I think as a school that's	<u>Whole school vision for PE – clear aims – good</u> <u>leadership.</u>
Supportive networks	317. our push the social side and trying to be a bit 318. more creative as well. We definitely have some 319. children that need to learn how to play together 320. nicely and work as a team so that is probably 321, where we will go from here. I think that with 322. the training we are having it is building people's 323. confidence to actually teach PE and I think that 324. has got to be the next step now getting the 325. children to actually work together and play 326. together nicely and things and I think that will 327. be helpful because it will help them play in the 328. playground and stuff at lunchtime	Supportive networks and developing teachers' pedagogical understanding and confidence.

Appendix 23 – Study 3 example of an analysed interview transcript from the children's group interviews

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Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009) Key – Descriptive comments (blue text), linguistic comments (<i>red italicised text</i>) and conceptual comments (<u>underlined</u>).		
Emergent themes	Original transcript	Exploratory Comments
Children concerned with the structure of lessons	 Interviewer: So my name is Emma and I'm going to ask you some questions about how active you are during your PE lessons, so you can all speak whenever you want but try and not talk over one another, but you don't need to put your hand up to speak. Is that ok with you? Children: yeah Child (boy): and also we do two PE lessons, and we do a rotation of activities. Interviewer: Thank you for sharing that with us but if you could remember that and share it with us in a little while. Is that ok, once I ask you some questions about your PE lessons? Child (boy): yeah. Interviewer: Ok so what do you think I mean by the words physically active? Child (boy): I think I know because I think you are getting to a point that you mean, active and how much do we run about stuff. Interviewer: Ok so you think it means running around? Child (boy): yeah 	Children discuss the structure of their PE lessons Children relate being active with running

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A scale of intensity	 24. Interviewer: so how active do you think you are 25. then if you think running around is being 	
	26. active?	
	27. Child (boy): so really active and then like lazy.	Children consider 'physical activity' as being on a
	28 so here's a har and I would put myself all the	scale – relates to the intensity of the PA
	20. way up to here I'm over the middle but I'm not	
Break times key window for	30. too high.	
activity	31. Interviewer: So how would that look across the	
	32. dav?	
	33. Child (boy): so at morning break, I want to play	Children view break times as an opportunity to be
A stive friendshine	34. with my best friend so I will go and look	active
Active mendships	35. around the whole playground and that will take	Mant to be active with their friends a graptive
	36. about 2 minutes because he is always	friendebing
	37 wondering about but then we will get physically	mendships
	38. active, at lunchtimes sometimes I go to clubs.	
	39 Interview: ok is anyone else active? Do you	
Activo ovonings	40 think you are more active at school or more	
Active evenings	41 active at home?	
	42. Child (hov): on Thursday I go to football	Children also discuss the activity they engage in
	42. Child (bby). On mulsuay 1 go to lootball	children also discuss the activity they engage in
	43. I dirining and 1 up a for or running about because	outside of school
	44. The a winger, and is that football training at	
	45. Interviewer, and is that football training at	
	46. SCHOOL?	Discuss playing for sports teams outside of school
Active at home and school	47. Child (boy): no for a team?	Discuss playing for sports teams outside of school
Active at nome and school	48. Child (boy): and I play for the same team as	
	49. him and we train on Thursdays and Saturdays	Children say they are active at home as well as
	50. and we play on Sundays so we are active quite	school
	51. a lot at home and at school it's like good	
	52. because we play a lot of games like tig and tag	At school they are active playing tig and tag –
	53. so it's lots of running about.	enjoying the thrill of the chase – competition
	54. Interviewer: so when do you play tig and tag	
	55. then?	

Break times key window for	56. Child (boy): at playtimes and lunchtimes and	Playtimes are key window in the school day for
activity	57. it's basically a little bit like British Bulldog, so we	the children to be active - interestingly the
	58. have one side as a den and then you have to	children don't mention PE as a time in which they
	59. get across to the other side.	are active.
	60. Interviewer: and what about the girls?	
	61. Child (boy): they enjoy skipping and	
	62. Interviewer: shall we ask them? So girls, how	
	63. active across the day?	
	64. Child (girl): guite a lot	
	65. Interviewer: guite a lot? And what do you do?	
	66. Child (girl): at school we play lots of games and	
Childron's world	67. in those games we have to run around quite a	
Children's world	68. lot and	Children like to create their own rule and
	69. Interviewer: and what are these games?	boundaries of games – child world
	70. Child (girl): we make the games up ourselves	boundaries organies - enild world
	71. and there are normally three or four of us that	Girls like to be in small friendship groups at break
Active friendships	72. are playing it.	times
	73. Interviewer: so do you think you are more	
	74. active at home or when you are in school?	Children are discussing break times as this
Active break times	75. Child (boy): at home	stemmed from them being asked if they were
	76. Child (girl): yeah at home	active. Break times are a key opportunity for them
	77. Child (boy): at home	to be active in the school day.
	78. Child (girl): home	
	Child (boy): well I think really it depends,	
	80. sometimes when I'm at home and I'm on the X	
Imaginany play	 81. Box but then sometimes I'm playing with Lego 	
imaginary play	82. and walking around the Study or I'm running	Children like to engage in imaginany play
	83. about with my pretend Spud Gun and I like	Children like to engage in imaginary play
	84. shoot at little pieces of potato.	
	85. Interviewer: ok, so do you think you could be	
	86. more active when you are in school then?	
	87. Children: yeah	

