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

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Children’s Physical Activity Levels 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 school-based 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 £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 dose-response 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 multi-colour 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 (Lonsdale 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

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<th>PHILOSOPHICAL WORLDVIEW</th>
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#### DESIGN, METHODS AND DATA ANALYSIS

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<td>Break times exploratory study</td>
<td>Convergent mixed methods – <strong>QUAN + QUAL</strong> (Cross sectional)</td>
<td>Systematic Observation: SOCARP (Ridgers, Stratton and McKenzie, 2010)</td>
<td>Descriptives Two-way ANOVA Correlations (Pearson’s and Spearman) Multiple Linear Regression</td>
<td>Children’s group interviews</td>
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<td><strong>Study 2</strong></td>
<td>Methods: SOCARP, Pedometers, Teacher individual interviews</td>
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<td>Initial discussions began in the 2nd year for study 2, but the intervention was delayed. Thus, data collection began in 4th year of study.</td>
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**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**
1.4 Publications 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
http://epe.sagepub.com/content/early/2015/06/24/1356336X15591135.abstract


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

1.4.2 Conference papers


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> 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 ≥ 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 (VO$_2$R), HR reserve (HHR), oxygen consumption (VO$_2$), 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> METs (ACSM, 2014). When classifying the relative intensity of activities: 40 – <60% VO$_2$R can be defined as moderate, and 60 – <85% VO$_2$R 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 composite-cardiovascular 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 Biddle, 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 quality 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 qualitative 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, qualitative 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 activity-related 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 walking. Children can transform situations into special arenas for their 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).

2.2.2.2.1 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 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.

2.2.2.2.3 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 interventions, understanding of how interventions work, 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 multi-component 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 in both children and adolescents recommended the need for future evaluations 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: socio-economic, 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).
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 Kulina, 2014), therefore, an additional aim of the current thesis was to use a mixed methods 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 advocated (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, Onwuegubuzie 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](image-url)
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 (Teddle 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).

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

1) 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;
2) 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;

2) Transferability: Providing detailed contextual information regarding the environment under study; and clearly communicating the boundaries of the study;

3) 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 devices, to further ensure the confidentiality 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.
<table>
<thead>
<tr>
<th>Study 1</th>
<th>Year 1 of PhD study</th>
<th>Methods: SOCARP, Children’s group interviews</th>
<th>Year 2 of PhD study</th>
<th>Methods: SOCARP, Pedometers, Teacher individual interview</th>
<th>Year 3 of PhD study</th>
<th>Methods: SOFIT, Children’s group interviews, Teacher individual interviews</th>
<th>Year 4 of PhD study</th>
<th>Methods: SOFIT, Teacher individual interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break time Exploratory Study</td>
<td>Study 2</td>
<td>Break time Intervention Study</td>
<td></td>
<td>Study 3</td>
<td>Physical education Exploratory Study</td>
<td></td>
<td>Study 4</td>
<td>Physical education Intervention Study</td>
</tr>
<tr>
<td>Study 3</td>
<td>Methods: SOFIT, Children’s group interviews, Teacher individual interviews</td>
<td></td>
<td></td>
<td>Methods: SOFIT, Teacher individual interviews</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**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

Initial discussions began in the 2nd year for study 2, but the intervention was delayed. Thus, data collection began in 4th year of study.
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.,
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 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 1795m² (±627), with a mean morning break time of 16 minutes (±2.2) and lunchtime of 36 minutes (±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>
<thead>
<tr>
<th>School ID</th>
<th>Size of the school</th>
<th>Demographics</th>
<th>Type of school</th>
<th>Adult supervisors</th>
<th>Equipment available (fixed and portable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1</td>
<td>236 children on roll</td>
<td>Two-thirds of the pupils are White British, the remainder coming from a range of other ethnic heritages.</td>
<td>Mixed sex</td>
<td>Morning</td>
<td>Trim trail (obstacle course)</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>The proportion of pupils who speak English as an additional language is below average.</td>
<td>Roman</td>
<td>break time – 2 Teachers Lunch break</td>
<td>Climbing frame</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>Pupil’s eligible for pupil premium is below the national average.</td>
<td>Catholic</td>
<td>– 4 lunchtime supervisors and a sports coach</td>
<td>Rubber tyres</td>
</tr>
<tr>
<td></td>
<td>Pupils come from a number of minority ethnic backgrounds with Pakistani, Bangladeshi and Black African pupils being the largest groups.</td>
<td>Pupil’s eligible for pupil premium is twice the national average (additional funding from central government for pupils known to be eligible for free school meals, children who are looked after by the local authority, or who have a parent in the armed forces).</td>
<td>Mixed sex</td>
<td>Morning</td>
<td>Trim trail (obstacle course)</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>Almost all pupils are from minority ethnic backgrounds and most pupils speak English as an additional language.</td>
<td>Community</td>
<td>break time – 2 Teachers Lunch break</td>
<td>Climbing frame</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>The proportion of disadvantaged pupils eligible for the pupil premium funding is well above average.</td>
<td>Mixed sex</td>
<td>– 4 lunchtime supervisors and a sports coach</td>
<td>Rubber tyres</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>Pupils come from a number of minority ethnic backgrounds with Pakistani, Bangladeshi and Black African pupils being the largest groups.</td>
<td>Community</td>
<td>Morning</td>
<td>Trim trail (obstacle course)</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>Almost all pupils are from minority ethnic backgrounds and most pupils speak English as an additional language.</td>
<td>Mixed sex</td>
<td>break time – 2 Teachers Lunch break</td>
<td>Climbing frame</td>
</tr>
<tr>
<td></td>
<td>The school is an average-sized primary school.</td>
<td>The proportion of disadvantaged pupils eligible for the pupil premium funding is well above average.</td>
<td>Community</td>
<td>– 4 lunchtime supervisors and a sports coach</td>
<td>Rubber tyres</td>
</tr>
</tbody>
</table>
Table 4.1 continued.

<table>
<thead>
<tr>
<th>School 4</th>
<th>143 children on roll</th>
<th>Smaller than average primary school</th>
<th>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.</th>
<th>Mixed sex Roman Catholic</th>
<th>Morning break time – 2 Teachers Lunch break – 3 lunchtime supervisors and a sports coach</th>
<th>Basketball posts Seating areas</th>
</tr>
</thead>
</table>

| School 5 | 400 children on roll | Larger than average primary school | 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 ($\eta_p^2$) (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 that experience. Thirdly, IPA is idiographic as it is committed to the detailed examination 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 ($F(1,80)=9.89, P<.01, \eta^2_p=.110$). 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 ($F(1,80)=29.04, P<.01, \eta^2_p=.266$) and small groups ($F(1,80)=21.23, P<.01, \eta^2_p=.210$) 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 ($F(1,80)=24.55, P<.01, \eta^2_p=.235$) and sedentary activities.
($F(1,80)$=21.99, $P<.01$, $\eta^2_p=.216$). 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 ($F(2,46)=3.401$, $P<0.05$, $r^2=.129$, $r^2_{adjusted} = .091$) (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 ($F(2,30)=4.915,P<0.05$, $r^2=.247$, $R^2_{adjusted} = .197$), along with pro-physical and pro-verbal predictors ($F(2,30)= 6.113$, $P<0.05$, $r^2=.290$, $r^2_{adjusted} = .242$) were negatively associated with girls’ VPA (Tables 4.5 and 4.7).
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

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

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 ($\eta_p^2$).
Table 4.3 Correlation matrix representing girls’ \((n=33)\) SOFIT outcome variables of: lying, sitting, moderate, MVPA, VPA; and predictor variables of: alone, games, locomotion, verbal conflict, physical conflict and equipment.

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

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

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Outcome variables</th>
<th>Sitting</th>
<th>Standing</th>
<th>MPA</th>
<th>MVPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(r)</td>
<td>.57**</td>
<td>-.13</td>
<td>.09</td>
<td>-.07</td>
<td>-.24</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>&lt;.01</td>
<td>.35</td>
<td>.50</td>
<td>.62</td>
<td>.09</td>
</tr>
<tr>
<td>Small group</td>
<td></td>
<td>.02</td>
<td>-.05</td>
<td>.30*</td>
<td>.06</td>
<td>-.33*</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.86</td>
<td>.70</td>
<td>.03</td>
<td>.67</td>
<td>.02</td>
</tr>
<tr>
<td>Large group</td>
<td></td>
<td>-.23</td>
<td>.16</td>
<td>-.29*</td>
<td>-.09</td>
<td>.24</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.11</td>
<td>.25</td>
<td>.04</td>
<td>.50</td>
<td>.08</td>
</tr>
<tr>
<td>Sport</td>
<td></td>
<td>-.24</td>
<td>-.32*</td>
<td>.06</td>
<td>.39**</td>
<td>.51**</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.08</td>
<td>.03</td>
<td>.67</td>
<td>.01</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Games</td>
<td></td>
<td>.02</td>
<td>.46**</td>
<td>-.29*</td>
<td>-.46**</td>
<td>-.30*</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.87</td>
<td>&lt;.01</td>
<td>.04</td>
<td>&lt;.01</td>
<td>.04</td>
</tr>
<tr>
<td>Locomotion</td>
<td></td>
<td>.18</td>
<td>-.17</td>
<td>.42**</td>
<td>.11</td>
<td>-.43**</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.19</td>
<td>.22</td>
<td>&lt;.01</td>
<td>.42</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
<td>-.373**</td>
<td>-.15</td>
<td>.24</td>
<td>.31*</td>
<td>.20</td>
</tr>
<tr>
<td></td>
<td>(p)</td>
<td>.01</td>
<td>.28</td>
<td>.08</td>
<td>.03</td>
<td>.16</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Standing</th>
<th>MPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictors</td>
<td>$B$ (SE)</td>
<td>$\beta$</td>
<td>$P$</td>
</tr>
<tr>
<td>Constant</td>
<td>40.81(3.24)</td>
<td>&lt;.01</td>
<td>17.40(2.96)</td>
</tr>
<tr>
<td>Small</td>
<td>.17(.07)</td>
<td>.304</td>
<td>.03</td>
</tr>
<tr>
<td>Medium</td>
<td>.146(.07)</td>
<td>.28</td>
<td>.06</td>
</tr>
<tr>
<td>Large</td>
<td>.10(.04)</td>
<td>.35</td>
<td>.02</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.00</td>
<td>.07</td>
<td>.09</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictors</td>
<td>$B$ (SE)</td>
<td>$\beta$</td>
<td>$P$</td>
</tr>
<tr>
<td>Constant</td>
<td>-.95(16.54)</td>
<td>.95</td>
<td>43.54(9.95)</td>
</tr>
<tr>
<td>Small</td>
<td>.42 (.23)</td>
<td>.57</td>
<td>.07</td>
</tr>
<tr>
<td>Medium</td>
<td>.57 (.24)</td>
<td>.72</td>
<td>.02</td>
</tr>
<tr>
<td>Large</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.17</td>
<td></td>
<td>.19</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>Standing</th>
<th>MPA</th>
<th>MVPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictors</td>
<td>B (SE)</td>
<td>β</td>
<td>P</td>
<td>B (SE)</td>
</tr>
<tr>
<td>Constant</td>
<td>52.03(5.3)</td>
<td>&lt;.01</td>
<td>-10.67(11.92)</td>
<td>.38</td>
</tr>
<tr>
<td>Locomotion</td>
<td>-.54(.12)</td>
<td>-.66</td>
<td>&lt;.01</td>
<td>1.104(.19)</td>
</tr>
<tr>
<td>Games</td>
<td>.42(.13)</td>
<td>.76</td>
<td>&lt;.01</td>
<td>.35(.15)</td>
</tr>
<tr>
<td>Sport</td>
<td>-.30(.06)</td>
<td>-.75</td>
<td>&lt;.01</td>
<td>.57(.12)</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>.32</td>
<td>.45</td>
<td>.41</td>
<td>.24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Standing</th>
<th>MPA</th>
<th>MVPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictors</td>
<td>B (SE)</td>
<td>β</td>
<td>P</td>
<td>B (SE)</td>
</tr>
<tr>
<td>Constant</td>
<td>79.95(11.07)</td>
<td>&lt;.01</td>
<td>-.73(7.65)</td>
<td>.92</td>
</tr>
<tr>
<td>Locomotion</td>
<td>-.91(.20)</td>
<td>-.81</td>
<td>&lt;.01</td>
<td>.85(.14)</td>
</tr>
<tr>
<td>Games</td>
<td>-.46(.15)</td>
<td>-.56</td>
<td>&lt;.01</td>
<td>.30(.10)</td>
</tr>
<tr>
<td>Sport</td>
<td>-.52(.23)</td>
<td>-.33</td>
<td>.03</td>
<td>.56(.163)</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>.41</td>
<td>.54</td>
<td>.61</td>
<td>.12</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>MPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>42.87 (2.95)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Anti-Verbal</td>
<td>-4.69 (1.67)</td>
<td>-.45</td>
</tr>
<tr>
<td>Anti-Physical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.17</td>
<td>.15</td>
</tr>
<tr>
<td>Constant</td>
<td>156.58 (43.09)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Pro-Verbal</td>
<td>-1.39 (.44)</td>
<td>-1.60</td>
</tr>
<tr>
<td>Pro-Physical</td>
<td>-1.58 (.45)</td>
<td>-1.77</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.00</td>
<td>.24</td>
</tr>
</tbody>
</table>

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. \(\beta\) = 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: 1\textsuperscript{st} and 2\textsuperscript{nd} order themes

<table>
<thead>
<tr>
<th>Intrapersonal</th>
<th>1\textsuperscript{st} Order Themes</th>
<th>2\textsuperscript{nd} Order Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s individual break time environment</td>
<td>- Imaginary role play</td>
<td>- Power hierarchies</td>
</tr>
<tr>
<td></td>
<td>- Manipulation of fixed equipment</td>
<td>- Challenge and competition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interpersonal</th>
<th>1\textsuperscript{st} Order Themes</th>
<th>2\textsuperscript{nd} Order Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The social environment of break times</td>
<td>- Adult input</td>
<td>- Boys and sport</td>
</tr>
<tr>
<td></td>
<td>- Girls’ walk and talk</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institutional</th>
<th>1\textsuperscript{st} Order Themes</th>
<th>2\textsuperscript{nd} Order Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The physical environment of break times</td>
<td>- Well-resourced versus poorly resources schools</td>
<td>- Boys’ football dominance</td>
</tr>
<tr>
<td></td>
<td>- Girls’ skipping</td>
<td></td>
</tr>
</tbody>
</table>

The physical environment of break times (emergent themes: well-resourced 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’ qualitative 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 track 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 qualitative 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.
| 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 individual interview | Outcomes: Positive short term effects on boys’ and girls’ step count and MVPA. Longer term positive effect on boys’ VPA. Boys dominated the walking track, girls participated in sedentary activities. Inconsistencies in the implementation of the intervention from school staff. A set of ‘how to principles are recommended. |
| Study 3 | Physical education | Exploratory Study | Methods: SOFIT, Children’s group interviews, Teacher individual interviews |
| Study 4 | Physical education | Intervention Study | Methods: SOFIT, Teacher individual interviews |

**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 multi-component 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 interventions in order to identify which combined strategies are effective (Parrish 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 nature-based 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 Onwueggbuzie, 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.
Table 5.1 Pedometer data sample at baseline, post-intervention and follow-up data collection points

