Chapter 1
Introduction

1.1 Introduction

The purpose of this chapter is to clarify what is meant by physical activity within the context of previous children’s physical activity research and the ideological and pedagogical interpretations found within the key stage curricula. Clarification of the way that physical activity is understood is important as it sets the scene for further debate about how the current recommended daily levels of physical activity for children are implemented as well as consider the appropriateness of much research with children that invariably employs self-report methodologies to ascertain physical activity levels. Consideration will also be made of the school setting as the place where children are (or can be) physically active and, in doing so, will highlight current political interest in schools as sites where children’s activity levels can be monitored and their wellbeing enhanced.

Within this chapter, the reflexive aspects of the research process will also be introduced. Reflection upon my previous research background enables consideration of how my own previous experiences of physical activity from a multi-disciplinary perspective have informed and influenced the thesis research. Finally, the chapter will identify the gaps in the field, the reasons for conducting the thesis research and the research aims and questions, which provide the central focus for the research. It will also identify the research setting and process, as well as an outline of the thesis structure.

1.1.1 What is physical activity?

Physical activity has been defined in numerous ways, it is however a “complex behaviour variable” which can vary “from day to day, in intensity, frequency and duration and consists of both unavoidable activity and variable activity” (Winsley and Armstrong, 2005, p.65). These suggestions follow Armstrong’s (1998) previous work, where he stated that “physical activity is a complex behaviour and the accurate assessment of young people’s physical activity is extremely difficult” (p.s9). For the purpose of the thesis research, physical activity is generally regarded as, “any bodily movement resulting in energy expenditure” (Sirad and Pate, 2001, p.440). However, this definition is
extended to include, as Oliver et al. (2007b) suggest, “fine (e.g. painting and sculpting) and gross (e.g. running and skipping)” motor skills (Oliver et al., 2007b, p.47).

Recently in the United Kingdom (UK), television advertising and local campaigns on behalf of the NHS and the UK Government such as the Change4Life programme (DH, 2009a) have focused on encouraging people, individually and in groups, to be more physically active to help benefit their own personal health and wellbeing. Whilst there is a substantial body of evidence on the benefits of physical activity in relation to health for adults, (Powell and Pratt, 1996; Bouchard et al., 2006; Warburton et al., 2006) the physical activity levels of children have not been so extensively explored and studied. Childhood is a time when early forms of socialisation, habits, likes and dislikes are being developed (Howells, 2012a) and this is the age during which the focus of the thesis research lies. The thesis research aimed to bring knowledge to the field of children’s physical activity, by assessing the extent to which Physical Education lessons contributed to overall physical activity levels of primary aged children during the school day.

1.1.2 Previous research into children’s physical activity

When physical activity levels of children have been examined and researched previously, the focus has been mainly on children aged seven and upwards, who are in the upper part of primary schools, and those children in secondary schools (Yelling et al., 2000; Fairclough and Stratton, 2005; Wang et al., 2005). Children who are aged between seven and eleven are often referred to as juniors and those children who are aged between four and seven years are often referred to as infants within the primary system in England. According to the National Curriculum for England (DfEE/QCA, 1999) infants are learning within the key stage one curriculum and juniors are learning within the key stage two curriculum (DfEE/QCA, 1999). For the purpose of the thesis research, these different year groups will be referred to as infants and juniors. There are differences in the ideologies and styles of teaching and learning within the curriculum between secondary and primary and also within the two different curriculum stages within primary; infants and juniors. The thesis research analysed the physical activity levels of both infants and juniors and drew
comparisons between the primary year groups. The infants within the thesis research were all aged 6 years at the start of the data collection and the juniors were all aged 9 years at the start of the data collection.

1.1.3 Ideological and pedagogical differences in key stage curricula

Alexander (1995) suggested that ideological and pedagogical differences between the different key stage curricula were more pronounced with the introduction of the 1988 Education Reform Act. In the secondary school setting, children move from class to class, and have many different class teachers, as the class teachers have specialist (subject) areas of one or potentially two. In the primary school setting, the children do not move from class to class and the class teacher is known as a generalist teacher who is able to teach all subject areas, although they personally may have a specialist subject area. For example the specialist subject area of both of the class teachers within the thesis research was Physical Education. Within the thesis research case study school, the juniors experience a more structured, formal style of lessons with learning occurring mainly within the classroom indoor environment and with the children sitting in set seats according to the subject being taught. The infants were permitted to free flow in their movement from one learning experience to another (Werner et al., 2012) and moved between the outdoor and indoor learning environment freely in their choice of learning. In both environments the infants enquired into and explored their learning physically and socially (Vygotsky, 1962). Ward and Roden (2008) recommended that enquiring is completed on a daily basis as this equips infants with the capabilities to discover information throughout life. This also allowed them to be active agents in their own learning (Baynes, 1996; Piaget, 1951). These differences within the curricula may contribute to differences in physical activity levels and differences in duration of the intensity levels that can be achieved within the school day. Therefore, mapping of the physical activity levels throughout the different parts of the school day for both age groups brings new information to the field of children’s physical activity. Due to these differences in the curricula and the potential opportunities for the infants to be allowed to move more freely within the classroom, the class teachers from the case study school predicted that the infants would be more physically active than the juniors within the school day.
1.1.4 Recommended daily levels of physical activity for children

Physical activity of at least a moderate intensity level for 60 minutes a day has been recommended for health benefits (such as improving cardiorespiratory and muscular fitness) for children by the Department of Health (DH, 2005; DH 2011) and by the World Health Organisation (WHO, 2010). In England, the DH (2005) set out delivery recommendations by the Minister of Sport and the Minister for Public Health for increasing levels of physical activity within the whole of the population. The Chief Medical Officer’s recommendations were devised from a review of scientific evidence on the contribution of physical activity for health and well-being (DH, 2004b). The DH (2011) extended the recommendations and suggested that additional moderate to vigorous activity beyond 60 minutes and up to several hours would impart greater health benefits for children. The WHO (2010) highlighted that “physical inactivity levels are rising in many countries” (p.7) and identified the “prevalence of noncommunicable diseases and the general health of the population” (p.7). The WHO Secretariat reviewed scientific evidences and used these to develop the recommendations.

Moderate physical activity has been described as when the body begins to sweat and breathing increases (Topendsports, 2011). Examples of types of activities that would be regarded by NHS (2011b) and DH (2011) as being at a moderate intensity are brisk walking which increases to jogging, running, playing football, bike riding and other games. Research into the intensity levels of children’s physical activity is important as the intensity level of physical activity achieved is difficult to judge visually for not only the children themselves but also for parents, teachers and researchers (Kolle et al., 2009). Children’s physical activity is rarely lengthy and is more often than not made of intermittent and spontaneous patterns, making activity profiling difficult (Waring et al., 2007; Kolle et al., 2009). Transitions between light and moderate physical activity levels may be sporadic as children move between these frequently and the different physical activity levels are not sustained for a long period of time. The outcome of the sporadic nature of the children’s physical activity and movements is that it is very difficult to tell if the children are reaching a moderate intensity level, whether their breathing is increasing or they are beginning to sweat.
1.1.5 Children’s difficulties in describing their physical activity levels

Children also find it difficult to describe their physical activity levels (Kolle et al., 2009). This could be due to the complex cognitive task (Janz et al., 1995) of recalling this type of information. Physical activity levels in children cannot be identified instantly or consistently and are difficult to identify without the use of specific measurement tools, such as pedometers, heart rate monitors or accelerometers. Accelerometers were used within the thesis research, as they are not cumbersome, they are easy to use with primary aged children, they do not display to the children how physically active they are and therefore, the children could not compare their data with each other and be influenced by the data. Oliver et al. (2009) considered that accelerometers are “the most appropriate objective measurement tool for quantifying physical activity” (p.185) and are more likely to “yield the most accurate information on physical activity” (Oliver et al., 2007a, p.1047). The methodological strategy for using accelerometers and the justification for the measurement tool used will be discussed further in chapter 3, section 3.5.1. The children’s perceived physical activity levels were recorded through the use of a physical activity questionnaire that was adapted from Kowalski et al. (2004) in terms of language and vocabulary to suit the age of the children, to reduce the complexity of the cognitive task and to help aid recall (discussed in chapter 3, section 3.5.2).

1.1.6 School as a place for physical activity

There is currently much debate surrounding the levels and extent of children’s physical activity and as a result Waring et al. (2007) suggested that much pressure has been placed upon the education system as the place to potentially increase children’s physical activity levels. However, the opportunities for children to be physically active during school time are limited (Dale et al., 2000). As a consequence, Physical Education lessons have been seen as “the most suitable vehicle” (Green, 2002, p.97) to encourage healthy and physically active lifestyles and have been targeted as a prime outlet for increasing childhood physical activity and reducing obesity (DH, 2005). Roberts (2011b) emphasised the value of Physical Education lessons in the context of one in ten children being identified as being obese in England. Mayhall et al. identified in 1996, by a survey of teachers and children, that Physical Education lessons are health focused. Research has shown that when Physical Education lessons are delivered daily in
primary schools, increases are found in physical activity levels throughout the whole of the day, not just during Physical Education lessons (Trudeau et al., 1999). Also as a result of these daily lessons, increases in physical activity levels carry on into later life (Howells et al., 2010a). The question still remains, however, whether Physical Education lessons are, or should have a health focus and be responsible for increasing the overall levels of childhood physical activity. The WHO (2008) suggested that increasing the number of Physical Education lessons is the most direct way to increase pupils’ physical activity, implying that Physical Education lessons are about being active. Fairclough and Stratton (2006a) agreed that Physical Education lessons could be considered as key opportunities to get children physically active but Howells et al. (2010a) questioned whether it can really be that simple; are Physical Education lessons just about being physically active (Howells, 2012b)? Also, before any concrete measures can be implemented in schools, a clearer understanding of the actual levels of physical activity children engage in is required. There are serious implications for any ‘knee-jerk’ reactions to addressing physical activity levels and to the implications those reactions may have on addressing obesity levels, health and wellbeing particularly in relation to the potential impact upon the role of Physical Education lessons in general. (This will be discussed further within chapter 2, the literature review). It is acknowledged that there is a link between obesity and physical activity levels within the literature. The focus of the thesis research was on the children’s physical activity levels and not on obesity levels.

1.1.7 Political landscape and children’s physical activity at time of data collection

At the time of data collection within the thesis research, the ‘New Labour’ party was in Government in England, having been elected in 1997 and remained in power until 2010. It is the DH (2005) and the WHO (2010) recommendations of 60 minutes of at least moderate physical activity a day that will be referred to within the thesis research. Though, it is acknowledged that other recommendations have been suggested such as that by Andersen et al. (2006) that children aged 9 may need 120 minutes of at least moderate physical activity to reduce cardiovascular disease, the thesis research will use the aforementioned 60 minutes recommended by the DH (2005) and the WHO (2010). These 60 minutes of at least moderate physical activity can accumulate throughout the day
and does not have to occur within one block (Gilson et al., 2001; WHO, 2010). However, the National Institute for Health and Clinical Excellence (NICE, 2009) suggested that the accumulation had to be within 10 minute bouts as a minimum, similar to the recommendation for adults’ physical activity (WHO, 2011). Yet Gilson et al. (2001) and WHO (2010) do not stipulate this for children. Within the thesis research, all physical activity of at least moderate intensity levels will be recorded through an accumulation method, and not limited to 10 minute bouts. It is also acknowledged, that during the process of completing the thesis research, there was a change in Government. The new Coalition Government (formed by Conservatives and Liberal Democrats) has altered the physical activity recommendations (DH, 2011; NHS, 2011a). These changes will be considered within the discussion chapter (chapter 6) and the implications of these recommendations will be linked to the findings within the thesis research.

The Labour Government recommended for health and wellbeing purposes (DH, 2005) that children should be physically active to at least a moderate intensity level for 60 minutes a day. The term day refers to the whole 24 hours of the day, not the waking day, nor the school day. Even though pressure has been placed on schools to take on responsibility of increased activity levels (Waring et al., 2007), it is important to know what can be achieved in a primary school day. This thesis research does not imply that all the children’s physical activity should be done whilst the child is in school, but a primary school is a place where all primary aged children will have similar opportunities to access and participate in physical activities that are provided within the school day. Children spend half their waking hours, up to seven out of their fourteen hours, within the primary school setting (Owens et al., 2000). Therefore, school life has the potential to have a significant impact on primary aged children’s lives due to the amount of time that is spent at school (Howells, 2011). This only leaves the children between five and seven hours outside of school while they are still awake (Breus, 2008). The pressure on schools to be responsible for providing the appropriate physical activity levels is not surprising. However, the questions arise: Can schools provide only half of a child’s physical activity levels, as up to 7 waking hours is spent outside of the school day? Or does school provide more than half of the recommended physical activity levels? The thesis research will explore what physical activity levels the infant and junior aged children can achieve within the
school day. The findings from the thesis research may also help to raise children’s awareness of their own physical activity and to potentially improve children’s physical activity participation within the school day. It is important to have informed knowledge about children’s physical activity levels and behaviours for schools to contribute to children’s overall daily physical activity levels.

1.2 Research background - myself as the researcher

I felt it was important to include a section that reflected me as a researcher, and to enable me to locate myself within the thesis research and to share this with the reader. The intention was to enable the reader to understand not only my starting point and the experience that has informed the thesis research but also the influence my personal background has had on the thesis research. I sit in and interchange between four silos (Collier, 2009). The concept of these silos is defined by Collier (2009) as each subject discipline taking a different viewpoint of a particular topic. For example, if each silo / subject discipline were to consider children’s physical activity, a different approach could and would be considered. I have a rare research background that has allowed me not only to engage myself in four different disciplines: (a) Sport and Exercise Sciences and Psychology, b) Health Sciences, c) Physical Education and d) Primary Education, but it has also meant that I can approach the thesis research from a multi disciplinary position, which allowed me to consider a broader range of possible factors that contribute to and influence children’s physical activity. Greig et al. (2007) supported the incorporation of multi disciplinary approaches and suggested that to understand a child fully, a holistic and inter-professional approach is necessary. I felt that my four different subject and discipline backgrounds enabled me to approach the thesis research in an unusual multidisciplinary way.

My original background is in Sport and Exercise Science and Psychology and therefore, I approached the thesis research with a physiological and psychological viewpoint. This meant that I may consider not only the ‘how’, but also the ‘what’ and the ‘why’ of the children’s physical activity levels. By measuring the physical activity of the children through the use of accelerometry, (this will be discussed within chapter 3, section 3.5.1), the thesis research could be considered to embrace a mainly physiological approach, which “focuses on the biological bases of behaviour and of psychological functioning” (Greig et al., 2007,
This approach assumed that all the behaviour is a result of biological factors. Greig et al. (2007) criticised this approach “as being too reductionist” (p.21) as it potentially can reduce a more complex story behind the children’s physical activity to just the physiological recordings of the accelerometers. Therefore, using a physiological approach alone could not be used to address more complex problems explored within the thesis research as these required an “eclectic or heuristic approach to theories, methods and findings in research questions about humans” (Greig et al., 2007, p.45). Adopting a more eclectic approach allows multiple theories and methods to be drawn on to gain a deeper insight into the physical activity levels of the children. This is why I felt that my physiological and psychological background allowed me to not just record the physical activity of the children, but to enquire more deeply into the perceived levels of intensity of the children’s physical activity. I examined the perceived levels of the children’s physical activity through the use of self recall in the form of a physical activity questionnaire (this will be discussed within chapter 3, section 3.4.2). I also made my own field notes; these were important details that may have been forgotten (see Appendices 1 – 3). One example of my field notes include noting that the children used the accelerometer pouches as a useful place to collect dead leaves. Had I not been in school I would not have known this was occurring. Also field notes were used to record the responses that were made, when sharing and disseminating the results to the class teachers as part of the action research cycle (McNiff, 2002).

The second discipline that I specialised in was Health Sciences. During my previous postgraduate Masters level research, I developed a biomechanist approach to human movement analysis. I gained experience in interacting with human participants and collecting biomechanical data on how people who had experienced a stroke moved from sitting to standing, a typical, functional, everyday task (Janssen et al., 2002) which is completed a surprising 90 times a day (McLeod et al., 1975), yet causes approximately one third of all falls (Cheng et al., 1998). Through this experience, I developed an understanding of how to interact and work in collaboration with people within a research setting and observe naturally occurring movements. By immersing myself within the research process, I was able to consider how valuable being part of the research was, rather than just being an onlooker and taking data from the outside. Brewer (2000) suggested
that by immersing in for example, the classroom setting, allows for data to be collected within the naturally occurring setting, which captures the social meaning of ordinary activities. These are valuable skills that I can apply to the thesis research when analysing the social understanding of the children's physical activity which occurs daily within the school day. Other skills that I believe I gained from this particular previous research experience were data collection and analysis using measurement tools to record kinetic and kinematic measurements (Zatsiorsky, 1998; Hall, 1999). This has been particularly helpful in the analysis of the accelerometry data collected within the thesis research. I also feel that from working with those who had experienced a stroke, I developed interpersonal skills, as I had to encourage them and make them feel at ease throughout the research. I was able to use these skills to ensure that the children felt at ease throughout the thesis research. Consequently, by drawing upon this discipline, I considered the importance of how the children completed and accumulated the physical activity levels that were recorded during the thesis research.

The third discipline that I specialised in was the study of Physical Education and how to deliver effective teaching and learning for children aged between four and nineteen years. It is within this field that I have developed a practical approach as to how Physical Education lessons can inspire and enhance the lives of the children. I believed that my knowledge and understanding of the theories of teaching and learning and of the National Curriculum for Physical Education (DfEE/QCA, 1999) and Physical Development of children (DfE, 2008), provided an insight into recognising the potential importance and value that Physical Education lessons may have within a primary school setting. Additionally, an understanding of the pedagogical skills related to accommodating the needs of the child, specifically ensuring that they felt comfortable throughout the research was incorporated into the thesis research. Consequently from this perspective, I approached the thesis research with the intention of considering how Physical Education lessons may or may not contribute to overall physical activity levels of the children and I asked if the children could understand the potential of Physical Education lessons on their physical activity levels. This background also allowed me to examine the potential contribution of Physical Education lessons to children’s physical activity and how this may vary, according to individual, year group and gender.
My final viewpoint or silo (Collier, 2009) is informed by my experience of Primary Education, which has taught me how the primary aged child learns and how to teach to differing abilities and ages of children. I currently work in a University setting where I lecture on numerous programmes within Primary Education and Childhood Studies, specialising in Physical Education and Teaching Young Children. In my lectures I help support the understanding and knowledge of student trainee teachers during their primary education teacher training and their school based practice. My critical approach led me to question the policies, strategies and ideas for practice. For example, can the DH’s (2005) or the WHO’s (2010) physical activity recommendations be implemented practically in a primary school setting? Are the physical activity recommendations realistic both for children and schools to achieve and provide, even though they are suggested for the whole day not just the school day? Also, having expertise in this discipline has allowed me not only to question and be critical, but to be accepted by the school as an insider or as an expert, someone who has knowledge and understanding of the primary school setting. Familiarity, according to Hammersley and Atkinson (1995), is vital for research within a natural setting, such as a primary school.

From these multi disciplinary backgrounds, I felt I could incorporate a mixed methodology to the thesis research, within a case study design, to examine the potential contribution that Physical Education lessons made to children’s overall physical activity levels. The very experience of a school day is multidimensional, in the sense that a Physical Education lesson cannot be considered in isolation, as this is only a small part of the child’s day. So the whole school day needed to be considered, as many factors within the child’s life / day can influence and impact on a lesson and these needed to be explored. Consequently the thesis research has been shaped by this multidimensional experience of the school day and my own multi disciplinary backgrounds.

1.3 Identifying a gap in the field of research

Children’s physical activity and their experience of Physical Education lessons in school can help determine their engagement in lifelong physical activity (Doherty and Brennan, 2007) and therefore, also have widespread health-related impacts. Prior to this thesis research there was a dearth of knowledge focusing on
primary aged children, although there is much research (as highlighted in section 1.1) related to physical activity at the secondary stage and age of children’s education (Yelling et al., 2000; Fairclough and Stratton, 2005; Wang et al., 2005). Therefore, the thesis research focused on the physical activity within primary aged Physical Education lessons and within the whole of the primary school day

The thesis research brings new knowledge to the field of children’s physical activity and in particular, comparisons between infants and juniors within the primary school setting, within primary Physical Education lessons. A gap became apparent also in terms of knowledge and understanding for the class teachers, the children, the school, the parents and also for myself (as a teacher educator within Primary Education); all of whom did not know prior to the thesis research what moderate to vigorous physical activity was being completed by the children. For some this was due to not knowing what moderate and vigorous physical activity looked like. This lack of knowledge may be in part explained by primary class teachers being ‘generalists’ and having to be able to teach the children in over 13 different subject areas. In comparison (as mentioned in section 1.1), a secondary teacher is a specialist in an individual subject area (or potentially two subject areas) and the children have different teachers for separate subjects. It could be difficult or even impossible for all involved (class teachers, the head teacher, parents, and teacher educators) to respond to recommended physical activity targets (DH, 2005; WHO, 2010) (although, again these are not stipulated for just the school day) if the current physical activity levels of the children are unknown. Harrington and Donnelly (2008) agreed and stated that “before any strategies to increase physical activity can be employed, the activity levels of children need to be known” (p.66). The thesis research addressed this apparent gap in the field and contributed to knowledge relating to the physical activity levels of primary aged children, in particular in the comparisons between infants and junior year groups.

1.4 Research aims and questions

As a Physical Education primary specialist I wanted to explore how physically active the children within the case study school were within the primary school day. This research would provide me with information as to the extent to which the primary school setting would contribute to children’s recommended
levels of physical activity (DH, 2005; WHO, 2010). Even though it is acknowledged that the recommendations for health benefits are for the child’s whole 24 hours and not just limited to the school day, the research would identify and highlight where within the school day the children were firstly active.

My thesis research has two ultimate aims the first aim was to explore the children’s physical activity levels within the primary school setting, investigating to see if there were variations in the physical activity levels of infants and juniors and boys and girls. The second aim was to examine and explore the contribution that Physical Education lessons made to primary aged children’s overall physical activity levels within the primary school day and if there was any variation for year group and gender. These ultimate aims were addressed through the following research questions:

1. How physically active are primary school children during the school day?

2. What are the differences in the physical activity levels during the school day between children aged six - seven years (infants) and aged nine - ten years (juniors)?

3. To what extent does the primary school setting contribute to children’s recommended levels of physical activity (DH, 2005; WHO, 2010)?

4. What contribution do Physical Education lessons make to primary children’s physical activity levels?

1.5 Research setting and process

The thesis research was conducted within an English primary school which followed the English National Curriculum (DfEE/QCA, 1999). The overall approach was a mixed methodology and mixed research strategies to support the case study design, data were obtained using accelerometry over a period of one academic school year and using Qwizdom technology to record data from physical activity questionnaires. Accelerometry is defined as: “the quantitative determination of acceleration and deceleration in the entire human body or a part of the body in the performance of a task” (McGraw-Hill, 2002, p.12). Qwizdom is
an “interactive learning system that uses two way infra red communications to provide instant assessment” (Johnson, no date, no page). The school was chosen as it was one with which I was familiar, due to my previous work within the school. According to Thomas et al. (2005), within research, “rapport is everything” (p.349). Familiarity with the staff enabled and facilitated my discussions relating to their physical activity policy and whether the staff and children knew if the children were reaching the recommended at least moderate intensity levels (DH, 2005; WHO, 2010) of physical activity? This meant that “an opportunity arose to investigate an interesting setting” (Hammersley and Atkinson, 1995, p.36), where meaningful data could be gathered. The class teachers had not measured the physical activity levels of the children prior to the thesis research and were unaware of the children’s physical activity levels within the school day. They did, however estimate from their assessments made during Physical Education lessons, what they thought might be the physical activity levels of the children (section 3.6.3 discusses this).

Geographically, the school is located outside a large town in the South East of England. The school is a relatively small, rural village Church of England school with less than 200 children in seven classes, one class per year group. The school day started at 9am and ended at 3.10pm, the period of time that is classed as ‘the school day’ although breakfast clubs and after school clubs do occur at the school beyond these times. This was also the length of time that the accelerometers collected data during each collection day and was referred to within the physical activity questionnaire as the school day. For the juniors, the opportunities that existed for physical activity within the school day, but outside of the Physical Education lessons, and which were examined for different intensity levels of physical activity; were morning break time (20 minutes) and lunchtime (60 minutes, this time included sitting and eating lunch). The infants not only had morning break time (20 minutes), and lunchtime (60 minutes), but they also had an afternoon break time (15 minutes) which the juniors did not have. The other part of the day in which physical activity was examined was curriculum time. Curriculum time is specific terminology used within this thesis and refers to all the teaching and learning that is outside of the Physical Education lesson and does not include break times as defined above (see also Glossary).
The school was also chosen because, through its physical activity policy and healthy school dinners, it had achieved a healthy school mark (Healthy Schools, 1999). The school also has class teachers who have specialised in Physical Education (Carney and Howells, 2008) and had more subject knowledge and understanding of Physical Education lessons within the school than other class teachers who had not specialised in Physical Education. The acting head teacher regarded these two class teachers as those who provided the best possible Physical Education lessons, due to their specialist knowledge. The school represented, as Hammersley and Atkinson (1995) referred to it as, a ‘good opportunity’ to explore in detail. This detail in terms of the thesis research was what physical activity the children completed within the school day and whether the children could achieve the recommendations of 60 minutes of at least moderate physical activity (DH, 2005; WHO, 2010) within the school day.

1.6 Thesis structure

The thesis consists of seven chapters. This chapter introduces the concept of physical activity, it considers the ages of participants previously focused on within physical activity research; upper primary (juniors) and secondary aged children as well as adults. It then draws attention to the gap in knowledge of children’s physical activity with regard to lower primary aged children (infants), that the thesis research aims to contribute to. It considers why researching children’s physical activity within a primary school is important for children, class teachers, the head teacher, parents and teacher educators. It introduces the difficulties in recording and observing physical activity and the concept of recording physical activity levels through accumulation methods. It highlights the potential use of Physical Education lessons as the answer (WHO, 2008) for directly increasing physical activity levels and how Physical Education lessons could encourage physical activity. It also explores my own research background and its shaping of the thesis research method design. It identifies the questions that are researched within the thesis research and explores the research setting and process of the data collection.

Chapter 2 evaluates and critically reviews the background literature surrounding all aspects of children’s physical activity, examining the difficulties in defining physical activity. It also explores the social influences of class, gender,
modern technology and the media and in particular how these may restrict physical activity. Current and previous physical activity research with children is considered as well as the processes and designs within that research. The role of Physical Education lessons particularly the links to physical activity is investigated within primary school settings and within the local area. It further explores physical activity and children’s obesity levels (Beard, 2011; Leake, 2011). It discusses the use of body mass index (BMI) (which is “an estimation of the amount of fat stored in adipose tissue that can be calculated by dividing the body weight in kilograms, by the square of the height in metres” (McGraw-Hill, 2002, p.261)) to record obesity levels. The geographical local impact of children’s physical activity is scrutinised in a number of ways, including: medical recommendations, the PESSCL (DfES and DCMS, 2002) strategy and playground play (Kent NHS Overview and Scrutiny Report (KNOSR), 2006). These key areas are examined to enable a context to be set and then linked to the thesis research case study school. Government policy relating to Education and Health is considered, with specific focus on the impact of the ‘being healthy’ outcome within the Every Child Matters agenda (DfES, 2003) on Physical Education provision and children’s physical activity. Another consideration is that of the impact of a whole school approach and physical activity programmes in increasing physical activity levels in children.