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Sedentary school life – maths and English	 88. Interviewer: so how could you be more active 89. when you are at school then? 90. Child (boy): I think at school and I think most 91. people would say this, during lesson time it's 92. not much active because most of the time you 93. are sitting down and it's normally maths and 94. English that are the least active. 95. Child (boy): but also in Art we just sit down and 96. like the teacher tells us what to do and then 97. we just sit down 	During lessons children are sedentary, mainly maths and English Children focus on these lessons as are they have them more frequently than any other subject area.
PA compensation	 98. Child (girl): we just sit down and we write, 99. write, write 100.Child (girl): well I'm not active at the end of the 101. day because I've done lots of work and I was 102.running around at morning play 103. Interviewer: and how about when you go 	Children compensate for times of the day when they are active <i>I'm not active at the end of the</i> <i>day because I've done lots of work and I was</i>
Sedentary home life	 103.Interviewer: and now about when you go 104.home, are you active at home? 105.Child (girl): no I just go home and watch the ty. 106.Child (boy): me and Will don't do much in the 107.first playtime because we have to do toast. 108.Child (boy): yeah we have to be the toast 109. monitors so that means we miss about 6 110.minutes of break. 111.Interviewer: but are you active when you go 112.outside? 113.Children: yeah 	Sedentary home life for some children – screen time TV
Range of activities in PE	114.Interviewer: Ok so if we start to think about 115.your PE lessons, can you tell me what you have 116. been learning in your PE lessons? 117.Child (girl): we have been learning about 118.gymnastics and hockey. 119.Interviewer: and what about gymnastics and	Children covering a various activity areas e.g. hockey and gymnastics

Focus on teachers points	120.hockey? What have you learnt about 121.gymnastics or hockey? Have you learnt any 122.particular skills? 123.Child (girl): when you are playing hockey your	Children can discuss the skills they learn in PE lessons – focus on teaching points e.g. where to place their hands on the hockey stick
Teachers good level of subject knowledge – teaching points	124.1etc hand always goes at the top. 125.Interviewer: Has anyone learnt anything else? 126.Child (boy): I've learnt how you tackle because 127.you are supposed to get the stick and push it 128.into the ball so that the ball goes up into the air	<u>Children have a good knowledge of what they</u> have been learning – indication of teachers good
Children understand what they are learning	129. to get it out of someone's hockey stick. 130.Child (girl): for gymnastics yesterday we were 131.learning how to do different sorts of jumps but	<u>certain skills</u>
	132.11 you did it wrong it sometimes nurt you leg of 133. something. 134.Interviewer: so can you name any of the 135 different jumps in dympastics?	Children understand what they have to do during PE
skills	136.Child (girl): a quarter turn, a tuck jump, a star 137.jump, a straight jump, a half turn jump. 138.Child (girl): one week we were doing sequences	Evidence of application of skills e.g. children being asked to create sequences in gymnastics
Promotion of out of class PA	 139. and we had to get in a roll a jump and a 140.balance and we were in partners and I learnt 141.how to do a lot of different rolls and how to 142.combine them together into a sequence. 143.Child (boy): also, normally at hockey I'm 144.good at dribbling and sliding it through the 145.goals. So like I have been practising at home 146.through the gates with my sister, and my sister 147.and my dad were in the middle and my dad 148.was on the other side. 	<u>Children practising the skills they have learnt at</u> school at home – promotion of out of class physical activity?
	149.Interviewer: so you practise your skills outside 150.of school as well then, and do you enjoy your 151.PE lessons? Or do you not enjoy your PE	