<table>
<thead>
<tr>
<th></th>
<th>Baseline $(n=81)$</th>
<th>Post-intervention $(n=75)$</th>
<th>Follow-up $(n=68)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Y1</td>
<td>$n=9$</td>
<td>$n=7$</td>
<td>$n=9$</td>
</tr>
<tr>
<td>Y2</td>
<td>$n=11$</td>
<td>$n=9$</td>
<td>$n=11$</td>
</tr>
<tr>
<td>Y3</td>
<td>$n=12$</td>
<td>$n=8$</td>
<td>$n=10$</td>
</tr>
<tr>
<td>Y4</td>
<td>$n=13$</td>
<td>$n=11$</td>
<td>$n=10$</td>
</tr>
</tbody>
</table>

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.
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 0.5 centimetre 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: $\text{BMI} = \frac{\text{body mass (kg)}}{\text{height}^2 \text{ (m}^2\text{)}}$. 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 \((n=10, \text{ boys } = 5; \text{ girls } = 5)\), post-intervention \((n=15, \text{ boys } = 6; \text{ girls } = 9)\), and follow-up \((n=14, \text{ boys } = 7; \text{ girls } = 7)\). 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 (ƞ₂) (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).
Table 5.2 The Walking Track Intervention’s theoretical constructs

<table>
<thead>
<tr>
<th>Social Ecological Components (McLeroy et al., 1988)</th>
<th>Behaviour Change Taxonomy (Michie et al., 2011)</th>
<th>Self Determination Theory (Ryan and Deci, 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrapersonal</strong></td>
<td><strong>Barrier Identification/Problem Solving</strong></td>
<td><strong>Competence</strong></td>
</tr>
<tr>
<td>• 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.</td>
<td>• An initial decision to target children’s PA behaviour from the PE Co-ordinator and head teacher.</td>
<td>• 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.</td>
</tr>
<tr>
<td><strong>Interpersonal</strong></td>
<td><strong>Action Planning</strong></td>
<td><strong>Relatedness</strong></td>
</tr>
<tr>
<td>• 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).</td>
<td>• Creation of a school action plan for increasing children’s PA levels, within this included targets specific to school break times.</td>
<td>• 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.</td>
</tr>
<tr>
<td><strong>Institutional</strong></td>
<td><strong>Model/Demonstrate the Behaviour</strong></td>
<td><strong>Autonomy</strong></td>
</tr>
<tr>
<td>• 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.</td>
<td>• 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.</td>
<td>• 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 track during morning break times.</td>
</tr>
<tr>
<td><strong>Community</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Official opening of the track, with the children, their parents and teachers.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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).

![Figure 5.5](image.png) 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 ($F(3,215)=11.08$, $P<.001$, $\eta_p^2=.134$) (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 post-
intervention ($MD=236, P<.001, 95\% \text{ CI } [236, 351]$). However, this was not sustained as there was also a significant decrease from post-intervention to follow-up data collection point ($MD=-230, P<.001, 95\% \text{ CI } [-351, -108]$). The results also indicated a main effect of ‘sex’ on the number of mean pedometer steps taken at morning break time ($R(1,215)=21.57, p<.001, \eta_p^2=.091$), 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 ($R(2,46)=3.88, P=.028, \eta_p^2=.144$). 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 ($MD=14.58, P=.019, 95\% \text{ CI } [1.89, 27.28]$); 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) ($R(2,46)=6.00, P=.005, \eta_p^2=.207$). 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’ ($F(2,46)=17.27$, $p<.004$, $\eta^2_p=429$). 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 ($F(2,46)=5.48$, $P=.007$, $\eta^2_p=192$). 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).
Table 5.3 Children’s anthropometric data collected at baseline ($M \pm SD$)

<table>
<thead>
<tr>
<th>Age (Years) ($M \pm SD$)</th>
<th>Body Mass (kg) ($M \pm SD$)</th>
<th>Stature (cm) ($M \pm SD$)</th>
<th>BMI (kg/m$^2$) ($M \pm SD$)</th>
<th>Body Mass Index Status (percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thinness</td>
</tr>
<tr>
<td>Whole school ($n=81$)</td>
<td>7.6±1.2</td>
<td>26.2±6.8</td>
<td>125.3±8.7</td>
<td>16.5±2.6</td>
</tr>
<tr>
<td>Boys ($n=43$)</td>
<td>7.5±1.2</td>
<td>26.0±5.7</td>
<td>125.1±8.1</td>
<td>16.1±1.6</td>
</tr>
<tr>
<td>Girls ($n=38$)</td>
<td>7.6±1.1</td>
<td>26.5±8.0</td>
<td>125.6±9.6</td>
<td>16.9±3.3</td>
</tr>
<tr>
<td>Y1 ($n=16$)</td>
<td>5.9±0.3</td>
<td>20.7±2.8</td>
<td>114.3±6.0</td>
<td>16.4±2.6</td>
</tr>
<tr>
<td>Y2 ($n=21$)</td>
<td>6.9±0.3</td>
<td>24.4±4.2</td>
<td>123.0±4.7</td>
<td>16.0±1.9</td>
</tr>
<tr>
<td>Y3 ($n=20$)</td>
<td>8.0±0.3</td>
<td>27.2±5.3</td>
<td>127.2±4.8</td>
<td>16.9±3.8</td>
</tr>
<tr>
<td>Y4 ($n=24$)</td>
<td>8.9±0.3</td>
<td>30.6±8.6</td>
<td>133.3±6.9</td>
<td>16.6±1.6</td>
</tr>
</tbody>
</table>
Table 5.4 Children’s pedometer step count during morning break times: baseline, post-intervention and follow-up data collection points (M±SD)

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

Figure 5.6 Point of data collection and year group on children’s mean pedometer morning break time step counts
Figure 5.7 Children’s mean daily step counts for morning breaks at baseline, post-intervention and follow-up; according to school year group

Figure 5.8 Boys’ and girls’ mean daily step counts for morning break time at baseline, post-intervention and follow-up data collection points
Table 5.5 Changes in Y3 and Y4 mean ($M\pm SD$) 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

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Baseline ($n=23$)</th>
<th>Post-intervention ($n=15$)(1-2 weeks)</th>
<th>Follow-up ($n=14$)(6-7 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lying down</td>
<td>1.39±4.81</td>
<td>0.00±0.00</td>
<td>1.43± 3.78</td>
</tr>
<tr>
<td>Sitting</td>
<td>3.97±5.91</td>
<td>4.09±7.94</td>
<td>6.95±11.18</td>
</tr>
<tr>
<td>Standing</td>
<td>33.06±23.65</td>
<td>31.61±10.98</td>
<td>22.72±9.68</td>
</tr>
<tr>
<td>MPA</td>
<td>42.79±16.52</td>
<td>45.49±20.78</td>
<td>37.63±11.92</td>
</tr>
<tr>
<td>VPA</td>
<td>18.52±13.58</td>
<td>32.02±16.55</td>
<td>34.90±11.53</td>
</tr>
<tr>
<td>Sedentary</td>
<td>38.42±22.75</td>
<td>21.38±17.91</td>
<td>25.92 ±14.35</td>
</tr>
<tr>
<td>MVPA</td>
<td>61.30±22.44</td>
<td>77.69±17.03</td>
<td>72.53±13.46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity Type</th>
<th>Baseline ($n=23$)</th>
<th>Post-intervention ($n=15$)(1-2 weeks)</th>
<th>Follow-up ($n=14$)(6-7 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track</td>
<td>0.00±0.00</td>
<td>56.02±48.06</td>
<td>22.47+27.66</td>
</tr>
<tr>
<td>Sports</td>
<td>41.67±47.34</td>
<td>21.74+39.67</td>
<td>14.48+28.15</td>
</tr>
<tr>
<td>Games</td>
<td>15.14±26.06</td>
<td>27.52±29.51</td>
<td>28.79+31.55</td>
</tr>
<tr>
<td>Sedentary</td>
<td>27.62±31.23</td>
<td>22.25±18.71</td>
<td>24.83±12.02</td>
</tr>
<tr>
<td>Locomotion</td>
<td>15.57±23.50</td>
<td>76.42±18.44</td>
<td>44.26+32.52</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Group Size</th>
<th>Baseline (n=23)</th>
<th>Post-intervention (n=15)(1-2 weeks)</th>
<th>Follow-up (n=14)(6-7 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys (n=12)</td>
<td>Girls (n=11)</td>
<td>Boys and Girls (n=23)</td>
</tr>
<tr>
<td>Small</td>
<td>47.58±38.48</td>
<td>69.03±26.62</td>
<td>57.84±34.39</td>
</tr>
<tr>
<td>Medium</td>
<td>26.56±39.11</td>
<td>17.50±28.47</td>
<td>22.23±33.98</td>
</tr>
<tr>
<td>Large</td>
<td>16.67±38.92</td>
<td>0.30±1.01</td>
<td>8.84±28.77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro-physical</td>
</tr>
<tr>
<td>Pro-verbal</td>
</tr>
<tr>
<td>Anti-physical</td>
</tr>
<tr>
<td>Anti-verbal</td>
</tr>
</tbody>
</table>
Figure 5.9 Y3 and Y4’s mean percentage of morning break time engaged in %MVPA at baseline, post-intervention and follow-up observations

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

<table>
<thead>
<tr>
<th>1st Order Themes</th>
<th>2nd Order Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intrapersonal</strong></td>
<td></td>
</tr>
<tr>
<td>Boys domination of the walking track</td>
<td>-Racing games</td>
</tr>
<tr>
<td></td>
<td>-Imaginary play</td>
</tr>
<tr>
<td></td>
<td>-Girls sitting and talking</td>
</tr>
<tr>
<td><strong>Interpersonal</strong></td>
<td></td>
</tr>
<tr>
<td>Conflicting visions of school staff</td>
<td>-Lack of buy in from some staff</td>
</tr>
<tr>
<td></td>
<td>-Not every child wants to be active</td>
</tr>
</tbody>
</table>

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 quote ‘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±366.42 (78.4 steps per minute); with Y3 and Y4 children spending 63.49±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.
Table 5.8 A comparison of break time intervention studies’ methodological quality and results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention type</th>
<th>Break time period access (morning/lunchtime)</th>
<th>Study quality</th>
<th>Level of evidence</th>
<th>PA measure</th>
<th>Intervention results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis’ chapter 5, study 2</td>
<td>Walking track</td>
<td>Morning</td>
<td>3</td>
<td>Small (Time series design, one control school)</td>
<td>Pedometer (Yamax Digi-Walker 700/701)</td>
<td>Steps per min for boys (Y1-4) 1-5 weeks +17.33 steps from baseline 6-9 weeks +3.9 steps from baseline</td>
</tr>
<tr>
<td>Elder et al. (2011)</td>
<td>Playground markings, walking clubs, organized activities</td>
<td>Before school, morning, lunchtime</td>
<td>3</td>
<td>Large RCT</td>
<td>Direct observation SOCARP</td>
<td>Mean % of time spent in MVPA boys (Y3+4) 1-5 weeks +12.44% from baseline 6-9 weeks +6.33% from baseline Mean % of time spent in VPA boys (Y3+4) 1-5 weeks +13.5% increase from baseline 6-9 weeks +16.38% from baseline</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean % of time spent in MVPA girls (Y3+4) 1-5 weeks +16.39% from baseline 6-9 weeks +11.23% from baseline</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean % of time spent in VPA girls (Y3+4) 1-5 weeks +17.05% from baseline 6-9 weeks +11.81% from baseline</td>
<td></td>
</tr>
</tbody>
</table>
### Table 5.8 continued

<table>
<thead>
<tr>
<th>Hyndman et al. (2014)</th>
<th>Moveable/ recycled materials</th>
<th>Lunchtime</th>
<th>6</th>
<th>Large &gt;250 participants (matched control trial, 1 control and 1 intervention school)</th>
<th>Pedometers Digi-Walker SW200</th>
<th>Pedometer determined PA remained significantly elevated in the short-term, but to a lesser extent at 8-months.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Steps per min (boys and girls) Intervention group</td>
<td>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&lt;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]).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Direct Observation SOPLAY</td>
<td>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 = &lt;0.001). VPA was significantly higher in the intervention school at 7-week (p = &lt;0.01) and 8-month (p = 0.01).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean % of time spent in MPA for boys and girls</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean % of time spent in VPA for boys and girls</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean mins spent in MVPA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Final day of a 5 day intervention:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sports equipment +3.07 mins from baseline</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Orienteering +2.15 mins from baseline</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Barton et al. (2015)</th>
<th>Playground equipment Nature-based orienteering</th>
<th>Lunchtime</th>
<th>3</th>
<th>Small &lt;250 children (two intervention groups in two schools of contrasting locations – urban and rural)</th>
<th>Accelerometers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mean mins spent</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>in MVPA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Final day of a 5 day intervention:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sports equipment +3.07 mins from baseline</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Orienteering +2.15 mins from baseline</td>
<td></td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Methodological quality criteria (Parrish et al., 2013)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>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. Randomization procedure clearly and explicitly described and adequately carried out (generation of allocation sequence, allocation concealment and implementation). Validated measures of PA (validation in same age group reported and/or cited). PA assessed a minimum of 6 months after pre-test. Potential cofounders accounted for in the PA analysis (e.g. baseline score, group/cluster, age) Summary results for each group + treatment effect (difference between groups) + its precision (e.g. 95% CI). Power calculation reported, and the study was adequately powered to detect hypothesized relationships. Timing of measures comparable between intervention and control groups (needs to describe explicitly).</td>
<td>0 1 0 1 0</td>
</tr>
</tbody>
</table>

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

Table 5.9 Criteria for assessment of methodological quality for the break time intervention
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 queues 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 qualitative 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 lowering 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.
<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
<th>Study 4</th>
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<tbody>
<tr>
<td>Break time</td>
<td>Break time</td>
<td>Physical education</td>
<td>Physical education</td>
</tr>
<tr>
<td>Exploratory Study</td>
<td>Intervention Study</td>
<td>Exploratory Study</td>
<td>Intervention Study</td>
</tr>
</tbody>
</table>

**Study 1**

**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 individual interview

**Outcomes:**
- Positive short term effects on boys’ and girls’ step count and MVPA
- Longer term positive effect on boys’ VPA
- Boys dominated the walking track, girls participated in sedentary activities
- Inconsistencies in the implementation of the intervention from school staff

A set of ‘how to’ principles are recommended

**Study 3**

**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**

**Methods:** SOFIT, Teacher individual 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 qualitative 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

<table>
<thead>
<tr>
<th>School ID</th>
<th>Size of the school</th>
<th>Demographics</th>
<th>Location</th>
<th>Type of school</th>
</tr>
</thead>
<tbody>
<tr>
<td>School 1</td>
<td>275 pupils on roll</td>
<td>Most pupils are from a White British heritage.</td>
<td>West Midlands</td>
<td>Mixed sexed Community School</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ranked 138 in terms of income and 103 in terms of health, where 1 is the most deprived and 326 is the least deprived.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 2</td>
<td>210 children on roll</td>
<td>Most pupils come from minority ethnic backgrounds, with few who do not speak English as a first language.</td>
<td>West Midlands</td>
<td>Mixed sexed Roman Catholic</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The school is larger than the average-sized primary school.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 3</td>
<td>321 pupils on roll</td>
<td>The majority of pupils are White British, but the proportion from a range of minority ethnic groups is above the national average.</td>
<td>West Midlands</td>
<td>Mixed sexed Community</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The school is larger than the average-sized primary school.</td>
<td></td>
<td></td>
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</tbody>
</table>

*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 two-way 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’ (\( r (23) = .696, p<.01, \hat{r} = .48, 95\% \text{ CI} [.398, .861] \)) (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.
### Table 6.2 PE lesson time (M, SD and the Range) according to children’s activity levels, lesson context and teacher promotion of physical activity

<table>
<thead>
<tr>
<th>SOFIT Category</th>
<th>Percentage of allocated lesson time (n=23)</th>
<th>Minutes of allocated lesson time (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student Activity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>M (%)</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>Lying</td>
<td>0.9</td>
<td>1.7</td>
</tr>
<tr>
<td>Sitting</td>
<td>21.7</td>
<td>18.1</td>
</tr>
<tr>
<td>Standing</td>
<td>34.0</td>
<td>13.0</td>
</tr>
<tr>
<td>MPA</td>
<td>25.4</td>
<td>13.3</td>
</tr>
<tr>
<td>VPA</td>
<td>17.0</td>
<td>10.0</td>
</tr>
<tr>
<td>MVPA</td>
<td>42.4</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>Lesson Context</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>M (%)</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>Management</td>
<td>17.8</td>
<td>9.5</td>
</tr>
<tr>
<td>Knowledge</td>
<td>20.7</td>
<td>11.5</td>
</tr>
<tr>
<td>Fitness</td>
<td>14.0</td>
<td>14.8</td>
</tr>
<tr>
<td>Skills</td>
<td>13.8</td>
<td>14.1</td>
</tr>
<tr>
<td>Games</td>
<td>29.2</td>
<td>18.9</td>
</tr>
<tr>
<td>Other</td>
<td>4.4</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Teacher Behaviour</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>M (%)</strong></td>
<td><strong>SD</strong></td>
</tr>
<tr>
<td>In class promotion of PA</td>
<td>16.1</td>
<td>12.1</td>
</tr>
<tr>
<td>Out of class promotion of PA</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>No promotion of PA</td>
<td>82.9</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>Length of lesson</strong></td>
<td>35.3</td>
<td>7.0</td>
</tr>
</tbody>
</table>
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 ($F(2,37)=3.76$, $P=0.033$, $\eta^2_p=0.17$), and %MPA ($F(2,37)=5.30$, $P=0.009$, $\eta^2_p=0.22$). 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.