Chapter 3 details the methodology that occurred in forming and shaping the thesis research. It also outlines how the methods in terms of research design were developed and refined. This chapter starts by analysing and justifying the methodological ‘thinking’ and the choices and decisions with regards to the data gathering that were used throughout all aspects of the thesis research. It defines the research questions based on the research aims and the knowledge gap identified in the literature review. The research questions were further informed by methodological considerations and the suitability of available methods. It then details the reasoning behind the use of a case study design for the examination of the children’s physical activity levels. The strategies used to support the case study, namely an action research approach and a longitudinal style are discussed. The final part of the chapter outlines and justifies the use of the accelerometers and Qwizdom questionnaires, which were used to collect the children’s physical activity data. The chapter also contains details of how access was gained to the
thesis research setting and of the children who participated in the thesis research. The key findings and reflections from the pilot phase of the thesis research are also summarised.

Chapter 4 details the analysis of the accelerometer data collected within the main phase of the research. This chapter is presented through a thematic approach examining the children’s physical activity levels within a primary school day by analysing their moderate and vigorous physical activity (MVPA) levels. Comparisons are made between year group, gender, type of day (those including Physical Education lessons (PE days) and those that did not (Non PE days)) and different parts of the school day. Light to moderate physical activity (LPA) levels and static activity (SA) are compared for year, gender, type of day and for different parts of the school day. The amount of MVPA, LPA and SA within Physical Education lessons is specifically discussed to explore the contribution that Physical Education lessons make to the children’s physical activity levels. Also, the field notes that were made to allow for reflection upon moments within the data collection and dissemination of the results are referred to (see Appendices 1 – 3).

Chapter 5 presents the findings from the physical activity questionnaires that were collected through the use of Qwizdom and illustrates these using graphs. The findings are analysed according to year group and gender. Sub-themes within the physical activity questionnaire are explored and they include: How the children travel to school, their perceptions of their physical activity during break time and lunch time, their preferences for lessons and their perceptions of how physically active they are in different activity areas within Physical Education lessons. It also analyses their perceptions of their physical activity completed at home and during after school activities and the overall perceptions of how physically active the children are within the last seven days including personal descriptions from the children of their own physical activity behaviour. Comparisons were made to the physical activity levels recorded in chapter 4.

Chapter 6 provides an overall discussion of the accelerometer data and the physical activity questionnaire results and then links these to the research questions. The focused areas that are interpreted include: The physical activity levels of the children during the primary school day; the differences between the
physical activity levels of infants and juniors; the differences between the physical activity levels of boys and girls; the differences in self reporting between infants, juniors, boys and girls; the extent to which Physical Education lessons affect primary school children’s physical activity levels; and the influence of break times as opportunities for physical activity, with or without the use of playground equipment. Throughout this chapter, links are made to aspects of the literature presented in chapter 2 as well as to the responses from the class teachers (see Appendices 1 – 3) following dissemination of the data gained from the thesis research.

Chapter 7 concludes the thesis research; answers the research questions proposed in this chapter and identifies the new knowledge in the field of children’s physical activity. It also discusses the limitations of the research including: Changes in Government’s policy and focus; the class teacher’s gender; recording physical activity during swimming; and active transport. Also within this chapter the possible extensions of the thesis as further research are considered, including the effect of: The introduction of after school clubs for infants; the development of whole school physical activity programmes; new playground equipment for all; physical activity levels of infants when they become juniors; the teacher influence in terms of attitudes and wearing the same coloured clothes as the children and; different activity areas of Physical Education lessons.
Chapter 2

Literature Review

2.1 Introduction

The purpose of this chapter is to outline, review and critique the wider prevailing literature considered relevant to the thesis research aims. The aims of the thesis research as outlined within the introduction chapter, (see also section 1.4) were to explore the children’s physical activity levels within the primary school setting, investigating to see if there were variations in the physical activity levels of infants and juniors and boys and girls. Also to examine and explore the contribution that Physical Education lessons made to primary aged children’s overall physical activity levels within the primary school day and if there was any variation for year group and gender. By researching these aims, the thesis research will bring new knowledge, to the field not only of children’s physical activity but also to primary Physical Education.

At the time of writing, there was a dearth of research which explored the ways in which Physical Education contributed to physical activity levels and what physical activity levels were achieved in primary Physical Education lessons. Previous research has been conducted over short periods of time, for example Duncan et al. (2007) carried out 4 days of children’s activity, 2 school days and 2 days at the weekend, 208 primary school children participated. From their results, they concluded that children in England undertook more physical activity during weekdays than at weekends, and boys had significantly higher physical activity levels than girls. However, they did not indicate what lessons were participated in within the school days, or what activities the children participated in at the weekend. By completing the research over a 4 day period it allowed for only a small snapshot of that time for those particular children. The thesis research was completed over a longer period of time, (a whole academic school year), to provide further and more long-term information.

Belton et al. (2009), like Duncan et al. (2007), used pedometers to measure the physical activity of children, but Belton et al. (2009) found the opposite result to Duncan et al. (2007). Belton et al. (2009) found that primary aged children in Ireland took more steps at the weekend than on weekdays. Their research was
undertaken over a period of 7 days and again it could be considered that this length of time allowed for only a snapshot of the children's physical activity. However, Trost et al. (2000) suggested that 7 days was the number of days needed to monitor physical activity, as it included all days of the weeks, which they believed provides “reliable estimates of usual physical activity” (p.426). In the thesis research, I examined the physical activity of the children over a longer duration, a whole academic year, and included comparison of the results between the infants (6 year olds) and the junior classes (9 year olds) which have not been examined previously in the literature (at time of writing).

2.1.1 Chapter structure

This chapter focuses on the key areas (influenced by the researcher’s background) of physical activity, in particular children’s physical activity. It begins with a consideration of what is understood by the term physical activity; it continues with an examination of social influences and on physical activity including; social class, gender, modern technology and the media. It explores physical activity and children’s obesity levels, sedentary behaviour and the use of BMI. It considers physical activity of children in the local area, in Physical Education lessons, the different intensity levels reported in Physical Education lessons and the impact of Every Child Matters agenda (DfES, 2003; DCSF, 2006). It examines physical activity programmes and the links between physical activity programmes and academic performance. It reviews physical activity and playground physical development as well as these within the local area. It finally considers physical activity and whole school approaches as well as physical activity and travelling to school.

To clarify, the phrase ‘Physical Education lessons’ referred to throughout the thesis is the formal input, which is organised and structured by the teacher, it is not child initiated or unorganized or consisting of informal activities (see Glossary). The focus of the thesis research is not, however, on the teaching and learning that occurred within Physical Education lessons, nor the teaching styles used within these lessons, although the class teachers who taught the Physical Education lessons within the case study school were regarded as specialists. They had both gained extra subject knowledge and understanding of teaching and learning within Physical Education during their teacher training and continued this within their
continuous professional development. The focus of the thesis research was on the physical activity that occurred within the Physical Education lessons and within the primary school day. This literature review chapter will in particular consider the roles and requirements of Physical Education lessons, the implementation of the National Curriculum for Physical Education (DfEE/QCA, 1999) and how this varies according to the child’s age. The chapter will consider the recommendations made by the ‘New Labour’ party relating to physical activity, as they were in Government during the time of data collection. In addition, further consideration is given to the current Coalition Government (who were elected in 2010) and their ideas about the primary curriculum, Physical Education and physical activity in chapter 6, the discussion chapter. ‘New Labour’ Government documents and strategies relating to obesity and physical activity will be addressed including the Every Child Matters (ECM) agenda (DfES, 2003), and a contribution will be made to the discussion about whether teachers need to be taught ‘being healthy’, one of the outcomes of the ECM agenda (DfES, 2003). The literature review will also consider the claims within the current social debate regarding the impact of and the potential for, moral panic around phrases being used such as ‘obesity crisis’ (Kirk, 2006) and how this is impacting on primary schools. Additionally, consideration will be paid to the local impact of physical activity in terms of the location where the research is set, also how physical activity is affecting the community and how it may be addressed through a whole school approach, which involves including pupils, teachers, governors, parents and external partners. It will conclude by focusing on physical activity research that has been specifically explored with children.

2.2 Physical activity defined

Views differ as to what is meant by physical activity, yet most agreed and viewed physical activity as a ‘complex’ term. Official recommendations (DH, 2005) have, in the view of some writers such as Stratton and Watson (2009), evolved from “expert opinion with limited scientific evidence to support them” (p.153). The WHO (2010) described physical activity for children aged 5 – 17 as activities that include: “play, games, sports, transportation, recreation, Physical Education or planned exercise, in the context of the family, school and community activities” (p.7). It could be suggested that the description contains a variety of potentially different intensity levels of physical activity and interestingly it includes Physical
Education lessons specifically. Plasqui and Westerterp (2007) in their previous research highlighted that physical activity includes a variety of different types of activities. They reviewed the ability of different accelerometers to assess daily physical activity and suggest that physical activity is indeed a complex behaviour and includes “sports as well as non-sports activities” (p.2371). Therefore, it is acknowledged that physical activity opportunities are possible in non-Physical Education lessons, within the school day, and that it is not suggested to be an either/or situation.

Armstrong’s (1998) previous work, demonstrated that “physical activity is a complex behaviour and the accurate assessment of young people’s physical activity patterns is extremely difficult” (p.s9). Pettee Gabriel et al. (2012) agreed with Armstrong’s (1998) definition and referred to physical activity as “a complex multidimensional behaviour” (p.s12). Winsley and Armstrong (2005) extended the definition of physical activity (as highlighted in the introduction chapter) and stated that “physical activity is a complex behavioural variable that varies from day to day in intensity, frequency and duration and consists of both unavoidable activity and voluntary activity” (p.65). Intensity varies from person to person and the WHO (2011) referred to intensity as how hard a person is working during a particular type of physical activity, it is the rate at which the activity is performed. With such complexities in the definitions of physical activity it is important to be aware of these prior to researching physical activity within a primary school setting with children. However, Sirad and Pate (2001) provide a more specific definition of physical activity as “any bodily movement produced by skeletal muscle resulting in energy expenditure” (p.440). It has also been defined earlier by Caspersen et al. (1985) who regard physical activity to be composed of “Movement of the body produced by the skeletal muscles, resulting [in] energy expenditure which varies from low to high, [and has], a positive correlation with physical fitness” (p.127). Armstrong (1998) defined physical activity in a very similar way to Caspersen et al. (1985) who also state that “physical activity can only occur as a result of skeletal muscle activity that is supported by energy expenditure” (p.126). Mulvihill et al. (2000) developed the definition of physical activity and explored the differences between moderate intensity physical activity and vigorous intensity physical activity. They suggested that moderate intensity is an activity which leaves the
participant feeling warm and a little out of breath, whereas vigorous physical activity will leave the participant out of breath and sweaty.

Physical activity, it is suggested by DH (2004b) provides “an important vehicle for play and recreation, learning physical and social skills, developing creative intelligence and stimulating growth and fitness” (p.31). In a recent study, Pearce et al. (2008) explored American rural middle school children’s own understanding of physical activity and found that children defined physical activity in a comparable way to Caspersen et al. (1985) as “body activity” and “if you’re moving” (p.178). They also continued to ask the children what they believed exercise is, to which the response was that exercise “is when you mean to do physical activity” (p.178). They also reported that children found it difficult to understand and articulate what is meant by intense or vigorous physical activity. Although Pearce et al. (2008) acknowledged that the results were limited due to only involving one school; their study did highlight an important factor; that of considering how children understand what is meant by physical activity. This is key, if the children in a primary school setting are not able to achieve the recommendations for physical activity, it could be reasonable to ask whether it is because the children do not understand what physical activity is or how they are supposed to achieve it. Or, alternatively are opportunities not provided for them within school? However, school could be regarded as a consistent setting within every child’s life therefore, it may be the only place where some children have physical activity opportunities provided for them.

Indeed, Oliver et al. (2007b) considered that the amount of physical activity required for very young children is not clear “and the types of activities that are important are yet to be determined,” (p.47). They also place value upon both family and early years learning settings such as parental encouragement in providing motivation to get the children to be physically active and the parents’ (or carers’) own levels of physical activity, as important factors in influencing both the physical activity and health of young children (Oliver et al., 2007b). The implication here is that early years and primary educators need to be supported to promote physical activity with their children, and also parents and carers need to be supported with the promotion of physical activity beyond the school gates. Consequently, it is considered that the findings within the thesis research (see
Chapter 5 (results) and 6 (discussion)) will give an indication of the children’s understanding of physical activity through self-recollection in the form of answers to a physical activity questionnaire, and also their recorded physical activity through accelerometry data in the thesis research. The comparison between perceived and actual physical activity can form a valuable educational tool to help the children understand the potential value of both Physical Education lessons and their place in daily activity, and also the other opportunities within the school day where and when they can be physically active, in particular at moderate and vigorous intensity level. One of the aims of exploring and examining education suggested by McNiff (2002) within action research (as in the thesis research) is to increase the understanding of the practice and what is occurring. By involving the children (and class teachers) in discussion of their own results collected in the thesis research, it is hoped that the children will develop a good understanding of the types of activities they completed during particular parts of the day and within the Physical Education lessons and which of these equate to the different intensity levels of physical activity.

The report of the Chief Medical Officer (DH, 2005) recommended a minimum level of physical activity of one hour per day of at least moderate intensity for children and young people aged between 5 and 18 years, where moderate intensity is defined as “exercise that results in an increase in breathing rate, an increase in heart rate, to the level where the pulse can be felt and feeling warmer possibly accompanied by sweating on hot or humid days or indoors,” (Kent NHS Overview and Scrutiny Report, (KNOSR) 2006, p.53). Yet, it did not state in the report whether these levels are being successfully achieved, nor does it state where within the school day and curriculum these activity levels should be reached, though one of the DH’s (2005) goals was to encourage activity in early years and schools. McKenzie et al. (2006) suggested that the majority of schools have insufficient frequency or duration of Physical Education lessons to achieve the physical activity recommendations for the promotion of health and fitness. Therefore, physical activity opportunities beyond Physical Education lessons need to be considered. The DH (2005) report stated that moderate intensity levels did not have to be achieved all at the same time, they can be accumulated and suggested that the activity can be “lifestyle activity, structured exercise or sport or a combination of these” (DH, 2005, p.7). Therefore, the mapping of children’s
physical activity within the school day will produce valuable information and will be completed within the thesis research.

Daley et al. (2008) researched whether general practitioners (GPs) knew about these recommended levels of physical activity in order to achieve health benefits. They found that only approximately 60% of GPs were able “to provide the correct answer regarding the minimum duration (in minutes) of physical activity required for health benefits; relatively few were aware of the minimum number of days per week adults should engage in moderate intensity physical activity” (Daley et al., 2008, p.589). However, these results were a dramatic improvement on similar research (Douglas et al., 2006) conducted in Scotland where only 13% of GPs were able to correctly identify the recommendations for physical activity. If GPs are not able to describe correctly the DH's (2005) current physical activity recommendations for prevention and treatment of medical conditions and for health benefits, should the sole responsibility be passed onto primary school teachers? It also raises the question of where the training should come from to aid all practitioners (medical and educational).

It has been recommended by the DH (2005) and the WHO (2010) that children are physically active for 60 minutes a day at an intensity of at least moderate level, with any physical activity over 60 minutes providing additional health benefits. The 60 minutes of physical activity can be accumulated throughout the day (Gilson et al., 2001; O’Donovan et al., 2010; WHO, 2010). However, as discussed in the introduction chapter, NICE (2009) suggested that the accumulation had to be within 10 minute bouts as a minimum, similar to the recommendations for the accumulation of adults’ physical activity (WHO, 2011). Yet, Gilson et al. (2001) and WHO (2010) did not stipulate this for children. Therefore, all physical activity levels at and over a moderate and vigorous level were recorded and reported upon within the thesis research. The DH (2002) in their Health Survey reported that 20% of boys and 30% of girls (aged between 2 – 15 years) completed less than 30 minutes of moderate and above moderate physical activity a day. School life has the potential to have a significant impact on primary aged children’s lives due to the amount of time spent within school per day. According to Owens et al. (2000), children sleep for 10.16 hours ±44.48 minutes, the child is; therefore, awake for approximately 14 hours within a whole
day, of which they spend 7 hours within the primary school day. The under seven year old child (infant) needs approximately between 10\(\frac{3}{4}\) and 12 hours sleep whilst those aged between seven and twelve (juniors) need between 10 and 11 hours sleep. Only leaving between five and seven hours outside of school while they are still awake (Breus, 2008) which would need to include getting up, going to bed, travelling to school and eating breakfast and tea. This may not leave a great deal of ‘spare’ time or potential time for physical activity to occur. Although it is not stipulated for the recommendations to be completed during the school day, the WHO (2010) has suggested school as a place that could contribute to daily physical activity recommendations with Physical Education lessons acting as opportunities to accumulate this further physical activity for health benefits.

Research into physical activity levels is important, as the physical activity levels that can be achieved by children are not readily quantifiable, so it is not easy to question or to examine whether a child is achieving the recommendations of at least moderate to vigorous levels of physical activity of 60 minutes a day (DH, 2005; WHO, 2010). Without the information how can schools ensure that they utilise Physical Education lessons as opportunities to accumulate physical activity for health benefits as the WHO (2010) suggested? Howells et al. (2009) suggested that is important for school, class teachers, the children and teacher educators to know how high the children’s “existing physical activity levels” (Howells et al., 2009, p.24) are (through the use of objective measurements) “before any strategies to increase physical activity can be employed” (Harrington and Donnelly, 2008, p.66) “or strategies for primary schools” can be implemented (Howells, 2010b, p.24). Children’s physical activity and experience of Physical Education in school can help determine their engagement in lifelong physical activity (Howells, 2012a). Therefore, it is important to map the children’s physical activity levels (as in the thesis research) within the school day and to examine the contribution made by Physical Education lessons to the children’s overall physical activity.

Kolle et al. (2009) advised that “children’s physical activity has provided serious measurement challenges for researchers” (p.1368). They proposed this was challenging due to the nature of children’s behaviour. Children found it difficult to estimate their own behaviour when using the technique of self-reporting,
whereby the children recall and describe their own physical activity levels. Children found it difficult to recall in detail their physical activity patterns (Kolle et al., 2009). According to the NHS Information Centre for Health and Social Care (2011), during 2009 – 2010 86% of children in England aged between 5 and 10 years, when self-reporting stated that they had taken part in sports activities outside of school time in the last four weeks and 78% had participated within the last week. However, they did not indicate what physical activity level these activities were at, or the types of activities they were reporting on, nor did they distinguish between the different intensity levels of the activities.

Both Freedson and Miller (2000) and Waring et al. (2007) found that primary school aged children were unable to recall physical activity accurately, due to movements being unstructured, informal, potentially natural responses and not necessarily planned. Also, children were unable to recall the aforementioned physical activity due to them not yet having developed the cognitive ability to recall over long periods of time. Children's physical activity participation was rarely lengthy and was more often than not made of intermittent and spontaneous patterns, making activity profiling difficult (Livingstone et al., 2003; Kolle et al., 2009). Nonetheless “habits of and attitudes toward physical activity are developed during childhood and assumed to continue” (Malina and Bouchard, 1991, p.6). These habits and attitudes may ultimately have a long term benefit on adult health; therefore, Malina and Bouchard (1991) regard regular physical activity participation as potentially vital. The length of time that is recommended for regular physical activity is 60 minutes at a moderate to vigorous intensity level, equivalent to a brisk walk a day. The question remains however, as to how physically active primary school children are during the school day?

2.3 Physical activity and social influences

Physical activity is affected by numerous social influences and constrictions. Within this section, the social influences of: class, gender, modern technology and the media will be discussed and examined to understand how these affect physical activity. Although the thesis research focus is not on class, modern technology nor media, it is important to be aware of these and their impact as found in previous research. It is acknowledged that there may be gender differences that occur within children’s physical activity and therefore, gender is
discussed within the literature review in relation to physical activity (within this section, 2.3). Similarities and differences in physical activity and gender are identified within the results and discussion chapters however the main focus of the thesis research is children’s physical activity levels.

2.3.1 Physical activity and social class

Lambirth (2011) defined a social class as “groups of people who share a similar social position in terms of power and status in society and certain political and cultural characteristics” (p.9). However, for the purposes of this thesis the differences within class are more related to economic and income related influences. Physical activity, according to the WHO Europe (2006), “is a fundamental means of improving physical and mental health” (p.ix), yet over the past century, for many people, physical activity levels have decreased due to changes in lifestyle. The effect of lifestyle changes appeared to be more marked in some socio-economic classes than others. The British Heart Foundation National Centre (BHFNC, 2011) proposed that there was a relationship between household income and levels of physical activity with those in lowest income households more likely to meet the recommendations than those in the highest quintile (those who are in the highest income households) even though people with lower socio-economic status tend to have “less free time and poorer access to leisure facilities or live in environments that do not support physical activity” (WHO Europe, 2006 p.ix). Yet, the Physical Activity and Health Alliance (2007) in Scotland highlighted that physical activity and social influences are much more complex and that age, gender and ethnicity also need to be considered not just social class, as they found that levels of physical activity are relatively consistent across the social classes. The Physical Activity and Health Alliance (2007) suggested this may be due to the high levels of physical activity required for manual jobs and the lack of motor vehicles for more deprived groups, therefore, more walking occurs and a higher level of overall physical activity is undertaken.

Peterson et al. (2006) supported the findings of the WHO Europe (2006) and suggested from their research that when addressing the relationship between being physically active and quality of life, health promotion in particular should focus on those individuals on lower incomes as this group have the most to gain from the promotion of physical activity, as it is a means to improve their health
issues. Overall, it seems that social influence on physical activity is a complex area. Wright et al. (2003) proposed that opportunities to participate in physical activity are affected by class, although, whilst these opportunities are often made available it does not necessarily mean that these opportunities are taken up. Indeed, Tammelin et al. (2003) found that social status was not a predictor of physical inactivity throughout the life course and they suggested that where adolescents in low social class were often associated with being physically inactive, at the age of 31, inactivity was no longer associated with social class. Copeland et al. (2012) highlighted societal values and policies as possible reasons for lack of physical activity in preschool child care centres. They found from focus group interviews that there were three barriers to children’s physical activity: injury concerns, some parents asked staff to restrict their children’s participation due to these concerns; financial; and a focus on developing academically which many of the parents did not feel could be done through physical activity. As a consequence, less challenging and exciting playgrounds are provided for the children. In attempting to ‘protect’ young people it could be argued that these measures may hinder the children’s physical development as well as their motivation to be physically active from an early age. Longitudinal research can therefore, highlight the impact of such restrictions on physical activity within preschool children to their long term physical activity choices and the often unintended consequences of initial interventions.

Of the few long term studies conducted, Barnett et al.’s (2008) 22 year study of physical activity found, similar to previous studies, that class was a significant factor in whether physical activity was undertaken. They suggested the importance of focusing health promotion efforts on lower socio-economic classes. The Physical Activity and Health Alliance (2007) also identified inequalities in physical activity, with those living in the most deprived areas being the least likely to meet the physical activity recommendations, which conflicts the previously discussed BHFNC (2011) findings, although, these deprived areas were not fully defined by the Physical Activity and Health Alliance, (2007). The focus of the Physical Activity and Health Alliance (2007) was specifically in Scotland, but they did however suggest ways, which may be suitable for all areas, to help overcome these inequalities including: “addressing cultural and environmental forces that create” (p.1) the inequalities, [by] developing facilities, access, opportunities and
increasing knowledge to inspire those in the deprived areas to become more physically active (Physical Activity and Health Alliance, 2007). Coalter (2005) challenged the notion of “development initiatives” (p.19) in deprived areas of Scotland as Coalter (2005) found that residents in these areas are “naturally sceptical” (p.19) of these ‘top down’ imposed strategies and that many new schemes are only short term. Coalter (2005) highlighted that it is important to ask those individuals within the areas what physical activity opportunities they would like and to identify if there is expertise already within these communities to run them in more of a ‘bottom up’ approach.

Dowler (2001) within her research into inequalities in diet and physical activity across Europe considered how socio-economic class affected the physical activity levels of children. She acknowledged that social class is difficult to define, however she emphasised the importance of income in relation to choices about food and activity and recognised income as an “important indicator for predicting health” (p. 703). She found that children from lower socio-economic classes (those families with the lowest income), particularly in the UK and Germany, reported taking less exercise, on average, than other children outside of school, even though they may cycle or walk to school because the family does not own a car. The lack of a car for those in low income families has been highlighted above by the Physical Activity and Health Alliance (2007). This is a particularly interesting concept when considering how academics, policy makers and the general public may offer different interpretations of what PA actually means. Recognition of the variety of ways that PA is interpreted was important during the practical stages of this research and particular attention was paid to the different types of physical activity identified within the physical activity questionnaire given to the children. Nevertheless, the differences highlighted by Dowler (2001) in physical activity levels and class, indicate once again how potentially important school can be in terms of providing opportunities for children to be physically active.

2.3.2 Physical activity and gender

The social interpretation of biological sex continues to influence the way sport, physical activity and Physical Education are constructed for girls and women (Scraton 1992). Historically, physical exertion and assertion was considered as
being harmful to girls’ overall development and the social understanding of concepts like ‘motherhood’ dictated that girls were seen as passive carers rather than as active providers (Woodward 1997). Evidence tends to suggest that many of these values are still supported. With regard to the focus of this thesis, such presumptions are limiting and, ultimately, harmful, since they construct social and cultural barriers to participation and engagement in personally beneficial and socially prestigious activities (Bailey, 2005). Concern is greatest during childhood, as early experiences of girls often provide the foundation for future participation (Birrell and Cole 1994, Hall 1996, Oliver and Lalik 2001, Cockburn and Clarke 2002).

Scraton (1992) identified how the early experiences of school sport were important in terms of girls’ future participation. The focus for her investigation was secondary school girls and, in this case, aspects of Physical Education lessons which were initially regarded as lesser concerns for school governing bodies, such as specific uniforms for Physical Education lessons or the standards of showering facilities, were found to be significant in girls’ lived experience of school sports. Nevertheless, the experiences of school sport that the girls reported to Scraton (1992) suggested that social constructions of gender still play an important part in the ways that young people view their bodies and physical activity. Indeed, it could be claimed that the social construction of the sexualised body can be seen to have encroached into younger children’s lives (De Palma and Atkinson 2006, Renold 2007, Wellard 2011).