-		
Children enjoy PE	152.lessons? 153.Child (boy): I really enjoy them because it's a 154.rotation because, so today is the day we do the 155. rotation so we aren't doing outdoor PE today	Children enjoy PE, they enjoy taking part in different activities
	 156. because the person who normally does it is 157. away but they are in charge of the whole school 158. because they are one of the head teachers. 159. Interviewer: How about anyone else? Do you 	
Active friendships – PE	160.enjoy PE or not? And why? 161.Child (girl): I don't really enjoy outdoor PE 162.because we get put into House Teams and 163.there are not girls from my class in my house 164.but I enjoy indoor gymnastics because I get put 165. with my friends	Children enjoy taking part with their friends, when they are separated this puts them off PE and perceive it as not enjoyable
	165. With the full. 166.Child (boy): I don't really enjoy outside PE 167.because all of my friends are in different House 168.Teams.	
Barrier to PE – groupings	169.Interviewer: so both of you, would you enjoy 170.outdoor PE if your friends were with you? 171.Children: yeah	Not being with friends is a barrier to enjoying PE lessons
	173.that, if we can move on now, so we spoke 174.earlier about being active and moving around 175.so now I'd like to know how active you think	
Gymnastics – low activity	176.you are during your PE lessons? 177. <mark>Child (boy): in gymnastics we are not very</mark> 178.active because the teacher demonstrates it and	Children acknowledge that they are not very active in their gymnastics lessons. – <u>Does teacher</u>
barrier – demonstration time	179.then we just to rolls and then jump off and 180. <u>that's</u> all that we do. 181.Child (boy): yeah we have to wait in a queue	learning time?
	182.for our turn quite a bit. 183.Child (boy): In outdoor PE I'd say that we are	Children waiting in queues for their turn – <u>the</u>

Demine everying	184.active quite a bit because for hockey we just	phrase 'quite a bit' implies that they are
Barrier – queuing	185. play one long game.	standing/sitting for a while before they have the
	186.Interviewer: so what do you mean by one long	opportunity to practise their skills.
	187.game?	
Outdoor PE is more active –	188 Child (Boy): so we do one long game because	Children perceive outdoor PE to be more active
no teacher interruptions –	190 it's not keen swanning each team against each	and attribute this not being interrupted by the
child's world	109. other. So you've got the whole DE lesson and	teacher
	190. Other. So you've got the whole PE lesson and	
	191. You II be moving quite a lot because you are not	
	192. going to be stopping at any point until the end.	
	193.Child (boy): in outdoor PE we get split into	Teacher demonstrates 'for ages' in PE lessons
Barrier – demonstration	194.House Teams but I always make a point to get	Children get bored during this time, playing with
timo	195.active so sometimes when the teacher is	an imaginany hall as the teacher restricts the
ume	196.demonstrating and she does it for like ages	amount of time the children have the encodering
	197 (expresses ages), so sometimes I get the	to play with roal againment
	108 bockey stick and pretend to bit like an invisible	to play with real equipment.
Imaginary equipment – PE	100 hall whilst looking at the teacher and then I'll	
	199. Dall Whilst looking at the coat	
	200. <u>De like Jogging on the spot.</u>	
	201.Interviewer: so what is your teaching doing	
	202.Whilst you do that then?	
	203.Child (boy): so she's just like demonstrating	
	204.how to pass or dribble or how to get through	
Children – good	205.the goals and then I say this to myself in my	Children have a good insight to pedagogical
pedagogical understanding	206.head, well you're taking for ages if you don't	practice e.g. 'well you're taking for ages if you
	207. realise that than I'll have to try and get active	don't realise that than I'll have to try and get
	208 and find a way. It's boring.	active and find a way. It's boring' Could teachers
Barriers – demonstration	200 Interviewer: so how about the girls then do	benefit from talking to the children about their
time and queuing	an you think you are active during your DE	views? Demonstration time seems to really
	210.you think you are active during your PE	impact upon children's learning and opportunity to
	211.16550FIS?	practise their skills.
	212.Children (giris): yean	Could this be a control issue with teachers not
	213.Interviewer: yeah, so why do you think that you	wanting to let the children go and practise, also
	214. are active during PE lessons, can you tell me a	the fact that they are queuing for their turn is this
	215.little bit more?	and fact that they are queating for their tarri, is tills,

To a shared a la sharef	Child (chil) and the opposite state of the second state of the sec	a la ale a frances in a france i a la billa. Ta a ale a secondada X
Teacher's lack of	216.Child (girl): so outdoor PE you are like running	<u>a lack of organisational skills. Leachers wouldn't</u>
pedagogical knowledge	217. around and everything and then indoor PE you	ask children to queue in a maths lesson to
	218. have to watch and see what she is trying to	complete a sum so why do they get children to do
	219.show us and then you've got to give it a go but	this in PE lessons? Is it accepted practice in PE?
	220. you have to wait in a queue for like four people	The norm?
	221. to do their turn.	
Barrier – queuing –	222.Child (boy): in hockey, we are active because	Children waiting in queue's for their turn to
comfortable in chaos	223 we don't do it in partners and we don't just	practise – 'comfortable in chaos'
	224 keep still and just pass it to the other partner	
	225. We run around we our hall and get it through	Children active in hockey lessons – activities
	225. We full a out a we out ball and get it through	reflect a game situation rather than static skills
	226. The goal and then back again.	
Outdoor PE – active	227.11 tel viewel, so il you welle a teacher, what	
	229.are active during PE lessons?	
	230.Child (boy): so maybe you could like, if you	Children focus on demonstration time, they view
Barriers – demonstration	231.could do it like quickly, you could demonstrate	this and queuing as the main things that impacts
time and queuing	232 everything at the start and then let us do it. <mark>So</mark>	up their activity during PE lessons
	233.demonstrate at the start and then you've got	
	234.the rest of the PE lesson to do what the	
	235.teacher's demonstrated.	
	236.Interviewer: so just one quick demonstration	
	237. at the start?	
	238.Children: yeah	
	239.Interviewer: has anyone got any other ideas?	
	240.What would you do if you were the teacher to	
Children – good	241.keep the children active?	Beneficial to reduce demonstration time –
pedagogical knowledge	242 Child (boy): I would just say like the children	children's perspective
	243 could pass the ball whilst I was demonstrating	
	244 Interviewer: ok bas anvone got anv other	
	pasidoac?	
	246 Child (girl): I think with indoor DE to make it	
	246.Child (gill). I think with induor PE to make it	
	247.more active, we could put all the children into	