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Outcome variables</th>
<th>Lying</th>
<th>Sitting</th>
<th>MPA</th>
<th>MVPA</th>
<th>VPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>-.45*</td>
<td>-.41</td>
<td>.39</td>
<td>.47*</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>.03</td>
<td>.05</td>
<td>.06</td>
<td>.02</td>
<td>.81</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>.75**</td>
<td>.44*</td>
<td>-.17</td>
<td>-.37</td>
<td>-.23</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>&lt;.01</td>
<td>.04</td>
<td>.44</td>
<td>.08</td>
<td>.29</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>.05</td>
<td>.70**</td>
<td>-.66**</td>
<td>-.61**</td>
<td>.13</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>.81</td>
<td>&lt;.01</td>
<td>.01</td>
<td>&lt;.01</td>
<td>.54</td>
</tr>
<tr>
<td>No promotion of PA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$r$</td>
<td>-.07</td>
<td>.18</td>
<td>.05</td>
<td>-.31</td>
<td>-45*</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>.76</td>
<td>.40</td>
<td>.82</td>
<td>.14</td>
<td>.03</td>
</tr>
</tbody>
</table>

*.Correlation is significant at the 0.05 level (2-tailed), **. Correlation is significant at the 0.01 level (2-tailed), $n=23$
Table 6.4 Positive and negative predictors of children’s activity behaviours during primary physical education from a backward selection multiple regression

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>Lying B (SE)</th>
<th>Lying β</th>
<th>Lying p</th>
<th>Sitting B (SE)</th>
<th>Sitting β</th>
<th>Sitting p</th>
<th>Standing B (SE)</th>
<th>Standing β</th>
<th>Standing p</th>
<th>MPA B (SE)</th>
<th>MPA β</th>
<th>MPA p</th>
<th>MVPA B (SE)</th>
<th>MVPA β</th>
<th>MVPA p</th>
<th>VPA B (SE)</th>
<th>VPA β</th>
<th>VPA p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>.20 (.29)</td>
<td>&lt;.01</td>
<td></td>
<td>119.72 (12.99)</td>
<td>&lt;.01</td>
<td></td>
<td>45.56 (4.50)</td>
<td>&lt;.01</td>
<td>1</td>
<td>-10.70 (13.21)</td>
<td>.42</td>
<td>&lt;.01</td>
<td>2.52 (3.22)</td>
<td>.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>-.76 (.20)</td>
<td>-.40</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td>-.81 (1.16)</td>
<td>-.67</td>
<td>&lt;.01</td>
<td>.76 (.26)</td>
<td>.92</td>
<td>.01</td>
<td>.72 (1.16)</td>
<td>1.11</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.17 (.03)</td>
<td>.75</td>
<td>&lt;.01</td>
<td>-.72 (.31)</td>
<td>-.44</td>
<td>.03</td>
<td>-.43 (.24)</td>
<td>-.25</td>
<td>.09</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness</td>
<td>-1.38 (.25)</td>
<td>-1.14</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td>-.48 (.17)</td>
<td>.44</td>
<td>.01</td>
<td>.534 (.32)</td>
<td>.65</td>
<td>&lt;.01</td>
<td>.534 (.32)</td>
<td>.65</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td>-1.66 (.24)</td>
<td>-1.30</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>.76 (.24)</td>
<td>.88</td>
<td>.01</td>
<td>.72 (1.16)</td>
<td>1.11</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Games</td>
<td>-1.42 (.21)</td>
<td>.21</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.72 (.21)</td>
<td>1.11</td>
<td>&lt;.01</td>
<td>.72 (1.16)</td>
<td>1.11</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>.17 (.03)</td>
<td>.75</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
<td>-.72 (.31)</td>
<td>-.44</td>
<td>.03</td>
<td>-.43 (.24)</td>
<td>-.25</td>
<td>.09</td>
<td>-.43 (.24)</td>
<td>-.25</td>
<td>.09</td>
<td></td>
<td></td>
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<tr>
<td>In class promotion of PA</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-.48 (.17)</td>
<td>.44</td>
<td>.01</td>
<td>.534 (.32)</td>
<td>.65</td>
<td>&lt;.01</td>
<td>.534 (.32)</td>
<td>.65</td>
<td>&lt;.01</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>School 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-10.60 (4.02)</td>
<td>-.40</td>
<td>.02</td>
<td>15.01 (3.22)</td>
<td>.74</td>
<td>&lt;.01</td>
<td>15.01 (3.22)</td>
<td>.74</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (Year Group) Y4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-12.75 (4.24)</td>
<td>-.48</td>
<td>.02</td>
<td>15.01 (3.22)</td>
<td>.74</td>
<td>&lt;.01</td>
<td>15.01 (3.22)</td>
<td>.74</td>
<td>&lt;.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adjusted $R^2$ | .53 | .74 | .26 | .59 | .42 | .53
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 qualitative 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 ($P<.01, \eta^2_p=.316$) and VPA ($P<.01, \eta^2_p=.263$). 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.
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<th>Year 1 of PhD study</th>
<th>Year 2 of PhD study</th>
<th>Year 3 of PhD study</th>
<th>Year 4 of PhD study</th>
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<tbody>
<tr>
<td><strong>Study 1</strong></td>
<td>Break time</td>
<td>Exploratory Study</td>
<td>Methods: SOCARP, Children’s group interviews</td>
<td>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</td>
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<tr>
<td><strong>Study 2</strong></td>
<td>Break time</td>
<td>Intervention Study</td>
<td>Methods: SOCARP, Pedometers, Teacher individual interview</td>
<td>Outcomes: Positive short term effects on boys’ and girls’ step count and MVPA Longer term positive effect on boys’ VPA Boys dominated the walking track, girls participated in sedentary activities Inconsistencies in the implementation of the intervention from school staff A set of ‘how to principles are recommended</td>
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<td><strong>Study 3</strong></td>
<td>Physical education</td>
<td>Exploratory Study</td>
<td>Methods: SOFIT, Children’s group interviews, Teacher individual interviews</td>
<td>Outcomes: Boys and girls engage in &lt;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</td>
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<tr>
<td><strong>Study 4</strong></td>
<td>Physical education</td>
<td>Intervention Study</td>
<td>Methods: SOFIT, Teacher individual interviews</td>
<td>Outcomes: Positive effect on both boys’ and girls’ MVPA, increasing by a 30% point increase The SHARP intervention has the potential to shift teachers’ current thinking to focus on active learning time during PE</td>
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**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 pre-intervention 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 post-intervention 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 Lounsbury, 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 active learning time.
- Teachers should ensure that they are familiar with the STEP framework (Space, Task, Equipment and People) for effective differentiation of activities (Doherty and Brennan, 2014). An example of the acronym STEP for a gymnastics lesson would be:

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<tr>
<th>STEP</th>
<th>Easier</th>
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<tr>
<td>Space</td>
<td>Working in their own space</td>
<td>Sharing multiple stations with others.</td>
</tr>
<tr>
<td>Task</td>
<td>Reducing the number of elements to be included in a sequence</td>
<td>Increasing the number of elements to be included in a sequence</td>
</tr>
<tr>
<td>Equipment</td>
<td>Using the floor and mats</td>
<td>Using the floor, mats and apparatus</td>
</tr>
<tr>
<td>People</td>
<td>Working with a partner</td>
<td>Working in a small group</td>
</tr>
</tbody>
</table>

**Reducing sitting and standing**
- As PE is the only required curriculum subject to provide MVPA to all children (Sallis et al., 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 et al., 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 throughout the lesson.

**Promoting in class physical activity**
- If teachers are to assist in the development of children’s lifelong PA they must make a conscious effort to change their instruction behaviours during PE lessons promoting in class PA (Sallis et al., 2012).
- This principle is also linked to the assessment of PA during PE lessons using the SOFIT observational tool (McKenzie, 2012; 2015). An example of the promotion of in class PA includes ‘great team work, keep moving and looking for 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 ($\eta_p^2$) (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; **H**igh repetition of motor skills; **A**ccessibility through differentiation; **R**educing sitting and standing; and **P**romoting in class physical activity.

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**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

<table>
<thead>
<tr>
<th>Social Ecological Components (McLeroy et al., 1988)</th>
<th>Behaviour Change Taxonomy (Michie et al., 2011)</th>
<th>Self Determination Theory (Ryan and Deci, 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrapersonal Level</td>
<td>Barrier Identification/Problem Solving</td>
<td>Competence</td>
</tr>
<tr>
<td>• Increasing teachers’ awareness of children’s PA levels in PE through the collection of baseline data.</td>
<td>• An initial decision to change behaviour from head teacher and PE Co-ordinator.</td>
<td>• Teachers’ competence developed through joint planning sessions and the SHARP Principles.</td>
</tr>
<tr>
<td>• Developing teachers’ knowledge and skills of PE through a joint planning session; SHARP principles where integrated to increase active learning time.</td>
<td>• 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).</td>
<td>• PE Co-ordinator’s and head teacher’s competence developed through baseline data collection.</td>
</tr>
<tr>
<td></td>
<td>• Meeting between the researcher and PE Co-ordinator to discuss barriers and identify possible ways of overcoming them. Including the implementation of the SHARP Principles.</td>
<td></td>
</tr>
<tr>
<td>Interpersonal Level</td>
<td>Action Planning</td>
<td>Relatedness</td>
</tr>
<tr>
<td>• Ongoing support for teachers from the lead researcher and the school’s PE Co-ordinator.</td>
<td>• 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.</td>
<td>• 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.</td>
</tr>
<tr>
<td>• Ongoing support for the PE Co-ordinator through regular emails and meetings; action plan and progress were reviewed.</td>
<td>• Action planning included: ‘target’, ‘rationale’, ‘action’, ‘timescale’ and ‘evidence/outcome’.</td>
<td>• The joint planning meetings assisted in providing social belonging and support from the lead researcher and their supporting year group teacher.</td>
</tr>
<tr>
<td>• Ongoing reference to the SHARP Principles.</td>
<td>• 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.</td>
<td></td>
</tr>
<tr>
<td>Institutional Level</td>
<td>Provide Instruction on How to Perform the Behaviour</td>
<td>Autonomy</td>
</tr>
<tr>
<td>• Ongoing support from the head teacher.</td>
<td>• Providing instruction, involved ‘telling’ the teachers ‘how’ to perform the behaviour (Michie et al., 2011). In this instance, joint planning sessions took place with year group teachers and the lead researcher.</td>
<td>• 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.</td>
</tr>
<tr>
<td>• Development of a PE and PA policy and action plan with the PE Co-ordinator, integrating SHARP Principles.</td>
<td>• 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.</td>
<td></td>
</tr>
<tr>
<td>• Creation of a curriculum map, which was used as a starting point.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 ($F(3,27)=11.07$, $p=.003$, $\eta^2_p=.316$), VPA ($F(3,27)=8.557$, $p=.007$, $\eta^2_p=.263$) and skill practice ($F(3,27)=14.87$, $p=.001$, $\eta^2_p=.383$) 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.

<table>
<thead>
<tr>
<th>SOFIT Category</th>
<th>Physical activity</th>
<th>Baseline Mean percentage of lesson time % (SD)</th>
<th>Post Intervention</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control School</td>
<td>Intervention School</td>
<td>Control School</td>
</tr>
<tr>
<td><strong>Lying</strong></td>
<td></td>
<td>0.34±0.89</td>
<td>0.86±1.08</td>
<td>0.00±0.00</td>
</tr>
<tr>
<td><strong>Sitting</strong></td>
<td></td>
<td>16.62±13.86</td>
<td>23.69±14.96</td>
<td>6.06±7.33</td>
</tr>
<tr>
<td><strong>Standing</strong></td>
<td></td>
<td>40.68±7.09</td>
<td>32.79±12.69</td>
<td>48.25±7.88</td>
</tr>
<tr>
<td><strong>MPA</strong></td>
<td></td>
<td>28.07±12.12</td>
<td>30.23±12.66</td>
<td>34.83±5.09</td>
</tr>
<tr>
<td><strong>VPA</strong></td>
<td></td>
<td>14.17±5.50</td>
<td>12.28±12.71</td>
<td>10.49±4.36</td>
</tr>
<tr>
<td><strong>MVPA</strong> a</td>
<td></td>
<td>42.23±13.58</td>
<td>42.51±12.41</td>
<td>45.32±4.66</td>
</tr>
<tr>
<td><strong>Lesson Context</strong></td>
<td></td>
<td>18.26±5.05</td>
<td>17.90±11.53</td>
<td>14.11±5.24</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td></td>
<td>21.29±7.41</td>
<td>17.30±8.71</td>
<td>22.30±7.89</td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td></td>
<td>10.43±5.13</td>
<td>26.36±21.66</td>
<td>13.18±6.75</td>
</tr>
<tr>
<td><strong>Fitness</strong></td>
<td></td>
<td>17.49±14.18</td>
<td>6.84±8.69</td>
<td>9.25±5.45</td>
</tr>
<tr>
<td><strong>Skills</strong></td>
<td></td>
<td>32.48±24.76</td>
<td>23.84±19.61</td>
<td>40.88±13.29</td>
</tr>
<tr>
<td><strong>Games</strong></td>
<td></td>
<td>0.00±0.00</td>
<td>7.66±10.04</td>
<td>0.63±1.17</td>
</tr>
<tr>
<td><strong>Teacher promotion of PA</strong></td>
<td></td>
<td>21.36±13.08</td>
<td>18.72±14.28</td>
<td>6.89±3.91</td>
</tr>
<tr>
<td>In class promotion</td>
<td></td>
<td>0.00±0.00</td>
<td>0.00±0.00</td>
<td>0.00±0.00</td>
</tr>
<tr>
<td>Out of class promotion</td>
<td></td>
<td>78.47±13.09</td>
<td>81.28±14.28</td>
<td>92.86±3.42</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>1st Order Themes</th>
<th>2nd Order Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paradigm Shift</td>
<td>-Rethinking their approach to primary PE (Intrapersonal)</td>
</tr>
<tr>
<td></td>
<td>-Raising awareness (Intrapersonal and institutional)</td>
</tr>
<tr>
<td></td>
<td>-A whole school approach (Interpersonal and institutional)</td>
</tr>
<tr>
<td>Developing Pedagogy</td>
<td>-Planning is the foundation (Intrapersonal)</td>
</tr>
<tr>
<td></td>
<td>-Being Comfortable in Chaos (Intrapersonal)</td>
</tr>
<tr>
<td></td>
<td>-PA as the main aim of primary PE (Intrapersonal and Institutional)</td>
</tr>
</tbody>
</table>
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 quality 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
Table 7.5 Risk of bias score for the SHARP teaching strategy intervention

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

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 amount 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 dose-response 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 school-based 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 post-intervention 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 lowering 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 qualitative 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 queuing, 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 non-specialists 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:

1. 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:

1. 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

2. 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:

1. **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);

2. **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;

3. **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;
4. **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

7. **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 non-specialists. 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
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 – 17 years, 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;
✓ 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;
✓ 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: Date:
Parent/guardian’s signature: Date:
Appendix 4 – Study 1 Children’s information leaflet

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, see how well you are growing and express your views then I’ll see you soon. If you have any worries or you do not want to take part then please speak to your parents or a teacher.