However, it is important to remember that gender is not only about girls’ bodies but that the discourses of gender often implicate the ways that both boys and girls have access to (or not) opportunities to engage fully in physical activities. As Connell (2008) pointed out, the recent ‘boys as victims’ discourse which has emerged as a ‘reaction’ to the perception that girls are being academically more successful within schools can be counter to addressing broader issues relating to all children. Consequently, it is important to strike a balance and attempt to move beyond a sole focus on gender and explore gender as complex and relational; that is, as always in dynamic relation with age, class, ethnicity, sexuality, cultural and national identity (Evans and Penney, 2002; Azzarito and Solomon, 2005).
Nevertheless, there remains a wide literature that explores the physical activity levels within the context of gender and it is worth mentioning some of these in order to assess their relevance to the research questions posed within this thesis. For instance, Currie et al. (2008) found that amongst eleven year old Scottish children 27% of girls and 40% of boys met the Scottish Executive (2003) recommendations of at least 60 minutes of moderate and vigorous physical activity. Currie et al. (2008) found that the differences in gender continued with fifteen year olds, with only 9% of girls and 21% of boys reaching the same recommendations. Ridgers et al. (2010) considered how boys and girls behaved in the playground and found in their study, that for ten and eleven year old children, girls and boys played differently; in that girls tended to spend time in smaller groups and engaged in more verbal games, conversation and socializing, whilst boys tended to play in larger groups, which were more physically active partaking in games such as football. As this difference in behaviour is key, the thesis research also investigates the physical activity levels of each gender within break times. Bromley et al. (2003) highlighted that there is in Scotland, a gender difference in physical activity levels, however this is greatest during adolescence, with girls’ physical activity levels decreasing with age especially post ten years of age. There have been recent reports of differences in the physical activity levels of boys and girls in Scotland as opposed to England. In the latest 2012 self reported levels of physical activity of children aged 2 to 15 in Scotland, 75% of boys and 72% of girls reported reaching the recommended moderate to vigorous physical activity for 60 minutes, whilst in England only 32% of boys and 24% of girls achieved this (British Heart Foundation, 2012).

Craig et al. (2008) identified that the boys were able to reach, on average, 85 minutes and the girls 61 minutes of moderate to vigorous physical activity per day. Craig et al.’s (2008) research is supported by Health Survey England (NHS Information Centre for Health and Social Care, 2009), which found that most children in England spent approximately 7.5 hours being sedentary per day. When children self-reported their levels of physical activity, Craig et al. (2008) suggested that the younger children under-estimated their levels of moderate to vigorous physical activity and the older children over estimated their physical activity levels, although they do not define the specific ages of ‘younger’ or ‘older’ children. They found that the boys were more active than the girls and, for the
In another study, Barford (2010) explored the introduction of a cheerleading programme initiative to help boys in deprived parts of Leeds become more physically active. This was partially funded by Leeds’ Primary Care Trust anti-obesity programme. According to Barford (2010), 37% of schools (in England) offered cheerleading in Physical Education lessons and this popularity may be in part explained by the appeal of street dance for young people and many recent popular TV programmes which include street dance such as *Glee* (Channel 4), *Step Up and Dance* (Bravo), *Britain’s Got Talent* (ITV), *High School Musical* (Disney) and *So You Think You Can Dance* (BBC). The Leeds cheerleading programme DAZL, Dance Action Zone Leeds (seen on *Wonderland: Boy Cheerleaders* (BBC)) has been used in the city to improve the boys’ physical health, as well as their mental wellbeing, their self-confidence and aspirations. Lindquist et al. (1999) suggested that physical activity of children is multidimensional and that social-cultural or social-economic factors are just one of many influences on children’s activity patterns. It could be claimed, however, that as the focus within this research is upon primary school children within the context of a ‘school day’, the impact of broader social cultural or social economic factors should be less influential, because all opportunities are inclusive and accessible for both boys and girls.

Smith et al. (2004) highlighted that obesity and being overweight was mostly associated with declining levels of participation in sport and Physical Education. They were particularly critical of Government policy that placed greater emphasis on the unquestioned assumption that sport and Physical Education would necessarily solve health related problems. Warren et al. (2003) were able to provide additional support for Smith et al’s arguments by identifying research in
biological and molecular science which showed obesity being caused by a selection of factors, not just lack of exercise. They felt that a key consideration regarding the raising of activity levels was the relationship that physical activity has with gender. Smith et al. (2004) suggested that males were significantly more involved in sport and physical activity than females. Further support is found within the study by Loucaides et al. (2003) portraying a clear distinction in the amount of physical motion produced by boys throughout the school day. However, any comparison between boys’ and girls’ physical activity levels, in the same Physical Education lesson is not mentioned in this study. Research attempting to identify the physical activity levels of a specific gender would be more informative if it were to indicate whether or not girls are, for example, less active in the playground but are still able to match boy’s physical activity levels in the same Physical Education lesson environment. As Pearce et al. (2008) found, physical activity is variable and it is difficult to assess and measure as it tends “to change with days, weeks, seasons” (p.169). Therefore, longitudinal research studies, such as the research in this thesis, are important, in particular within a primary school setting.

Inchley et al. (2005) considered the physical activity levels of Scottish school children over four-yearly intervals between 1990 and 2002, in which they explored the “inter-relationships between gender, age and socio-economic status in relation to physical activity participation” (p.386) using a health behaviour questionnaire, used internationally by the WHO. From their results, they found that girls reported lower levels of vigorous physical activity levels, similar to previous studies in Scotland, who also reported gender differences. Inchley et al. (2005) also found that children from lower socio-economic groups reported lower levels of vigorous physical activity. The researchers suggested that the results pin-pointed those who were particularly at risk of adverse health effects linked to low levels of physical activity and suggested that these groups be targeted by intervention, though they did not suggested the type of intervention that would be most appropriate to these groups. Raudsepp and Päll (1999) explored the physical activity of Estonian primary school children and found that boys self recalled higher physical activity levels than girls; however, with the use of accelerometer data, they found no difference in recorded physical activity levels within the age seven year old group. There was however a difference in the eight
to nine year old groups with the boys’ data matching their self recall data and being higher than girls. This research was only performed over 2 days but with 174 children and shows how important it is to use accelerometers alongside self recall for children. This is just one of the reasons why both these measurement tools were used in the thesis research.

Welsman and Armstrong (1998), like Inchley et al. (2005) considered the impact of family on physical activity levels. They researched 122 families in Exeter and in particular the relationship between five to seven year old children and their mothers. Focusing on the role of parents and especially mothers has been viewed by Cox et al. (2010) as important in terms of investigating the responsibility for mothers’ influence on the children’s physical activity and health behaviour. Welsman and Armstrong (1998) measured these physical activity patterns by recording heart rate over a period of 3 days and found that overall; the children’s mothers were relatively sedentary and did not achieve the recommended physical activity levels for adults. However, there was no link between the mothers’ physical activity levels and those of the children. Many of the children frequently achieved five minute periods of moderately intense physical activity and all children accumulated 30 minutes a day of this physical activity intensity level. Thirty minutes of accumulative, moderate intensity physical activity was also found by Armstrong and Van Mechelen (1998) in similar research. Armstrong and Van Mechelen (1998) found that only a few children were able to sustain 20 minutes of continuous physical activity. They also found that the boys were more physically active than the girls and that physical activity declined with age. Yet, Jago et al. (2010) found that there was a link between the sedentary time of girls and their mothers, but no associations in the physical activity levels.

Interestingly, Welsman and Armstrong (1998) did not consider the impact of fathers or family life as a unit, but just focused on the mothers’ physical activity levels. It could be suggested that there is a need to explore the fathers’ physical activity levels as well as also considering the physical activity levels of siblings and the possible influence of these over the activity levels of children. Especially, given that as Davis and Meyer (2008) found, when considering the sports that the siblings of elite athletes competed in, these siblings all competed within the same sports. They stated that some children relished the idea of competing and being
better than siblings, this raised “enjoyment, progression and willingness to play sports” (p.222). Raudsepp and Viira (2000) investigated the self recalled physical activity levels of 13 to 14 year olds and their parents and siblings and found that “significant others [such as parents and siblings] do exert an influence on adolescents’ participation in physical activity” (p.173). Yet Furman and Buhrmester (1985) warned that sibling rivalry may have the opposite effect and decrease participation and activity levels.

The Health Survey for England (NHS Information Centre for Health and Social Care, 2009), stated that boys aged between 2 and 10 years of age met the physical activity recommendations more if their parents also met the adults physical activity recommendations. Yet, for girls, the activity levels of their parents “made relatively little difference to the proportion meeting recommendations. However, those who had parents with low activity levels were considerably more likely to be in the low activity category themselves” (British Heart Foundation National Centre (BHFNC), 2011, p.2). This highlighted how important parental influence may be in the children’s physical activity level. Though this is not a focus of the thesis research it is important to recognize the potentially strong influence on children’s physical activity. Armstrong (1998) also agreed with Welsman and Armstrong (1998) and with Armstrong and Van Mechelen (1998) in stating that sustained periods of moderate to vigorous physical activity are not characteristic of either children’s or adolescent’s physical activity patterns. The difference in physical activity at this early age (5 – 7 years) between the boys and the girls found by Welsman and Armstrong (1998) was an interesting result, which Hussey et al. (2001) also found to be true of Dublin children aged 7 – 9 years. This is investigated further within the thesis research to see if there is a significant difference in physical activity achieved within a school day between genders and year groups.

2.3.3. Physical activity and modern technology

Another factor influencing lifestyle changes is modern technology. Undoubtedly, modern technology influences lifestyle and may appear to undermine Physical Education (Woods, 2010) as it is considered to contribute to the ‘couch-potato culture’, by increasing the amount of time being static whilst playing video games, whereas Physical Education aims to get the children moving.
However, Physical Education is one subject area where pupils cannot always see tangible evidence of their progress (Woods, 2010). Examples of this can be found in such National Curriculum activity areas as gymnastics and dance (DfEE/QCA, 1999), which may potentially lead to a lack of enjoyment or interest due to not being able to see evidence of progression, as easily as other activity areas. Children can only feel the progression of their own movements, kinaesthetically, not necessarily visually, especially in these activity areas, but with the use of technology it is possible to see your own individual improvement. Thomas and Stratton (2006) suggested that the use of technologies within Physical Education lessons can have a significant impact on motivation and ultimately on enjoyment, which may lead to increases in physical activity. Using a variety of different technologies could ensure that the children found them interesting and become more inquisitive in wanting to use them, enhancing the activity and ultimately (potentially) increasing the levels of physical activity within the Physical Education lessons (Guo et al., 2010).

British Education Communications Technology Agency (BECTA) (2005) carried out a survey and discovered that many teachers were reluctant to use technologies within Physical Education lesson, as they felt that the lessons should be more about ‘doing’ as time for this subject in the primary setting is limited and that practical work should be a priority. Yet, BECTA (2005) recommended that technologies could and should be used to analyse movement skills, movement patterns and whole performances and that they have positive outcomes in the teaching and learning of Physical Education. This is especially important as a current primary school child will grow up in a world that has never been without the internet, nor mobile phones, they will communicate through social networking and taught in virtual and physical classrooms, and will be regarded as being digitally literate (Nehrling, 2009). Therefore, if technology can be used to enhance physical activity then it should be encouraged within and beyond Physical Education lesson.

People use cars to drive more often and further to work, dropping children off at school on the way to increasingly sedentary jobs (Garrad, 2011). Other advances in modern technology mean that the “simplest tasks are becoming mechanised and people do not need to use as much energy to survive” (WHO,
2007, no page number). These factors are contributing to more sedentary lifestyles. This change in daily physical activity levels has had dramatic effects on individual health and wellbeing, with the WHO (2007) estimating nearly 600,000 deaths per year in the European Region being associated with physical inactivity. Oliver et al. (2007b) believed that inactivity was not just a decrease in physical activity, but also an increase in behaviour associated with unhealthy activities such as increased consumption of fatty foods, which the WHO Europe (2006) also acknowledged as a reason for decrease in physical activity. In addition, an increase in unhealthy diets has contributed to “rapid increases in obesity in both adults and children with 22% of men and 23% of women in England now obese” according to DH (2005, p.6).

In a podcast (Britain becoming lazy, 2009) it was suggested that ‘Britain is becoming lazy’ and the impact of technology was highlighted as the reasoning behind this laziness. A third of the respondents suggested that they were “too lazy to run to catch a bus, over half will not walk up two flights of stairs to reach their office” (Britain becoming lazy, 2009), 75% admit they did not get enough exercise and a third of respondents would rather watch a programme on the TV if the remote was broken than get up and change the channel on the TV. The poll was conducted using 2000 adults’ opinions, the questions were multiple choice and therefore, it could be proposed that the responses were lead (or biased) due to the fact that the respondent had to choose one of the predetermined answers in the self-reporting poll. Further, there is no indication of the age of the respondents or where they were geographically situated. However, their results gave a snapshot of physical activity behaviour in Britain, in 2009, although the validity of the snapshot needs to be questioned as only a small amount of the population were asked. It was also suggested within the podcast that the Government was investing £75 million in England to counter obesity levels over the next 3 years, which was vital to ensure that children did not develop habits of sedentary behaviour or physical inactivity.

Nigg (2003) suggested that “technology has contributed to a secular decline in physical activity”. However, he also highlighted that although it was currently untested “technology may have a beneficial impact on physical activity adoption and maintenance in the future” (p.57). Consequently it could also be claimed that
technology is beginning to encourage people to be aware of their inactivity, through the introduction of high tech products that enable people to be physically active within their own home. Recent technology from Nike does just this, through the Fuelband which is described as a sports tested accelerometer which tracks movement and calories burnt during the day. It was advertised as a tool that aided the wearer in being more active by measuring daily activity, recording every move that the wearer makes. The Fuelband could also set target goals to be achieved each day, which were highlighted by a traffic light coding for visual illustration of how close the wearer is to the goal. It had the tag line of being the ‘ultimate measure of activity of sport, of commitment of the entire athletic life’ (Nike, 2012). This is acknowledged as marketing terminology, but is highlighted as an example of how the media is promoting technology and physical activity in 2012.

As discussed previously, Guo et al. (2010) advocated that, by giving the children something ‘new’ to use, their instinct is to want to play with it and experiment with its functions and within Physical Education lessons this may increase the physical activity levels of that child or group of children. Therefore, combining the use of technologies and Physical Education lessons could potentially enhance activity and help children to recognise the importance of their own participation and the participation of others. It will also allow groups to recognise if they have put their learnt skills into practice. Bailey (2001) highlighted many benefits that would not be available without the use of technologies such as the use of photograph and video to replay movement skills and movement patterns for analysis. However, there is a need for this potential enhancement to be longitudinally researched to consider how physical activity is adopted and maintained into children’s lifelong futures (Nigg, 2003) (although this was not the focus of the thesis research). The children, school and class teachers within the case study in the thesis research were not aware, previously, and would not have been aware of the intensity levels of their physical activity if it were not for the use of accelerometers in the thesis research to act as a measurement technology (see section 3.5.1).

Since Nigg’s (2003) publication, games have been developed to incorporate, motivate and increase physical activity levels, for example: the Wii Fit (Nintendo), My Fitness Coach (Nintendo), Kinect Your Shape (Xbox), and Kinect
Zumba Fitness (Xbox). This select range of products allows for a much more interactive method of physical activity than traditional fitness videos. The Wii Fit Plus (Nintendo), now also includes measurements of metabolic equivalents (METs), which was defined as the “energy cost of an activity” (Sports Coach, 1997, no page number) and calorie counts, related to the activities performed within the game. “MET values are assigned to activities to denote their intensity and are given in multiples of resting metabolic rate” (DH, 2004b, p.80). Byrne et al. (2005) identify that, although MET values were first derived from one person, a 70 kg, 40 year old man, that the use of the concept has gained widespread scientific acceptance as a measurement of physical activity.

1 MET was defined by Ainsworth et al. (1993) as the energy expenditure for sitting quietly, which for the average adult is approximately 3.5ml of oxygen uptake per kilogram of body weight per minute; for the 70kg individual, this was 1.2kcal / min. Therefore, 2 METs would require twice the metabolic energy expenditure of sitting quietly. METs are now a “widely used physiological concept that is considered to be a simple procedure for expressing the energy cost of physical activity” (Bryne et al., 2005, p.1112). The METs values are commonly reported on in the UK by DH (2004c) and by the WHO (2010) and the use of METs values as a recording tool for physical activity would be used within the thesis research. Moderate to vigorous intensity is referred to as 3 METs and over (and the measurement benchmark used within the thesis research), and includes activities such as brisk walking, dancing, games and sports, (WHO, 2010). Light intensity is referred to as 2 METs and over, but under 3 METs (and this measurement benchmark will also be used within the thesis research as light physical activity, LPA) and includes activities a short walk round the classroom, going up stairs or playing (Topendsports, 2011). Although the MET-based measurement used in the thesis research was based on a 70kg individual, all the children who participated were of similar stature and weight, therefore, the errors that exist from using this measure were consistent.

The Wii Fit Plus (Nintendo) explains to the user that MET is a measurement of physical activity and the games have different activities to complete that have a different MET rating, so this may raise awareness and promote the amount of physical activity that is targeted per day. A third of the games within the Wii Fit
Plus (Nintendo) are designed to use energy expenditure that is the equivalent to moderate intensity exercise (Smith, 2009) and potentially they could be used with primary school children to help them lose weight and be more physically active (Khan, 2008). For example, one school in Kent in the South East of England (in the same county where the thesis research case study school is set) have started using the Wii Fit (Nintendo) game within their breakfast club to educate children about physical activity and to provide opportunities before school starts for children to access physical activity. The Wii Fit Plus (Nintendo) game has been the first game to be endorsed (Wallop, 2009) by the Department of Health, in that Nintendo has been given permission to use the NHS’s Change4Life logo in its advertising and in shops with the possibility of using it on the game itself from 2010. However, it is noted that the Wii Fit and Wii Fit Plus manufacturer, Nintendo, sponsors the Department of Health’s Change4Life (DH, 2009a) programme with is own money. It may be the case that further research is needed to assess whether these products increase physical activity if they are used consistently and regularly and how this may differ for age, gender and social-economic status.

Foley and Maddison (2010) reviewed and “assessed active video games as a means of increasing energy expenditure and physical activity behaviour in children” (p.7). They found that active video games elicit greater energy expenditure compared to non-active video games; however, the physical activity intensity level was found to be only between mild to moderate, not moderate and above moderate, which is the intensity level recommended by the DH (2005) and WHO (2010) to achieve health benefits. Foley and Maddison (2010) suggested that there is the potential for these games to aid and develop physical activity levels of children but, as suggested previously, further larger studies are required to examine long term benefits for children. Mhurchu et al. (2008) found similar conclusions to Foley and Maddison (2010) and also advised that further research was needed to establish whether playing active video games over a longer time could have positive benefits for children. However, in 2006 the use of video games was seen as a positive way to increase physical activity of children. In all 765 public schools in the state of West Virginia, America, USA a routine was introduced into the curriculum of using active dance mat video games. Within the games “players step on pressure sensitive pads in the order dictated by on screen arrows” (Ashcroft and Snow, 2008, p.53) in time to songs, the associated dance
moves for which have different levels of difficulty and intensity. The participants themselves choose the level. A study from West Virginia University found that this was a way to increase physical activity levels in children (Ashcroft and Snow, 2008). Following the use of video games in West Virginia, in 2007, California Governor Arnold Schwarzenegger supported the introduction of the home version of Dance Dance Revolution (DDR) into all schools in California, and into State Universities as a Physical Education credit option (Ashcroft and Snow, 2008). This introduction into schools and University showed how high this particular video game and modern technology was valued as a key opportunity to increase the physical activity levels of children and adults during school and University time.

Esliger et al. (2010) also examined the impact of modern technology on children by examining the differences in physical activity for children aged between 8 and 13 years old for a period of 7 consecutive days. Their focus was on the physical activity that happened outside school, through the use of Actigraph accelerometers, the same measurement tool that is used in the thesis research. “When applied to the measurement of physical activity, an accelerometer can assess the magnitude and total volume of movement as a function of time” (Cliff et al., 2009, p.559)). The children involved in Esliger et al.’s (2010) comparison study included those who did not have access to modern technology such as those in rural Saskatchewan families and those children who are from the Old Order Amish, or Mennonite families, who as a culture choose not to access modern technology. They found that the children from the Old Order Amish and Mennonite families were more sedentary and were 44% less active than those children who have access to modern technology compared to previous research. This is a surprising result, suggesting that modern technology has a positive factor on children’s physical activity, linking to the potential of such products as the *Wii Fit Plus* (Nintendo). The downside to the advantages of these new technology related activities may be that the lower socio-economic classes that would most benefit may have least access to them due to the costing of such items. This is an interesting result and it is important to note that the children who participated within the thesis research were from the same socio-economic background and all of whom had access to modern technology.
2.3.4 Physical activity and the media

According to Wright et al. (2003) “health promotion and movement science research literature has been dominated by concerns with the amount and kind of physical activity participated in by young people” (p.17). The emphasis of media and local campaigns has been to encourage families to be more physically active. Campaigns such as Change4Life (DH, 2009a) encouraged parents to consider how well their children were at being physically active and whether they were ‘Eating well, Moving more’, suggesting that if the family were doing both of these they would Live Longer (DH, 2009a). It is described within the Change4Life guidance (DH, 2009a) as not just a campaign, but a societal movement to change the behaviour of the people of England (DH, 2010). Whilst Winsley and Armstrong (2005) highlight in their review that many studies have reported that overweight or obese children tend to be less physically active, some studies have shown no significant differences in the physical activity levels of overweight or obese children and leaner children. They suggest a need for a multidisciplinary approach, as was suggested by the Change4Life scheme (DH, 2009a). This scheme examined not only being more physically active, but also what diet and behavioural changes could be made to help children continue with physical activity into later life. In terms of primary school this can be achieved through a whole school approach which will be discussed in more depth in section 2.9.

Kirk (2006) stated that it is “widely reported in the media that levels of fitness and physical activity in children are low and declining” (p.123). However, Harris and Cale (2007) suggested that fitness test data provided little evidence that children’s aerobic fitness levels are low or have declined. This was, however, partly due to the difficulties in measuring children’s aerobic fitness and consequently data on children’s fitness should be viewed with caution. Green (2004) argued against the media’s reported views of declining physical activity levels and stated that evidence since the 1980s has shown an increase in opportunities for participation in physical activity and high proportions of children willingly taking up these opportunities (Green, 2004). There have been numerous policies that have been produced with a focus on physical activity, by a variety of different Government departments. These have included (to name a few) the call to action of healthy lives and healthy people (HM, 2011), the call for physical activity increases through increasing participation in sport (DCMS and Strategy
Unit Cabinet Office, 2002) and the call for increasing physical activity by focusing on learning through Physical Education and Sport (DfES and DCMS, 2002). However, interpretation of the policies is difficult as these take time to implement effectively in (for example), a primary school setting. Trost (2006) continued to also confirm Green’s (2004) viewpoint that there was an increase in activity and participation levels and suggested that a large proportion of children and adolescents meet the recommendations for daily participation in physical activity. However, Trost’s 2006 data set was produced from a large population self-reporting survey. Thus the accuracy of the data could be questioned as it is known that populations tend to respond in a positive or media influenced manner when questioned for a survey (Cohen et al., 2007) and also there are difficulties in self recall and accurately reporting, as Kolle et al. (2009) highlighted, (discussed further in section 2.2).

2.4 Physical activity and children’s obesity levels

Physical activity, or in fact the lack of physical activity (sedentary behaviour) is at times linked to obesity levels, in particular with children. Therefore, these two areas will be examined as well as the measurement tool of BMI that is often used to measure obesity. (It is acknowledged that the focus of the thesis research is not on children’s obesity levels, but on their physical activity levels). Kirk (2006) emphasised the need to define terms and importantly questioned, the difference between obesity and being overweight. As Evans (2003) advised, there has been a ‘slippage’ between the uses of the terms overweight and obese but, each referred to a totally different concept. Obesity was defined as an excess of fat, whilst overweight was defined as body weight in excess of a fixed standard. Evans (2003) felt that the slippage in these meanings, in relation to health, was regularly apparent within health and scientific communities. There is currently much debate surrounding the level and extent of children’s physical activity. “Today’s generation of children will be the first for over a century for whom life expectancy falls” (Hills et al., 2007, p.533). The proposed reduction in life expectancy has been linked to obesity and with it concomitant health problems. The DH (2004b) speculated that by 2020 one in two youngsters will be obese. Once children have become obese there is the suggestion that there is a tendency for their levels of obesity to continue into adulthood, which then links to life threatening diseases that in turn impact on Health Services. The prediction that
obese children are likely to become obese adults was suggested by Zaninotto et al. (2006), alongside a forecast that one in five children (one million, in England) by 2010 will be obese, (DH, 2006), representing an increase of 9.6% in boys and 10.3% in girls in England over the last 15 years. According to the Health Survey for England (NHS, Information Centre for Health and Social Care, 2009), 30% of children were overweight or obese. It was projected that if the trend continued, by 2050 nine out of ten adults will be overweight or obese (Government Office of Science, 2007), whilst in 2011(b), Roberts suggested that one in 10 children in England was obese, not as extreme as predicted by Zaniotto et al. (2006). However, the statistic of one in five children being obese was reported in the county where the case study school is situated by Beard (2011). The global issue of obesity (‘globesity’, Howells, 2011, p.119) is now such a prominent feature within society that increasing pressure has been placed upon the education system and in particular upon primary schools to rectify this serious problem (Waring et al., 2007).

Aicken et al. (2008) highlighted that “the UK government identified obesity as a policy priority and set targets to halt the year-on-year rise in childhood obesity by 2010” (p2). This priority policy however, took almost four years to get underway and in 2008, the Government recognised “obesity reduction as a national priority and set out an aim to reverse the current obesity trend” (Aicken et al., 2008, p.1), reducing the number of obese children, by 2020, to the same level as that of 2000 (Kalra and Newman, 2009). Even though the Government had now set obesity reduction as a priority, costing £372 million within the ‘Healthy Weight, Healthy Lives: A Cross Government Strategy for England’ initiative designed to help everyone lead a healthier life, two years on since the start of the strategy the obesity rates are still too high, according to the Cross-Government Obesity Unit (2010). However, the prevalence of obesity and overweight children is beginning to stabilize and level off stated the Cross-Government Obesity Unit (2010). It has recently been reported by Green Heritage (2010) and by Townsend (2010) that children as young as 10 are showing early signs of heart disease due to obesity and advice for local health care districts is now to measure children’s BMI twice during primary school, once at four or five years and again at ten or eleven years, with the idea of helping families reverse the levels of obesity if required. However, the report does not suggest how this reversal can be assured.
Yet again, despite knowledge of the difficulties of BMI and it not being a suitable measurement to be used for children, it is being used again within policy initiatives. Kalra and Newman (2009) further suggested research is required to understand the “dynamics of weight gain amongst young people... to design effective policy solutions” (p.1). This understanding would help ensure that effective solutions could be sought and implemented for all school aged children.

Researchers (Al-Nakeeb et al., 2007) in Birmingham investigated the “precise estimate” (p.1) of both physical activity and body fatness in primary school children. They completed their research in four different schools, all within the same catchment area. Heart rate monitors were used continuously for 12 hours a day to record frequency, intensity and duration of physical activity. The children’s percentage of body fat was assessed using an air displacement plethysmography. They found that over their three separate recording days 52% of children did not achieve a single 15 minute bout of moderate physical activity, although, Gilson et al. (2001), WHO (2010) and O'Donovan et al. (2010) all suggested that physical activity could be accumulated and did not have to be completed in single bouts of 10 or 15 minutes. Al-Nakeeb et al. (2007) also found that girls were significantly fatter than boys. From Al-Nakeeb et al.’s (2007) length of data collection, it could be proposed that the time frame is short and, similar to Duncan et al. (2007) provided a snapshot of these children in Birmingham at the time of the research. Their results were also slightly surprising because the children knew they were being monitored and, unlike Fairclough and Stratton’s (2005) work, in which they suggested that being monitored prompted a potential increase in physical activity for some children, no such increase was seen. Al-Nakeeb et al. (2007) did, however, find that the children were more physically active during weekdays than at weekends, yet they did not highlight the lessons that were undertaken during the weekdays at school. These results though, provided hard evidence (the notion of hard evidence has been suggested by Mortimore (2000)) and have implications for Physical Education lessons within school as being a potential place where the children could benefit most from initiatives to improve health and physical activity; as potentially for some children the Physical Education lesson may be one of the few physical activity opportunities that they have within the day. Al-Nakeeb et al. (2007) suggested that the decline in physical activity levels in young children appeared to relate to the combination of a high prevalence of obesity / being
overweight and a reduction in participation in organised sport or family activities. This research suggested the need for further research in the form of a longitudinal study to establish whether the initiatives implemented to improve health and physical activity within school time have an impact on physical activity and the body fatness of the children.