	248 their home tables and there should be 6 of	
Children's insight – reducing	249 them and there could be some mats and	Reducing the number of children in groups –
the group size	250.benches and 3 children could go on a mat and	children have more opportunity to be active and
	251.then each person could do a jump.	practice their skills
Children's insidet -	252.Child (girl): I think for maybe indoor and	Even/body needs their own bit of space - children
everybody needs their own	253. Outdoor PE if everyone had their own bit of the	astute in relation to pedagogy in PE and how to
space	254. playground of hall then it would take as long	maximise upon lesson time and available space.
	255. Decause they could just do it over and over	
	250.ggdiii and everyone would get more practice.	
	258 space to work in rather than?	
Obilden in live days arises of	259 Child (girl): because normally we are in a team	Children offereller stingets succine in their DE
Children's lived experience	260.and we have to wait for 5 other people in front	Children offer alternatives to queuing in their PE
	261.of us but if you're on your own you can do it a	good understanding they are part of it and have a
	262.lot quicker because you are not waiting for	lived experienced.
	263.anyone else.	
	264.Child (boy): I would say all the jumps and then	
Barrier – demonstration	265. If they didn't know them I would ask them to	
time	266.put their hand up and then whilst they were	Demonstration time needs to be shorter.
	267.doing the jumps I would demonstrate them.	
	268.111.El viewel . So has anyone got anything else	
	209 that they would like to add about their PE	
	276.1635013 Before we finish.	

Appendix 24 - Study 4 Head teacher consent form



Informed School Consent – Head teacher

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- Researchers will be present in a selection of physical education lessons and will systematically observe physical activity levels, lesson context and teacher behaviour.
- ✓ Observations of PE lessons will take place at two time points across the school year.
- ✓ Children with consent will be asked to wear a coloured band during their PE lessons so that the researchers can easily identify them (no more than 6 children per lesson).
- ✓ The study will not cause children any physical or psychological harm.
- ✓ The study will not affect the children's learning in any way.
- ✓ Staff involved in the research project will receive training from Newman University to develop their pedagogical awareness of children's active learning time in PE lessons.
- Researchers will work with the PE Coordinator to create action plans and develop supporting documents for school staff involved in the research, with the aim of increasing children's active learning time in PE.
- ✓ This study is designed to further our knowledge in the area of physical education and all procedures have been approved by Newman University's Research Ethics Committee.
- ✓ The school is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing.
- Procedures, benefits or risks of the research have been explained to the school through an information booklet and discussions with the physical education coordinator.
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer.
- Results will be shared with the school, communicated through an evidence report/pack.

By signing and returning this form, I agree to the school participating in this study.

Head teacher's signature:

Date:

Appendix 25 – Study 4 Class teacher consent form



Informed Teacher Consent (Class Teachers)

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- ✓ I will be observed teaching primary PE lessons at two different points in the school year.
- ✓ Individual children will be observed for four minutes during the observations, they will be asked to wear a coloured band so that they can be easily identified.
- ✓ The researcher/s will stand/sit on the edge of the working space, with a clipboard and MP3 player so that they can take time sampling observations (every 20 seconds).
- ✓ The observations will contribute to providing a bigger picture of physical education/physical activity within my school setting and all procedures have been approved by Newman University's Research Ethics Committee.
- ✓ All individual results, information will remain confidential and will be stored securely on a password protected computer.
- $\checkmark~$ No real names will be used in the write up of the study.
- \checkmark There will be an opportunity for feedback from the lesson observations.
- ✓ I am under no obligation to take part in the study and have the right to withdraw from the study at any stage for any reason, and I will not be required to explain my reasons for withdrawing.
- ✓ Procedures, benefits or risks of the research have been explained to me.
- Results will be shared with the school, communicated through an evidence report/pack.
- ✓ I will be involved in training with the aim to increase my pedagogical awareness of children's active learning time in primary PE lessons.
- ✓ I will be involved in an individual interview to evaluate the effectiveness of the training.