If you change your mind at anytime that’s ok, just tell your teacher or one of the researchers.

Research Study
Dear Children,
My name is Alice 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 break 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/carers.

Newman University
Great West Road
Birmingham
B32 5BT

My physical activity during playtimes
Children’s information leaflet

Newman University
Great West Road
Birmingham
B32 5BT
SOCARP Recording Form
(System for Observing Children’s Activity and Relationships during Play)

Date: [ ]
School: [ ]
Observer: [ ]
Study: [ ]

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
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<td>30</td>
<td>1 2 3 4 5</td>
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</tbody>
</table>

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?)
Appendix 7 - Study 1 example of children’s drawings of break times
### Appendix 8 - Study 1 example of an analysed interview transcript from the children’s group interviews

#### Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009)

**Key** – Descriptive comments (blue text), linguistic comments (red italicised text) and conceptual comments (underlined).

<table>
<thead>
<tr>
<th>Emergent themes</th>
<th>Original transcript</th>
<th>Exploratory Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value input from adults</td>
<td>Initial questions were asked to encourage children to talk and to be able to recognize their names when transcribing.</td>
<td>Children like having the football coach with them during both outdoor and indoor play. <em>Children value the contribution of the football coach, they have fun with him.</em> &quot;We play fun games!&quot;</td>
</tr>
<tr>
<td>Physical activity opportunities at indoor play</td>
<td></td>
<td>Children still have the opportunity to ‘play’ indoors if it is wet play.</td>
</tr>
<tr>
<td>Value input from adults</td>
<td></td>
<td>Children enjoy playing football 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?</td>
</tr>
<tr>
<td>Rules and boundaries</td>
<td></td>
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</tbody>
</table>

1. Interviewer: What do you like, what do you enjoy about breaktimes?
2. Child male: Sometimes we have the football coach and when we go inside we play fun games.
3. Interviewer: So you like it when the football coach comes and does he do lots of different games in the playground with you outside?
5. Interviewer: and when does he do it inside?
7. Interviewer: When it’s raining and you come inside to play games in the hall?
8. Child male: Yes
9. Interviewer: What else do you play to do at breaktimes?
10. Child male: At breaktimes, I like playing with the football coach.
11. Interviewer: You like playing with the football coach.
Physical activity opportunities

Interviewer: What types of things does he do with you?

Child: He plays football and bench ball, inside he sometimes he plays different sports when it's raining.

Interviewer: so what does he do outside with you?

Child: He plays football

Interviewer: He plays football, does he organise any other sports with you or play any other games?

Child: Just football.

Interviewer: and does everybody play football with the football coach?

Child: Inside he has to choose a small amount of people but if you want to play football you can.

Child: We have a timetable, on Monday it's Y6, on Tuesday it's Y5, on Wednesday it's us (Y4), on Thursday it's Y6 and on Friday it's Y5 so we only have it on Wednesday.

Interviewer: and that's outside?

Child: Yeah, if it's raining we go inside in the school hall.

Interviewer: So what do you like to do at breaktimes?

Child: I like to climb on the climbing frame because it's so high and I like to race down with my friends.

Physical activity opportunities

Value adult input

Rules and boundaries

Physical activity linked to challenge and competition

Physical activity linked to friendships

There's always a backup plan if it rains, children still get the opportunity to be active.

Not all children have the option if inside, only a select few. This is probably due to indoor space and health and safety reasons. The coach gives the children options, values their opinion.

School has a timetable for various activities. Children view this as a fair system, but they do realise that they have it less opportunity to play football than Y5 and 6. We only have it on Wednesday.

Children enjoy playing on the climbing frame, like to play with friends. They like the challenge because it's so high. They like play races, this
| Rules and boundaries | 52 Interviewer: What do you like to do at breaktimes?  
53 Child male: I like to play Star Wars with my friends.  
56 Interviewer: and what do you do when you're playing Star Wars? What types of things do you do? What would I see you doing if I came outside and you were playing Star Wars?  
60 Child male: We pretend we have light sabers and there are the heroes and the villains and the emperor is Darth Sidious and the master is Darth Vader.  
64 Interviewer: and what do you do when you're playing those games, do you stay in one spot in the playground, do you move around – what do you do?  
68 Child male: yeah we move around, I'm Darth Vader.  
70 Child male: I like to play zombie games.  
71 Interviewer: You like to play zombie games and what would I see you doing if you were playing your zombie games?  
74 Child male: One of us would be lying on the bench then we move and we wake up and then they all chase us and when they catch one of us they put us on the bench and then they have to catch us.  
79 Child male: because they turn into the zombie because the other zombie eats them and we're the doctors and we're trying to fix them.  
82 Interviewer: Do you chase each other when you're zombies?  
83 | adds an additional challenge, they like to add their own games to the fixed equipment.  

Children like to play Star Wars with their friends. Brings an element of imaginary play to the playground, making links between the home environment and that of the school environment.

‘We pretend we have light sabers’ Children know they are pretending, they transform the playground into their own imaginary world. Children have heroes and villains – they become the characters. They understand that there is good and bad.

Children move around when they are playing their imaginary games. Physical activity is a by-product of imaginary play.

Children enjoy zombie games. Imaginary play, involved in their own world, transforming the playground into their own arena.

Children able to describe their games in detail, they all know the rules to the game. Children form their own rules and have a joint understanding of their games. Children are active as a result of the chase element in the zombie games.

| Imaginary play |  

| Home and school environment |  

| Imaginary play |  

| Morality – good and bad/right and wrong |  

| Physical activity promoted through imaginary play |  

| Transforming the playground environment |  

| Rules and boundaries |  

| Physical activity promoted through imaginary play |
| Rules and boundaries – ownership | Child male: No the zombie chases us and he catches us and puts us on the bench and then they move and have to chase us. Interviewer: What does anyone else like to do at breaktimes? Child male: Zombies Interviewer: You like to play the zombie games as well? Child male: I like to go in the wooded area and I like to read with my friends. Interviewer: You like to go in the wooded area and what do you read in the wooded area? Child male: comics Interviewer: and what do you do when you’re reading, do you sit down and read, is there a place for you to sit down? Children: yes there’s a bench Child male: Sometimes I like to play, I like to play Minium Rush with my friends. Interviewer: and what’s that? Child male: Minium Rush is someone needs to be the minium and someone needs to be like they want to choose which villain, they are three types yeah and when the villain comes they need to get the things that are safe back to us and then the villain loses. Child male: Minium Rush you can download it on your phone, it’s a game. Interviewer: Ok so has everybody told me what they like about breaktimes? Child male: I like playing the zombie games as well. |
| Imaginary play | Children are very specific about their rules of the game. These games mean a lot to them, they have created the rules with their friends, therefore there is a sense of ownership. Most children engage in imaginary play. Like to read in the wooded area – comics Children appreciate the welcoming environment. They acknowledge the various zones within the playground and change their physical activity behaviours accordingly. |
| Adapt physical activity behaviours according to zones | Children like to play imaginary games with their friends There is a cross over between their online games and their playground games. Villains and heroes in their imaginary play Children understand the moral concepts of good and bad, they have to work together with their friends to succeed. Developing their teamwork and social skills. Links between digital and real world Enjoy imaginary play – zombie games – monsters |
| Imaginary play | 116 Interviewer: You like playing the zombie games? What do you do in the zombie games? 118 Child male: oh, somebody chooses who is going to be the zombie, then they lie down on the bench, then when they wake up and they have to catch us. 122 Child male: I like to play zombie games because when they lie on the bench I like to tickle them and they wake up and they catch us. 125 Interviewer: and do they run to catch you do they chase you? 127 Children: yeah, if they catch you, you have to go on the bench and they have to be a zombie and the game carries on and they run and catch us. 131 Child male: they tickle me. 132 Interviewer: Ok you told me what you like at breaktimes, now I want you to tell me what you don’t like about breaktimes? 135 Child male: I don’t like it when people ruin my games. 137 Interviewer: You don’t like it when people ruin your games and what do they do to ruin your games? 140 Child male: They choose another game 141 Interviewer: They choose another game, so they stop the game that you’re playing? 143 Child male: Miss today we were playing Star Wars and he came and said to all of us let’s play the zombie game and he ruined the game. 146 Child male: I didn’t know you were playing any game. 147 |
| Rules and boundaries |  
| Challenge and competition |  
| Physical activity promoted through imaginary play |  
| Rules and boundaries – friendship groups |  
| Arenas of play – bounded system |  

Children understand the rules of their imaginary games. Own rules within the bounded system of their friendship groups.

Children enjoy the element of the chase. Physical activity is a by-product of their imaginary play.

Children don’t like it when others interfere with their imaginary games. They have their own rules and systems which they value. Others outside of their friendship groups don’t understand the rules.

Almost a sense of fear of being brought back to reality, they like to be within their own arena and are unaware of others outside of their friendship groups.
<table>
<thead>
<tr>
<th>Arenas of play – Bounded systems</th>
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</table>
| **Interviewer:** So why don’t you like it when people change your games then, because do not still have fun playing the other games? **Child male:** I don’t like playing the zombie game. **Interviewer:** and why don’t you like that? **Child male:** because my favourite game is Star Wars. **Child male:** I don’t like it when people be mean to me and just randomly because sometimes me and my friends play a game someone comes up and says no no no no and I say why you being mean to me and they say I didn’t do nothing, so they just annoy me. **Interviewer:** and how does that make you feel, **why do you think people are mean?** **Child male:** I don’t know. **Child male:** I don’t like when people come up to me and they say let’s play a different game, when I’m playing a game with someone and they just come to me and they take me away from (Child’s name) and they say let’s play this game instead of (child’s name) game. **Interviewer:** Ok but do you like to play different games, anyway? **Child male:** Yeah I like to play some of my games. **Interviewer:** What do you not like about breaktimes? **Child male:** I don’t like it when people come to and be mean and say nasty words. **Child male:** I don’t like it when people call me.

**Children don’t like it when others stop their game or interfere in anyway. They interpret this as being mean, however it appears that they don’t like their own imaginary world to be interrupted.**

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<thead>
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<th>Arenas of play – bounded systems</th>
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| **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.**

<table>
<thead>
<tr>
<th>Morality – right and wrong/good and bad</th>
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<tbody>
<tr>
<td><strong>Children don’t appreciate being spoken to in a nasty way. Children understand what is right and</strong></td>
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</table>
### Arenas of play – bounded systems

#### Morality – right and wrong / good and bad

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<thead>
<tr>
<th>Line</th>
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<tbody>
<tr>
<td>180</td>
<td>names and they annoy me.</td>
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<tr>
<td>181</td>
<td>Interviewer: Is there anything else we don't like about breaktimes?</td>
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<td>182</td>
<td>Child male: I don't like it when someone comes to me and annoys me loads of times</td>
</tr>
<tr>
<td>183</td>
<td>Child male: I don't like it when people come up to me when I'm on the bouncy hoppers and they just push me off the bouncy hoppers and I want to play on the bouncy hoppers and they just take me away.</td>
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<tr>
<td>184</td>
<td>Interviewer: So you say that people are mean to you at breaktimes, does this happen all the time or just sometimes?</td>
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<tr>
<td>185</td>
<td>Children: Sometimes</td>
</tr>
<tr>
<td>186</td>
<td>Child male: All the time</td>
</tr>
<tr>
<td>187</td>
<td>Child male: I don't like it when I kick the ball over and then people say that you kicked the ball over and then (member of staff) says that you are bad</td>
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<td>188</td>
<td>Interviewer: Who's (member of staff)?</td>
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<td>189</td>
<td>Child male: one of the dinner supervisors</td>
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<td>190</td>
<td>Interviewer: One of the lunchtime supervisors?</td>
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<td>191</td>
<td>Child male: He's not a dinner supervisor.</td>
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<td>192</td>
<td>Interviewer: What does he do?</td>
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<td>193</td>
<td>Child male: He just takes out toys and he's one of the supervisors.</td>
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<td>194</td>
<td>Interviewer: Next question: How active do you think you are at breaktimes? What do you think I mean by active? What does active mean?</td>
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<td>195</td>
<td>Child male: like if you're running and if you just don't stop</td>
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<td>196</td>
<td>Interviewer: Yes, so I want to know how busy</td>
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**wrong.**

Children don't like anti physical behaviours and they don't enjoy being taken away from an element of play. Children value their play, gives them a sense of ownership and independence – hence they are not happy if this is taken from them by other children and they just take me away.

The negative verbal and physical behaviour is not a common occurrence in the playground.

Children don't like being told that they have done something wrong if it was an accident! **Sense of morality, right and wrong/good and bad.**
Children are active at breaktimes, they like to run around Locomotive activity behaviours.

They like to be active on the fixed equipment with their friends Physical activity promoted through fixed equipment and friendship groups.

Busy with friends through imaginary play physical activity promoted through their own imaginations – links between home and school environment. "I pretend" Children understand that their games are not real – adopting the role of characters.

Children enjoying playing chasing games with their friends. Friendships are an important element of physical activity.

Enjoy running with their friends, element of competition.

Children are very active when they play football with the coach Aware of the affects of physical activity e.g. hot, tired and needing a drink. Do they know the benefits of being active?