The EarlyBird team (2010) in Plymouth measured over 200 children at various points during 3 years and found that “physical inactivity appears to be the result of fatness rather than its cause” (no page number) and suggested that this may explain why increases in physical activity and physical activity programmes have not shown reductions in obesity levels (Brimelow, 2010). The focus, the EarlyBird team (2010) suggested, should be on nutrition rather than exercise, whilst Haslam (2010) from the National Obesity Forum, in response to the EarlyBird team (2010) research, warned that wider health benefits of physical activity not be overlooked, such as increases in self-confidence, concentration and academic performance, as discussed in section 2.7.1. Cavill et al. (2001) however, had a similar view to Haslam (2010) and maintained that it was important to promote children’s participation in physical activity as they believed this would lead to a reduction of childhood obesity. They also suggested that the choices children make to be physically active will continue into adulthood. Yet, the DH (2004b) suggested that there was “only weak to moderate evidence that participation in physical activity tracks through from childhood to adulthood” (p.31). Longitudinal research needs to be completed to support either of these claims.

During Tony Blair’s second term in office as Prime Minister (2001 – 2005), he pledged £1 billion of public money to be spent on interventions and initiatives to aid school Physical Education and reduce the obesity levels of children and young people. However, health based physical activity initiatives have remained marginal in the UK, USA and Australia (Bull and the Expert Working Groups, 2010). Kirk (2006) highlighted that physical educators find difficulties in improving children’s fitness “given class sizes of 30 or more, [and] the need to apply principles of progressive overload within individualised exercise programmes and efficacy of fitness testing for monitoring and motivational purposes” (p.127). According to Waring et al. (2007), the prevalence of obesity in childhood was due to the levels of activity that children exhibited, whilst Story (1999) previously
referred to school being the ideal setting for physical activity to take place. The idea that school is the vehicle for physical activity to help reduce children’s levels of obesity is also supported by Hills et al. (2007), Reilly and Dorosty (1999), Chinn and Rona (2001) and Rudolf et al. (2001). Waring et al. (2007) suggested that the place for children to be physically active is within Physical Education lessons and that primary schools have the potential to be good settings to promote children’s physical activity. Harris and Cale (2007) and Gregory and Lave (2000) supported this assertion that Physical Education lessons were one of the ideal places for physical activity within the school day. Sollerhed and Ejlertsson (2008) agreed with Waring et al. (2007) and recommended expanding the time allocated for Physical Education lessons, with a particular focus on aerobic fitness. If physical activity levels were increased per day this could then be “effective in combating BMI increases” (Sollerhed and Ejlertsson, 2008 p.102). Yet, the question remained if such physical activity levels were improving within Physical Education lessons were these reflected in falling levels in obesity?

2.4.1 Physical activity and sedentary behaviour

Interestingly, Biddle et al. (2003) proposed that active and sedentary behaviour could be seen in the same individual and are possibly even commonplace. Craig et al. (2008) suggested that sedentary behaviours are “associated with increased risk of obesity and cardiovascular disease” (p.5). However, Metcalf et al. (2011) proposed from their longitudinal research that “physical inactivity is the result rather than the cause of obesity” (p.942). Craig et al. (2008) also informed that in England, physical inactivity was estimated in 2002 to cost the NHS £8.2 billion a year. Craig et al.’s (2008) research consisted of self-reporting of physical activity levels from the previous week for children and for the previous four weeks for adults. Adults were also selected to measure their physical activity levels with use of accelerometers over a period of one day or four days. (Both measurement tools are used in the data collection of the thesis research). Craig et al. (2008) found that men “had significantly longer periods of sedentary time per day, on average, than women” (Craig et al., 2008, p.6) and when the accelerometer results were compared to the self-reporting, it was found that the majority of respondents over estimated their physical activity levels. From the children’s accelerometer data, they found that sedentary activity accounted for the majority of their time. Hill et al. (1994) identified that physical activity could
help prevent moderate obesity in some individuals whilst in others inactivity contributed to the development of obesity. Marshall et al. (2004) agreed with the dilemma over the ultimate effect of physical activity in their conclusion that a relationship existed “between television viewing and body fatness among children” (p.1246). However, they felt that this lacked clinical relevance and that factors affecting body fatness are complex and increases in body fat could not be accounted for by a single factor. There is the need to consider other factors, for example, whether women and men eat and drink different food or at different times of the day and do these factors also affect body fatness (Marshall et al., 2004).

2.4.2 Physical activity and the use of BMI

Butland et al. (2007) measured obesity through the use of the body mass index (BMI). There is considerable criticism about using this index to measure obesity because it compares weight to height and it does not take into account the percentage of body fat or the percentage of muscle in a person. For example someone who has a lot of muscle may have a BMI level that is outside of the healthy range, some professional rugby players or American football players find themselves as being obese within the BMI index despite them having very little body fat (Oswald, 2007). With children the criticism has a slightly different focus, as BMI does not take growth into consideration. As children grow at different times, a child who may be quite muscular and very tall for their age, may be regarded as obese, but if they were the same height and weight, but two years old, may be regarded as slim and within acceptable limits. Therefore, it is important that aspects of nutrition and activity need to be included within the whole education process to ensure that children understand ‘being healthy’, this may be delivered in some primary schools within Science, or within Personal Social, Health Education or may be within the teaching of knowledge and understanding of health and fitness within Physical Education. Teachers, parents and children also need to know the implications of using such measures as BMI to indicate their ‘fatness’ or obesity levels and how it relates to their health.

Marshall et al. (2004) reported that there were serious limitations in terms of the methodology in measuring children’s body fat by using BMI. They suggested that it was particularly difficult with children and this was a key factor, when considering the range of BMI as norms for an age group. We need to consider
whether maturation age should be used versus the chronological age of the child. Maturation age is difficult to assess accurately, which means that the obesity indicators may be unclear and predictions of children getting fatter may not be accurate. Classifying a child as obese by these uncertain measures could have a potentially detrimental, negative or adverse psychological effect on the child (Biddle and Mutrie, 2002) which could cause undue concern for the child and for the parents / carers. Examples of these psychological effects on parents can be seen within the comments section of the NHS National Child Measurement Programme (2012) website, on which parents have expressed their opinions and feelings of their children being labelled as overweight or obese and also being told they must do something about it to improve their child’s life and health.

BMI was not used within the thesis research due to these reliability issues, and the focus was on the physical activity achieved by the children and no predictions nor suggestions relating to obesity levels, have been formulated. Armstrong and Welsman (1997) acknowledged the arguments about the confounding influence of the maturational age on any measurement of children’s fitness such as BMI and felt that physical educators and clinicians should begin the discussion about the types of health related physical activity that children should participate in. This is especially important as health is continually viewed, as Green (1998) suggested as a by-product of participation in games dominated programmes within Physical Education lessons. This then questions whether children should participate in non-games programmes, such as, gymnastics, athletics, swimming and dance, within Physical Education lessons, as these programmes are not directly linked to improvements in health, if the aim of Physical Educations lessons is to improve children’s health (Green, 1998). However, Doherty and Brennan (2007) viewed that a physically educated child is more than just developing physical well being, such as health benefits, but also to the develop child’s social, moral and emotional wellbeing within Physical Education lessons. Therefore, physical educators should not just focus on health related physical activity within Physical Education lessons. Gard (2004a) questioned whether Physical Educators should accept the proposed shift of focus towards physical activity within Physical Education and the insistence that they alone can provide the solution to the obesity problem. Kirk (2006) suggested that there was a shift within Physical Education from exercising and receiving fresh air,
good nutrition and sanitation to decreasing the risk of diseases associated with sedentariness. Physical Education is not the only opportunity or place within the primary school setting for physical activity to occur. The thesis research examined whether there were other opportunities or places within the school day for physical activity to take place, such as break times and lunch times. The focus of the thesis research was on physical activity, not on the levels of obesity of the children.

2.5 Physical activity of children in the local area

The thesis research school is set within the county of Kent, in South East, England and therefore, it was important to examine the local impact of children’s physical activity levels. According to the Kent NHS Overview and Scrutiny Report (KNOSR, 2006), “In Kent and Medway, obesity is more prevalent than in the South East as a whole; but it is only marginally more prevalent in Kent and Medway than it is across England as a whole” (p.20). Leake (2011) reported that 30% of adults are obese in Kent and Beard (2011) reported that one in five, ten to eleven year olds in Kent and Medway are obese; however, these statistics are based on BMI, which as discussed in the previous section is not an ideal measurement to be used with children. The DH (2005) stated in ‘Choosing Activity, a physical activity plan’, that “three out of ten boys and four out of ten girls” (p.13) in England are insufficiently active enough to benefit their health, though they did not state how this had been measured, the document also stated that “16.6% of boys and 16.7% of girls are now obese” (p.13). These data were from the Health Survey England (DH, 2002). Aspects of nutrition and activity can be included within the primary curriculum (as in Kent and Medway in the South East of England) in such areas as Science, in particular Sc2 life processes and living things, (DfEE/QCA, 1999) Personal, Social and Health Education and, at times, within the knowledge of health and fitness strand of Physical Education (DfEE/QCA, 1999). This is to ensure that children understand ‘being healthy’, one of the outcomes of the Every Child Matters agenda (DfES, 2003) (discussed further in section 2.6.3).

In 2005 the Kent Survey of Health and Lifestyle (Palmer et al., 2006) was completed to consider physical activity and BMI levels within the local area. Both of these measurement tools have been critiqued in this chapter (sections 2.2 and 2.4.2). The Kent Survey (Palmer et al., 2006) was a self reporting postal survey of
22,861 people, with a response rate of only 27%. From the data, the results showed that there was an average increase from the 2001 Kent Survey of 1% in the number of adults in Kent who are obese and a 15.6% increase in the level of obesity. If the results from the survey are compared to England 2004 data, it shows that Kent people were “less likely to be obese than in England as a whole” (p.3). Yet, this was in contrast to the data collected by KNOSR (2006). However, the data from Kent was self-reported and it could be suggested that a certain type of person would return a postal survey, in that they were happy to report on their personal physical activity levels. Therefore, the results may be questioned in terms of their reliability and validity with regards to whether they accurately reflect the physical activity levels and the obesity levels of people in Kent or beyond. The result may have been subjective or may have had a level of subject bias within them and consequently may not give a true reflection (Cohen et al., 2007) of the people of Kent whilst the England data were taken from direct measurement (Palmer et al., 2007).

From the physical activity data of the Kent Survey (Palmer et al., 2006), 72.5% of the respondents described themselves as physically active at least some of the time, whilst 21.3% described themselves as not active. When linking the responses to the recommended target for adults of being physically active to at least a moderate intensity level for 150 minutes (WHO, 2011), ideally in periods of 30 minutes per day at least 5 times a week, only 23.5% of the respondents described themselves having reached this level and duration of physical activity (Palmer et al., 2006). For adults, the WHO (2011) recommended these activity levels should occur within bouts of at least 10 minutes. However, when Palmer et al. (2007) compared the Kent Survey (2005) results to the results of the 2001 Kent Survey, women’s physical activity levels had increased. Palmer et al. (2007) highlighted that overall the number of respondents being physically active was a relatively low percentage, especially when the respondents could potentially be regarded as a group of people, who may be more likely to be comfortable with their physical activity levels, leading to them responding to the postal survey and answering questions on their own physical activity levels. Another interesting result of the survey was that on the question of whether they achieved the levels of recommended physical activity, 16.3% of the people surveyed did not respond. This is one of the disadvantages of using a postal survey (Thomas et al., 2011) as
it would have been interesting to complete follow up research on why some answers were not responded to within the survey. Did the respondents not know what the recommended physical activity levels were, or did they just not want to disclose, due to them not meeting the targets and not wanting to admit it?

### 2.6 Physical activity and Physical Education lessons

As one of the research questions of the thesis research is what contribution do Physical Education lessons make to primary children’s physical activity levels, it is necessary to review within this section: physical activity and Physical Education lessons; previous research into physical activity levels within Physical Education lessons; the physical activity levels in Physical Education lessons in the local area; and the link between physical activity, Physical Education lessons and the Every Child Matters agenda.

Cale and Harris (2006) claim that it is important to offer physical activity to all children. Green (2002) emphasised the importance of Physical Education and suggested it was the most suitable “vehicle” (p.97) for the encouragement of a lifestyle which is both healthy and physically active. Rink et al. (2010) suggested that “Physical Education programs are now designed to prepare students to be physically active” (p.49) so that the pupils will be physically active within Physical Education lessons and outside the class. It was also suggested by Rink et al. (2010) that the role of the teacher was to ensure that this physical activity was being achieved by the pupils. The WHO (2008) suggested that increasing the number of Physical Education lessons the children have, was the most direct way to increase children’s physical activity, however this was assuming that Physical Education lessons were about being active (Howells, 2012b). Physical Education lessons have also been targeted by the Department of Health (DH, 2005) as being a prime outlet for increasing childhood physical activity and reducing levels of obesity. This view of the Physical Education lessons as being the place for focusing on health was echoed when Mayall et al. (1996) identified in their survey that children and teachers thought that Physical Education lessons were health focused. Fairclough and Stratton (2006a) also proposed that Physical Education lessons could be considered purely as being opportunities to get children physically active (cited in Howells et al., 2010b).
The School Sport and Young People Strategy in England (DH, 2009b) aimed to provide all children with at least five hours of sport every week, which included two hours of Physical Education lesson time. Although a self reported measurement there has been a significant increase from 34% in 2003 / 2004 to 78% in 2007 / 2008 in the number of children reported to be taking part in two hours or more of curricular Physical Education lessons in England and an increased provision for Physical Education lesson time in primary schools (British Heart Foundation, 2009). Physical activity, fitness and obesity are very complex concepts and although obesity levels are not the focus of the thesis research, it is acknowledged that there is often the link between reducing obesity and increasing physical activity levels (Reilly and Dorosty, 1999; Chinn and Rona, 2001; Rudolf et al., 2001). However, as previously highlighted, there was no attempt to measure the levels of obesity of the children within the thesis research as the focus of the thesis research was on physical activity levels.

Sallis and Owen (1999) suggested that Physical Education lessons provided the main opportunity for physical activity for many young people. Murphy and Ní Chroinin (2011) agreed and highlighted that Physical Education lessons were a vital part of the child’s life in school, as Physical Education lessons may be one of the only places within the curriculum where a child can “learn in and through movement” (p.142). However, primary Physical Education is not just about being physically active, but about developing and educating the child physically, in a holistic manner (Doherty and Brennan, 2007) and about developing basic skills and movements (Jess and Dewar, 2004). Hellison and Templin (1991) suggested that social learning should be a particular focus within Physical Education lessons. Fairclough (2003) agreed and recognised that the goals of secondary Physical Education lessons were very similar to those found at primary and include development of motor skills, creative and artistic expression, moral, social and self-development. Murphy and Ní Chroinin (2011) also suggested that wider global and environmental issues can be explored within Physical Education. Aicken et al. (2008) who had similar viewpoints to Waring et al. (2007) highlighted that the global concern of rising rates of obesity suggested that it is of widespread concern, not only in the UK, but also internationally. However, the concern of rising obesity levels “is not yet matched by either a clear map of interventions provided for children and young people or a robust evidence base on the
effectiveness of interventions” (Aicken et al., 2008, p.2) in particular within a primary school setting. Yet, Kirk (2006) reported prior to Hills et al. (2007), Waring et al. (2007) and Aicken et al. (2008) that the obesity crisis being experienced “is almost entirely without foundation” (precedence) (Kirk, 2006, p.121). He acknowledged at the same time, that it was “increasingly difficult to resist calls for Physical Education lessons to be held accountable for children’s health” (Kirk, 2006, p.121).

Kirk (2006) reflected on Johns’ (2005) work and suggested that “when children are mentioned in the obesity crisis discourse, school Physical Education lessons are implicated immediately, both as a source of and as a possible solution to the problem” (Kirk, 2006, p.122). McMinn et al. (2010) provided support for this reflection by suggesting that “school settings have been identified as key social establishments in which to promote physical activity, particularly through the medium of school clubs and Physical Education lessons” (McMinn et al., 2010, p.68). In Illinois in USA, it has been state law since 1957 for children aged 3 – 18 to have mandated daily PE, though space, staffing and finances are making this harder to achieve (Gill, 2012). Cox et al. (2010) echoed the suggestion that schools may be “attributed responsibility for children’s physical activity” (p.46), in a number of ways due to the school being able to provide “access to equipment / facilities, number of Physical Education hours, time outdoors, trained / supportive staff”. Trost (2007, p.1) also suggested that “schools serve as an excellent venue to provide students with the opportunity for daily physical activity”. But he also highlighted that this is often not the case and that “most children get little or no physical activity in school” (Trost, 2007, p.1) therefore, impacting on the child’s physical development health and wellbeing. Tremblay et al. (2005) and Copeland et al. (2005) proposed that children’s physical activity levels had declined over time. Parker-Pope (2008) also highlighted that as children grew, activity quickly slowed, Rowlands et al. (2008, p.26) suggested that decreased physical activity levels had “led to an increased focus on the quantity and quality of physical activity that children experience in school Physical Education lessons”. Rowlands et al. (2008, p.26) continued and highlighted, however, that there has also been a decline in the amount of timetabled Physical Education lessons within English schools due to increased pressures from other areas of the curriculum. This had meant that there had been increased pressure on Physical Education lessons to
deliver the “optimal opportunity for participation in physical activity”….. and also to have encouraged “physical activity outside of class time” (Rowlands et al., 2008, p.26).

Physical Education within school is not about tackling the obesity crisis, (DfEE/QCA, 1999). Simons-Morton et al. (1994) did emphasis the importance of Physical Education lessons for those who do little or no physical activity outside of these lessons or outside of school. They suggested that substantial amounts of physical activity could occur within Physical Education lessons (Simons-Morton et al., 1994). Yet, according to Howells (2011) Physical Education “should encompass individual physical development, health and wellbeing” (p.119) and had a crucial role in primary school education, as it was much more than just simply providing exercising opportunities for every child. Within primary school, children are at a stage where habits, likes and dislikes are formed (Howells, 2012a); therefore, Physical Education is more than just the act of being physically active. Yelling et al. (2000) prior to Howells (2012a) suggested that physical activity was “only one consideration of Physical Education lessons and the National Curriculum for Physical Education” (p.62). The aims of the National Curriculum for Physical Education (DfEE/QCA, 1999) encompassed promotion of the pupils’ spiritual, moral, social, cultural and academic development. The Every Child Matters (ECM) agenda (DfES, 2003) ‘being healthy’ outcome also links to the National Curriculum for Physical Education, within the fourth strand of the programme of study ‘knowledge and understanding of fitness and health’ where children are taught the importance of being active and healthy (DfEE/QCA, 1999). However, it was noted that at the time of writing it was currently unknown whether the new coalition Government are to continue with the ECM agenda (DfES, 2003), although the ECM agenda continues in primary schools, including the school in which the thesis research was set.

Learning about the benefits of physical activity within Physical Education lessons can help aid a “positive attitude towards a healthy and active lifestyle” (Yelling et al., 2000, p.62). Through a whole embodied education process (Doherty and Brennan, 2007), the child’s attitudes and interests in physical development and physical activity can be fostered and an understanding of the importance of a healthy lifestyle can be imparted, rather than simply providing
exercising opportunities for every child. The Physical Education Review Group in Scotland (2004) recommended that through a positive attitude and emphasis on engagement this would improve participation and physical activity levels. Rose (2009) in his primary curriculum review suggested taking an inclusive stance, that encouraged all “….young people to become: successful learners who enjoy learning, make progress and achieve; confident individuals who are able to live safe, healthy and fulfilling lives; responsible citizens who make a positive contribution to society” (p.177). This was a considerable amount for a teacher to be able to achieve within 2 hours of Physical Education a week, especially if they are not a Physical Education specialist. Stewart (2008) reported that 40 per cent of newly qualified teachers going into primary schools will have had six hours or less initial teacher training for Physical Education, if they have not opted to become a specialist in Physical Education and they may have little opportunity for further specific Physical Education training. Yet the newly qualified teachers will still be expected to know and deliver all of the benefits of Physical Education lessons to the children in their class.

Price (2008) believed that these benefits of Physical Education to the whole child were not to be under-estimated. He suggested that Physical Education played a strong role in children’s ‘physical, social, affective and cognitive development’. Alder (2000) identified enjoyment as the key to children’s learning, with Hirt and Ramos (2008) suggesting fun as being potentially the central focus of Physical Education lesson. Yet, the National Association for Sport and Physical Education (2005) identified that fun is a subjective principle. They highlighted that fun is “not a widely accepted goal or objective” (p.26) and nowhere within the National Curriculum for Physical Education (DfEE/QCA, 1999) was ‘fun’ defined as an expected outcome. Dismore and Bailey (2011) suggested that “fun has not always been considered an appropriate outcome of Physical Education” (p.499). Just because a child is having fun, does not in itself guarantee that progression is being made in the learning or in the child’s physical development. At best, Physical Education lessons can play a role in shaping the character of a child, forming a supportive, honourable, considerate, individual (Flemming and Bunting, 2007). Children may be able to create and consolidate friendships through using communication skills to construct and develop positive relationships (Flemming and Bunting, 2007). Raymond (1998) highlighted that requiring ‘silence’ and an
inherent lack of communication in Physical Education lessons is a misconception. He suggested that there was rarely a need for silence, though it was often used as a tool, or demanded within the lessons, by teachers who were lacking confidence and wished to feel in control of the learning environment within Physical Education. It is important that children have a positive experience of Physical Education during school from primary onwards to increase confidence and, in particular, self-esteem. Pupils will then understand the benefits of regularly participating in physical activity and will be comfortable about wanting to continue with such activities throughout life. Therefore, there is a need for positive, motivated and enthusiastic role models, in particular the class teachers within a primary school setting (Howells, 2007).

Jennings-Aburto et al. (2009) discovered that in primary schools in Mexico City the only opportunities for children to participate in physical activity were during playtimes and Physical Education lessons, highlighting how vital Physical Education lessons could be for children. However, Physical Education lessons only occurred once a week in the primary schools in Mexico City. They acknowledged Physical Education lesson were a place for physical activity to occur, yet questioned the inclusiveness of the Physical Education lessons that were observed and whether all children would be able to access vital physical activity opportunities. They suggested that schools should be increasing both the “quantity and quality of physical activity, especially during playtime” (Jennings-Aburto et al., 2009, p.141). Cardon and De Bourdeaudhuij (2002) also recommended that school and in particular Physical Education lessons and playtimes, were ideal opportunities for promoting physical activity and could promote an “active lifestyle” (p.5) during school time. Yet, limited Physical Education time or “limited promotion of physical activity outside” (p.5) of the Physical Education lessons meant that children may not reach the daily recommended physical activity target.

Wang et al. (2005) contrary to Jennings-Aburto et al. (2009) found that time within Physical Education, in their opinion was wasted with less than 70% of the total time of a Physical Education lesson being active. They had assessed the children’s physical activity levels through the use of heart rate monitors. However it is important to consider that if the child being recorded is unfit or unskilled then
their heart rate will increase quickly and will remain high upon starting activities, therefore, it is important to consider the ability and fitness of the children too. Wang et al. (2005) reported that, on average, 14.4 minutes of a 45 minute Physical Education lesson was spent in moderate to vigorous physical activity and 6.7 minutes of the same lesson was spent at a vigorous physical activity level, so a total of 21.1 minutes of the 45 minutes was spent at moderate or vigorous physical activity levels. Yet, they do not highlight how much physical activity was at a light or static level, which might be the level of physical activity required for evaluation and analysis of performance the latter are requisites of the National Curriculum for Physical Education (DfEE/QCA, 1999). Wang et al. (2005) suggested that improvements were needed in Physical Education lessons, with further emphasis upon encouraging children to engage in more physical activity being required, including speeding up getting changed into Physical Education kit to allow more time for physical activity opportunities to occur during the Physical Education lesson. However, they do not mention, or record in their original research how long it took the children to get changed, nor did they divulge the strategies that were used to encourage the children to get changed more quickly. From an early years’ developmental viewpoint (DfE, 2008), getting changed and re-changed are, in fact, life skills that are important for the child to learn and develop. These life skills help with overall fine and gross motor skills (Gallahue, 1996) and the overall physical development of the child. Therefore, the opportunities should be valued and not necessarily always rushed.

Sit et al. (2007) recommended that improvements in the frequency and intensity of Physical Education lessons were needed when they examined the physical activity levels of children within special schools. They also suggested more physical activity opportunities within break and lunch times were needed to help the children reach recommended physical activity levels. Nevertheless they did not offer suggestions as to what these opportunities should be. The Tell Us4 Survey (National Foundation for Education Research, 2010) reported on the activity levels of boys and girls in year six, eight and ten (aged ten, twelve and fourteen) within the Wolverhampton area (UK) during lessons, break times and after school. They found that boys reported more activity levels in all three settings with 47% of boys and 26% of girls reporting that they were active during break times. 26% of boys and 15% of girls reported that they were active during
lessons and 42% of boys and 30% of girls reported that they were active every day after school. However, the lesson time did also include Physical Education lessons and the survey was based only on a self-report questionnaire, which as a method, has many limitations, as Kolle et al. (2009) noted that children found it difficult to accurately recall, (as discussed in section 2.2). The Tell Us4 Survey (National Foundation for Education Research, 2010) did not follow the self-reporting questionnaire up with other measurement tools to record the activity levels within each of these time areas. This however would be completed within the data collection of the thesis research.

Kirk (2006) in his critical examination of the obesity crisis highlighted the range of competing and contributing factors, suggesting that it was “manufactured not through a conspiracy of scientists and politicians but instead through a complex process of social production of knowledge” (p.122 – 123). In other words, any research exploring physical activity needs to be mindful of the multiple ways in which physical activity is, in fact, constituted. This has bearings upon how physical activity is investigated. For instance, Mallam et al. (2003) found in their comparative research of physical activity levels measured by accelerometers in three different schools, that the amount of physical activity did not depend on how much Physical Education was timetabled and suggested that children compensated for this with the physical activity they completed outside of school. Cawley et al. (2007), in contrast to Mallam et al. (2003), researched children in America and found that increasing the number of Physical Education lessons completed by the children increased the physical activity of girls, but they found no evidence that Physical Education lessons “lowers BMI or the probability that the student is overweight” (p.1287) and felt that Physical Education should not be used as part of an “anti-obesity initiative” (Cawley et al., p.1287).