By signing and returning this form, I agree to participate in this study. If you require any further information please email me on <u>e.powell@neman.ac.uk</u>. **Teacher's name: Teacher's signature: Date:**

Appendix 26 – Study 4 Guardian consent form

Research Study: Children's physical activity levels during primary physical education

Dear Parent/Guardian,

Newman University would like to invite your child to participate in a research study which will focus on how active your child is during their PE lessons. Physical activity is important for your child's muscle and bone development along with protection against a number of diseases. Your child's school aims to ensure that your child receives the best possible PE lessons and the research project will help to monitor the provision it provides.

The school will be visited over the course of two to three weeks. During this time your child will be observed in PE lessons to track their physical activity levels. This will happen at two different points in the year, approximately 6 to 12 months apart, but each time your child will only be observed for one four minute period. So that the researcher can identify them, they will be asked to wear a coloured band. The researchers will aim to position themselves on the edge of the working space to avoid any interruptions to your child's learning. The lead researcher is a qualified teacher and is currently a Senior Lecturer in Primary Education at Newman University. Other researchers may accompany the lead researcher, but in all cases visitors will hold CRB/DBS clearance forms and ID which will be checked by the school.

The overall results of the study will be shared with the school which will enable them to reflect upon the PE opportunities it provides for all children. Individual results of your child can also be provided for you upon request. All information provided will be anonymous and kept confidential. Data will be stored securely at Newman University. Taking part in this study is voluntary and you may choose for your child to take part or not and they may leave the study at any time. If you are happy for your child to take part in the research, please can you sign the parental consent form. It is important that this is completed otherwise your child will not be able to take part in the study. If you have any questions or concerns about the research please speak to your child's class teacher and he/she will be happy to discuss it with you. Your child has also been given an information leaflet containing details of the study in child friendly language. Please could you take the time to discuss it with them, to find out if they want to take part or not.

Yours faithfully,

5. Powell

Mrs Emma Powell Senior Lecturer in Primary Education

Informed Parental Consent

Research Study: Children's physical activity levels during primary physical education

It is my understanding that:

- My child's physical activity patterns will be tracked during physical education lessons using direct observation.
- ✓ My child will be asked to wear a coloured band, so that they can be easily identified by the observer.
- ✓ The study will not cause my child any physical or psychological harm.
- \checkmark The study will not affect my child's learning in any way.
- This study is designed to further our knowledge and contribute towards improving physical education in the school and the wider researcher community.
- ✓ All procedures have been approved by Newman University's Research Ethics Committee.
- ✓ My child is under no obligation to take part in the study and has the right to withdraw from the study at any stage for any reason, and will not be required to explain reasons for withdrawing.
- Procedures, benefits or risks of the research have been explained to me through the attached letter.
- ✓ All results will remain confidential and will be stored securely on a password protected computer.

By signing and returning this form, I agree to my child participating in this study.

Child's Name: Child's Date of Birth: Child's School Class: **Parent/Guardian's Signature:** Date:



Appendix 27 – Study 4 Children's information leaflet

PE Research



Dear Children,

My name is Emma and I am a Lecturer in Education at Newman University in Birmingham. I love to learn new things and really enjoy carrying out science investigations.

As you probably already know, keeping active is a really important part of maintaining a healthy heart. In a typical day, children should be active for at least 60 minutes, which is around 12,000 steps!

I have spoken to your teachers and they are keen to find out how active you are during your PE lessons.

How will I be involved?

The investigation will involve me or one of my work friends visiting your PE lessons at two different points during the school year. We will use an observation form to track how busy you are, taking notes during the PE lesson. You may be asked to wear a coloured PE band during the lesson, so I can spot you easily. Just like in the picture below. You don't need to do anything special, just enjoy your PE lessons! If you decide at any point you don't want to wear the band or to be observed that's ok, just tell your teacher and we will stop.



What will happen to the results?

I will share the overall results of the study with your school. I will also write and talk about how active you are during your PE lessons to some other people. This will help other children and schools to be more active during PE. However, to protect your school,



information top secret by using disguise names.

Do I have to take part? If you don't want to take part that's ok you may still see us in your PE lessons but we will not be watching you. If you do wish to take part then please talk to your parents about it, as they will have a letter too; and don't forget to return your permission slip to your teacher.
Appendix 28 – Study 4 PE intervention evaluation interview questions

Post Intervention Evaluation Questions

Values (Intrapersonal and interpersonal)

What do you feel are the main aims of primary physical education? How do you currently feel about teaching physical education? Why do you think this is?

How would you currently describe the status of physical education in your school?

Pedagogy (Intrapersonal)

What is effective teaching in Physical Education, what does it look like? Do you feel like you are an effective PE teacher? Why is this?

Intervention (Intrapersonal, institutional)

Could you share with me any training, support, guidance that you have had over the past year in relation to physical education? Do you think that your practice has improved or not because of this training/support/guidance?