Children enjoy playing on the trim trail with their friends, this is a challenge for them, makes them
<table>
<thead>
<tr>
<th>Physical activity promoted through fixed equipment</th>
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<tbody>
<tr>
<td>High activity levels</td>
</tr>
<tr>
<td>Challenge and competition</td>
</tr>
<tr>
<td>Physical activity behaviours promoted through fixed equipment</td>
</tr>
<tr>
<td>Physical activity promoted through fixed and portable equipment</td>
</tr>
<tr>
<td>Rules and boundaries</td>
</tr>
<tr>
<td>Physical activity promoted through sport's games</td>
</tr>
</tbody>
</table>

243 Then? You run around a lot?
244 Children: Yeah
245 Interviewer: Ok then so you've already told me a little bit about some of the activities you like to do at breaktimes, but do you use any equipment? So it might be that you have things in your playground like the climbing frame or somebody might bring out some equipment.
246 What do you like to use and what do you use?
247 Child male: The sand toys
248 Child male: We use the moon hoppers
249 Child male: Skipping ropes and this thing that you put on your foot and you have to swing it around
250 Child male: I like going on the thing and you have to hold it and you have to run across, you have to hold the rope and there's like a rolling thing at the bottom and you have to get across and if you fall down you are out of the game.
251 Child male: Sometimes I like bring out the football and play or sometimes from the boxes we'll get the basketball and play
252 Interviewer: Ok it sounds like you have lots of equipment
253 Child male: Most of the time I play with the sand toys
254 Interviewer: Only two more questions and they can go back to class, so you're doing really well. Ok then so now I want to know what you did at breaktimes today? Where you outside for breaktimes today?
255 Children know that they are busy and active at playtimes. This is linked to enjoyment and challenge.
256 Children enjoy playing with the sand toys, they enjoy the sensory touch and having something to do - this promotes standing.
257 Children enjoy using a range of portable and fixed equipment in the playground.
258 Apply their own games/rule to the fixed equipment. Children like to have a sense of ownership e.g. implementing their own rules.
259 Enjoy playing sports related games e.g. football and basketball.
Children take part in imaginary games, sports specific games, and play on the fixed equipment.

Children would like more fixed equipment. Do they like fixed equipment because it will always be there rather than portable equipment which can be taken away from them or damaged?

I would change that we had a zip wire.
I would change... like a pogo stick.
Rollercoaster's
Children: Wow!
Interviewer: Do you think we would be able to do that?
Children: Yeah, just a little one.
Children: Yes
Interviewer: Okay, so what did you do today?
Child male: I played football with (Child's name).
Child male: I did the assault courses.
Child male: I was playing football and I was playing the zombie game.
Child male: I played the zombie game too.
Child male: I played football and I played on the monkey bars.
Child male: I played Star Wars.
Child male: I played football Star Wars and the zombie game.
Child male: I played the zombie game as well.
Interviewer: Okay, then last question now. If you could change anything about breaktimes so maybe if you wanted some different equipment, what would you change about your breaktimes.
Child male: I would change that we had a zip wire, like, it's like something they have, slides and swings.
Child male: the same.
Child male: a zip wire.
Child male: a zip wire.
Child male: I would change... like a pogo stick.
Child male: Rollercoaster's
Children: Wow!
Interviewer: Do you think we would be able to do that?
Children: Yeah, just a little one.
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;
- 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: Date: 
PE Co-ordinator: 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:

- 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.
- 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

<table>
<thead>
<tr>
<th>Name:</th>
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<tbody>
<tr>
<td>Pedometer Number:</td>
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<table>
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<tr>
<th>Day 1</th>
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<tbody>
<tr>
<td>Number of steps before break time</td>
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<table>
<thead>
<tr>
<th>Day 2</th>
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<tbody>
<tr>
<td>Number of steps before break time</td>
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<tr>
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<tr>
<td>Number of steps before break time</td>
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<tr>
<th>Day 4</th>
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<tbody>
<tr>
<td>Number of steps before break time</td>
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<td>-------------------------------------------</td>
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</table>
Appendix 12 – Study 2 Adapted SOCARP recording form

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

Date:  School:  Observer:  Study:  

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 ___  

<table>
<thead>
<tr>
<th>Interval</th>
<th>Activity</th>
<th>Group</th>
<th>Size</th>
<th>Activity</th>
<th>Interactions</th>
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</table>

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 post-intervention 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 (red italicised text) and conceptual comments (underlined).

<table>
<thead>
<tr>
<th>Emergent themes</th>
<th>Original transcript</th>
<th>Exploratory Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial buzz</td>
<td>1. Interviewer: Ok then, my first question is how did the children respond to the walking track during morning break times?</td>
<td>An initial wow factor in relation to the walking track. Acknowledges an initial 'buzz' about the track and anticipated a decline in activity.</td>
</tr>
<tr>
<td>Health and safety concerns</td>
<td>4. 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 being encouraged more to walk 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 not...yeah. 15. Interviewer: So do you think the boys or girls are using the track more?</td>
<td></td>
</tr>
<tr>
<td>Girls socialise at break times</td>
<td>16.</td>
<td>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.</td>
</tr>
<tr>
<td>Boys race around the track</td>
<td>21. Teacher: the boys definitely use it more than the girls, the girls kind of don't sustain it as much as the boys do. The boys are more</td>
<td>Girls only walking around the track once and then going and chatting somewhere else in the playground. Girls view playtime as an opportunity to socialise with their friends.</td>
</tr>
<tr>
<td></td>
<td>22.</td>
<td>Boys use the track more than the girls, boys are competitive to see how many laps they can do around the track.</td>
</tr>
<tr>
<td>Boys dominate the track</td>
<td>Boys dominating the track, especially if they are racing around the track this probably puts the girls off from using the track: they don’t want to compete with the boys.</td>
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<tr>
<td>Girls sit and talk</td>
<td>Girls walk and talk around the track</td>
<td></td>
</tr>
<tr>
<td>Boys dominate the</td>
<td>Girls go to the huts and benches to sit and have a chat with their friends. Girls are drawn to the physical features of the playground that encourage sedentary behaviour. The huts have seating areas inside of them. The benches placed around the walking track encouraged the girls to sit and chat. Also they were drawn to spaces in the playground that were not dominated by the boys.</td>
<td></td>
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<tr>
<td>playground space</td>
<td></td>
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<tr>
<td>Boys and competition –</td>
<td>Boys enjoy competition and racing around the track boys utilise their playground environment</td>
<td></td>
</tr>
<tr>
<td>racing around the track</td>
<td></td>
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</tbody>
</table>
| Boys and imaginary play | keep the boys going?  
56. Teacher: yeah so we have incentives of timing,  
57. erm, I think the boys just like the fact that they  
58. are top of the school now and getting the  
59. younger ones to come and join them. So it was  
60. kind of staff saying well how far can you get  
61. around in three minutes, how many laps can  
62. you do, so lots of staff encouragement really  
63. but saying that the boys like playing  
64. superheroes around the track and pretending  
65. they are superman and different things like that  
66. and yeah they kind of initiate their own games  
67. really as well as the staff supporting them. The  
68. boys love it and you don't want to discourage  
69. them but because they kind of bound on  
70. passed the girls who are walking by they might  
71. intimidate them a little bit but yeah the boys  
72. seem to access it more despite encouragement  
73. from us. I think it's helped that when we do our  
74. run a mile as a class, they see us as role  
75. models doing it with them. I think if you model  
76. it more they are more inclined to follow.  
77. Interviewer: in terms of the girls then, their  
78. data showed an initial increase in their  
79. moderate PA and then it dropped back down to  
80. baseline figures, do you think there are any  
81. other reasons why the girls may have not been  
82. that interested?  
83. Teacher: I think, they were more inclined to do  
84. like skipping and the imaginary play, so from  
85. when you walk out and about the girls are  
86. playing mums and dads games, or dancing so  
87. |  
| Boys played superheroes around the track and imitated their own games Boys engaged in imaginary role play using the track as stimuli, created their own child world rather than an adult imposed playground. 'Boys loved it' boys really enjoyed the track, staff know they dominate but don't want to discourage them from using the track. 'bound pass the girls' intimidate the girls, dominate the space. Boys dominated the track, boys engaged in a higher intensity of PA than girls who were just walking around the track. Girls were intimidated so were pushed to other areas of the playground and resumed to their habitual behaviour of sitting and talking in huts and on benches away from the boys. |  
| Girls sitting and talking |  
| Girls and imaginary play |  

Girls are also engaged in imaginary play, teachers view them as more 'creative than physical.' Teachers lack of understanding of
<table>
<thead>
<tr>
<th>Boys are more physical</th>
<th>Staff concerns</th>
<th>physical activity, can they be creative and active?</th>
</tr>
</thead>
<tbody>
<tr>
<td>317</td>
<td>88. then it seems more creative than physical if that makes sense.</td>
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<tr>
<td>317</td>
<td>90. Interviewer: so if we think about school staff now, so how did they respond to the implementation and use of the walking track?</td>
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<tr>
<td>317</td>
<td>92. Teacher: So when we did the PE audit if you like, it was mentioned as an idea and everyone was really keen and thought it was a really good idea because of the health of the children but there were questions raised relating to inclusion, weather and time. So as a staff we all came together and collated all the worries I guess and thought of solutions and everyone seemed to take it on board and be really involved in it and they all signed the PE policy to say this is what we are going to be doing and I think generally as a rule the staff thought it was a really good idea and great use of space and you can always see teachers out there, but it is just making sure it's regular because I think curriculum takes over and data takes over and sometimes physical activity isn't as important as getting your writing finished so...</td>
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<tr>
<td>317</td>
<td>106. I think once we launch this next initiative hopefully that will make it more of a buzz then but everyone has been really supportive and thinks it's a great idea and that's including governors as well, they were really impressed and the use of the money.</td>
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<td>317</td>
<td>114. Interviewer: So how did you involve the governors then?</td>
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<tr>
<td>317</td>
<td>116. Teacher: so I went to speak to them and...</td>
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</table>

All staff thought the walking track was a good idea in relation to children's health. A good idea but... staff agreed that the track was a good idea but they still had concerns. Also the teacher is discussing the use of the track during curriculum talk for 'walk a mile a day'. This was their main focus probably because they had control over the 'walk a mile a day' instead of children freely using it at break times.

Priority subjects of English and Maths. Importance in primary schools will also be linked to these subjects.

Supportive staff, everyone thinks it's a good idea, however it's harder to put into practice. Primary school teachers have lots of pressures. The school needs to move away from adult input in the playground and have adults as facilitators rather than placing more work on them.
<p>| Physical activity is important | showed them the data that we had collected from the beginning and kind of the ideas that we had for this term with Woodrow winners and around the world. We were hoping to start the run a mile with parents as well so it's trying to keep things fresh I think because it is an initial buzz and it has died down and we knew it would anyway and with the constraints of staff and time it's hard to keep it fresh and keep everyone motivated by it, so it's trying to find different ways. | Physical activity is important, reporting back to the school governors; does the collection of data and use of measurement make it more important? Links back to previous comments on use of data in schools. |
| Difficult to sustain PA increase | |
| Staff control – adult view of the playground | Interviewer: and are the boys still using the track did you say? Teacher: yeah I would say the boys are still dominating the track really, it's more the girls that are choosing more creative options which are more available at lunch times really rather than morning break. The morning break skipping is out for key stage two but for key stage one there are not that many resources out, maybe that is something that we need to consider. It's hard for staff because when they have to go back in and they are thinking about lessons that they are doing after playtime, its had to give them a game to lead if you like because they haven't got time. It's just trying to get a balance really (laughs). Interviewer: do you think that there is any way that you could encourage the girls to walk around the track? Teacher: there might be, we could just say who wants to go for a walk, I don't know how you |
| Boys domination of the track | Boys dominating the track, girls are choosing other options. Boys dominate the playground space and the girls move into other available space. |
| Staff control | |
| Time constraints | Again the school believe that children's PA should be adult led. Wants to find an easy solution, with not too much strain on staff resource and time. If this is the case they need to move away from the 'adult view of the playground'. Girls need more encouragement to walk around |</p>
<table>
<thead>
<tr>
<th>Boys dominate the track</th>
<th>Interviewer: would encourage that for them to do it on their own I guess. Definitely that would be something easier to do but it would be how we could encourage that. I don’t know what the answer is to be honest.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not all children should be active – lack of staff agreement</td>
<td>Interviewer: So during the observations, some of the observers noted that some of the children especially the girls were sitting and drawing with chalk. Teacher: (laughs and shakes her head)</td>
</tr>
<tr>
<td>Lack of ‘buy in’ from some staff</td>
<td>Interviewer: can you share with me why the chalk was introduced and whether there was a staff consensus for this? teacher: so erm, heh, it was in the KS2 meeting and it was felt that there was a lack, in arts, creative things for the children who would like to be drawing and writing so the deputy head who would be KS2 leader thought it was a good idea to take the chalk out and that’s how it came about really so she kind of put it out there and we have to agree really so that’s how that came about.</td>
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<tr>
<td>Importance of support from senior management</td>
<td>Interviewer: and were there any alternative ideas put forward? Teacher: yeah from that we have the scooters out on certain days and football and skipping so different things are going on but she felt that there was something lacking for those who wished to not take part in that really, yeah (laughs). Interviewer: so as a school then, what was the vision for the walking track?</td>
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</table>

the track – this is probably not going to happen whilst the boys are dominating the track with their racing activities.

From her body language she disagreed with this.

Teachers believe that they need a break and don’t have time to promote children’s PA at break times, yet teachers are encouraging children to continue with their writing at break times. Don’t children need a break too?

Not all of the staff have bought into the idea of encouraging children to be physically active at break times. Links back to the vision for the walking track, staff needed to understand the importance of PA for children.

’she put it out there and we have to agree really’ highlights the importance of senior management support, if they have different priorities and visions it can be detrimental to the work the PE coordinator was trying to achieve.
### School vision

**Teacher:** I think definitely to raise the culture of physical activity, we need to get the children enjoying moving and using it as much as we can across lessons so I know nursery have gone around on an autumn hunt and we have used it for phonics on different trails and things, and we have used it as much as we can across the curriculum but generally it was to get the community involved and we have had two Olympians come in now and then we had one of the local footballers came and official open the track so we have had a couple of people come around which is great for the kids so they can see that keeping healthy and keeping focused is good and what you can achieve. Erm but as a school the vision is to raise the status of it in school really and I think as a school we need to do more about the healthy living generally not just moving but having healthy eating and things so that’s in the pipe line I think for this yeah but yeah that’s where we are.

**Interviewer:** So do you think you have achieved this vision now?

**Teacher:** I think its work in progress still, I think it’s definitely risen across the school it feels more prominent but I think it is the beginning really because it’s only been 6 months hasn’t really so we have a long journey I guess. I think there is a lot to build on which is good.

**Interviewer:** Ok so you kind of mentioned a little bit about this before, about how you got

### Staff control

### An outward projection

They had an agreed vision as a school e.g. ‘to raise the culture of physical activity’.

Their focus wasn’t just on break times, they wanted children to be active across the curriculum, however this can clash with the existing busy primary school day. Maybe they overloaded the teachers and children during curriculum time with the walk a mile a day.

Olympians visiting the school to promote the track and football to officially open the track. Demonstrates the importance of the track to the school – but was this just an outward projection of success rather than focusing on increasing and sustaining children’s physical activity levels.