Dale et al. (2000) investigated the activity of pupils throughout the school day and stated that the “opportunities for children to be physically active during school time are sparse and becoming increasingly so” (p.240). The American school in which Dale et al. (2000) carried out his investigations had two days a week in which there was no physical activity within the school day and the majority of these two days were spent in front of computers or laptops. However, Dale et al. (2000) still found that on days where physical activity was promoted,
opportunities for activity were sparse. This may be due to physical activity not being a consistent component of the curriculum in the school so the children were not necessarily used to taking advantage of physical activity opportunities that were available to them. It may also have been the case that the teachers did not promote or encourage children towards physical activity as much as they could have done. Waring et al. (2007) examined physical activity in school. They suggested that school was the ideal setting for meeting the DH (2005) recommended physical activity target. They completed a large longitudinal study over 5 years with 374 children, aged 5 – 11. They recorded physical activity every 15 seconds in Physical Education lessons, break time and lunch time. The results showed the amount of moderate and vigorous activity found within Physical Education lessons to be ‘alarmingly low’ (Waring et al., 2007, p.35). They highlighted that Physical Education lessons had minimal additive effect on overall physical activity levels. Hannon (2008) highlighted Physical Education lessons as a time within school dedicated to providing an opportunity for physical activity.

Waring et al. (2007) also suggested that Physical Education lessons should continue to remain a target area within the school day for enhancing and increasing physical activity levels for children. They indicated that large parts of the “lessons were spent statically developing skills” (p.35) and this would possibly be due to the teachers not having the knowledge to deliver effective learning experiences at moderate and vigorous physical activity levels. This is not surprising considering the potentially limited number of training hours experienced as previously reported by Stewart (2008). Waring et al.’s (2007) research methodology used a selection of techniques including an observation recording system, which has limitations in gaining precise data, though the observers were given six hours training. This form of methodology can also be subjective as several researchers were used, which would have allowed for possible inconsistencies between observers because of individual interpretation of the levels of activity being achieved (Thomas et al., 2011). They also did not consider the other opportunities within the school curriculum for physical activity, nor did they break the data down into age groups (infants and juniors) to consider how the variations in the different curricula may potentially affect the physical activity levels. The thesis research data collection would examine the whole school day
including other possible physical activity opportunities within the school curriculum and the differences that year group and gender may have on the results.

Trudeau et al. (1999) concluded that the daily Physical Education in primary schools had a long term effect on the physical activity throughout the school day and later on in life (cited in Howells et al., 2010a). Trudeau and Shephard (2008) also suggested that physical activity (which included Physical Education lesson time) “can be added to the school curriculum by taking time from other subjects without risk of hindering student academic achievements” (p.5). Rowlands et al. (2008) discussed in their analysis of children’s physical activity McKenzie et al.’s (2004) intervention research which spanned 2 years and focused on improving physical activity levels. McKenzie et al. (2004) were able to increase the amount of moderate to vigorous physical activity by 3 minutes per Physical Education lesson. This increase of 18% is similar, to that found in McKenzie et al.’s (1996) previous intervention work in which they increased moderate to vigorous physical activity within Physical Education lessons by 14.4%.

Within Rowlands et al. (2008) work they used the intervention of an external specialist company ‘Motive8’ to provide sport and Physical Education within the school. Carney and Howells (2008) questioned the use of sports coaches delivering Physical Education lessons considering whether they will have the expert pedagogical knowledge and understanding of both Physical Education and the education of primary age children. Sloan (2010) suggested that specialist support is welcomed to help aid primary school teachers, in terms of knowledge of activity areas within the National Curriculum (DfEE/QCA, 1999). For many primary teachers, the idea of being replaced by a sports coach Sloan (2010, p.267) suggested would make them feel resentful and feel as though they were “being placed on the periphery”. This was the viewpoint that many primary teachers commented on when contemplating if a specialist took their Physical Education lessons. However, Rowlands et al. (2008) found that the ‘Motive8’ classes provided 4.7 minutes more moderate to vigorous physical activity and 2.8 minutes more vigorous physical activity compared to Physical Education lessons provided by the class teacher, with the biggest difference in physical activity occurring between a football led ‘Motive8’ class and a school football lesson. Yet the differences in the physical activity that were found could be explained due to
unknown factors such as the impact of the winter weather on outdoor lessons and pedagogical principles used which might change if the class teachers were trained as Physical Education specialists or not. Also if the sports coaches were football players themselves this may have had an impact on the motivation and physical activity levels of the children.

Howells et al. (2010b) proposed that it is difficult to know which physical activity is suitable for specific individuals let alone for a whole class to ensure that all children are working at a moderate to vigorous physical activity that is heading towards the recommended physical activity target. Rees et al. (2001) suggested that more innovative choices in school Physical Education such as dancing, cycling or aerobics was needed to promote and increase physical activity levels. Brunton et al. (2003) recommended that such improvements were needed in school Physical Education lessons to improve overall physical activity levels, but did not suggest what these improvements should be. Conversely, it could be noted that there has been a recent shift in the view or focus of Physical Education lessons since London secured the Olympic Games in 2012. A new importance has been placed upon health and physical activity and also upon preparing and finding talent within schools (Marsden and Weston, 2007). Though not a key focus of the thesis research it is important to acknowledge the potential shift in the focus of Physical Education lessons, as it could be questioned whether primary school teachers have felt the shift at all (Whittingdale, 2008) or if they have the expertise to prepare and find talent within the early years, whilst remaining inclusive, an element that Manners and Carroll (1995) highlighted the need for.

Whittingdale (2008) is unconvinced by the potential shift and the highlighted new role of Physical Education lessons in producing Olympic standard athletes, stating that children who are particularly adept cannot and do not receive the required level of teaching and training in a setting where inclusion of the whole class is essential and promoted. Humphrey (2002) warned of the need to pay attention to the negative effects of Physical Education lessons on children, in particular on social skills through competition and the constant emphasis on talent. Yet, Lord Coe (2011) summarised the vision of the Olympics as “changing the lives of young people through sport, to inspire young people around the world to choose sport” (p.21). However, it could be questioned whether, in reality Coe’s
vision was only changing the lives of a few, as it did not suggest within his vision how this “changing the lives of young people through sport” (p.21) can be achieved by primary school teachers for the whole of the country. Vasagar (2012) warned that school sport is ‘withering away’ and expressed the fear at what would come after the Olympics with Government cuts in sport in school. He highlighted that there was a lack of specific and pragmatic vision, to inspire children of the future. Many schools have chosen to follow a whole school approach (Quennerstedt, 2008) focusing on physical activity within Physical Education lessons, rather than finding talent.

Fairclough and Stratton (2006a) focused on the contribution of Physical Education lessons towards physical activity levels and suggested that they could be considered as being a pure opportunity for children to be physically active and that other elements of Physical Education lessons such as motor, cognitive and social development are less relevant. These elements are potential hindrances in the achievement of the physical gain of getting the children physically active. Fairclough and Stratton’s (2006a) main focus of research was on health benefits and physical activity, rather than educating the child physically, which could be the focus of a Physical Educationalist. Gilliver (2003) took an alternative stance and his work focused much more on the children learning through being physically active. Doherty and Brennan (2007), also contrary to Fairclough and Stratton (2006a), have similar views to Gilliver (2003) and suggested that there is much more to school Physical Education lessons than just being physically active. Physical Education is about the whole educational process of the child “that is concerned with lifelong physical, intellectual, social and emotional wellbeing that accrues through experiencing physical activities in a variety of contexts” (Doherty and Brennan, 2007, p.6). Through the whole education process, the child’s attitudes and interests in physical development and physical activity can be fostered and an understanding of the importance of not only exercise, but also a healthy lifestyle can be imparted, rather than just simply providing exercise opportunities for every child.

2.6.1 Physical activity levels in Physical Education lessons

Simons-Morton et al. (1994) observed levels of physical activity within Physical Education lessons in elementary (primary) and middle schools in
America. The children were aged between ten and eleven years, and in America there are national recommendations of 50% of Physical Education lessons to be at a moderate to vigorous level of physical activity (Simon-Morton et al., 1994; US Department of Health and Human Services, 2010). Simons-Morton et al. (1994) found that in their sample of primary schools only 8.6% of the Physical Education lesson was at the moderate to vigorous physical activity level, 41.4% lower than the national recommendation (Simons-Morton et al., 1994; US Department of Health and Human Services, 2010). The sample even included schools that were identified by the Texas County as having excellent Physical Education programmes. These findings might indicate that there were other aspects of the Physical Education lessons or programmes that made them excellent, and that the focus of the school Physical Education lessons was more than just about physical activity levels. Indeed, Doherty and Brennan (2007) commented on the importance of developing and educating the child physically, as a whole, to include physical, social, emotional and spiritual development in a holistic manner. Yet, within the same state of Texas in the USA it has recently been reported that high school sports programme are being shut down due to school districts budgets being cut (Zimmerman, 2012). The reduction in funding have also occurred within Westport Connecticut where the removal of two members of the Physical Education staff and the reduction of Physical Education lessons by half allowed for more, uninterrupted hours on the fundamentals of mathematics, literacy, social sciences and science. However, Klein (2012, no page number) warned that Physical Education “is not a luxury, it is a necessity”. There are good strong community links within the area of Westport but it was a worry that such budget cuts were halving the time of Physical Education that had previously been valued and even provided credits for completion and participation within the USA curriculum, for all children and University students (Ashcroft and Snow, 2008). Vasagar (2012) also cautioned that the reduction in school sports was also occurring within the UK. Cuts in the school sports partnership programme by the coalition Government, have led to competitions and after school clubs being cancelled (Vasagar, 2012). The reduction may be due to lack of funding to pay external coaches or the pressures on parents to pay for clubs and competitions which were previously free and available to all.
Fairclough and Stratton (2005) considered the difficult question ‘how does Physical Education help children to become and remain healthy?’ Their evidence came from assessing physical activity within Physical Education lessons with children aged between eleven and fourteen years, wearing heart rate telemeters to identify how physically active each child was during the Physical Education lesson. Fairclough and Stratton (2005) found that, on average, children engaged in moderate to vigorous physical activity for 21.8% of the lesson and were at a vigorous physical activity level for 11.1% of the lesson. However, these results do not take into account nor acknowledge that the children may potentially have changed their normal behaviour because they were being watched, recorded and knowingly assessed on their levels of physical activity. This was reflected in the results of the low ability children being unexpectedly more active than the average ability pupils. Fairclough and Stratton (2005) reasoned that this unexpected result may be due to inaccuracies in the teachers’ assessments of the pupils. Or, alternatively it could be suggested that the teachers had the correct assessment of the children in terms of ability and skills in Physical Education; but it was the children’s lack of skills that was causing them to have to use more physical effort to be successful in the games setting; more physical effort is needed by those of a lower ability to complete the skills, as the skill is less efficient and needs a higher intensity level of physical activity.

Fairclough and Stratton (2005) also suggested from their findings that “Physical Education may make a more significant contribution to young people’s regular physical activity participation if lessons are planned for and delivered with, moderate and vigorous physical activity goals in mind” (p.14). This research could be used to inform teachers when planning their Physical Education lessons in the future, to ensure that all children have the motor competence to complete the planned activities. This will help to make sure that lessons contain moderate and vigorous physical activities enabling children to be healthy with the aid of Physical Education lessons. Yet, this is a difficult task to accomplish with up to 34 children in one class all of potentially varying abilities and skills. Also, young children need to learn basic movements and skills (Jess and Dewar, 2004) to be able to apply them within highly physically active lessons and sessions. Other suggestions from Fairclough and Stratton’s (2005) work that could impact on educational practice within Physical Education stem out of the ideas and evidence from Sport England
(2001) regarding engagement levels in team sport. Sport England (2001) suggested that “team sports dominate English Physical Education curricular yet bear limited relation to activities that young people participate in, out of school and after compulsory education” (p.15). Therefore, to ensure that every child is being healthy and that lifelong physical activity is being promoted, a broader base of Physical Education activities needs to be offered to all.

Yet, Cleland et al. (2008) found contra evidence to Fairclough and Stratton (2005) and Sport England (2001) in their 20 year study of physical activity levels. Cleland et al. (2008) questioned whether the patterns in childhood of being overweight and of physical activity levels continued into adulthood. They explored this by assigning categories to the different levels of physical activity and examining the compulsory Physical Education that the child was exposed to within school. They found that the prevalence of being overweight in childhood and in adulthood were similar across all groups of physical activity levels, indicating that the amount of physical activity or Physical Education experienced within school was not associated with being overweight in adulthood. Cleland et al. (2008) suggested that there are other factors that “override any effects of school physical activity provision” (Cleland et al., 2008, p.10), though they do not discuss what these factors may be nor how to overcome them to help prevent children and adults becoming overweight.

2.6.2 Physical activity levels in Physical Education lessons in the local area

The National Physical Education, School Sport and Club Links (PESSCL) (DfES and DCMS, 2002) strategy was a long term ambition of the Labour Government such that by 2010 all children should be participating in at least 4 hours of physical activity every week. This activity was to comprise of at least 2 hours of high quality Physical Education and sport at school with the expectation that this would be delivered totally within the curriculum with an additional 2 – 3 hours beyond the school day delivered by a range of school, community and club providers. According to the Kent NHS Overview and Scrutiny Report (KNOSR, 2006), all children within Kent and Medway received at least 3 hours of high quality Physical Education / Sport. Kent and Medway were creating and launching initiatives that “will facilitate more competitive sport in schools, support after school sports clubs and sponsor more inter school competitions and holiday sports
programmes,” (KNOSR, 2006, p.74). As an example of this, the Kent Youth Games were established on a biennial basis. One interpretation of the PESSCL strategy (DfES and DCMS, 2002) could be that children are receiving 2 to 3 hours a week of physical activity, but without further investigation, it is difficult to ascertain whether the high quality Physical Education / Sport involves the children reaching moderate to vigorous levels of physical activity. The thesis research would examine the duration and the physical activity intensity levels that occur within Physical Education lessons.

The NHS Information Centre for Health and Social Care (2011) reported on the participation levels in Physical Education lessons in primary schools. Of all children surveyed, 64% recalled participating in at least three hours of high quality Physical Education and out of hours school sport in a week during 2009 – 2010, but the report did not define what was seen as high quality. As part of the PESSCL, (DfES and DCMS, 2002) strategy the Government provided £100m to District Councils to deliver a further 3 hours physical activity in the week on top of 2 hours of Physical Education and Sport within school. Even if 5 hours were provided during and after school, they may not be accessible to all children, due to potential costing implications associated with after school club provision, or due to the limitations of particular age groups only being allowed to participate in certain activities. Children within the county that the thesis research was located are only receiving 1 hour extra beyond the curriculum time (3 hours in total) as highlighted above in the KNOSR (2006) report. This total falls well below the recommendation and thus the onus was on either Physical Education lessons to provide time for children to be physically active, or on the provision of other opportunities within the school day such as playground play (discussed in section 2.8) or physical activity programmes (discussed in section 2.7) to enhance the children's physical activity levels.

KNOSR (2006, p.74) stated that “Physical Education lessons alone could not provide enough physical activity to meet the target”. Physical Education was more of an “academic subject” than previously, (Trudeau and Shephard, 2006, p.91) as a proportion of class is spent on theory, this is especially true within secondary education when Physical Education is studied at GCSE and A level standard. The report goes on to suggest that “Physical Education did not have a
high enough profile or sufficient priority in the National Curriculum” (KNOSR, 2006, p.74). On the other hand, this may potentially change in the future with the new primary curriculum, from the Coalition Government, which was due, at time of writing, in September 2013. The Government, at time of writing, was proposing that Physical Education is one of four core subjects. There was no suggestion from KNOSR (2006) as to where else the physical activity time should be provided within the curriculum. Nor did it acknowledge that Physical Education was often dropped in primary schools, such as in the case study school within the thesis research, to allow room for other activities, such as the practising and performing of the ‘Nativity Play’. It could be suggested that whilst practising for the ‘Nativity Play’ may still include physical activity; it does not develop the children as regards their Physical Education.

2.6.3 Physical activity, Physical Education lessons and the Every Child Matters agenda

There are five outcomes of the Every Child Matters (ECM) agenda (DfES, 2003). The ‘being healthy’ outcome was particularly relevant to children’s physical activity and Physical Education provision. As such it is the main focus of this section. The link has previously been identified within this chapter between the ‘being healthy’ outcome and the fourth strand of the Physical Education programme of study ‘knowledge and understanding of fitness and health’ (DfEE/QCA, 1999). At the time of writing it was unknown whether the Coalition Government would continue with the ECM agenda (DfES, 2003). It was used and formed part of the physical activity policy within the case study school in the thesis research, therefore, was included and would be critiqued within this section. Mortimore (2000) suggested that research used different techniques and methodologies to observe and record systematically, to analyse and draw out implications, to publish findings and importantly, to attempt to improve educational processes and outcomes. He advised that we should not accept anecdote or opinion for answers, but instead only rely on hard evidence. He also advocated that we should “speak up for what we believe is right” (Mortimore, 2000, p.6) and noted that it is the role of the educational researcher to ask the difficult questions, to demand the evidence and to formulate new theories which will then impact on policies and practice (Mortimore, 2000).
This type of hard evidence demanded by Mortimore (2000) did not appear to have been used in the formation of the ECM agenda (DfES, 2003). The ECM agenda (DfES, 2003) was a policy that was a reaction from the Government to the Laming (2003) report, which was the official inquiry of the situation surrounding Victoria Climbie. Victoria was an 8 year old girl who was abused and later died in the care of her guardians. The inquiry led to changes in child protection. The aim of the ECM agenda (DfES, 2003) was to prevent such failures occurring again, to improve processes within the children’s services and also to ensure that a strategy was developed incorporating a multiagency approach. The Laming (2003) report stated that if professionals had followed basic principles of practice and if support services had better skills and organisational structure with more effective management and leadership, then Victoria would have been saved, but the exact analysis of the processes and the reasons behind their failure have not been considered.

Research does not produce immediate results, whereas politically there is an imperative to act at once and in the case of Victoria Climbie and the formation of ECM agenda (DfES, 2003) this was what the Labour Government did. It could be suggested, that by rushing to respond, the ECM agenda (DfES, 2003) was an imprudent overreaction to Laming’s (2003) Report. The Labour Government needed to respond to Laming’s (2003) Report and a full investigation may not have been possible as they may not have had the required time available to them to perform a longitudinal study or investigate the issues, solutions and the consequent impact on children thoroughly (Cohen et al., 2007). There is a need for educational researchers to work with teachers and others in the educational system in order to look below the surface for the best solutions and to analyse the basic principles of practice. Yet Hammersley (2003) disagreed with Mortimore (2000) and suggested that improvements of policy and practice were matters for politicians and practitioners and he objected to the subordination of research to policy and practice improvement. He suggested that educational researchers were there to provide high quality information, which may not have been geared towards directly improving educational practice. Mortimore (2000) highlighted that there are: “two national contexts in which educational research is currently pursued – education policy making and educational practice” (p.8). In terms of the ECM agenda (DfES, 2003), Mortimore (2000) felt that allowing time for
educational research to occur would have provided the foundation for the educational policy. Educational research can suggest implications from its findings that would impact on policy.

An example of educational research is data from the Department for Children, Schools and Families (DCSF, 2006) who highlighted that the number of children on child protection registers in England in 2003, when Laming’s (2003) Report and the ECM agenda (DfES, 2003) were produced, was 26,600. Three years on, in 2006 there were still 26,400 children on the child protection register. This shows a reduction of only 200 children. Why has a significant change to safeguard the children not occurred since the ECM agenda (DfES, 2003) was implemented? Or was it that there have been increases in surveillance of children at risk and therefore, increased pressure to keep children on the register and even add more children to it, to safeguard both children and the reputation of the professionals involved?

Physical Education was an important subject area in school to help achieve the outcomes of the ECM agenda (DfES, 2003). The ‘being healthy’ outcome however was often regarded as the most obviously linked to Physical Education. One reason for this was due to the conceptual links of both physical activity and ‘being healthy’ to Physical Education lessons. Pearce et al. (2008) suggested that early childhood and school experiences are important to being healthy as “physical activity patterns established in childhood continue into adulthood” (p.169). Kimball et al. (2009) agreed with Pearce et al. (2008) about the importance of early experiences of physical activity and suggested that low physical activity levels of female adults linked to their negative experiences of physical activity in high school. Kimball et al. (2009) suggested that Physical Education lessons “need to engage in a more inclusive curriculum” (p.249) that better prepare children for continuing moderate to vigorous physical activity levels into adulthood. When positive attitudes are promoted, regarding active and healthy lifestyles, within the National Curriculum for Physical Education the DfEE/QCA (1999) suggested that these continue into lifelong involvement in physical activity.

Another reason why Physical Education was an important subject area to achieve the ‘Being Healthy’ outcome in the ECM agenda (DfES, 2003) in school
was because those involved in “delivering Physical Education and school sport are in a unique position” as they often are able to “form close social relationships with young people” (Griggs and Wheeler, 2007, p.279). It could be suggested that within school Physical Education, lessons are key to developing and educating the children about ‘being healthy’. Griggs and Wheeler (2007) also suggested that Physical Education teachers often see pupils in “states of undress” (p.279) (for example, wearing t-shirts and shorts) where they may for instance see evidence of physical abuse that no other person beyond the family would. This idea again, suggested an increase in surveillance, and teachers looking more closely for those children who might be 'at risk'. This surveillance has the potential for creating a climate where children are seen as potential victims. Bayless and Cutter (1986) propose that when Physical Education teachers or coaches detect signs of abuse, it is their responsibility to both the pupil and to the law to report it.

It may be proposed that teachers did not need to be told about children ‘being healthy’ through the ECM agenda (DfES, 2003). Especially as the fourth strand of the National Curriculum for Physical Education (DfEE/QCA, 1999) related to the development of knowledge and understanding of health and fitness and highlighted that children should be taught “how important it is to be active” (4a, DfEE/QCA, 1999). Therefore, within the National Curriculum, for England, teachers had been teaching children how to be active for four years before the ECM agenda (DfES, 2003) was outlined. Griggs (2007) warned that the attainment across all four strands may be “uneven” (p.61). As recently as 10 years ago, teachers of Physical Education were exclusivists, they rewarded those children who were good at sport and excluded those who were less able. For example, those who could not kick a football would be left embarrassed, sitting and watching from the side lines (Fitzgerald, 2009). Some teachers may have regarded the ECM agenda (DfES, 2003) as nothing new, however the emphasis was on ensuring that all children were physically active and that they understood the importance of being healthy.

Adams (2007) suggested that the ‘Being Healthy’ outcome of the ECM agenda (DfES, 2003) implied that prior to the policy “teachers have not cared and policy is required to ensure that they do” (p.226). Adams (2007) also highlighted a section of the thinking behind the ‘being healthy’ outcome (DfES, 2003) which he
regarded as “not new” (p.229). He noted that “high expectations and a broad view of supporting children and young people are common features of highly successful schools, as schools already contribute to pupils’ wider wellbeing” (Adams, 2007, p.229). Therefore, the question could be: what more does the ‘being healthy’ outcome (DfES, 2003) achieve? There seemed to be a need to interpret the ‘being healthy’ outcome (DfES, 2003), especially within and across primary schools. Were all primary schools interpreting the agenda in the same way? How were they implementing, for example, the school’s physical activity policy in a manner that was applicable to the ‘being healthy’ outcome (DfES, 2003)? What was the most successful way for it to be implemented within the school setting? Adams (2007, p.235) also criticised the “performative direction for the educational policy”. The measures by which services are to be judged are “simplistic, quantitative measures”. Since the formation of the Coalition Government, the status of the ECM agenda (DfES, 2003) is currently undetermined. There has been some movement away from it, and the degree to which the principles and structures will continue to be used in the future is unclear. At the time of writing the thesis, it was still being used in school and specifically in the case study school where the data were collected.

By asking further questions, it would allow the measures to go beyond just a ‘tick box’ approach. Stern (2007) proposed that the ECM agenda (DfES, 2003) “raises questions about what mattering means in school contexts and how schools will know the extent to which Every Child Matters” (p.283). He highlighted that “people who work in school know that children matter” (Stern 2007, p.292) and that every child is important. He also suggested that the “education, health and social care professionals are still uncertain as to whether the policy will have the impact expected of it and whether every child will indeed matter in a new way” (p.283). Stern (2007), like Adams (2007), suggested that “children have always mattered in the sense that teachers and others have always cared for and cared about children so the new policy cannot be an attempt to teach the old dogs of the education system entirely new tricks” (p.283). Stern (2007) emphasised Cooper’s (1997) occupation study in which Cooper (1997) declared that teaching is the fourth most stressful job out of the 104 occupations examined. However, Stern (2007) looked to Newton and Tarrant (1992) for ways of implementing the ECM (DfES, 2003) policy within schools. They suggested that teachers who are
“unhappy, stressed, workaholics are not good role models for young people” (Newton and Tarrant, 1992, p.14), especially for promoting physical activity, if teachers themselves do not have time to be physically active for health benefits. Therefore, teachers may potentially not have been the best set of people to be implementing change through the ECM agenda (DfES, 2003). There are several questions that remain regarding the implications of the ECM agenda and the ‘being healthy’ outcome on teachers: What identifiable changes have been made in their own practices as a result of the ECM agenda (DfES, 2003)? Can these be broken down into subject specific areas, for example, Physical Education, so this can be compared across practitioners? What is their view of the ECM agenda (DfES, 2003)? These questions are not the focus of the thesis research, however, it is important to acknowledge the implications and the outstanding questions from the ECM agenda (DfES, 2003) as the results of the ‘being healthy’ outcome impacts on the shift in Physical Education provision (as highlighted previously) and physical activity policy, within the case study school in the thesis research.

A target and success indicator of the ‘being healthy’ outcome is a reduction in obesity levels of the under 11s, yet there are no regular measures of the target outcome ‘being healthy’ taken, which could be analysed to determine whether it is being achieved. The Cross-Government Obesity Unit (2008) reported from the Child Health Programme that “if no action is taken, by 2050 it is suggested that 25% of children will be obese and 30% will be overweight. Children who are obese in childhood are likely to remain obese into adulthood” (p.10) (Cross Government Obesity Unit, 2008), although currently there has been no longitudinal study to confirm this relationship. To properly examine the aforementioned claims regarding obesity levels, more longitudinal studies, and statistics or as Mortimore (2000) described it ‘hard evidence’ is required. The Cross Government Unit (2008) paper suggested that “only 3% of overweight or obese children have parents who are not overweight or obese” (p.10). They also recommended that a whole family approach to the problem should be used. This is an important point, (as highlighted in section 2.3.1) as it is all very well trying to encourage the children to engage in healthy lifestyles and become increasingly physically active whilst in school, but if within their home life this support does not continue, the children are still potentially at risk. This may mean that education is also needed
for parents and carers, yet, this has to be approached sensitively so as not to imply blame.