As you know we have been monitoring the physical activity levels in PE lessons over the past year. The physical activity levels in your observed lessons were very high, from pre data collection to post data collection, as a school they increased from 42% to 72%. Why do you think this was?

Did you change any element of your practice? Do you feel that you have still maintained higher activity levels in your lessons? Why has this continued / not continued?

How have the children responded to higher activity levels?

What advice would you give to other teachers with regards to increasing children's physical activity levels in physical education lessons?

Facilitators and Barriers (Institutional, intrapersonal, interpersonal)

Could you share with me any facilitators or barriers to ensuring children are active during PE lessons?

Do you feel you need any/ or would like any further support/training with regards to physical education?

What do you think the next steps are as a school in relation to physical activity and PE?

Appendix 29 – Study 4 Example of individual teacher interview analysis

Emergent themes	Original transcript	Exploratory Comments
Developing teachers awareness of PA in PE Rethinking their approach to PE Reflective practice	 Interviewer: So if we start off with then, your values, so what do you feel are the main aims Of primary PE? Participant: Erm, I think to expose children to a variety of different sports and the skills that one does through those sports, to, but, erm, to keep the children active has to be the primary aim and concern really in some cases and I guess that something that we've really benefitted from the help, work that you've done with us, has really sort of taught me to rethink how I'm teaching those skills and to ensure that the activity levels are much higher than they were and er I find that during sessions now I am reflecting upon what I'm doing whilst I'm teaching it and I'm thinking are all the children moving? If they are not, how can I make this activity more physically exerting, what could I do differently. 	Physical activity needs to be the primary aim of Physical Education, the intervention has helped the teacher re-think their approach to teaching F 'so the work that you have done with us, has really sort of taught me to rethink how I'm teaching those skills and to ensure that the activity levels are much higher than they were, I' say much, much higher than they were' The intervention work has assisted in increasing teacher's awareness of physical activity in PE, again there is a current muddled message in terms of aims, by highlighting the importance of PA in PE, teachers have enhanced their practice Consistently reflection, upon activity levels, adapting teaching during PE lessons – transference of skills from classroom based

Rethinking approach to pedagogy in PE – combining motor skills and high levels of activity	 24 motor skills. Do you feel as if you have 25 integrated those now? 26 Participant: Yes, so as a colleague of mine said 27 recently, the skills, we're teachers we are 28 always trying to teach skills but now it's 29 teaching those skills in an active way, whether 30 it's more through a quick mini plenary here or 31 there, or whether it's just working quickly with 	Acknowledging that the role of a teacher is to develop new skills, but this can be achieved in an active way Links back to teachers being comfortable in chaos and rethinking their approach to pedagogy in PE 'we're teachers we are always trying to teach skills but now its
Enjoys teaching PE – links with personal past experiences.	 a group to correct the misconceptions so that the children are always doing, doing, doing and moving moving, moving the whole time. So yes it's all integrated. Interviewer: So, I remember from last year that you enjoyed teaching PE and it was a positive experience for you and it came from positive past experiences. So is that how you currently feel about PE? Participant: Yes when the weather is nice (laughs), no I really enjoy teaching PE, I mean to be honest with you there are very few subjects that I don't enjoy teaching. I think that I really value the importance of PE, not being good at sports necessarily but enjoying sports, so that's what we as a school try to do through our PE sessions to ensure that all the children are trying access and enjoy the sports and to facilitate that is naturally fun. Interviewer: What is effective teaching in PE, to you. If you walked in and observed somebodies lesson, what would effective 	Enjoys teaching PE, links back to his own past experiences. He states that he wasn't necessarily good at sport but he enjoyed participating and that is what they are trying to develop as a school.

	56 Participant: If I walked in I would want to see Transference of pedagogical practice across the
Transference of	st things that I would see in most lessons
pedagogical practice	se children heing engaged, enthusiastically taking
pedagogical practice	50 part in what they are doing. The lesson is at an
	so appropriate level for the children and that
	60 appropriate reversion the children and that
	en are able to accord that lesson. So that's
	62 are able to access that lesson. So that s
	53 Something that I look for across the board in
	of any ressol and in PE ressons in particular then,
Physical activity is the main	Reducing sedentary behaviour in PE and taking
aim/priority of PE	part in their learning, main aim of PE is for
	children to be active 'I would be looking first and
	foremost for that physical activity, the children
	69 and watching. I would want them, don't get me doing stuff 'I would want to see them active and
	70 wrong there is a time for that I am sure, but in doing'.
	71 the session I would want to see them active
	72 and doing.
	73 Interviewer: So do you feel then currently that
	74 you are an effective teacher of PE?
Muddle message for	75 Participant: Yean I think so, yean. Well I mean
primary PE	76 (laughs), if we think about the things that I ngniy or wrongly stems from the current muddle
	77 have just said that I'd want to see in a lesson, $\frac{\text{message in primary PE} - \text{what are the main}}{\frac{1}{2}$
	78 rightly or wrongly that's what I would do in a <u>aims?</u>
	79 lesson. So I feel that I am always trying to do
	80 those things in the lessons and it's not to say
	81 that every lesson is absolutely amazing but
	82 that's what I am aiming to do in my lessons.
	83 Interviewer: In terms of your activity levels
	84 then of the children when we recorded them, I
	85 think in some cases they shot from 20% to
	86 80%, so if you could pin it down to particular
	87 parts of your practise within the lesson, could