Physical activity has risen across the school ‘I think it is more prominent’ beginning of the journey as not all staff have bought into the idea just yet.
<table>
<thead>
<tr>
<th>Health and safety concerns – lack of focus on children’s PA</th>
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<tbody>
<tr>
<td>Staff control</td>
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<tr>
<td>Sense of autonomy</td>
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</table>

216. the staff to sign the policy so my next question  
217. then is there any formal or informal policies the kind of dos and don’ts for the use of  
218. the track?  
219. Teacher: Yeah so as a staff we thought about  
220. health and safety so about how you overtake at  
221. certain points, that we don’t push people out  
222. the way and we agreed as a staff that we  
223. would have certain people positioned around  
224. the track. On the policy we agreed that we  
225. would do it as much as we can within the  
226. curriculum time erm, yeah. So then we had an  
227. assembly about the dos and don’ts and shared  
228. it with the children and then in class they  
229. wrote class rules with how they would use it to  
230. make sure they were safe and to make sure  
231. everyone’s joining in and stuff really so yeah it  
232. kind of funnelled down right to the children  
233. really which was good.  
234. Interviewer: so how were the staff then  
235. involved in the planning stage?  
236. Teacher: so initially I went to the head teacher  
237. with the idea and then the idea was put onto a  
238. piece of paper that he drew and then basically  
239. we got all the planning for the funding and  
240. things and we knew it was coming, I put in the  
241. staff room this is what’s happening can you  
242. write down any concerns that you have got and  
243. then we came together in a staff meeting and  
244. we discussed then, so instead of me kind of  
245. saying this this and this, we discussed it  
246. together and then in the key stage meetings we  

Some agreed principles but related to the health and safety of the track rather than increasing children’s physical activity.

The children were told what they could and couldn’t do, is this placing an adult view on the playground?  

A funnelled down approach rather than starting with the children.

Tried to provide staff with an element of autonomy – collected staff concerns – considered inclusion e.g. boy in a wheel chair.
<table>
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<th>Health and safety concerns</th>
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<td>wrote down a list of all their concerns and they had to find the solutions to them. So for example one of them was about a little boy and his wheelchair and how he would access that and then we agreed that he wouldn’t go on the grass we would keep him on the track so that he wouldn’t get stuff on the grass. So that kind of stuff was discussed and agreed really, so instead of me saying x, y and z, everyone came together and then I shared everyone’s thoughts and then we agreed a final protocol if you like and then we went from there.</td>
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<td>Staff control</td>
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<td>Teacher: they were signing to the ethos of PE and what we are doing, so they signed to agreed that they would do the run a mile and they signed up to the kind of change of culture really that we are pushing for not just outside but in lessons as well when they see team work or fairness and respect. So that’s what the policy was for and everyone signed to say that they would do that.</td>
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<td>Interviewer: After the implementation of the walking track some benches were placed around the track so can you share with me the reasoning behind this? Teacher: I can’t really, the head teacher might be able to, I don’t know why, I think they are an absolute... yeah, I think they are a massive deterrent to what we are trying to do personally. The head teacher thought in the</td>
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However staff concerns were more related to the health and safety of the track rather than the children’s physical activity levels. Staff agreed a protocol – but related to health and safety and the dos/don’ts of the track. Staff didn’t really sign up to the break time use of the track, it was more of a curriculum time initiative that was their focus. They wanted to utilise the track at other times of the day. However, does this not add extra pressures onto staff time and resource?

She couldn’t explain what the reasoning behind the benches was. This was the head teacher’s idea. The PE coordinator didn’t believe in the benches, she described it as ‘a massive deterrent to what we are trying to do’.
| Outward projection | summer it would be nice for them to have a walk around the track and then have a sit and a chat and then have another walk around. I think it's a massive deterrent to be honest, I think it's, I don't think it helps, but that's the head teachers call. 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.  
Interviewer: So do you think that links back to the concerns that you have the staff to list?  
Teacher: yeah, because some of the staff was like it doesn't have to be run a mile it can be walk a mile, so I think some of them thought that physical activity just means running which doesn't, so maybe it is to encourage a walk and a stop, a walk and a stop he never really told me the reason behind it (laughs). I think maybe he thought about the appearance of the track not necessarily how it is used. That's what I think (laughs). It's a bit awkward to have that chat with the head teacher because he made the decision so... yeah that's my feeling about it... I told you I would be honest.  
Interviewer: so as a school then you introduced the walk/run a mile a day as well during curriculum time, erm, so again what was the reasoning behind introducing that?  
Teacher: I think it was easier thinking how we are going to track how many steps they were doing rather than at lunch time there could be teacher was more concerned with the appearance of the track rather than considering the impact the benches would have on children's physical activity.  
The head teacher's call – the PE co-ordinator agree with the installation of the benches however, the head teacher has the final say. Despite the PE co-ordinators knowledge the HT doesn't seem to let her lead the subject. Reinforces the need for the head teacher to support but also understand the key components of an intervention.  
School staff lack of understanding of the concept of physical activity.  
PE coordinator doesn't agree, head teacher more concern with the appearance of the track an outward reflection of the school rather than focusing on the children's needs.  
The school wanted to find an easy way of tracking children's physical activity. They have more control over it during curriculum time rather |
| Boys and girls have different activity preferences | Teacher: I would say it’s been really useful to identify if there is a trend growing in the school, or whether there are certain sub groups that are accessing physical activity more than others and if they enjoy it because like we said before the girls like more creative stuff and that what they always go for whereas the boys like the racing games and the cars, so they tend to access the track more so I think for us we know the track isn’t being used as much so we need to think of a way that we can sustain it but also encourage those that aren’t likely to do it without being guided so it’s trying to think of... I think it’s speaking to your children and what interest them but making sure that you are not being complacent with it and keeping it relevant and with people still using it and keep nagging people about the use of it really because there is a lot of money invested in it.

Interviewer: what would your advice be to other schools if they were thinking of implementing a walking track?

Interviewer: than at break times, even though this impedes on their existing busy schedule. |

| Staff control | Sustainability is key |

Believes it is important to target girls and boys separately, from her own observations realises that the girls are not as active as the boys. Sustainability is key – consulting the children is important however it seems as though they still want to place an adult view of the playground on the children.

The school invested a lot of money into the track - does this give it more importance? Is the importance appearance of the school to the head teacher rather than children’s physical activity levels? |
344. When we first stated to consider break time interventions we discussed kind of imaginary stimuli as well as the walking track. Do you think that may have captured the girls interest?
345. Teacher: definitely, the girls you can give them a piece of ribbon and they are away, they are well away but I think a lot of it as well sound daft its storage so a lot of the teachers haven't got time to get the box of stuff get it out and then put it all away, they haven't got time to, so there are different constraints. At morning play it needs to be something that is self initiated or... I don't know what that would be or what that would look like but it would be great to do something like that... but I don't know really.
346. Interviewer: initially we discussed putting imaginary characters of different things on the playground, even having signs up around with different characters around the track or mini fairy doors around the playground.
347. Teacher: yeah we had the ideas with the fairy doors didn't we but yeah... I spoke to some of the girls the other day when they were standing by the wall having a chat and I said to them I'm just interested you know, is this going on and that going on, I'm just interested you know why you are standing here really, you are not in trouble or anything, I am just interested. They said well I kind of like dancing and cheering leading and gymnastics and stuff like that and I thought well I can't get the mats out

Girls and imaginary play – teachers links imaginary play to portable resources rather than considering fixed equipment or playground markings and paintings of superheroes etc.

Staff have limited time

PE coordinator started to consider that the children’s PA needs to be facilitated rather than led by adults.

PE coordinator is restricted by what the head teacher wants, she knows they need to try and target the girls physical activity.
Staff control – adult view of the playground

376. but maybe if we had some sort of music stereo out there, its where we are going to put things now I mean we have a table tennis table coming that the head teacher has been banging on about for ages but its where are we going to put it. Key stage two have so much now and key stage one have hardly anything around here. I mean we have those huts that are a waste of space and we had those horrible pencils that have all been taken off now but we need something this side, we need to have a think about it.

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391. 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.
# Appendix 15 – SOFIT systematic observation form

**SOFIT RECORDING FORM**

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<th>Lesson Context</th>
<th>Notes</th>
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**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.
✓ Group interviews will take place with children from years 3 and 4.
✓ 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.
✓ 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.
✓ No real names will be used in the write up of the study.
✓ 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 e.powell@newman.ac.uk.

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.
✓ My child will be involved in a small group interview.
✓ 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 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.
✓ 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.

Newman University
Genners Lane
Bartley Green
Birmingham
B32 3NT

Children’s information leaflet

My physical activity during PE lessons
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. **Physical Education**: 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. **School Sport**: 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?
Appendix 22 – Study 3 example of an analysed interview transcript from the teacher interviews

Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009)

Key – Descriptive comments (blue text), linguistic comments (red italicised text) and conceptual comments (underlined).

<table>
<thead>
<tr>
<th>Emergent themes</th>
<th>Original transcript</th>
<th>Exploratory Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixture of positive and negative past experiences of PE</td>
<td>1. 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? 2. 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 kit we were never allowed to wear trousers. So that was not a positive memory for me looking back on it now. 3. But when I was at primary school I remember gymnastics on the apparatus and like running around doing games and sports days and things so positive when it comes to primary and not so positive when it comes to secondary. I suppose that’s why I am a primary school teacher. 4. Interviewer: So why do you think that they</td>
<td>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. Own reflections on career choice - positive primary school experiences.</td>
</tr>
</tbody>
</table>
24. were more positive memories at primary school?
25. Interviewee: I just think it was more fun, it just seemed more fun and we just did things that were a lot more fun to a child going on the apparatus in the hall and sports days and things in the playground. I just remember those in a much more positive light than I do those at secondary school. I think it was just more fun for me really and at secondary school it felt more serious, it was more about learning specific skills and things.
26. Interviewer: So do you take part in any exercise, physical activity or sport yourself now?
27. Interviewee: No not really I go to an exercise class once a week, legs bums and tums, but I would say I do that because I enjoy the physical aspect of it, I just want to keep fit and stuff. But that’s it really I have never been like a massive sport’s fan so...
28. Interviewer: Do you think that might be why you enjoyed primary school PE more?
29. Interviewee: I think it was, I think that was more fun but when you were at secondary school it’s all learning like specific sports and I hated, I just didn’t like netball at all. I have really bad memories of being freezing cold on the netball court. I just wanted to be anywhere else but here at that moment...
30. Interviewer: So do you think if the netball was indoors you would have still felt the same?
31. Interviewee: probably, just because everything...
| PE should be fun – sport is not fun | 56. felt more serious at secondary school and you had to learn things and there was more pressure on you to do the right thing. And I think from secondary school, it’s kind of put me off...  
61. Interviewer: Ok if we move onto the next question. So how would you describe the status of PE in your school then?  
64. Interviewee: I think we do quite a lot of PE here, I know that the PE coordinator is really good and he does loads of sports and activities. We make sure we do two PE lessons of PE each week, we do one indoor and one outdoor so they get quite a nice range as well. We make sure we go out even when it’s really cold as well. We make sure we get out there and do our two lessons of PE and we cover a wide range of subjects. I think it’s quite good here and we have lots of training as well if we need it. I had training in my first year and because I never enjoyed PE that much at secondary school I was like this is quite daunting now to come and teach PE to 30 children but we have a lot of training if we need it and that was really helpful. You could have training in the areas where you need instead of just saying you are going to have training in this so yeah I think PE is really good here compared to some schools that I’ve heard of, I think we do quite a lot and we make sure we get it done as well because I know the children need to have so much time doing exercise a week and we try | PE should be enjoyable rather than serious sports with rules probably why she chooses fitness classes rather than sports now as an adult.  
Values the PE – coordinator – believes he has the skills to complete the role.  
Broad range of activities covered in PE lessons  
Her enjoyment and experiences of PE impacted her teaching on PE as a subject, particularly in relation to her confidence  
Sense of autonomy – choice in training they receive as staff  
Putting the children first in terms of their health |
<p>| Values the PE coordinator | 57. | |
| Broad range of activities taught in PE | 58. | |
| Past experiences of PE impacted upon confidence | 59. | |
| Sense of autonomy | 60. | |
| Children come first | 62. | |
| Awareness of benefits of PA | 88. and catch up on our exercise and we haven’t done it this year yet but I know we are going to start. Like we did skipping every playtime and afternoon play when I was in Y5 so that was quite good, so they are definitely getting that amount of exercise that they are supposed to have. |
| Negative experiences of invasion games – linked to past memories | 95. Interviewer: OK thank you, so you have kind of touched in this a little bit but how do you feel then about teaching PE? |
| Low confidence | 96. Interviewee: I was quite daunted by the prospect of it when I first came and I had a Y5 class so obviously it’s a bit scary when they are older because I felt like they probably knew more than I did when it came to specific rules for netball and basketball, I thought oh gosh they know more than I do about it so how am I going to teach them something new but obviously from the training I feel a lot more confident with it now. I feel like when I have time to really prepare a lesson then I really enjoyed doing it but I do feel honestly that PE sometimes is one of those things that because in the afternoon and it’s the same with all afternoon lessons 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 at what I’m going to do. So the times that I have taken the time to really prepare a good lesson I do really enjoy teaching it because I feel as |
| School training opportunities – confidence | 97. |
| PE a low priority subject area | 98. |
| Importance of maths and English | 99. |
| Time is a barrier | 100. |
| Aware of DH’s guidelines – not quite sure of the exact guidance | 101. |
| Relates to her own experiences of PE – daunted by the prospect of teaching something she didn’t enjoy. | 102. |
| Low confidence in her own ability – hung up on knowing the rules of specific sports – comes from secondary school experiences | 103. |
| School training has increased her confidence | 104. |
| PE low priority – pressures of maths and English | 105. |
| Time can be a barrier to delivering effective lessons | 106. |
| Focus on pupil progress during PE | 120. though it has gone really well and I can see the children have made progress throughout the lesson and they have really enjoyed it so I love doing it when I know that I am prepared for it. 124. I find it a little bit more daunting when I haven’t really prepared for it that much and I’ve just kind of got to go in and pick it up and go with it and I can, I can and I do pick it up as I go along and I can see what I need to do and how I can move them on from that and I definitely prefer doing it when I know I have prepared for the lesson. I think the training has helped me a lot because we did some training on how to move them on throughout the lesson, so instead of having to keep stopping them and saying oh we are going to do this next, it was with Aspire, and they go around and make sure that you can see the groups of children that need more support or moving on and then you just move that group on instead of stopping the whole class, so they are getting the exercise that they should be doing in the lesson as well. I am definitely more confident than I was, which is good. 144. Interviewer: So what would you say are the facilitators and barriers to delivering a good PE lesson in which you feel confident? 147. Interviewee: I think it’s time, that’s the biggest barrier, time and confidence. If it is something that I quite enjoy doing like I quite enjoy teaching gymnastics but if I was teaching netball I would be thinking I don’t want to |
| PE is a priority in the school | Focus on learning during PE lessons e.g. ‘I can see the children have made progress’ |
| Developing pedagogical skills | School training helps to develop staff – so there must be a focus on PE as the school provides the time for training – is this related to the sports premium funding? |
| High PA levels in PE | Developing pedagogical skills – considering different approaches – differentiation and working with individual groups rather than stopping the whole class. |
| Time is a barrier | Indicate high PA levels in PE lessons She is conscious of how active the children are during PE – are they achieving above 50%? |
| The subjects she feels most confident in delivering are the ones that she enjoyed at | Time is a barrier to effective lessons |</p>
<table>
<thead>
<tr>
<th>Time is a barrier</th>
<th>Subject knowledge — rules of games</th>
<th>Supportive networks</th>
<th>Developing competence — positive training environment</th>
</tr>
</thead>
</table>
| teach, netball, I don’t know the rules myself and then you have to research and go away and if you do have time to go away and have a good read and find all the rules out then it’s fine but for me I think my biggest barrier is that I don’t know all the rules to the different games we teach and we teach so many because it’s primary school then I’m not sure of them so I have to go away and learn them so that’s my biggest barrier it’s just having time to prepare so that I have the confidence in what I’m teaching but I think once I’ve sorted that out I will feel a lot better about it then. Interviewer: So what do you think could help with that then? Interviewee: I think I mean obviously all the training and I did get the chance to train in two different subjects like volleyball and gymnastics so there is always the opportunity to train in different things which really increases your confidence and having somebody come in and even things like learning walks and stuff, I mean they are horrible to have but I had one with the PE coordinator and the headteacher last year and actually they both came out of it and said that was really good, I would send somebody to you if they were struggling to teach gymnastics and that was a big confidence boost because obviously I thought you know that it might not have been brilliant but to hear that was really good. So the training definitely primary school – they are also the ones that she chose to have training in. Time is a barrier and subject knowledge in relation to rules of the games primary PE is more than rules of the games and this demonstrates a lack of subject knowledge in relation to children’s maturation and development. A supportive school – supportive networks Leadership team – positive feedback develops confidence – she does have the skills and knowledge, just her past negative experiences from secondary impact upon her confidence of...
| Time is a barrier | 184. works and I don’t really know what else to say because I think it’s mainly just time to be able to prepare but you know we cannot magic time from nowhere (laughs) but obviously we get a lot of support from the PE coordinator and I know we can just go and talk to him and say I’m not quite sure how to teach this and he would come up with some really good ideas as well.  
193. Interviewer: So are schemes in place then for you to deliver from?  
195. Interviewee: Oh yeah there are lots of things like there are lots of resources on the internet and I know the PE coordinator has found a website that we can get a lot of planning from and that is really good and we have the TOPs cards which talks about the differentiation and there’s loads of things we can use there are lots of resources and stuff like lesson plans, it’s having the time to find them when you have taught maths and English and you are trying to get all your marking done sometimes you just don’t have that time.  
207. Interviewer: So your next question relates to something you were saying earlier relating to your training with Aspire. So Afpe recently release their health position paper and they recommend that children should be active for 50-80% of a PE lesson. So I just want to know your views on this really?  
214. Interviewee: I think that definitely is, I’m sorry I keep coming back to this training, but it was | teaching PE.  
Time is a barrier  
Supportive networks – PE coordinator  
Lots of resources available – but time can be a barrier to reading the resources – maths and English a priority |
really good to see and obviously the Aspire coaches come in and they teach a lesson for you and actually the kids were doing exercise for most of the lesson and it was definitely more than 50% it was probably more towards the 80% and they were pretty much doing stuff right from the beginning. She'd talk to them a little bit and then she would set them off and the she would just go around then and she would get more equipment out as they needed it, which is what I'm trying to do now. So when I teach gymnastics so instead of constantly stopping them I will just go around and see which children can be moved on instead of stopping the whole class. I don't think that it is completely realistic that you can do it but I think that you have got to know the strategies that you can put into place. I mean I am quite lucky because I have had all this training but I can see if teachers haven't had all the training then they probably wouldn't know those steps to take.