**2.7 Physical activity programmes**

This section will examine physical activity programmes that are currently used within the school setting and how they have been linked to academic performance. The National Institute for Health and Clinical Excellence (NICE, 2009) suggested that education institutions should deliver “multi-component physical activity programmes involving school, family and community based activities” (p.22). These are designed to educate and increase awareness of physical activity benefits. Schools in particular were informed that they should increase opportunities for physical activity during breaks and after the school day, but it was not suggested how this should have been done on a local or national scale. One of these whole school approaches has been the integration into the school day of physical activity programmes such as: ‘Wake Up and Shake Up’; ‘Huff and Puff’; ‘Take 10’; Group Juggling; Skipping and Seated Sports (Howells, 2007). These physical activity programmes were often delivered within school on a whole school basis and are creative ways to promote health and wellbeing and increase physical activity levels for all children. These opportunities are beyond the perhaps ‘normally’ considered cross curricular links (Barnes, 2011) between physical activity and other subject (e.g. drama) and other curriculum areas, beyond Physical Education lessons. In South Birmingham (UK) schools the ‘Wake Up and Shake Up’ programme was being used to link physical activity and Physical Education to the ‘being healthy’ outcome of the ECM agenda (DfES, 2003). The South Birmingham public health Physical Education specialist believed that “physical activity is crucial in tackling obesity” (Howells, 2007, p.ii) and that the ‘Wake Up and Shake Up’ physical activity programmes were not only benefiting the pupils but also the staff who were delivering them. There had also been increases in confidence and self-esteem in pupils and there was an increase in the learning and understanding of the benefits of regular participation in physical activity (Howells, 2007).

Programmes such as ‘Wake Up and Shake Up’ that incorporate physical activity into everyday school life have shown improvements in physical and emotional wellbeing, concentration and academic performance (Callington School,
These programmes have contributed to acceleration in the children’s academic progress through whole brain learning caused by movements across the midline linking the left and right hemispheres (Howells, 2007). There were also improvements in co-ordination, self-esteem, team work, and the activities were frequently considered to be good fun for the children. They could boost the pupils’ academic performances in terms of increasing both spelling and reading ages and can be extended naturally during playtimes (Howells, 2007). At St Edmund’s School Sport Partnership in Salisbury the children’s spelling vastly improved over a three month ‘Wake Up and Shake Up’ period with a dramatic improvement for one pupil who had severe learning difficulties. This pupil’s spelling age increased by 52 months during this time (DfES, 2006). Similar results have also been found by Preedy et al. (2004) when children completed a daily 15 minute physical activity exercise programme for 9 months. Improvements were made in self-esteem and concentration levels which were noticed, not only by the teachers, but by the children themselves. According to the Youth Sport Trust (2008), over 5,000 children (including wheelchair users, children with muscular dystrophy, or those with cerebral palsy) are doing daily ‘Wake Up and Shake Up’ physical activity programmes in 75% of Youth Sport Trust partnership schools. Teachers have reported that children were showing better behaviour and concentration (Youth Sport Trust, 2008). Overall, these findings show how fundamentally important the integration of physical activity was within the school day, showing benefits beyond just improvements on the levels of obesity (Howells, 2007). Within the thesis research, at the time of data collection the case study school did not undertake any physical activity programmes within the school day.

2.7.1 Physical activity programmes and academic performance

Trost (2007) emphasised the importance of physical activity and how it can lead to better concentration. Therefore, it could potentially be suggested that physical activity might lead to better academic performance. However, Keeley and Fox (2009) suggested that there may not be enough concrete evidence to prove the link between the two. The idea of a potential link is certainly attractive to educationalists (Keeley and Fox, 2009). Sibley and Ethnier (2003) identified a significant correlation between physical activity and cognitive function; measured in areas such as perceptual skills, IQ, verbal skills and mathematics skills. This was seen across all school age children in their study, but was particularly
noticeable in children aged between four and thirteen years. Shoval and Shulruf (2011) considered that young children are more likely to benefit from movement based activities as it reflected their natural learning style and then were often promoted throughout the infant curriculum (DfEE/QCA, 1999; DfE, 2008). This was disputed by Trudeau and Shephard (2009) who argued that whilst there are a multitude of stimuli for learning there was a question as to whether physical activity is one of them.

The impact of age as a variable, when studying the link between physical activity and academic achievement could be seen in the American study carried out by Caterino and Polak (1999). They found that daily physical activity had a significant positive correlation on the academic achievement of students aged between nine and ten years. Interestingly though, the correlation was not seen in any of the other year groups when studied by Sibley and Ethnier (2003) in their research. Vail (2006) identified that there was a significant positive correlation between the BMI of the students and their scores in mathematics tests. The validity of this study has to be called into question however as BMI has been recommended by Eto et al. (2004), to be an inappropriate measure of children’s fitness. Demerath et al. (2006) also proposed the measure to be unreliable in children as the BMI measure does not take into account growth (see section 2.4.2).

Field et al. (2001) identified a significant positive correlation in academic achievement based on the amount of physical activity that the pupils achieved outside of school. Harrison and Gopalakrishnan (2003) furthered this investigation into physical activity and academic achievement in their large scale study in the USA, which found that children who took part in extracurricular sport were 58% more likely to spend 3 or more hours on homework a week. There were however, significant differences in terms of amount of equipment, space and opportunities available in the UK (where the thesis research was located) compared to the extracurricular sport available in the USA, (with less being available in the UK).

In spite of these positive findings of physical activity and academic performance, several studies have found no significant improvement in academic ability despite increased physical activity (MacMahon and Gross, 1987; Raviv and
Low, 1990; and Sanders et al., 2000). Notably, however, none of these studies have found that the time taken out of the curriculum for physical activity programmes was detrimental on academic achievement (Ahamed et al., 2007). It could be hypothesised that physical activity may have been contributing other positive benefits which were not necessarily academic. Kirk et al. (1989) focused on Physical Education lessons rather than physical activity programmes and they surveyed primary school teachers’ perceptions on how daily Physical Education could impact on children’s attitudes towards work and their academic performance. One such teacher described Physical Education lessons as having “definitely improved their school work and I can’t prove that it has. But it has improved their outlook and the atmosphere in the class and that to me that’s an improvement” (Kirk et al., 1989, p.14). Dollman et al. (2006) acknowledged that due to the individual’s varying levels of participation and the differing nature of their physiological reactions, it was hard to generalise conclusions about the impact of physical activity programmes on academic achievement. They noted that is was important to consider the needs of the individuals and potential improvement that might occur for them.

It has been identified by Zoeller (2010) that the type of physical activity has little relevance to any academic improvement measured. Yet contrary to this, Knight and Rizzuto (1993) discovered that literacy and numeracy scores were directly correlated to the children’s ability to balance. Balance is an area that has not been previously found to be correlated to children’s ability. However, some research suggested that physical activity in the form of games, which may involve problem solving, is beneficial to cognitive learning and engagement (Light, 2002). Webb et al. (2009) proposed that this kind of games based approach was beneficial to the children’s cognitive learning as it required tactical thinking and decision making, rather than imitating body movement or learning motor skills. This was also supported by Doherty and Brennan (2007) who noted that these skills and others, such as strategising, creative thinking and evaluating could be developed through physical activity in the form of specific games activities. It may be that this could have been due to the children having used higher order thinking to engage with the physical activity (Bloom, 1956).
2.8 Physical activity and playground development

Howells et al.’s (2010b) research suggested that it was not only during Physical Education lesson time that moderate to intense levels of physical activity could be achieved, but also throughout break and lunch times. Therefore, within this section physical activity and playground development will be considered. Ridgers et al. (2006) reinforced the importance of break and lunch times within a school day, by stating that “playtime can contribute between 5 and 40% of the recommended daily physical activity levels when no interventions have been utilised” (p.359). According to Pate et al. (1996), “children best accumulate physical activity during playtime and in unstructured environments, where they are free to interact with their peers” (p.96). The class teachers within the case study school felt that break times were important for developing the children socially, emotionally and physically as Dau (1999) suggested. Yet, Waring et al. (2007) suggested that free time in lunch breaks and play time was clearly underutilised in terms of the promotion of physical activity.

It is doubtful that physical activity can be achieved during playtime in the future, especially if schools are built in a similar manner to those in, for example, Peterborough, Cambridgeshire, in the East of England, which did not have playgrounds or play areas and neglected the importance of play as a consideration (Beckford, 2007). The charity, Fields in Trust (2011b), reported that outdoor recreational spaces such as playing fields on school sites were under threat particularly during difficult economic times, and planning applications to build on such playing fields had more than doubled since 1999 when there were 625 applications, to 1322 applications in 2009. At the aforementioned rate there would soon be neither playing fields, nor playgrounds in schools as they would only have to provide suitable outdoor space, rather than as the previous strict rules stated, space that was dependent on the number of children at the school and of an area of at least 5,000 square metres (Harrison, 2012). The Department of Health was quoted in a newspaper article as saying (Beckford, 2007) “we do promote health and exercise in children but it doesn’t have to take place in the playground” (no page number). Yet, it has been reported that Peterborough has the second highest child obesity levels in the East of England with 19.7% of children aged eleven (in year six of primary school) now being classed as obese and “the number of children described as being physically active is significantly below the
national average" (McGurran, 2011, no page number). Beckford (2007, no page number) discussed the concept of not having playgrounds or play areas with Dr McMurdo, the Principal of The Academy in Peterborough and reported that “if children concentrate on lessons throughout the day, then their work improves. We are not intending to have any playtimes; pupils won’t need to let off steam because they will not be bored”. Yet, previous research (Sibley and Ethnier, 2003; Doherty and Brennan, 2007; Howells, 2007; Shoval and Shulruf, 2011) had found contrary evidence that supported the need for physical activity to improve concentration levels and academic performance (as discussed in section 2.7.1).

Pate (1996), Ridgers et al. (2006) and Waring et al. (2007) all suggested that opportunities for physical activity were available during break times on the playground or in the play areas. Pellegrini and Davis (1993) also identified other important aspects of break time; indicating that a lack of break time had a negative impact on children’s performance in the classroom, with children becoming less attentive to both the tasks at hand and learning in general. Grugeon (2005) suggested that children’s play during break time was important in developing children’s literacy skills, such as the communication skills of listening and speaking. There are also opportunities to develop emotionally (Blatchford and Baines, 2006) and socially in a positive way (Adams, 1993) during break time. Blatchford and Sumpner (1998) also emphasised the value of break times as time to “let off steam” (p.92). Ridgers et al. (2011) suggested that the “majority of children’s social interactions were positive” within the primary school setting during break time, and that the removal of break times could “influence both physical and social health” (p.364) detrimentally.

From a similar viewpoint to that of the Principal of The Academy in Peterborough, some primary schools it has been reported, have banned games for boys in the playground and linking arms together has been banned for girls for health and safety reasons (Daily Mail, 2007). In Manchester, the council has banned ball games in the street and ASBOs have been given to children for playing football (Lashley, 2008). It comes as no surprise, therefore, that children were not able to reach their recommended physical activity target (DH, 2005; WHO, 2010) if they were not encouraged or are even prevented from utilising and taking every opportunity to be physically active in activities of their choice (such as
football) during break times or outside of schools. An example of this exists within my own University grounds, on the main campus there is a grass quadrant which is an ideal setting for physical activity to occur, however there are signs on all sides of it which state ‘no ball games or other games at any times’. These previously discussed authors and examples are of particular concern as they reduce physical activity opportunities, and using the outdoor environment could be a key place to increase physical activity opportunities. As Stratton’s (2000) suggested that opportunities did occur for physical activity in the playground setting. He compared physical activity before and after the painting of fluorescent markings on the school playground. He found through heart rate monitor recordings, that the new markings had a positive impact on increasing physical activity levels, and suggested that playgrounds are important for physical activity and that markings and other factors that encourage opportunities for physical activity should be extended within school time.

2.8.1 Physical activity and playground development in the local area

The Kent NHS Overview Scrutiny Report (KNOSR) (2006, discussed in further depth previously in section 2.5) suggested that playground play within the same county as the school that is the subject of the thesis research was located should be encouraged by providing hopscotch grids and basketball hoops in the playgrounds. However, the concept and idea of encouraging children may not allow all children to achieve the necessary moderate and above moderate physical activity levels. More structured sessions may be needed for some children. The KNOSR (2006) also considered a pupil survey undertaken by the National Foundation for Educational Research “which showed that young people would like more opportunity to undertake individual sports and physical activities such as running, cycling, swimming and racket sports” (KNOSR, 2006, p.76). Although this may be considered positive, it may be that schools did not have access to such facilities on a regular basis, or they may not have space for these activities to be undertaken. Again, the KNOSR (2006) provided statements, but it did not offer solutions as to how these ideal opportunities for physical activity could be initiated within a primary school setting that may have limited space, resources, equipment and funding.
An example of one of the local opportunities for physical activity was Don’t Sit Get Fit! (Health Regeneration Partnership, 2004), which was a project that promotes healthy eating and physical activity among children aged between 5 and 13 years in deprived wards of Dartford and Gravesham (North Kent). It has been funded by the Kent Children’s Fund and the idea of Don’t Sit Get Fit! was designed and led by the children it was seeking to help with the aim “to improve the lifestyles of local children through engaging them in fun activities and education about the problems associated with physical inactivity and poor diet,” (Health Regeneration Partnership, 2004, p.2). Coalter (2005) (previously discussed in section 2.3.1) highlights the importance of ensuring that initiatives were driven by those it sought to help, as Don’t Sit Get Fit! (Health Regeneration Partnership, 2004) does. Within the KNOSR (2006) the long term implications of the initiative Don’t Sit Get Fit! (Health Regeneration Partnership, 2004), are currently unknown as the KNOSR (2006), stated that the research in Dartford and Gravesham existed; it did not evaluate its impact on the physical activity levels of the children.

Another way to increase the levels of children’s physical activity within the school day is by developing playground play through improving the play time environment, in order to help tackle inactivity, boredom and poor behaviour (Brady et al., 2008). This is particularly important as children, especially infants have been shown to, spend up to a quarter of their school day in the playground (Ridgers et al., 2006). Kent County Council (KCC) (2006) suggested that physical activity could be improved through their playground improvement scheme. KCC (2006, p.1) gave schools a grant of £5000 to add facilities to school playgrounds that would “increase sporting opportunities, develop skills based activity and raise levels of physical activity”. KCC’s (2006) evaluation found that 83% of schools within the scheme stated that, through the grant, they had increased sporting opportunities during playtime and that this had led to greater physical activity. However, it could be noted that lunch time playground supervisors or mid day supervisors, who were supervising the children during these playtimes, may not have been qualified or have been contracted to organise physical activities for the children, unless some of the grant money was spent on developing the staff’s knowledge and understanding. Also children were not forced, just encouraged to complete such activities during break and lunch time so there may be children who chose to sit on the side and observe rather than participate.
Movement and physical activity around the playground could be encouraged through the use of the simple additions of brightly coloured, markings on the playground and interesting and exciting new additions such as playground and adventure equipment. These additions encouraged children to participate in “running, jumping and balance” ultimately helping to “develop stamina, suppleness and flexibility” (KCC, 2006, p.1). Although an increase in activity levels was reported by schools and observed through the case study visits, the scheme evaluation also reported that this increase varied from school to school. The greatest increase in activity was found when children understood the purpose of the new equipment or line markings and how to use them. Yet, the biggest limiting factor was the lack of equipment, to be used in conjunction with the new line markings, for example markings for tennis were placed in playgrounds, but the schools struggled to fund tennis rackets for more than one class within the school (KCC, 2006). The amount of physical activity within break times was assessed within the thesis case study school to consider the amount of moderate to vigorous physical activity that occurred during morning break, lunch time and afternoon break.

2.9 Physical activity and whole school approaches

Gidlow et al. (2008) considered the physical activity levels of children, in both primary and secondary school and found that in particular younger children were more physically active outside of the school day. They suggested that physical activity within school needed to be promoted, but did not suggest the types of physical activity that could be encouraged or where within the school day this could occur. Hills et al. (2007) also discussed the important role that schools have in helping to increase physical activity levels and in combating obesity in general rather than just Physical Education lessons. The WHO (2008) suggested that increasing the number of Physical Education lessons the students have is the most direct way to increase students’ physical activity. This is an area of research in which a case study would be beneficial, (as in the thesis research) to explore how Physical Education lessons may (or may not) contribute to children’s physical activity levels. Quennerstedt (2008) promoted using a salutogenic approach to view physical activity and movement as “something more than mere protection against disease or overweight” (p.267) and suggested a wider whole school approach of learning about health and physical activity. This would allow the
children to consider the possible contributions of Physical Education, play times to their physical activity levels. Becker et al. (2010) identified salutogenesis as the concept first introduced by Antonovsky in 1979, as a study of health development and is often referred to as the approach that considered the relationships between stress and health. Barker (2007, no page number) reported that using a whole school salutogenic approach, “rather than tackling individual children” is an important way of addressing Britain’s “obesity timebomb”.

Martin (2007) reported that the “Government strategist Foresight warns that a quarter of all British children will be obese by 2050” (no page number). In 2007 “one in 10 children were classified as obese” (Barker 2007, no page number) and children’s waistlines had increased by between 8 and 10 centimetres over the 30 years up until 2007. She suggests that school nurses are ideally placed to educate the whole school and help monitor children’s weight. Sleap and Warburton (1996) support the idea of health professionals being involved in the education of children within the school setting; as also suggested within the ECM agenda (DfES, 2003). However, only a minority of primary schools have school nurses, therefore, for a whole school approach to work it would fall onto the teachers to educate, monitor and measure the children. In an already overcrowded primary school curriculum day, not all teachers could replace this aspect of the school nurse’s work and find the time for this to be successful. Sit et al. (2007) expanded Sleap and Warburton’s (1996) and Barker’s (2007) ideas and made the further suggestion that home and community agencies should also be involved to ensure children, particularly those who are in special schools, are able to reach the recommended physical activity target.

According to the Healthy Schools Initiative (2009, no page number), the aim of their physical activity guidance is to “support the whole school approach to promoting healthy active lifestyles” and this should be an “integral part of daily life in a health-promoting school.” It is important to identify the whole school approach to physical activity. In the thesis research, the case study school has ‘Healthy Schools’ status and, therefore, should be endeavouring to follow the guidance set out in the National Healthy Schools Programme. Though this is not a focus of the thesis research, it is important to acknowledge the physical activity policies and provisions that the school has already implemented through having gained Healthy
School status. Lee et al. (2007) suggested the need to go beyond just policies but to also enhance staff development, so staff are aware and able to provide opportunities for children to be physically active not just in Physical Education lessons, but throughout the school day. By 2005, the DH had set a target of 50% of schools within England to achieve healthy school status and by 2009 all schools within England were working within or towards the healthy schools programme. The DH (2005) highlighted that 16,400 schools at that time were involved in the healthy schools programme.

Within the physical activity Healthy Schools Booklet A (Health Schools 2007: Physical Activity guidance) it states that the 2002 Health Survey for England “found that 30% of boys and 39% of girls aged 2 to 15 are still not reaching the recommended levels of Physical Activity to benefit their health” (p.6). This also means that within all the primary schools within England that 70% of boys and 61% of girls were reaching the recommended levels of physical activity. However, Healthy Schools (2007) do not state how these physical activity measurements were made, so it is difficult to comment on the experimental method which produced these results as there was no mention of the measurement tool used or the length of time over which these children were recorded made. Healthy Schools (2007) do suggest that pedometers can be used within school to measure physical activity levels and they indicated in their guidance that Physical Education lessons are a place for physical activity to be undertaken. Yet, within the guidance there was no results as to how much Physical Education lessons contribute to overall physical activity levels within the school day. It appears from the guidance that they have just assumed that Physical Education lessons do contribute. Therefore, it is important, as in the thesis research, to examine not only the physical activity levels of the children within a primary setting but also how Physical Education lessons may contribute, if at all, to children’s overall physical activity levels.

Rees et al. (2001) recommended that for those “wishing to implement effective physical activity interventions, a whole school approach can promote greater involvement in physical activity” (p.6). They suggested that it is important to involve all members of the school community, including peer-led initiatives, in particular with regards to choosing the activities on offer. Focusing on the fun of
the activity helps to improve self-confidence, rather than focusing on mastering all skills within the activity (Rees et al., 2001). Gorely et al. (2009) completed an intervention programme involving a whole school approach and found that those children in the intervention schools had significantly increased the total time children spent at moderate to vigorous physical activity levels compared to those in the control schools where the whole school intervention approach did not occur. The interventions included physical activity events such as one mile school runs / walks, using pedometers and accelerometers and recording fruit and vegetable consumption; however, they concluded that more work is needed on promoting fruit and vegetables as consumption levels were relatively low. Gorley et al. (2009) also suggested moving towards a whole school approach to involve parents and carers to help increase physical activity of children.

Carroll and Loumidis (2001) contrary to Rees et al. (2001) and Gorely et al.’s (2009) suggested that there was no link between the level of motivation within school Physical Education and the quantity of physical activity participation, with children with low levels of enjoyment still participating in “school team type of activities” (p.38). Gorely et al. (2009) highlighted that there was a conflict for those teaching school Physical Education between increasing physical activity levels and learning of skills and that teachers need to recognise that fun and competence may not necessarily be the first priority in teaching Physical Education. Indicating that other possibilities or opportunities for increasing and maintaining physical activity levels within Physical Education lessons and within other parts of the school are needed to ensure a whole school approach can be effectively used so the children have positive experiences and continue with physical activity beyond the school gates (Yelling et al., 2000).

The Football Association (Malvern, 2010) has called for clocks to move an hour forward to give lighter evenings to encourage more opportunities for exercise and physical activity. This could enable all children and parents to become or continue to be at moderate to vigorous physical activity levels throughout the whole year. NICE (2009) suggested that school facilities should be made available outside of school time, e.g. after the school day, at weekends and during school holidays “to provide physical activity programmes and opportunities for physically active play” (p.16). However, NICE (2009) did not suggest who should
be responsible for running these programmes or opportunities. As a whole school approach to increasing opportunities to exercise and for physical activity to occur, the school could decide to, during winter time, whilst the daylight saving bill, is currently being discussed in parliament, to open an hour earlier to allow these benefits for the children on a micro scale. Goodman et al. (2012) agreed with the Football Association in terms of wanting to move the clocks forward and found in their research that children aged eight to eleven were the most physically active (recorded using accelerometers) during the summer evenings between the hours of 5pm – 8pm. Yet, they found that football as an activity itself was not affected by the amount of daylight. Goodman et al. (2012) concluded and suggested that more daylight hours would promote children’s physical activity.

2.9.1 Physical activity and travelling to school

Indeed, evidence suggests that the proportion of children walking to school has dramatically reduced since 1970s, with a main cause being parents’ perceptions of risk outside the home (O’Brien et al., 2000) (as previously indicated in sections 2.3.1 and 2.6.3). Louv (2010) suggests that children do not walk to school because of fear; parents do not allow children to do the activities, such as walking to school that they themselves did as children. Yet, Cooper et al. (2005) identify that primary school children who walked to school had overall higher physical activity levels than those who travelled to school by car. The DH (2004a) highlights how patterns and trends of the total miles travelled per year on foot and miles travelled cycling have fallen by 26% when 1999 – 2001 is compared with 1975 – 1976. Fields in Trust (2011a) report that people living more than one mile from a park are 27% more likely to be obese. Schools (within the county of the case study school) encourage schemes such as ‘walking buses’ to both overcome parents’ fears and to re-instate this important physical activity of walking to school in primary aged children. The walking bus scheme has a set route and published timetables, it involves 2 adult volunteers who act as a ‘driver’ and a ‘conductor’ and escort the children (the bus passengers) to school (Kent Highway Services, 2012). The walking bus ensures that the children not only get safely to school, but develop social and independence skills and undertake daily exercise (DH, 2004a). Durnin (1992) suggested that children are now expending less energy than 50 years ago. Fields in Trust (2011a) reported that 88% of parents said they had more freedom when they were children and were allowed to play outside alone. Di
Guiseppi et al. (1998) proposed the changes in the levels of physical activity and energy expenditure could be attributed to the changes in modes of transport.

In the DH’s (2002) Health Survey, between 1985 and 1986, 67% of primary aged children walked to school, whereas in 1999 – 2000 this has dropped to only 54% of children walking to school. The 2009 National Travel Survey (Department for Transport (DfT), 2010) found that the average length of trip to school had increased to 2.5 miles in 2009, from 2.1 miles in 1995 / 1997. If children are not walking to school, the physical activity achieved in Physical Education lessons could potentially become a vital part of the children’s daily physical activity total. Without walking to school children may be relying more on opportunities within school; such as Physical Education lessons, to contribute to their overall physical activity levels. Zeigler (1994) agreed with Malina and Bouchard (1991) in suggesting that school Physical Education lessons provide a context for regular and structured physical activity participation for all children. This physical activity within the Physical Education lessons will ultimately aid children’s health, as “regular physical activity participation is especially important in regulation of body weight” (Malina and Bouchard, 1991, p.6).

In summary, this chapter has provided an overview of the literature in related disciplines of physical activity that impact upon children’s physical activity. It has taken a critical reflective approach to the existing knowledge base and has been structured in a logical way so that links can be made to the case study setting. The literature reviewed has helped shape the research focus for the thesis, specifically in relation to the physical activity levels of primary school children. In particular, the literature review has highlighted the lack of research conducted with both infants and juniors. The intention is to examine both similarities and differences of the children’s physical activity within specific year groups. The research will also consider the similarities and differences that occur in boys and girls’ physical activity levels, as well as the contribution Physical Education lessons make to the children’s overall physical activity levels within a school day.
Chapter 3
Methodology and Methods

3.1 Introduction

The purpose of this chapter is to outline the methodological underpinning of this thesis and the thought processes that influenced how the research was formed and shaped, so that attempts could be made to “search for the truth” (Cohen et al., 2007, p.5). By discussing the methodological approach to the research, the intention is to help the reader understand the rationale for adopting specific strategies that were incorporated to facilitate the research design and data collection.

The chapter starts by outlining the research questions that were formed through identification of research aims and the gap in the field following the literature review (as described in chapter 2). The research questions were informed by methodological considerations (see sections 3.2 and 3.3.) and the suitability of available methods (see section 3.4). The methodological ‘thinking’ incorporated within this study has been informed by a mixed-method approach where it is considered that the ‘scientific problem’ of children’s physical activity, as discussed in chapter 2, needs to accommodate not only the scientific principles found in a positivist approach but also philosophical and qualitative considerations (see section 3.3).

The research design is then outlined through a detailed explanation of how children’s physical activity levels could best be explored through a case study design. Here, the strategies used that supported the case study, namely an action research approach and a longitudinal strategy, enabled a reflexive approach to examining my own practice (as a teacher educator) and the practices that were occurring within the primary school over an extended period of time (see section 3.4). The final part of the chapter outlines the data collection tools. In this case, accelerometers and Qwizdom questionnaires which were used to collect the children’s physical activity data (see section 3.5) and. The chapter also contains details of how access was gained to the research setting, a description of the setting and of the children who participated in the research. A review and
justification of the data collection tools used through the thesis research is provided in section 3.5.

3.2 Research questions

The thesis research (as identified in section 1.4) has two ultimate aims, firstly to examine the physical activity levels of primary aged children both infants and juniors within a primary school setting and day. The second aim was to find out the contribution that Physical Education lessons make to the children’s overall physical activity levels. Following an extensive literature review and identification of the research gap in the field, it was considered appropriate to address these aims through the following research questions:

1. How physically active are primary school children during the school day?

2. What are the differences in the physical activity levels during the school day between children aged six - seven (infants) and aged nine - ten (juniors)?

3. To what extent does the primary school setting contribute to children’s recommended levels of physical activity (DH, 2005; WHO, 2010)?

4. What contribution do Physical Education lessons make to primary children’s physical activity levels?

3.3 Methodology

3.3.1 Positivism

A positivist perspective, associated with objective assumptions, views the world as a concrete structure. Here, it is assumed that the natural and human sciences will share commonality in logic and methodology. Thus, empirical study of the social world that can generate precise and consistent laws and systems, knowledge of reality and social phenomena can be determined through scientific observation of cause and effect (Henn et al., 2006). Knowledge can be developed through observation of that which is available to be observed. In other words, knowledge of the world is gained through the observation of events and phenomena (Robson, 2002) followed by the generation of a general law from data
obtained (Outhwaite, 1987). This proposes that truth is therefore, only discovered if it is put to the test through direct measurement (Gray, 2004).