	 88 you pin it down? 89 Participant: So if we think about dance, dance 90 was something that we across the school had 91 had very little training and I think I myself not 	Teacher confidence and competence links to past personal experiences and school based training
Reflective practice – transference of pedagogical skills	 being a particular brilliant dancer in any shape or form so felt less confident teaching that. But then we have had a lot of work dealing with what is to be expected of the children at that level in dance and in hindsight how on earth we were trying to teach something without 	Transference of pedagogical skills, acknowledging that this practice doesn't happen in other areas of the curriculum, so it was 'bizarre' that they were doing that with PE.
Developing awareness – planning support and CPD	 98 knowing what was expected was a bit bizarre 99 but then we also had input with our planning 100 and because of all those activity ideas seeing 101 that dance is something necessarily totally 102 reliant on skills but equally about all children 	Developing own awareness of primary PE curriculum i.e. what is expected.
Integrating skills and activity levels	103 being active during the session. Thave certainly 104 and I think we all have changed our approach 105 to that. I think probably in dance there is still a 106 little bit to go because I think you learn through 107 doing as with anything that you do.	'I have certainly and I think we all have changed our approach to that' combining skill development and children being active 'dance is something necessarily totally reliant on skills but equally all about children being active during the session'
Physical activity, main aim of primary PE – Paradigm shift	 108 Interviewer. So do you leer that the activity 109 levels that you achieve in dance and swimming 110 have been transferred to other activity areas 111 within the primary PE curriculum? 112 Participant: Absolutely yeah, I mean I've 113 changed all the lessons that I teach and how I 114 teach them to be honest with you, as a result of 115 the work that we have done directly. Because 116 yeah, like you said the activity now comes at 117 the forefront of my mind when I'm planning 118 and when I'm teaching, so I am always thinking 119 what are the children doing, are they moving 	'The activity now comes at the forefront of my mind when I'm planning and when I'm teaching' Shifted in regards to their own understanding of PE – what are the main aims for PE? Developing their awareness of physical activity and the importance of it within a PE lesson. Change of thought patterns, paradigm shift

PE the epi centre of school based PA Teacher's developing awareness of PA throughout the whole school day	 120 are they active, how could this be more active. 121 Interviewer: Has it had an effect on other 122 subjects within the primary curriculum, have 123 you thought maybe in maths or English that 124 they are sitting down a lot? Has it spilled over 125 or is it just mainly PE? 126 Participant: PE is where there has been the 127 biggest difference in activity levels, in terms of 128 other subjects I am always aware of the space 129 that we have got and then whether permits, or 130 when circumstances permit to using a bigger 131 space, so that naturally encourages children to 132 be more active and run around but nonetheless 133 I mean there isn't going to be the opportunities 134 to be as active in those lessons as in PE 135 because of the nature of the lesson and you 136 have to teach different things and you have 137 different responsibilities but it's something now 138 that I think, I reflect and I think about just in 139 the day as a whole, how active have the 140 children been today. I mean especially if I have 141 been on break time duty or I just go out at 142 lunch to play with the children and you notice 143 the children that are always running and always 	Physical activity still bound by the limits of a PE lesson, not yet transferred across the school day into other curriculum lessons is PE the first step for a physically active school, the core of a PA model, next steps would be to transfer to other parts of the school day. Each subject area has its own priorities, PA not yet integrated into whole school day, however teacher's awareness has developed 'It's something now that I think about just in the day as a whole, how active have the children been today?'
Windows of opportunity,	 141 been on break time duty of 1 just go out ut 142 lunch to play with the children and you notice 143 the children that are always running and always 144 doing stuff and you think about ways that 145 maybe you could do little things to help those 146 children to be active as well. 147 Interviewer: So what things would you do for 148 those children? 149 Participant: maybe just coming out at playtime 150 and kicking a football with them or erm, doing a 	Awareness of other windows of opportunity within
Tient step bleak times	151 bit of skipping, just those sort of things and	The school day – In class physical activity may not