Interviewer: So what advice would you give to other teachers to increase their children’s PA levels during PE lessons?

Interviewee: Say if you were sort of throwing or something and they were getting it, I would probably try and get them to do it in a more physical way, so get some running involved as well and just change like the pace of it a little bit. So trying to make sure that those children that have got the skill can apply it then to...
Focus on pupil progress

Different situations. I know I keep coming back to gymnastics but that’s just because I am teaching it at the moment. So for example if we were doing rolling and we were sort of practising the skills of rolling and there was a group that could clearly do more I would probably get them to apply it and put it into a sequence with things we had been learning about like a jump and balance and different ways of travelling. I would do it that way and try to get them to apply it to different situations.

Interviewer: you mentioned with the Aspire training, with your formal teacher training do they provide you with any of those strategies?

Interviewee: I can honestly say that I don’t think that I have ever taught anything that I learnt at university and I know that might sound really bad. I did a B.Ed and we did days on PE but I can’t really remember it. I felt like a lot of things you learn at university until you actually start teaching, that all goes out the window and you start a fresh, so definitely looking back for me I learnt a lot more from the Aspire training than I did when I was at University. I think you just forget about it all.

It’s only when you are actually working with children that you realise how to do it.

Interviewer: I was just wondering whether Aspire was just refreshing things or whether it is new knowledge.

Interviewee: I think for me anyway where I

Opportunities are provided in PE for children to apply their skills and therefore make progress.

Limited training on PE during ITE

‘Forget it all’ is this because they have limited opportunities to apply what they have learnt in ITE? And then they forget what they have been taught?
<table>
<thead>
<tr>
<th>Supportive networks – Aspire training – team teaching</th>
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</thead>
<tbody>
<tr>
<td>went to Uni, I didn’t learn the stuff about making sure that they are all doing something and running around and focusing on different groups and moving different groups on and that was something that I had never seen. But that’s just me, I’m not saying that every university is like that. The training for me was really useful probably more than I learnt at Uni. Interviewer: Ok so if we just finish off with then in terms of needs, your individual needs and training, what are your next steps? Interviewee: Possibly some training in invasion games, so I’ve done a lot of work on gymnastics, but obviously I’ve already mentioned about netball I don’t enjoy netball, that probably those kinds of specific games where you need to know rules to be able to do it that’s the kind of thing I would like training in. because I feel I could probably apply things that I have learnt in gymnastics to things like dance and follow the same technique but when it comes to netball, basketball or football when there are specific rules to learn to be able to play a game, I think that is where my next area of development is. If it was possible because I have already had PE training in like two subjects. Interviewer: and then as a school? What do you think the next steps are as a school? Interviewee: I think, I know that we are trying to push on the social and creative side of PE.</td>
</tr>
<tr>
<td>Low confidence – negative past experiences</td>
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<tr>
<td>At university she didn’t focus on the pedagogical aspects of teaching PE – making just the activity/sport content.</td>
</tr>
<tr>
<td>Training from Aspire – really useful – opportunities provided by the school – CPD for teachers.</td>
</tr>
<tr>
<td>Doesn’t enjoy netball – links with her own past personal experiences.</td>
</tr>
<tr>
<td>Invasion games – areas of development – links to past personal experiences of PE – knowing the rules of games – subject knowledge – lack of confidence</td>
</tr>
<tr>
<td>Subject knowledge – rules of the games</td>
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</tbody>
</table>
| 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  
> 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 | **Whole school vision for PE – clear aims – good leadership.** |
| | **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

<table>
<thead>
<tr>
<th>Emergent themes</th>
<th>Original transcript</th>
<th>Exploratory Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children concerned with the</td>
<td>1. 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?</td>
<td></td>
</tr>
<tr>
<td>structure of lessons</td>
<td>8. Children: yeah 9. Child (boy): and also we do two PE lessons, and we do a rotation of activities. 11. 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? 15. Child (boy): yeah. 16. Interviewer: Ok so what do you think I mean by the words physically active? 18. 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. 21. Interviewer: Ok so you think it means running around? 23. Child (boy): yeah</td>
<td>Children discuss the structure of their PE lessons Children relate being active with running</td>
</tr>
<tr>
<td>Active is running</td>
<td></td>
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</tbody>
</table>

Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009)
Key – Descriptive comments (blue text), linguistic comments (red italicised text) and conceptual comments (underlined).
<table>
<thead>
<tr>
<th>A scale of intensity</th>
<th>24. Interviewer: so how active do you think you are then if you think running around is being active?</th>
<th>Children consider ‘physical activity’ as being on a scale – relates to the intensity of the PA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Break times key window for activity</td>
<td>27. Child (boy): so really active and then like lazy, so here’s a bar and I would put myself all the way up to here. I’m over the middle but I’m not too high.</td>
<td>Children view break times as an opportunity to be active</td>
</tr>
<tr>
<td>Active friendships</td>
<td>31. Interviewer: So how would that look across the day?</td>
<td>Want to be active with their friends e.g. active friendships</td>
</tr>
<tr>
<td>Active evenings</td>
<td>33. Child (boy): so at morning break, I want to play with my best friend so I will go and look around the whole playground and that will take about 2 minutes because he is always wondering about but then we will get physically active, at lunchtimes sometimes I go to dubs.</td>
<td>Children also discuss the activity they engage in outside of school</td>
</tr>
<tr>
<td>Active at home and school</td>
<td>39. Interviewer: ok is anyone else active? Do you think you are more active at school or more active at home?</td>
<td>Discuss playing for sports teams outside of school</td>
</tr>
<tr>
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<td>42. Child (boy): on Thursday I go to football training and I do a lot of running about because I’m a winger.</td>
<td>Children say they are active at home as well as school</td>
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<tr>
<td></td>
<td>45. Interviewer: and is that football training at school?</td>
<td>At school they are active playing tig and tag – enjoying the thrill of the chase – competition</td>
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<tr>
<td></td>
<td>47. Child (boy): no for a team?</td>
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<td>48. Child (boy): and I play for the same team as him and we train on Thursdays and Saturdays and we play on Sundays so we are active quite a lot at home and at school it’s like good because we play a lot of games like tig and tag so it’s lots of running about.</td>
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<td></td>
<td>54. Interviewer: so when do you play tig and tag then?</td>
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<tr>
<td>Break times key window for activity</td>
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<td>55. Child (boy): at playtimes and lunchtimes and</td>
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<td>56. It’s basically a little bit like British Bulldog, so we</td>
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<td>57. have one side as a den and then you have to</td>
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<td>58. get across to the other side.</td>
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<td>59. Interviewer: and what about the girls?</td>
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<td>60. Child (boy): they enjoy skipping and...</td>
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<tr>
<td>61. Interviewer: shall we ask them? So girls, how</td>
<td></td>
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<td>62. active across the day?</td>
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<tr>
<td>63. Child (girl): quite a lot</td>
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<tr>
<td>64. Interviewer: quite a lot? And what do you do?</td>
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<td>65. Child (girl): at school we play lots of games and</td>
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<td>66. in those games we have to run around quite a</td>
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<tr>
<td>67. lot and...</td>
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<td>68. Interviewer: and what are these games?</td>
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<td>69. Child (girl): we make the games up ourselves</td>
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<td>70. and there are normally three or four of us that</td>
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<tr>
<td>71. are playing it.</td>
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<td>72. Interviewer: so do you think you are more</td>
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<tr>
<td>73. active at home or when you are in school?</td>
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<tr>
<td>74. Child (boy): at home</td>
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<tr>
<td>75. Child (girl): yeah at home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>76. Child (boy): at home</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77. Child (girl): home</td>
<td></td>
<td></td>
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<tr>
<td>78. Child (boy): well I think really it depends,</td>
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<td>79. sometimes when I’m at home and I’m on the X</td>
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<tr>
<td>80. Box but then sometimes I’m playing with Lego</td>
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<tr>
<td>81. and walking around the Study or I’m running</td>
<td></td>
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<tr>
<td>82. about with my pretend Spud Gun and I like</td>
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<tr>
<td>83. shoot at little pieces of potato.</td>
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<tr>
<td>84. Interviewer: ok, so do you think you could be</td>
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<td>85. more active when you are in school then?</td>
<td></td>
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<tr>
<td>86. Children: yeah</td>
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<thead>
<tr>
<th>Children's world</th>
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<tbody>
<tr>
<td>Playtimes are key window in the school day for the children to be active – interestingly the children don’t mention PE as a time in which they are active.</td>
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<table>
<thead>
<tr>
<th>Active friendships</th>
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<tbody>
<tr>
<td>Children like to create their own rule and boundaries of games – child world</td>
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<table>
<thead>
<tr>
<th>Active break times</th>
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<tbody>
<tr>
<td>Girls like to be in small friendship groups at break times</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Imaginary play</th>
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<tbody>
<tr>
<td>Children are discussing break times as this stemmed from them being asked if they were active. Break times are a key opportunity for them to be active in the school day.</td>
</tr>
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</table>