Positivism is often supposed to provide a ‘standard-view’ of our social world, historically viewed as a logical approach, a perception that later evolved to include a belief that evidence collected through positivist means is value-free and based on fact (Torgerson, 1986). Rationale for this arises from the methods used, which have been considered to incorporate control, objectivity and standardisation. Methods are thus ‘structured’ and ‘reliable’, and evidence is independent from value.

A core argument against the belief that positivism represents a ‘standard view’ questions whether observation of general laws made in natural sciences, can also be made in the social, such as a school setting. This includes uncertainty as to whether theory necessarily represents reality, as it is observed in the social world, and whether objectivism is appropriate to understand phenomena relating to human behaviour (Blaikie 1993, Robson, 2002). Those that question positivism’s use within social research, challenge the notion of neutrality or standardisation of methods used; questioning the assumption that by using quantitative data the input of the researcher is neutralised, and that standardisation is achieved when the evidence collected by using quantifiable data (Sarantakos, 1998).

From the evidence detailed in chapter 2, it could be claimed that much of the research conducted within the context of physical activity and physical health has adopted quantitative approaches which have been influenced by logical positivism. The belief was that the world (as well as the body) could be viewed as a machine and that the tasks of the researcher were to discover the laws by which the machine operates. These laws have emerged from measurements and quantification of observable data. Melia (1982) suggested that in physical sciences these observable data have been derived from a scientific method of investigation using technology. Technology is used in the thesis research to collect the children’s physical activity data and their recall data, via the measurement tools of accelerometers and Qwizdom, respectively. These will be discussed further in section 3.5. Dempsey and Dempsey (1996) defined
quantitative research as research that is aimed at discovery; such as the initial quantification of the children’s physical activity levels within a school day. Dempsey and Dempsey (1996) suggested that, through the manipulation of numeric data and statistical procedures, it is possible to describe phenomena and the extent of the relationship between variables. The research methods used in quantitative approaches are empirically based upon scientific methods of enquiry and according to Burns and Grove (1987) were sometimes referred to as the traditional research processes, and were regarded as being acceptable methods for developing a science. Polit and Hungler (1995) described quantitative research as a hard science with the emphasis on deductive reasoning, rules of logic and measurable attributes of human experience, whilst Corner (1991) argued that the use of labels such as ‘hard science’ suggested that analysis by numbers was of a superior quality to analysis by words.

Greig et al. (2007) when discussing the possibilities of researching children through a positivist approach referred to children as “knowable, objective” and “measurable” (p.46) and therefore, suggested that it is possible to use quantitative research when collecting data from children. Nettleton (1995) believed that the more the human body was studied, the more it was found that the body was like a machine containing both software and hardware, almost like a computer. According to Macdonald et al. (2009), early research in Physical Education took the form of a positivist approach although, in more recent years, there has been a shift within education and Physical Education research away from positivism due to the recognition that humans are complex in their behaviour. Greig et al. (2007) argued that the physiological and positivist approach has been criticised “as being too reductionist” (p.21), in that it does not take into consideration the softer, personal, human factors (Cohen et al., 2007). Silverman (2006) also criticised this approach as having “little or no contact with the people” (p.42). Silverman (2006) went on to indicate the need for a cautious positivism to allow for reflection on the sociological natural environment, such as the school in the thesis research, to be considered.

An example of an alternative to these deductive principles is when a researcher uses an inductive or top down approach in which the data are collected and observations are then built up for testing (Smith and Hunt, 1997). The choices
of methods are still debated in the philosophy of science and the methods of investigation that are chosen depend upon the researcher’s assumptions of society (Bowling, 1997). Popper (1975), however, argued that scientific hypotheses could never be more than informed estimates about the universe since they cannot be proven to be true. He felt that scientists should concentrate on developing testable hypotheses formulated in a way that allows predications to be made and then construct investigations which attempt to disprove their hypotheses.

Quantitative researchers establish numerical scales in order to determine the extent to which a trait or characteristic is present. Using numerical scales allows the researcher to be objective and if the researcher is not emotionally involved with the subject of research, the scales can act as an unbiased interpretation of the results (Dempsey and Dempsey, 1996). McCullough (2002) suggested that the advantages of quantitative research included that the results were statistically reliable, which inferred that it be ‘more truthful’. Bury and Mead (1998) agreed noting that quantitative research allowed for greater control of the variables being studied, reducing bias and increasing precision. The data were narrowed with a limited, clear focus, following a set of logical predefined steps that allowed for attempts to generalise beyond the children within the study. Quantitative design strived to control for bias so that the facts could be understood in an objective way (Bowen, 2002). The main problem facing the thesis research was that it dealt with human beings and social settings, so it is acknowledged that it would be difficult for the researcher to remain totally emotionally uninvolved with the children. This emphasises the importance of using additional methods as detached objectivity becomes more difficult as elements of interpretation and subjectivity enter the frame.

Bargagliotti (1983) urged caution with using only quantitative research on humans, as attempts at capturing a holistic viewpoint are restricted because it is only possible to study what is observable. He suggested that quantitative data yields useful but limited data as only a partial glimpse of the phenomena being investigated is revealed. Berg and Latin (2008) suggested, similarly to Bargagliotti (1983), the use of qualitative research was more beneficial as it allowed for a more “holistic” (p.246) approach. Greig et al. (2007) argued that attempting to
understand how children perceive their experience requires an interpretive approach. Consequently, within the thesis research, such interpretative strategies were incorporated, which captured both objective measurements and subjective viewpoints. This was achieved by the use of both the accelerometer data gained from the children’s physical activity and a questionnaire recording the children’s perception of their physical activity. Alongside this, the field notes in the thesis research provided a wider holistic overview (Hammersley and Atkinson, 1995) of the children within the case study.

The quantitative approach (accelerometer data) facilitated the development of quantifiable information whilst the qualitative approach (questionnaire and field notes) was invaluable for the full exploration of the children’s physical activity. However, the questionnaire was recorded through a quantitative method via the use of Qwizdom (see section 3.5.2). Troiano et al. (2012) suggested that integrating both device-based (accelerometers) and reported methods (questionnaire) could provide a more comprehensive view of physical activity. When the accelerometer data and the questionnaire data are reflected upon alongside the field notes, this could be regarded as an element of triangulation, although this is recognised as limited within the thesis research. Thomas et al. (2011) recognised that if a range of approaches was used there was an advantage as it allowed for “methodological triangulation” (p.111). Haskell (2012) proposed that triangulating and using both self report and objective measures has the potential “to provide new insights” (p.s5). Thomas (2009) proposed that the process of triangulation and “viewing from several points is better than viewing from one” (p.111). Morse (1991) suggested that triangulation not only maximised the strengths and minimised the weaknesses of each approach, but strengthened research results and contributed to theory and knowledge development. Patton (2002) recommended that the use of triangulation adds credibility to the results and Robert-Holmes (2005) suggested that it provides greater validity of the results. A mixed methodology would incorporate “empirical data collection, using numerical and verbal data in order to gather rounded, reliable data” (Cohen et al., 2007, p.5).
3.3.2. Interpretivism

For the social scientist, there are a number of questions and perspectives that must be addressed within the process of generating knowledge. Firstly, do distinct patterns and laws exist in social science in a similar manner to the natural, that is can we view the world and the phenomena that occurs objectively or subjectively? On one side, there are those who are confident that social research is able to borrow from methods within the natural sciences, which emphasise the use of experimentation and direct measurement. On the other, there are those who believe the social world to be very different from that of the natural, and therefore, a different set of approaches to investigate phenomena is required (Henn et al., 2006). Therefore, an initial consideration for the social researcher is to decide how the analysis of phenomena will be approached, in order to fully capture its true richness and depth. To begin the inquiry, the researcher is required to make a number of assumptions (Creswell, 2007). That is, decisions on the research stance towards the interpretation of the nature of reality (ontological assumptions) and on how that which the researcher knows, is known (epistemological assumptions). Ontological assumptions question the nature of social reality (Morgan and Smircich, 1980) or the nature of being and of social beings (Bryman, 2004, Gray, 2004), which provide understanding of the basic features of the social world and enables appreciation of society, and its major social or small scale institutions (Blaikie, 2000). In this way, ontological assumptions are concerned with making sense of, or appreciating our surroundings. In contrast, epistemological assumptions are those that consider the acquisition of that which is considered acceptable knowledge (Bryman, 2004). This involves beliefs on how we achieve knowledge of the social world, ‘how we know what is known’, and choice of approaches involved in developing our knowledge (Morgan and Smircich, 1980). In this way, epistemology considers how we gather information, namely the practices adopted in gathering understanding on our surroundings. In essence, an epistemological position reflects beliefs held on the way which reality operates, and a stance on the reality of the nature of the social world and the way in which institutions, individuals and the environment relate within this. These assumptions held outline how knowledge of social reality will be gathered and how that which is believed to exist can be identified; with core assumptions held by the researcher directing the selection of methodology and method employed (Weed, 2009).
Murris (1992) suggested that philosophical questions are thought-provoking, as they open up enquiry, rather than closing it down with a single answer. This type of philosophical enquiry produced most of our general and unifying visions and insights (Osterhoudt, 1978). Nevertheless, it can be argued that scientific research has always involved the systematic study of a phenomenon of interest by detailed observation and accurate measurement of the outcome, using senses aided by technical instruments (Davey, 1994). Observations such as the recording of physical activity can be performed with the use of accelerometers (incorporated in this research) precisely because, as Berg and Latin (2008) suggest, when researching behaviour (such as physical activity) there may be difficulties in how children are able to provide “accurate and honest information” (P. 242) due to the difficult nature of recording physical activity. As discussed in the literature review (section 2.2), Kolle et al. (2009) suggested that “children's physical activity has provided serious measurement challenges for researchers” (p.1368) and children find it difficult to recall in detail their physical activity patterns (Kolle et al., 2009). Therefore, the use of accelerometers can potentially help to overcome these difficulties. The philosophy of science as highlighted over thirty years ago by Osterhoudt (1978), entailed a philosophical investigation into the whole of the scientific phenomenon. It is the systematic examination of the nature and significance of science, including the basic character and limitations of scientific knowledge. Parse (1987) suggested each branch of scientific enquiry is based on a set of theoretical perspectives or paradigms that guide enquiry and create scientific development. It is important to be aware of these theoretical perspectives and assumptions about research topics and to report these honestly when designing research and analysing data (Bowling, 1997).

The validity and assumptions that are made in the choices of methods of investigation are still debated in the philosophy of science. The methods that were chosen were dependent on the incorporation of a reflexive stance (Hammersley and Atkinson, 1995) which took into account the researcher's assumption of society. In the introduction chapter, I described how the thesis research has been heavily influenced by my role as a researcher through my own personal multi disciplinary background of Sport and Exercise Science, Psychology, Health Sciences, Physical Education, Primary Education and my present professional role (at time of writing) and understanding of both the primary school setting and of
Physical Education. From my personal research background, I am able to approach the research questions from a variety of theoretical perspectives. The main approach for the thesis research was physiologically based, which “focuses on the biological basis of behaviour and of psychological functioning” (Greig et al. 2007, p.20). It is through this exploration of the physical activity that data were collected using accelerometers. This approach assumed that all the behaviour is a result of biological factors. The physiological approach could also be described as a positivist approach (section 3.3.1) or objectivist viewpoint in which the “natural world is viewed as being hard and real” (Cohen et al. 2007, p.8).

3.3.3 Idiographic approach

Burrell and Morgan (1979) and Kirk and Miller (1986) suggested that mixed methodology could also be described as an idiographic approach or ideographic paradigm. Wellard (2009) proposed that “school settings are considered a prime site for constructing understandings of the individual body” (p.67). Therefore, school was an ideal place to explore what happened in relation to children’s bodies and physical activity levels within the school day. Consequently, the contribution that Physical Education lessons (may or may not) make to the children’s physical activity levels could also be explored. Silverman (2006) argued that mixed methodology could also be viewed as a form of naturalism. As the focus of the thesis research was concerned with “pursuits of the content of everyday life” (p.57) the children’s physical activity levels within the school day, could be considered to offer “deep insights into the ‘what’ of reality” (p.57). The deep insights that Silverman (2006) discussed could be incorporated within the thesis research questions by considering what contribution Physical Education lessons make (or do not make) to the children’s overall physical activity. It could be suggested that both an idiographic and naturalist approach are being used in the thesis research. Thomas et al. (2011) echoed these discussions and suggested that there is not one way to complete mixed method research. They described mixed methodology research as a “pragmatic approach of addressing interrelated questions” (p.357). They emphasised that often when mixed methodologies are used in research, they can occur in sequence, but the ordering of the sequence could be either quantitative or qualitative occurring first, or they could occur in parallel.
3.3.4 Mixed methodology

A physiological or positivist approach alone could not be used in investigating complex problems such as those involved in the exploration of children’s physical activity and of the contribution that Physical Education lessons make to the children’s physical activity, which is the focus for the thesis research. These ‘problems’ highlight the merits of adopting a more holistic approach to observing children within their ‘natural’ setting of the primary school. Brewer (2000) recommended that an immersion in the naturally occurring setting is needed to “capture the social meaning of activities” (p.56). Therefore, an “eclectic and heuristic approach to theories, methods and findings in research questions about humans” (Greig et al., 2007, p.45) was deemed necessary and consequently used within the thesis research. The benefits of immersion in a social setting such as a classroom were also described by Cohen et al. (2007) as an antipositivism (subjectivist) approach. In this case, the thesis research included participants’ observations and personal opinions, collected through a physical activity questionnaire using the collection tool of Qwizdom (see section 3.5.2).

Silverman (2006) advocated the use of a mixed methodology and mixed thinking, as it could allow for a “deeper understanding of social phenomena” (p.56) such as in the case of understanding the physical activity of the primary school children and the contribution that Physical Education lessons (may or may not) make to their physical activity. Polit and Hungler (1993) described research as an emphasis on the holistic and individual aspects of human experience. Cormack (1996) agreed that research allows the researcher to study the motivation of people. Dempsey and Dempsey (1996) concurred and suggested that research should involve the purposeful, systematic collection and analysis of data using investigative methods as these will enhance knowledge, which in turn will permit development and improvement where necessary. These link to the thesis research in that, as suggested by Polit and Hungler (1995), the thesis research considered the ‘experiences’ of the children’s physical activity that was completed within the school day. The thesis research also questioned the children as to their own perception of their levels of physical activity and collected and analysed this data in a systematic way, as Dempsey and Dempsey (1996) suggested (see section 3.5).
3.4 Methods

Greig et al. (2007) suggested that research that involved children needs to be considered from as many different directions or angles as possible as children are very complex. The key research design involved in the thesis research was the use of a case study; this design was aided through an action research approach over a longitudinal period and therefore, used a longitudinal strategy. A variety of strategies to support the case study design allowed me as a researcher to be in the centre of the research experiencing and collecting data in the everyday setting of the primary school classroom, throughout a full academic year. The use of a case study within one school, allowed for a focused analysis and investigation. Humes and Bryce (2001) advised that a researcher undertakes “investigative activity intended to yield new knowledge and understanding” (p.330). By positioning myself in the research, in a centralised setting, I was able to observe and record a form of critical realism through action research to examine a ‘what works approach’ (Bridges, 1999) throughout the thesis research. The general epistemological paradigm that was featured in the thesis research is of a positive position, (see section 3.3.2) which was a “process by which the researcher seeks to establish the truth of a theoretical statement” (Greig et al. 2007, p.46). Macdonald et al. (2009) suggested that positivism researchers traditionally work towards finding “a single, testable truth” (p.375). The theoretical statement in the thesis research was that - Physical Education lessons contribute significantly to overall children’s physical activity levels during the primary curriculum school day. This statement would be explored through a systematic collection of quantitative data regarding physical activity levels using accelerometers.

By using a case study design the children within the thesis research have some of their variables isolated, in that they all attended the same school and were all from a similar socio-economic background. Therefore, according to Greig et al. (2007, p.46) predictions could be made “to populations represented by samples being studied”; here they were referring to the other children within the case study setting of the primary school. For example the thesis research could be generalised to the rest of the children within the same classes of the case study school, as they would all be experiencing the same curriculum and format of the day and would also have the same physical activity opportunities available to
them. Greig et al. (2007) urged caution with this style of research as it involves human participants and both the children and I bring a conceptualisation of the research setting and what is expected to happen within the research. I, therefore, considered how the children might perceive both me as the researcher and being part of the research. This is why it was important to ensure that the children were familiar with me (this is further discussed in section 3.6.1).

3.4.1 Case study (research design)

The case study design was used within the thesis research, Baxter and Jack (2008) referred to this design as qualitative methodology that “provides tools for researchers to study complex phenomena”. The case study allowed as Crowe et al. (2011) described “in-depth, multi-faceted explorations of complex issues in their real-life settings” (no page number). Gratton and Jones (2004) have similar views and suggested that case studies could be used to provide an intensive study of a specific school. The case study design was chosen to provide a “foundation of knowledge” (Berg and Latin, 2008, p.241), upon which to fully examine the impact and contribution that Physical Education can make to physical activity levels within one school. As Thomas et al. (2005, p.19) suggested, a case study can “provide detailed information...and aims to determine unique characteristics.” Berg and Latin (2008) suggested that case studies provide a “method of bringing to the reader an account of a reality that may not be easily perceptible” (p.248). This is particularly important as physical activity is difficult to consistently visually judge, for instance a teacher may have a great deal of difficulty making assessments about a child’s activity through occasional observations. The thesis research findings will provide information not readily or quickly available for all children. Greig et al. (2007) proposed that case studies are of “immense value.... In particular when they provide a wealth of detail” (p.9) and are “suitable for real life settings” (p.146). Thomas et al. (2011) agreed that a case study provides great detail. Zainal (2007) suggested that a case study can produce a thorough report for a single case, such as a school.

Simons (2009) defined a case study as a focused exploration of a particular place, person or example, analysing the complexity of it from different perspectives. Thomas et al. (2011) had similar ideas and suggested that using a case study design has enabled focused questions to be explored from several
different angles, whilst causing minimal disruption to the participants’ daily routine. Yin (2008) also suggested that case studies allow for study of the individual or situation from multiple angles and emphasised in previous work (Yin, 1994) that case studies are suitable for investigating within real life contexts. Thomas (2009) focused on the fact that case studies can include a range of as many different tools and procedures as necessary. In the thesis research the case study was the exploration of the school, the children and their physical activity levels by year group, gender and type of day. The multiple angles are achieved through using both accelerometer data collection and physical activity questionnaire data as the main focus, but also referring to the field notes (see Appendices 1 - 3) made throughout the case study.

As the thesis research was to be completed over an academic year, it aimed to provide a wealth of information about the children’s physical activity levels. This was important, in terms of the class teachers understanding through being able to visually see the children’s physical activity measurements and then responding to the results. Yin (2008) also stated that “case studies have been completed about programmes, about the implementation process and about organizational change” (p.29) “to investigate a contemporary phenomenon within its real life context” (Yin, 2008, p.18). These ideas particularly reflected my case study approach which examined and explored how active primary school children were during the school day and also investigated the extent to which the primary school setting contributes to the children’s recommended levels of physical activity (DH, 2005; WHO, 2010). It also measured the contribution of Physical Education lessons to the primary children’s physical activity levels within the school day.

Bell (2005) stated that evidence in a case study “has to be collected systematically, the relationship between variables studied... and the investigation methodically planned” (p.12). One advantage of using a case study approach is “the detailed documentation of the context” (Berg and Latin, 2008, p.248). This again was reflected in the methods: the data were collected systematically from the accelerometers, with detailed documentation of factors that occurred on that day, such as the different time of day and weather conditions that prevailed (see section 3.9.1.4). The relationship between the variables was studied in that the data were collected from both those days that included Physical Education lessons
and also those days that did not. This allowed for consideration of the contribution that Physical Education made to overall physical activity levels. The days were methodically planned and recorded throughout the school year.

The difficulties of using case studies were highlighted by Bell (2005) who questioned “the value of the study of single events” (p.11) as it is difficult for other researchers to cross check the information or any isolated events. Walliman (2011) too, suggested that case studies can often be hard to generalise. Therefore, by completing the case study over a long period of time (an academic year) it meant that it was possible to look at more than just one isolated event of the children’s physical activity, thus making the results more robust. This robustness was described by Thomas (2009, p.116) as a ‘rich picture with thick description’. I acknowledged that the use of a case study approach may mean that the results reflected only this particular school, and it may be difficult to generalise to other schools, but it would be possible to generalise to the other classes within the case study school. Gillham (2000) suggested that it was vital to enter the case study with a completely open mind to ensure that no outside thoughts affect the outcome. The case study was a way of considering and examining the children’s physical activity over an extended occasion in time and it was useful for understanding what occurs to this physical activity within a particular real life context (Qi, 2009). In the case of the thesis research, the context was the primary school on both days that included Physical Education and those that did not. Nisbet and Watt (1984) continued to develop the idea of a case study by suggesting that the reasoning behind conducting a case study for research was that it allows for the results to be more easily understood by a wider audience.

Overall, it was important to investigate whether Physical Education lessons could contribute to physical activity levels and if the DH (2005) and the WHO (2010) physical activity level recommendations for children were achievable within one school. As Thomas et al. (2005) suggested, “one of the advantages of a case study is that of formulating new ideas and hypotheses about problem areas, especially for which there is no clear cut model” (p.292). This reflected directly on the research in that the results may be able to present new ideas within the area of physical activity. In particular, it maybe able to provide new information on the
physical activity levels of infants and juniors and whether there are differences in
their physical activity levels or intensities within a primary school setting. It could
be argued that as the case study is in combination with a longitudinal strategy of
collecting data over an academic year, it can investigate the impact that Physical
Education can (or not) contribute to physical activity levels. In comparison to
previous physical activity research, such as Belton et al. (2009; 2010) who
considered physical activity over a period of seven days in children aged seven to
nine, the use of 36 days and the expansion of the age range to include infants as
young as six years of age and juniors up to ten years of age allowed for a more
detailed examination of physical activity levels within the whole of a primary school
setting.

3.4.2 Action research

McNiff (2002) defined action research as “a way of researching your own
learning,” (p.15) whilst Cohen et al. (2007) defined action research as any context
when specific knowledge is required for a specific problem in a specific situation,
which is why action research can be used within a case study, as it focuses within
a specific situation. Pearce (2010) added that action research “is often carried out
by practitioners within their own working contexts” (p.503) which she regarded as
a very “supportive form of enquiry” (p.503). These definitions provided practical
ways of examining practice. The thesis research question – “What contribution did
Physical Education lessons make to primary children’s physical activity levels?”
was a specific question in a particular situation. Therefore, the thesis research
question linked to the above definitions of action research. Mortimore (2000) and
Hammersley (2003) agreed and suggested that educational research (such as
action research) is important in terms of evaluations of practice since it deals with
human actions and therefore, has to be evaluative by nature, linking to McNiff’s
(2002) definition of action research. However, Bassey’s (1995) viewpoint,
alysed by Hammersley (2003) was that research in educational settings is only
educational if it is concerned with attempts to improve. The thesis research was
searching for what is occurring within the school day in terms of physical activity
and Physical Education lessons’ contribution to children’s physical activity levels.
The results may offer suggestions for the class teachers as to where opportunities
for physical activity could occur, or be enhanced, following dissemination of the
results. The thesis research does not, however, solely focus on attempts to
improve physical activity levels as this would assume and imply that the school was not currently achieving the recommended physical activity levels (DH, 2005; WHO, 2010). Action research allowed me to encourage the children, parents, class teachers and school to consider the information gained from the thesis research (see chapter 6 for the class teachers’ reactions to the results).

Action research contemplated the possibility of research and practice coming together and thus by implication embedded theory within practice rather than the theory being abstract from it. In terms of educational practice, what is ‘good’ is always based on a commitment to certain values which need to be tested and evaluated. Action research also has the ability to examine and explain how and why one adopts specific practices, whether there were any improvements that were needed and whether those improvements took place (McNiff, 2002). This is particularly prevalent in the teaching profession, where teachers constantly evaluate and examine their own practice to aid their teaching and the children’s learning. Hargreaves (1999) referred to this kind of evaluation and examination as the teachers / practitioners “habitually tinkering” (p.242). McKernan (1996, p.5) defined action research as “a systematic self reflective enquiry by practitioners to improve practice”. However, action research exists also to understand events and situations that occur within ‘the setting’; in the thesis research the setting is the primary school. McKernan’s (1996) definition has particular resonance to the thesis research as my reflective look at the extent to which Physical Education contributes to overall physical activity levels was achieved through the use of physiological data, questionnaires and field notes. These results can then be “disseminated” to support development “towards more effective and better” (Radford, 2006, p.179) awareness of children’s physical activity, by the children, class teachers, parents and myself as a teacher educator. Radford (2006) emphasised dissemination as an important part of action research and a way of closing the action research loop (the dissemination of results and the class teachers’ responses to the results and the closing of the action research loop will be discussed within chapter 6).

According to Wallace (2005), the use of observations and in particular field notes (see Appendices 1 – 3 for field notes), was important for the following purposes: to log events, describe situations and “to record and reflect upon
incidents and experiences from which something useful can be learnt that will help us to develop and enhance our professional practice" (p.22). In addition McNiff et al. (2003) recommended that people keep a record (such as field notes) for a variety of reasons. I will use my field notes to reflect on what has occurred throughout the thesis research, in particular within the pilot phase to explore any adaptations that were needed for the main phase of the research (see section 3.9.1 and Appendix 1). Bourdieu and Wacquant (1992) suggested the importance of a reflexive approach and through using field notes this enabled me to have this viewpoint, in particular after the pilot phase to reflect on the results and what happened during the data collection, before completing the main phase. Also the reflection of the class teachers as the results were disseminated was important, and also linked to the action research loop (as discussed in chapter 6). I also felt that the use of field notes was a utilitarian approach that was applicable and relevant to the setting of teaching and it would have an impact on my own practice and the practices within the case study school. Impacting upon my own practice was important; as Furedi (2004) highlighted, research informed teaching allows academics to rethink, rework, and explore fundamental concepts within their own disciplines. Concepts such as: the contribution of Physical Education lessons to the children’s overall physical activity levels and also how much physical activity children are able to complete within a primary school day.

Radford (2006) advocated that “research should provide specific and useful information that feeds directly into educational improvement” (p.179). The results and data set will not only impact on my practice as an educator of new primary school teachers, but it will also have an impact through the dissemination of the information to the class teachers within the case study school (see chapter 6 for the class teachers responses). This will potentially “improve quality of life in social settings” (McKernan, 1996, p.3). McNiff (2009) proposed that the focus of action research should be to answer the questions outlined in Appendix 4, in which I have given my initial answers to McNiff’s (2009) questions, the action of which helped form and shape the thesis research.