	152 encouraging them to take part in different	be the answer, its making the most of break times
	152 encouraging them to take part in different	as well as PF lessons
	153 detivities. Of maybe in they are children that	
Paradigm shift a way of	154 have an intervention group or something else	
thinking	so compating that they can do and get them up	Paradium shift 'get them up and moving as well.
	156 Something that they can do, and get them up	veah where possible veah it's certainly
	157 did moving as well, year where possible year,	something that's at the forefront of my mind now'.
	158 It's certainly something that's at the foreir ont of	, · · · · · · · · · · · · · · · · ·
	159 THY HIMA HOW.	'it's always been activity levels at the top of
	160 Intel viewer, would you say that's across the	everything that everyone has said at the training
	161 WHOLE SCHOOL HOW?	so I would certainly hope it's in the psyche of the
	162 Participant: Yean I think my understanding of it	staff Developing awareness of PA, paradigm
	163 IS year, because I mean you've put in a lot of	shift, a way of thinking
	164 WORK and we had additional training as well and	
	165 It's always been activity levels at the top of	
	166 everything that everyone has said at training	
	167 SO I Would certainly nope it's in the psyche of	
	168 the staff.	
	169 Interviewer: So what advice would you give to	
	170 another teacher in terms of increasing their	
	171 activity levels in a PE lesson? What would be	
	172 the key things that you would get them to think	
Importance of planning	173 about?	
(active planning)	<mark>174</mark> Participant: Ok I mean, <mark>as always start off at</mark>	Planning is important stage; need to think about
	175 the planning stage and I would want them to	the activity levels of children.
	176 look at the activities carefully and decide how	
	177 active those activities are. I mean if you are	Activities people be adapted as that the shildren
	178 throwing and catching a ball and you are just	Activities need to be adapted, so that the children
	179 throwing and catching then that can be a	and active and moving if you are just throwing
	180 boring activity, so is there a way that that could	and caloning a pair men mar douvity call be
	181 be more exciting and more active and then I	exciting and more active?
Reflective practice - is there	182 think those moments were, I mean as a student	Reflecting upon past training – is that how it
Nonective practice - 15 tilele	183 I was always encouraged to stop and then	Nenceung apon pastuaining – is unat now it

	-	
a better way?	184 reflect and do a little plenary. So I think how	should be done? Is there a better way?
	185 could that be integrated into the activity itself,	Deflection companies tion in language data it
	186 is it necessary for the whole class, is it going to	Reflecting upon organisation in lessons – does it
Pofloctivo practico	187 be a benefit for the whole class, I mean some	nave to be a whole class approach, meeting the
adapting pedagogy -	188 of them can already do the skill, so how are you	
paradigm shift	189 going to move them forward, which is good	
paradigin sint	190 practice in general but those who can maybe	
	191 that's the time just to work with those a little	
	192 bit and have a little plenary with them and keep	
Breaking up traditional	193 them active and then go and work with the	Breaking up traditional practice, is there a better
practice – interrupting the	194 other ones and just breaking up that that the	way? Paradigm shift, are children moving, is
cycle	195 format of a lesson to make sure that the	stopping the whole class beneficial?
	190 Children ale always, always colling.	
	197 Intel viewer. OK then so do you leer that you	
	200 Participant: I think to be honest with you you	how never step (corning) willingpass of staff loarn
	201 never ston learning in any subject across the	you never stop rearning willingness of starriearri
	202 curriculum so additional support in training is	new unings
	203 always welcomed. I mean I enjoy teaching PE.	
	204 I	
Confidence in practice –	205 feel confident in what I'm doing but yeah	Confidence in current practice – being ahead of
being ahead of the game	206 always always and thinking behind subjects and	the game
	207 research is always changing and as a teacher.	
	208 you're sort of, things filter through before they	things filter through before they get to you and
	209 get to you and you're at the bottom so if you're	you're at the bottom'
	210 not always learning and not always listening to	
	211 those who are in universities or whatever and	
	212 doing the research then your practice is going	
	213 to get out off date very quickly so of course	
	214 yes, I think always.	
	215 Interveiwer: Ok thank you and as a school what	

PE is at the epi centre of a school based physical activity model, next steps break times, active lessons	 216 do you think your next steps are so in relation 217 to PE or physical activity as a whole school? 218 Participant: Yeah I think something that we still 219 haven't developed fully that needs to be 220 developed is the outdoor space and getting 221 children active at playtimes and especially in 222 the winter it's difficult and it's a difficult 223 challenge and not one that I would have a 	Next steps in terms of a school, break times consideration of outdoor space/physical environment
	224 solution for and stopping that sort of just they 225 are inactive in the classroom and they inactive 226 outside, they are going back in the classroom 227 and they are sat down again and PE being seen	'PE is seen as the only active subject'
We should be doing more	228 as the only active subject, so like you were 229 saying that, that question I can't think that I do 230 that much, really active things in other lessons, 231 so maybe we should be doing something more. 232 So yeah, that's the outdoors, more activity in	<u>Reflective practice</u> – 'maybe we should be doing more?'
	233 other lessons and generally just to ensure the 234 good practice that has been put in place this 235 year is being carried on further now and being 236 carried across the school and being carried with 237 not only the teachers in the classroom but all 238 the adults across the school so that they 239 understand what is important in lessons, so that 240 it's at the forefront of everybody's minds	Whole school approach – transference of what they have learned to go across the school into other year groups

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