| Children like to engage in imaginary play |
| Sedentary school life – maths and English | 88. Interviewer: so how could you be more active when you are at school then? 89. Child (boy): I think at school and I think most people would say this, during lesson time it’s not much active because most of the time you are sitting down and it’s normally maths and English that are the least active. 90. Child (boy): but also in Art we just sit down and like the teacher tells us what to do and then we just sit down... 91. Child (girl): we just sit down and we write, write, write... 92. Child (girl): well I’m not active at the end of the day because I’ve done lots of work and I was running around at morning play 93. Interviewer: and how about when you go home, are you active at home? 94. Child (girl): no I just go home and watch the tv. 95. Child (boy): me and Will don’t do much in the first playtime because we have to do toast. 96. Child (boy): yeah we have to be the toast monitors so that means we miss about 6 minutes of break. 97. Interviewer: but are you active when you go outside? 98. Child: yeah 99. Interviewer: Ok so if we start to think about your PE lessons, can you tell me what you have been learning in your PE lessons? 100. Child (girl): we have been learning about gymnastics and hockey. 101. Interviewer: and what about gymnastics and... |
| PA compensation | 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. |
| Sedentary home life | Children compensate for times of the day when they are active "I’m not active at the end of the day because I’ve done lots of work and I was running at morning play". |
| Range of activities in PE | Sedentary home life for some children – screen time TV |
| 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  
124. left 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  
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  
132. if you did it wrong it sometimes hurt your leg or  
133. something.  
134. Interviewer: so can you name any of the  
135. different jumps in gymnastics?  
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  
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.  
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 can discuss the skills they learn in PE lessons – focus on teaching points e.g. where to place their hands on the hockey stick  
Children have a good knowledge of what they have been learning – indication of teachers good subject knowledge in relation to teaching points of certain skills  
Children understand what they have to do during PE  
Evidence of application of skills e.g. children being asked to create sequences in gymnastics  
Children practising the skills they have learnt at school at home – promotion of out of class physical activity? |
| Children enjoy PE | 152. *lessons?*
| --- | --- |
| 153. *Child (boy):* I really enjoy them because it's a rotation because, so today is the day we do the rotation so we aren't doing outdoor PE today because the person who normally does it is away but they are in charge of the whole school because they are one of the head teachers. | 154. *Interviewer: How about anyone else? Do you enjoy PE or not? And why?*
| 155. *Child (girl):* I don't really enjoy outdoor PE because we get put into House Teams and there are not girls from my class in my house but I enjoy indoor gymnastics because I get put with my friends. | 156. *Child (boy):* I don't really enjoy outside PE because all of my friends are in different House Teams. |
| 157. *Interviewer: so both of you, would you enjoy outdoor PE if your friends were with you?* | 158. *Children: yeah*
| 159. *Interviewer: Ok so thank you for sharing all of that, if we can move on now, so we spoke earlier about being active and moving around so now I'd like to know how active you think you are during your PE lessons?*
<p>| 160. <em>Child (boy):</em> In gymnastics we are not very active because the teacher demonstrates it and then we just do rolls and then jump off and that's all that we do. |
| 161. <em>Child (boy):</em> yeah we have to wait in a queue for our turn quite a bit. |
| 162. <em>Child (boy):</em> In outdoor PE I'd say that we are |
| Active friendships – PE | Children enjoy PE, they enjoy taking part in different activities |
| Active friendships – PE | Children enjoy taking part with their friends, when they are separated this puts them off PE and perceive it as not enjoyable |
| Barrier to PE – groupings | Not being with friends is a barrier to enjoying PE lessons |
| Gymnastics – low activity | Children acknowledge that they are not very active in their gymnastics lessons. – Does teacher demonstration impact upon children’s active learning time? |
| Barrier – demonstration time | Children waiting in queues for their turn – the |</p>
<table>
<thead>
<tr>
<th>Barrier – queuing</th>
<th>184. active quite a bit because for hockey we just play one long game. 185. Interviewer: so what do you mean by one long game? 186. Child (Boy): so we do one long game because it’s not keep swapping each team against each other. So you’ve got the whole PE lesson and you’ll be moving quite a lot because you are not going to be stopping at any point until the end. 189. Child (Boy): in outdoor PE we get split into House Teams but I always make a point to get active so sometimes when the teacher is demonstrating and she does it for like ages (expresses ages), so sometimes I get the hockey stick and pretend to hit like an invisible ball whilst looking at the teacher and then I’ll be like jogging on the spot. 201. Interviewer: so what is your teaching doing whilst you do that then? 203. Child (Boy): so she’s just like demonstrating how to pass or dribble or how to get through the goals and then I say this to myself in my head, well you’re taking for ages if you don’t realise that than I’ll have to try and get active and find a way. It’s boring. 209. Interviewer: so how about the girls then, do you think you are active during your PE lessons? 212. Children (girls): yeah. 214. Interviewer: yeah, so why do you think that you are active during PE lessons, can you tell me a little bit more?</th>
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<tr>
<td>Outdoor PE is more active – no teacher interruptions – child’s world</td>
<td>phrase ‘quite a bit’ implies that they are standing/sitting for a while before they have the opportunity to practise their skills. Children perceive outdoor PE to be more active and attribute this not being interrupted by the teacher. Teacher demonstrates ‘for ages’ in PE lessons Children get bored during this time, playing with an imaginary ball as the teacher restricts the amount of time the children have the opportunity to play with real equipment. Children have a good insight to pedagogical practice e.g. ‘well you’re taking for ages if you don’t realise that than I’ll have to try and get active and find a way. It’s boring.’ Could teachers benefit from talking to the children about their views? Demonstration time seems to really impact upon children’s learning and opportunity to practise their skills. Could this be a control issue with teachers, not wanting to let the children go and practise, also the fact that they are queuing for their turn is this.</td>
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<tr>
<td>Barrier – demonstration time</td>
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<td>Imaginary equipment – PE</td>
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<tr>
<td>Children – good pedagogical understanding</td>
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<tr>
<td>Barriers – demonstration time and queuing</td>
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</table>
| Teacher's lack of pedagogical knowledge | 216. Child (girl): so outdoor PE you are like running around and everything and then indoor PE you have to watch and see what she is trying to show us and then you've got to give it a go but you have to wait in a queue like four people to do their turn.  
217. Child (boy): in hockey, we are active because we don't do it in partners and we don't just keep still and just pass it to the other partner. We run around with our ball and get it through the goal and then back again.  
218. Interviewer: so if you were a teacher, what would you do to make sure that your children are active during PE lessons?  
219. Child (boy): so maybe you could like, if you could do it like quickly, you could demonstrate everything at the start and then let us do it. So demonstrate at the start and then you've got the rest of the PE lesson to do what the teacher's demonstrated.  
220. Interviewer: so just one quick demonstration at the start?  
221. Children: yeah  
222. Interviewer: has anyone got any other ideas?  
223. Child: What would you do if you were the teacher to keep the children active?  
224. Child (boy): I would just say like the children could pass the ball whilst I was demonstrating.  
225. Interviewer: ok, has anyone got any other ideas?  
226. Child (girl): I think with indoor PE to make it more active, we could put all the children into a lack of organisational skills. Teachers wouldn't ask children to queue in a maths lesson to complete a sum so why do they get children to do this in PE lessons? Is it accepted practice in PE? The norm?  
Children waiting in queue's for their turn to practise – ‘comfortable in chaos’  
Children active in hockey lessons – activities reflect a game situation rather than static skills  
Children focus on demonstration time, they view this and queuing as the main things that impacts up their activity during PE lessons  
Beneficial to reduce demonstration time – children’s perspective |
| --- | --- |
| Children's insight – reducing the group size | 248. their home tables and there should be 6 of them and there could be some mats and benches and 3 children could go on a mat and then each person could do a jump.  
252. Child (girl): I think for maybe indoor and outdoor PE if everyone had their own bit of the playground or hall then it would take as long because they could just do it over and over again and everyone would get more practice.  
257. Interviewer: so if they had their own bit of space to work in rather than?  
259. Child (girl): because normally we are in a team and we have to wait for 5 other people in front of us but if you’re on your own you can do it a lot quicker because you are not waiting for anyone else.  
264. Child (boy): I would say all the jumps and then if they didn’t know them I would ask them to put their hand up and then whilst they were doing the jumps I would demonstrate them.  
268. Interviewer: so has anyone got anything else that they would like to add about their PE lessons before we finish? |
| Children's insight – everybody needs their own space |
| Children's lived experience |
| Barrier – demonstration time |
| Reducing the number of children in groups – children have more opportunity to be active and practice their skills |
| Everybody needs their own bit of space – children astute in relation to pedagogy in PE and how to maximise upon lesson time and available space |
| Children offer alternatives to queuing in their PE lessons – these children are 7-8 years old. Very good understanding, they are part of it and have a lived experience |
| Demonstration time needs to be shorter |
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.
- No real names will be used in the write up of the study.
- 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 e.powell@neman.ac.uk.

**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,

E. 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.
- 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

My physical activity during PE lessons

Newman University
Birmingham

Children’s information leaflet
Research Project

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 lesson 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, as I can spot you easily. Just like in the picture below. You don’t need to do anything special, just enjoy your PE lesson! 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 all the 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

**Interpretive Phenomenological Analysis (Smith, Flowers and Larkin, 2009)**

Key – Descriptive comments (blue text), linguistic comments (red italicised text) and conceptual comments (underlined).

<table>
<thead>
<tr>
<th>Emergent themes</th>
<th>Original transcript</th>
<th>Exploratory Comments</th>
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<tbody>
<tr>
<td>Developing teachers</td>
<td>1 Interviewer: So if we start off with then, your values, so what do you feel are the main aims</td>
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<tr>
<td>awareness of PA in PE</td>
<td>2 Of primary PE?</td>
<td>Physical activity needs to be the primary aim of Physical Education, the intervention has helped the teacher re-think their approach to teaching PE</td>
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<tr>
<td>Rethinking their approach</td>
<td>4 Participant: Erm, I think to expose children to a variety of different sports and the skills that one</td>
<td>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'd say much, much higher than they were.</td>
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<tr>
<td>to PE</td>
<td>5 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, I'd say much, much higher than they were.</td>
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<td>Reflective practice</td>
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<td>23</td>
<td>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.</td>
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<td>Consistently reflection, upon activity levels, adapting teaching during PE lessons – transference of skills from classroom based learning in other curriculum areas.</td>
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<tr>
<td>Rethinking approach to pedagogy in PE – combining motor skills and high levels of activity</td>
<td>24</td>
<td>motor skills. Do you feel as if you have integrated those now?</td>
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<tr>
<td>Participant: Yes, so as a colleague of mine said recently, the skills, we’re teachers we are always trying to teach skills but now it’s teaching those skills in an active way, whether it’s more through a quick mini plenary here or there, or whether it’s just working quickly with 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.</td>
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<td>Interviewer: So, I remember from last year that you enjoyed teaching PE and it was a positive experience for you and that came from positive past experiences. So is that how you currently feel about PE?</td>
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<td>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 and PE is one of them that I 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.</td>
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<td>Interviewer: What is effective teaching in PE, to you. If you walked in and observed somebody’s lesson, what would effective teaching look like?</td>
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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 it’s teaching those skills in an active way.

Enjoy 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.
| Transference of pedagogical practice | Participant: If I walked in, I would want to see things that I would see in most lessons, children being engaged, enthusiastically taking part in what they are doing. The lesson is at an appropriate level for the children and that irrespective of a child's disability or ability they are able to access that lesson. So that's something that I look for across the board in any lesson and in PE lessons in particular then, I think, now thinking about the work that we've done I would be looking, first and foremost for that physical activity, the children doing stuff, I wouldn't want to see them sitting and listening and watching. I would want them, don't get me wrong there is a time for that I am sure, but in the session I would want to see them active and doing. Interviewer: So do you feel then currently that you are an effective teacher of PE? Participant: Yeah I think so, yeah. Well I mean (laughs), if we think about the things that I have just said that I'd want to see in a lesson, rightly or wrongly that's what I would do in a lesson. So I feel that I am always trying to do those things in the lessons and it's not to say that every lesson is absolutely amazing but that's what I am aiming to do in my lessons. Interviewer: In terms of your activity levels then of the children when we recorded them, I think in some cases they shot from 20% to 80%, so if you could pin it down to particular parts of your practise within the lesson, could

Transference of pedagogical practice across the curriculum subjects.

Reducing sedentary behaviour in PE and taking 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 doing stuff I would want to see them active and doing.

"rightly or wrongly" stems from the current muddle message in primary PE – what are the main aims?
Reflective practice – transference of pedagogical skills

Developing awareness – planning support and CPD

Integrating skills and activity levels

Physical activity, main aim of primary PE – Paradigm shift

Teacher confidence and competence links to past personal experiences and school based training

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 own awareness of primary PE curriculum i.e. what is expected:

‘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’.

‘The activity now comes at the forefront of my mind when I’m planning and when I’m teaching’ Shifting 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.
Interviewer: Has it had an effect on other subjects within the primary curriculum, have you thought maybe in maths or English that they are sitting down a lot? Has it spilled over or is it just mainly PE?

Participant: PE is where there has been the biggest difference in activity levels, in terms of other subjects I am always aware of the space that we have got and then whether permits, or when circumstances permit to using a bigger space, so that naturally encourages children to be more active and run around but nonetheless I mean there isn't going to be the opportunities to be as active in those lessons as in PE because of the nature of the lesson and you have different responsibilities but it's something now that I think, I reflect and I think about just in the day as a whole, how active have the children been today. I mean especially if I have been on break time duty or I just go out at lunch to play with the children and you notice the children that are always running and always doing stuff and you think about ways that maybe you could do little things to help those children to be active as well.

Interviewer: So what things would you do for those children?

Participant: maybe just coming out at playtime and kicking a football with them or erm, doing a bit of skipping, just those sort of things and

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?”

Awareness of other windows of opportunity within the school day – in class physical activity may not
Paradigm shift, a way of thinking

Critical incident: "Encouraging them to take part in different activities. Or maybe if they are children that have an intervention group or something else that has been put in place for them, then that is something that they can do, and get them up and moving as well, yeah where possible yeah, it's certainly something that's at the forefront of my mind now."

Interviewer: "Would you say that's across the whole school now?"

Participant: "Yeah I think my understanding of it is yeah, because I mean you've put in a lot of work and we had additional training as well and it's always been activity levels at the top of everything that everyone has said at training so I would certainly hope it's in the psyche of the staff."

Interviewer: "So what advice would you give to another teacher in terms of increasing their activity levels in a PE lesson? What would be the key things that you would get them to think about?"

Participant: "Ok I mean, as always start off at the planning stage and I would want them to look at the activities carefully and decide how active those activities are. I mean if you are throwing and catching a ball and you are just throwing and catching then that can be a boring activity, so is there a way that that could be more exciting and more active and then I think those moments were, I mean as a student I was always encouraged to stop and then be the answer, it's making the most of break times as well as PE lessons.

Paradigm shift ‘get them up and moving as well, yeah where possible yeah, it's certainly something that’s at the forefront of my mind now’.

"It's always been activity levels at the top of everything that everyone has said at the training so I would certainly hope it's in the psyche of the staff. Developing awareness of PA, paradigm shift, a way of thinking"

Importance of planning (active planning)

Reflective practice - is there

Planning is important stage; need to think about the activity levels of children.

Activities need to be adapted, so that the children are active and moving ‘if you are just throwing and catching a ball then that activity can be boring, so is there a way that that could be more exciting and more active.’ Reflecting upon past training – is that how it
| 184 reflect and do a little plenary. So I think how  |
| 185 could that be integrated into the activity itself,  |
| 186 is it necessary for the whole class, is it going to  |
| 187 be a benefit for the whole class, I mean some  |
| 188 of them can already do the skill, so how are you  |
| 189 going to move them forward, which is good  |
| 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  |
| 193 them active and then go and work with the  |
| 194 other ones and just breaking up that traditional  |
| 195 format of a lesson to make sure that the  |
| 196 children are always, always doing.  |
| 197 Interviewer: Ok then so do you feel that you  |
| 198 need any further support or training in terms of  |
| 199 PE?  |
| 200 Participant: I think to be honest with you, you  |
| 201 never stop learning in any subject across the  |
| 202 curriculum so additional support in training is  |
| 203 always welcomed. I mean I enjoy teaching PE,  |
| 204 I  |
| 205 feel confident in what I’m doing but yeah  |
| 206 always always and thinking behind subjects and  |
| 207 research is always changing and as a teacher,  |
| 208 you’re sort of, things filter through before they  |
| 209 get to you and you’re at the bottom so if you’re  |
| 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 of date very quickly so of course  |
| 214 yes, I think always.  |
| 215 Interviewer: Ok thank you and as a school what  |

Reflecting upon organisation in lessons – does it have to be a whole class approach, meeting the needs of individuals

Breaking up traditional practice, is there a better way? Paradigm shift, are children moving, is stopping the whole class beneficial?

‘you never stop learning’ willingness of staff learn new things

Confidence in current practice – being ahead of the game

‘things filter through before they get to you and you’re at the bottom’
| PE is at the epicentre of a school-based physical activity model, next steps break times, active lessons | do you think your next steps are so in relation to PE or physical activity as a whole school?
Participant: Yeah I think something that we still haven’t developed fully that needs to be developed is the outdoor space and getting children active at playtimes and especially in the winter it’s difficult and it’s a difficult challenge and not one that I would have a solution for and stopping that sort of just they are inactive in the classroom and they are inactive outside, they are going back in the classroom and they are sat down again and PE being seen as the only active subject, so like you were saying that, that question I can’t think that I do that much, really active things in other lessons, so maybe we should be doing something more.
So yeah, that’s the outdoors, more activity in other lessons and generally just to ensure the good practice that has been put in place this year is being carried on further now and being carried across the school and being carried with not only the teachers in the classroom but all the adults across the school so that they understand what is important in lessons, so that it’s at the forefront of everybody’s minds. |
| --- | Next steps in terms of a school, break times consideration of outdoor space/physical environment
'PE is seen as the only active subject'
Reflective practice – ‘maybe we should be doing more?’
Whole school approach – transference of what they have learned to go across the school into other year groups |
References


meta-analysis of moderate-to-vigorous physical activity levels in elementary school physical education lessons’, *Preventive Medicine*, 86, pp.34-54.


Renold, E. (1997) "All They've Got on Their Brains is Football. 'Sport, Masculinity and the Gendered Practices of Playground Relations', *Sport, Education and Society, 2* (1), pp.5-23.


Sandercock, G.R., Alibrahim, M. and Bellamy, M. (2016) Media device ownership and media use: Associations with sedentary time, physical activity and fitness in English youth. *Preventive Medicine Reports*, [online only], http://dx.doi.org/10.1016/j.pmedr.2016.05.013