Lomax (2002) also provided a list of questions when considering action research; these are particularly relevant to my approach to this research. Under the ‘purpose’ heading she asked; “can I use my knowledge and influence to
improve the situation?” (p.124) Knowing the contribution that Physical Education lessons make to overall physical activity levels within a school day and how active children are within the primary school day (through mapping their physical activity levels) may influence and help improve the situation for the children. Within Bell’s research (2005) she questioned Lomax’s (2002) ideas and asked “whether the action researcher can collect rigorous data which will provide evidence to support claims for action” (p.9). Knight et al. (2006) advise that accelerometers allow for rigorous data to be collected as they “can be easily worn….., they can be used anywhere” (p.117). Knight et al. (2006), considered the use of accelerometers to collect data in a number of different settings including “measuring aspects of human performance, which may be used for teaching and demonstrating skill acquisition, coaching sporting activities, sports and human movement research, and teaching subjects such as physics and Physical Education” (Knight et al., 2006, p.117).

Bell (2005) suggested that action research “involves a feedback loop in which initial findings generate possibilities for change” (p.9). The feedback loop within the thesis research will be the process of feeding back to the head teacher, class teachers, parents and children. The aim of feeding back to the class teachers and the head teacher is to provide them with information about the activity levels of their children, within the school day over an extended period, so that they can make informed choices about any changes to Physical Education lessons or the places and opportunities for physical activity to occur in their school day (see chapter 6 for the class teachers responses). The results may suggest potential opportunities for increasing, promoting or rewarding physical activity throughout the school day. However, determining what was occurring within the school day was of primary importance before any changes or strategies could be implemented. Feeding back to the parents may help them to become aware of the potential needs of their children, for example, whether the children need opportunities for further physical activity outside of school time. The aim of feeding back to the children was to help educate them and develop their understanding of how physically active they were and needed to be, or could be during the school day. I feel that by integrating myself within the school, those to whom I am feeding back will appreciate that I am not being critical about the current situation but am instead aiming to highlight the current situation in order to
aid the school, parents and children in promoting and developing the physical activity of these children. As mentioned previously, this closing of the action research loop (Bell, 2005) through feeding back will be completed and discussed within chapter 6.

### 3.4.2.1 Action research and primary education

Teaching is a reflective and reflexive profession (Browne and Haylock, 2004). At Canterbury Christ Church University, at the time of writing, students are taught to place an evaluation box on every lesson plan that they develop so that they can record their own evaluations of their teaching and also of the children’s learning. This reflection can impact upon their planning for the next lesson. This was referred to as critical reflection within the action research cycle by Elliot (1991). It allowed for the process of learning to be adapted for the individual and the group. It also allowed for personal examination of the effectiveness of the teaching (Fry et al., 1999). It was, therefore, important to reflect upon and to be aware of what was happening within the case study setting of the primary school, in terms of the children’s levels of physical activity. This was in accordance with Macdonald et al.’s (2009) view of reflexivity, which they suggested entails “an awareness of oneself as a knowledge producer who generates rather than collects data and so as far as possible must write themselves into their studies” (Macdonald et al., 2009, p.376). I am writing myself into the thesis research by allowing the results to impact on the school within the case study and questioning my assumptions of the contribution of Physical Education lessons to children’s physical activity levels. I am also using the thesis research to inform my own teaching of Physical Primary Education.

Within a primary education setting “action research is a process in which teachers investigate teaching and learning, so as to improve both, their own and their students’ learning” (Teachers’ TV, 2006, no page number). As such action research projects can currently occur within the primary school settings, providing insight and solutions. As Socrates (cited in Wallace, 2005, no date) claimed “The unexamined life is not worth living” (p.21). Wallace (2005) felt that Socrates’ words of wisdom were still relevant in present times, in that there was a need to examine and reflect upon experiences in a constructive way in order to learn from successes and mistakes.
3.4.3 Longitudinal strategy

A longitudinal strategy of collecting data over a long period was chosen because whilst many theorists and previous researchers have examined physical activity, it has often been performed within a limited timeframe of between three and seven days such as Duncan et al. (2007) who only considered four days or Belton et al. (2009) who examined seven days. However, this potentially does not show the whole impact that Physical Education lessons could make to physical activity levels. These previous lengths of time allowed for only a small snapshot of time for those particular children, where the data may potentially not be a true reflection of the physical activity that children normally experience within the primary school setting, particularly when considering that in Physical Education, the activities within the National Curriculum (DfEE/QCA, 1999) vary across the academic year and across year groups (infants and juniors). Therefore, I thought it valuable to consider the whole academic year in order to see a more realistic profile of how Physical Education may or may not contribute to physical activity levels throughout the year. Thomas et al. (2011) supported the use of a longitudinal strategy (as in the thesis research) stating that “longitudinal studies are powerful” (Thomas et al., 2011, p.292) as they could display a change in behaviour across the period of research within the same group of participants. This would allow the data to capture the nature of the physical activity of the children within the whole year, through the notion of longer periods of time, rather than one off snapshots. The longitudinal strategy justified the use of only one school, rather than that of many schools, for a shorter period of time, due to the potential depth of data to be collected (Thomas et al., 2011). Also, by using a longitudinal strategy throughout both the pilot and main phases of research, it allowed for the children to become familiar with the data collection tools and remove their need to ‘fiddle’ with them, which might have impacted the results during a shorter data collection period. This is of particular importance when considering the age of the children and their inquisitive nature.

Elements of ecological research were also used within the thesis research, which link to the longitudinal strategy used. Hastie and Sidentop (2009) defined the ecological model of research as “a study of classroom life as it naturally unfolds” (p.395). They suggested that the ecological model can only be achieved through long term observation. In the case of the thesis research, the long term
observation is the longitudinal recording of the physical activity levels of the children through accelerometry, within their natural setting of the primary school. The ecological paradigm is often used by teachers to help them understand the behaviour and dynamics that occur within the classroom (the classroom in terms of Physical Education lessons also includes the outdoor environment, or the indoor hall, rather than just the physical classroom), alongside or within an action research approach, to help inform practice. Sidentop (1998) suggested that the ecological style allowed researchers to: interpret, predict, and respond. In the thesis research this style was implemented in particular with the analysis of the results, especially, in terms of where potential opportunities within the school day and within the Physical Education lessons could be utilised to increase the physical activity levels of the children.

3.5 Data collection tools

This section considers the data collection tools (the apparatus) used within the thesis research. These include the use of accelerometers to record the data on the physical activity levels of the children and Qwizdom to record the children’s own perceived levels of physical activity.

3.5.1 Accelerometers

The first part of this section explores the different objective techniques for assessing and measuring physical activity and discusses the rationale behind using accelerometers within the thesis research. Armstrong and Welsman (2006) believed that the techniques used to measure physical activity in children must be socially acceptable, should not burden the child with cumbersome equipment and should only minimally influence the person’s normal physical activity levels. A key reason why accelerometers were used within the thesis research was that they are not cumbersome, they are socially acceptable by the children, school and parents and being so small, they would only minimally influence the children’s physical activity levels. Oliver et al. (2009) suggested that “accelerometers are arguably the most appropriate objective measurement tool for quantifying physical activity” (p.185) and that objective measurements (such as accelerometers) are more likely to “yield the most accurate information on physical activity” (Oliver et al., 2007a, p.1047). Cardon et al. (2007), prior to Oliver et al. (2009; 2007a), stated that the use of accelerometers has been shown to be a valid, reliable and objective
method of monitoring physical activity in children in field settings. Rowlands’ (2007) earlier work supported Oliver et al. (2007a; 2009) and stated that the use of accelerometry is a strength as this measurement tool is a “valid, reliable, objective measure of children’s physical activity” (Rowlands, 2007, p.1067). Evenson et al. (2008) conducted a calibration study and found that the ActiGraph (the same make of accelerometer as used in the thesis research) accelerometer’s discrimination of sedentary behaviour was, as Evenson et al. (2008) described, ‘almost perfect’. Although it was not as precise as it was for the sedentary behaviour, its discrimination of moderate and vigorous activity was acceptable. From their calibration investigation, they suggested that the ActiGraph accelerometer “can be used to distinguish differing levels of physical activity intensity as well as inactivity among children 5 to 8 years of age” (Evenson et al., 2008, p.1557). Therefore, this was considered suitable for the primary aged children within the thesis research. Yet, Oliver et al. (2009) aired caution and highlighted that there are multiple issues that existed regarding “collection, reduction and interpretation of accelerometer data” (p.185).

In their more recent study, Oliver et al. (2009) considered the use of accelerometry to assess preschoolers’ (a child who is below the official school starting age of 5 years, and attends a nursery setting) free play; they suggested that, due to the age of the children, they had relatively immature movement patterns, seen in the initial stage or elementary stage of fundamental movement stages when described by Gallahue (1996). The implications of the children showing immature movement patterns meant that the activity types and sustained durations that were shown during the “activity monitor calibration were unlikely to be replicated in the natural environment” (Oliver et al., 2009, p.182) of these young children. They videoed the young children as well as taking measurements from the accelerometers that they wore to consider if discrepancies had existed in the time spent in each physical activity level, as suggested by Mahar et al. (2008). They suggested that activity was being missed, in terms of being recorded, if epochs (the measurement of time that accelerometers record the physical activity in) were set too high and that shorter epochs of 1, 3 or 5 seconds should be used, especially for children in the initial or elementary stage of motor development (Gallahue, 1996). Oliver et al. (2009) found that if they used 15 second epoch measurements 82% of the epochs were measured correctly when compared with
the observations, with 11% overestimated and 6% under estimated. They also suggested that “the ability to accurately measure physical activity at the most basic level is important because it is this information that is eventually translated and promoted to the general public for interventions and health promotion messages” (Oliver et al., 2009, p.188).

In relation to the thesis research, the epoch recording time was considered in light of Oliver et al.’s (2009) work and 60 second intervals were chosen. Puyau et al. (2002) used 60 second intervals in their research and Nilsson et al. (2002) proposed that using 60 second intervals was appropriate when observing prolonged activity patterns, as in a longitudinal study such as the thesis research. Rowlands et al. (2006) also recommended 60 second time sampling intervals and proposed that in most field studies 60 second epochs were used, as the “use of epochs lower than this resulted in limited recording time” (p.52). The decision to use 60 second intervals within the thesis research was due to the age of the children, who were between 6 and 7 years (infants) and between 9 and 10 years (juniors) and as such were all considerably older than those used by Oliver et al. (2009) and at a more advanced stage of motor development (Gallahue, 1996).

According to Gallahue (1996) children reach the mature stage any time between the ages of 5 and 7 years, by which time they become more mechanically efficient, coordinated and controlled (Gallahue and Ozman, 2002; Pickup and Price, 2007). This meant that it would be very unlikely, that movements would be missed and that it would also be possible to replicate the movements. Prior to the start of the thesis research, to ensure that no movements would be missed, all of the children who participated were assessed through visual observations by myself and the class teachers during a Physical Education lesson, to check that they had reached the mature stage of their physical development. Discussions were undertaken and comparisons were made to the stages of physical development. In accordance with Gallahue (1996), no child was excluded from the thesis research on this basis. The other consideration of the 60 seconds recording epoch was the amount of data that would be recorded over an academic year within the longitudinal study. 16 million rows of data would be produced when the data were collected at 60 second intervals, and there were 371 minutes in a school day, and 720 days (in total for all participants) being collected for the
pilot and main phases of the thesis research (36 days per participant). This number of rows of data I considered a manageable data set. Recoding the data at any substantially higher degree of granularity would have started to render the data set considerably less manageable from an analysis perspective.

Oliver et al. (2007c) recommended the “gold standard for physical activity measurement” (p.303) to be direct observation; however, this is time consuming, expensive and in the case of this thesis research, impractical. If I as the researcher was in the class setting throughout all the testing days, the children’s constantly observed behaviour may have differed from their more natural / usual unobserved behaviour and as the purpose of this thesis research was to observe the children’s natural physical activity, it was important to consider other methods of observations. Oliver et al. (2007c) suggested that although “objective techniques have been used widely in school aged children limited work has assessed the efficacy of these instruments” (p.303). Oliver et al. (2007c) believed that accelerometers are far more reliable, although they are not as accessible as other physical activity measurement tools. However, accelerometers are still somewhat too sensitive for certain actions such as unwanted singular movements that directly affect the accelerometer (Bravata et al., 2007), as opposed to sustained activity. An example of this is when someone swings or shakes the device; this is one of the reasons for completing a pilot phase of the thesis research to ensure a reduction in this behaviour which prevented a “loss of data due to improper use” (Muntz, 2009, p.3), as much as possible. However, Oliver et al. (2009) advise that the swinging or shaking of the devices should be included as natural physical activity, in particular with young children, although this could be criticised as producing higher activity readings. This behaviour could be explained as being part of their curiosity and hence could be considered creative and spontaneous movement. Curiosity and creativity are both encouraged within the physical development and creative development areas of learning within the Early Years Foundation Stage (DfE, 2008) and therefore, this could be regarded as natural movement. Part of the purpose of the pilot phase (see section 3.9) was to help overcome this potential type of behaviour, although natural, to ensure consistency and also to increase the familiarity of wearing the accelerometer around their waist, rather than removing them to swing them round their heads.
One limiting factor in using the accelerometers was accessibility (as they are not a common item found in the primary school) and another factor was that they are relatively expensive. Therefore, the school could not easily repeat the measurements if they wanted to, by themselves due to the high cost of the apparatus. The data obtained from an accelerometer is much more difficult to interpret when compared to counting the number of steps taken (as in pedometers), but it is possible to transform the data that has been collected and stored on the accelerometer into understandable data known as METs (metabolic equivalents value which is a physiological concept of expressing the energy cost of physical activity). Thus, it is possible to calculate how many METs have been achieved throughout the day (see also section 2.3.3 for further discussion on METs). For children, the average number of METs for moderate and above physical activity is at and over three and needs to be achieved for at least sixty, one minute occasions throughout the day to achieve the hour of physical activity (Butland et al. 2007, Poskitt and Edmunds, 2008) recommended by DH (2005) and WHO (2010). For example, 1 MET is equivalent to the body being at rest and represents the metabolic energy expenditure during rest. At and over 2 METs but under 3 METs is the equivalent of light physical activity, in which the body is moving, for example, for a short walk round the classroom, going up stairs or playing (Topendsports, 2011). At and over 3 METs is the equivalent of moderate to vigorous physical activity, in which the body begins to sweat and breathing increases. Examples of these types of activities would include brisk walking, jogging, running, playing football (NHS, 2011b) (see also section 2.3.3 for previous definitions).

Sirad and Pate (2001) considered how physical activity is assessed in children and adolescents. In particular, they explored objective techniques including heart rate monitors, pedometers and accelerometers. They believed that using accelerometers, even though they are inaccessible (due to cost) to many, is the most reliable way of assessing activity. Sirad and Pate (2001) also suggested that heart rate monitors rely on “the linear relationship between heart rate and oxygen consumption” (p.443) and they showed that at low physical activity intensities this relationship was not ‘robust’, finding that the “relationship could be affected by factors other than body movement such as psychology and environmental stress” (Sirad and Pate, 2001, p.443). Armstrong (1998) also
suggests that measuring heart rate is not a direct measure of physical activity as it measures “the relative stress placed on the cardiopulmonary system by the activity” (s.10), not the activity itself. The relationship between heart rate and physical activity Armstrong (1998) implied was more secure at high intensities rather than low level physical activity. The strengths, however, of using a heart rate monitor suggested by Sirad and Pate (2001) were that it is “unobtrusive, requires minimal participant and experimenter burden and is cost effective for use in small to moderate size studies” (p.444). However for the thesis research, heart rate monitors were considered to be obtrusive because in order to enable the children to wear them and to ensure that they were correctly placed would make them undesirably noticeable and may interfere with the children’s activities. Heart rate monitors are not items that the children could easily forget about and because of the age of the young children within the thesis research, they might fidget with the heart rate monitors causing a disconnection between the heart rate band and the children’s chests and potential losses in data collection and recording. It was also identified and decided that the heart rate monitors available for the thesis research would be too big for the primary aged children and therefore, not appropriate for use, as they may cause recording errors due to not fitting correctly.

Sirad and Pate (2001) reviewed the use of pedometers. A Pedometer is a motion sensor that is regarded as a “relatively simple electronic device used to estimate mileage walked or the number of steps taken over a period of time” (p.445), which has existed since the 1500s according to Janz (2006), although not in an electronic form. Studies such as those by Eston et al. (1998) and Louise et al. (1999) observed a strong association between the use of pedometers and the observation of number of steps taken, with Cordon and de Bourdeaudhuij (2007) identifying a value of “13,874 steps as comparable to the accumulation of 60 minutes of moderate to vigorous physical activity throughout the day” (p.1052). The strengths of this type of motion sensor are that they are “relatively inexpensive, reusable, objective and non reactive” (p.1052). However, even though Cardon and de Bourdeaudhuij (2007) identified the number of steps, Sirad and Pate (2001) suggested that pedometers do not record the intensity of the activity, only the amount of steps carried out during the activity; a statement supported by Armstrong and Welsman (2006).
Pedometers are quite commonly used as a research tool because they are relatively cheap, simple to use, children friendly and are suggested within the Healthy Schools Booklet A (Healthy Schools, 2007) for use in school, to measure physical activity. However, results from pedometers can be inaccurate, as according to Bravata et al. (2007), pedometers are insufficiently sensitive. Tudor-Locke et al. (2006) highlighted one of these limitations as the possibility of the digital displays on pedometers accidentally resetting themselves, yet some pedometers have a delayed reset button to prevent this from occurring. It is widely believed that 10,000 steps a day are enough to reduce mortality, a statistic that has gained much media attention (Krucoff, 1999; Spilner and Robertson, 2000; DeSa, 2001; Kosta, 2001). Tudor-Locke and Bassett (2004) suggested that 10,000 steps a day represents the threshold that should be used to classify individuals as active and that also provides health benefits similar to the daily target of at least moderate physical activity at and over 3 METs, although Tudor-Locke and Bassett (2004) highlighted that 10,000 steps a day may be too low for children. This threshold may be too low due to each individual child being different (e.g. body size) and therefore, ‘definitive’ numbers should be viewed with a degree of caution. Taking this into account, research by Tudor-Locke and Myers (2001) suggested that a healthy adult takes between 7,000 and 13,000 steps a day. Welk et al. (2000) believed that on days that require little physical activity, 7,400 steps is an average amount that should be walked. This figure is also supported by both Tudor-Locke et al. (2002) and Bassett et al. (2000) in respect of the 40 – 69 age range; furthermore, they claim that an average of 6,000 steps are taken on inactive, non sporting days amongst healthy candidates. Rowlands et al. (1999) believed that children who live in the UK already take 12,000 – 16,000 steps a day, with boys averaging 13,000 steps and girls averaging 11,000 steps at least five days a week.

It is important to consider also the variance that may occur with the type of pedometer. Until 2003, only Bassett et al. (1996) had conducted a multi brand study of pedometers. From their research, they were able to conclude that pedometers became more accurate as the speed of walking increased. In 2003, Crouter et al. also considered different brands of pedometers and found that, in general, pedometers were most accurate when assessing steps; however, there was more variance in accuracy when assessing distance and kilocalories of
individuals. So Crouter et al. (2003) suggested caution to be taken in analysing the data, when and if a variety of pedometers are used. The “sensitivity thresholds for detecting steps can vary between different types of pedometers” (McClain and Tudor-Locke, 2009, p.528) which may mean different pedometers record different numbers of steps for individual children compared with the true number of steps taken. Pedometers also display the total number of steps recorded for the participants which was not regarded as being a suitable value for the thesis research. The children are used to a testing environment, but I did not want them to become competitive with each other and consequently display behaviour that was not indicative of their everyday physical activity. Knowing the true results would also make the children’s perceived level of physical activity invalid as they could then just look at the number of steps rather than estimate their own physical activity levels. Wragg (2001) advised that this competitive nature can often occur when children reach an age, in particular juniors, when figures count, especially test figures. I wanted the children to reflect their ‘normal’ physical activity within a school day, and so I regarded it as not suitable to use pedometers. As accelerometers do not visually display the results this would ensure that the number being recorded did not act as an external motivator. It is acknowledged that the children would know that they are being recorded and may act differently, however this was another reason for completing the pilot phase of the thesis research to allow the children to become familiar with the tool and not allow it to unduly affect their ‘normal’ physical activity. McMinn et al. (2010) researched the validity of using NL-1000 pedometer as an inexpensive accurate measure of physical activity. They compared the NL-1000 pedometer to the Actigraph GT1M accelerometer. Children wore both devices during 3 different conditions, a Physical Education lesson, a cross country run and a classroom based physical activity, and they found that the physical activity intensity level data by the NL-1000 was not significantly different from that obtained from the GT1M. They suggested that the NL-1000 pedometer which shows the number of steps completed and the time spent in moderate to vigorous physical activity levels is a suitable, inexpensive substitute to the accelerometer that could be used within a primary school setting (McMinn et al., 2010). However, these pedometers still display the children’s physical activity results which was not wanted within the thesis research and therefore, made them an unsuitable measurement tool.
Louie and Chan (2003) considered the positioning of the pedometers on the body and suggested that there are no significant differences between pedometers worn on the left and right hips. Oliver et al. (2007c) suggested wearing pedometers at the back to prevent reactivity, however the children used in the thesis research are at an inquisitive stage in life and even if they were wearing the pedometers on their back, there would be the potential that they would turn them round to their fronts to see how they were doing and therefore, be reactive and potentially trigger ‘fake’ steps in doing so. To prevent this reactivity, pedometers were not used in the thesis research. Also, McClain and Tudor-Locke (2009) proposed in their review of pedometers that “pedometers are not designed to detect time in specific intensity categories” (p.528). Therefore, these would not be an appropriate tool to address the thesis research question of how active are primary school children during the school day as the different intensity levels were also required to fully explore this question.

Sirad and Pate (2001) also reviewed the use of accelerometers, which they define as “more sophisticated electronic devices that measure accelerations produced by body movement” (p.445). They found that there was considerable variability in the results from accelerometers but found that this was due to the position on the body that the accelerometers were placed, “hip, low back or ankle” (p.445). The major limitation of accelerometers, however, is their cost: They are approximately 32 times the price of pedometers, with an accelerometer costing £190; whilst a pedometer costs £6 (Heyward, 2010). This cost factor “potentially limits their use in larger research studies” (Oliver et al., 2007c, p.1054). According to Janz (2006), another limitation of the accelerometers is their “inability to assess load carrying and (generally) upper body movement” (p.191). Fairweather et al. (1999) and Puyau et al. (2002) proposed in their research that even though accelerometers only measure in the vertical plane, and are not able to measure upper body movement, load carriage or changes in terrain, they are more than adequate to quantify children’s physical activity levels. This limitation of upper body movement, could be overcome by wearing the accelerometer around the wrist rather than the waist, but this would potentially overestimate the amount of physical activity especially if the wrist that the accelerometer was worn on was the one used by the child to raise up in class when indicating that they knew the answer to the teachers questions. Because, within a school setting, there are few
opportunities for load carrying, it was regarded that wearing the accelerometer around the waist would provide a more than accurate reflection of the child’s physical activity.

Oliver et al. (2007a) reviewed studies in preschool physical activity and found that the majority of them had used ActiGraph accelerometers, which is the type of accelerometer used within the thesis research. By using this type of accelerometer, the data output provided a measure of activity volume and / or activity rate, which can be transformed to derive “frequency, intensity and duration of physical activity” (p.529), a particular strength of this type pf accelerometer according to McClain and Tudor-Locke (2009). These authors stated that using this type of data collection tool can “minimize error associated with data manipulation” (p.529), an important factor when considering the amount of data collected within the thesis research. Sirad and Pate (2001) also found that accelerometers “provided an objective, nonreactive and re-usable tool, but have limited ability to assess cycling” (p.447). However, this identified limitation would not be a problem in the thesis research as cycling is not part of the school curriculum. Armstrong and Welsman (2006) highlighted that there are only a few European studies that have more than 3 days worth of data collection using accelerometers. Therefore, the thesis research would add to the field of knowledge of physical activity data in particular by supplying new information from within the primary school setting on the differences in physical activity of the infant and junior aged children. It would also add to general children’s physical activity information, as the thesis research will be conducted over a longer period of time than previous studies. Another key advantage of accelerometers according to Oliver et al. (2007a) “is that data collected are likely to be free from researcher bias” (p.1047) and that they can be used to record physical activity over an extended period of time, which is particularly useful in this longitudinal case study approach. A practical advantage of using the accelerometers over heart rate monitors or pedometers was that the ActiGraph model came with an elasticated belt, which meant that they were easy for the children to wear, easy to take on and off when changing into Physical Education clothing and reduced the chance of the child “inadvertently losing the instrument” (McClain and Tudor-Locke, 2009, p.531). This prevention of losing is considered as a vital factor by McClain and
Tudor-Locke (2009) when using accelerometers on young children, thus reducing participation burden.

The ActiGraph accelerometer model 7161 (MTI Health Services online, no date: Manufacturing Technologies Inc) (see Figure 1) was the type used in the thesis research. Janz (1994) and Janz et al. (1995) have shown this type of accelerometer to be a valid, reliable and objective tool for monitoring physical activity in children. With the ActiGraph accelerometer, the ActiSoft analysis software 3.2 system was used to collect physical activity data (MTI Health Services online, no date). The ActiGraph accelerometers can be worn in a variety of ways: Directly on an elastic belt around a wrist; or around an ankle; or in a pouch on an elastic belt around the waist. Welk (2002) identified that the movement can be measured accurately using any of the three positions. The latter positioning around the waist (on the hip) was chosen as this was regarded as the most appropriate design to be used with primary school aged children; the other methods could result in damage to the accelerometer through droppage or spillage. Welk (2002) also suggested that the preferred site for most researchers using accelerometers was around the hip, as in this location it records “normal locomotor movements and participants find it less obtrusive for sitting and moving around” (p.126), an important factor to consider when using this equipment with children. Welk (2005) concluded that there is little evidence to suggest that one position is better than another, though the hip is the most common location. Fairweather et al. (1999) identified the right hip as the most popular site but argued that the side is not important, as long as the position is standardised. The positioning of the accelerometer was consistent throughout the pilot and main phase of the thesis research to ensure that the results were comparable. The important part of the positioning of the accelerometer was consistency and ensuring that the belt was securely tightened (Welk, 2005). This positioning and tightening of the belt that held the accelerometer in the pouch was replicated in the thesis research (see Figure 2).

The ActiGraph accelerometer weighs $1^{1/2}$ ounces, the equivalent to 44 grams (MTI Health Services, no date) (see Figure 1). As this is a small weight, the accelerometer would not impact on the children’s normal physical activity routines. The accelerometers were chosen due to the fact that they were less restrictive and
allowed full movement compared to the heart rate monitors (as discussed previously). I demonstrated to the children (prior to the start of the pilot and main phase of data collection) how to put the belts on with the accelerometer in the pouch at the appropriate height for their hip over their school trousers or skirts and how to adjust them so that they were held against the body. I described this to the children as ‘feeling snug’ and asking them to make sure that the pouch ‘did not flop around’ (see Figure 2). I also demonstrated to them (again, prior to the start of the pilot and main phase of data collection) how to take them off and where they would be kept whilst at school in their allocated box, which had their name on it so that they knew which box to put their accelerometer into at the end of the day. This also meant that the children used the same accelerometers each time, although the class teachers and I did also check this prior to each day of data collection to ensure that each child used the same accelerometer each time. The class teachers agreed to help me by ensuring that all the children were able to wear their accelerometers correctly throughout the whole school day. This procedure was put in place due to the age of the children so as to ensure consistency of location of the accelerometers. The only other time they took them off and put them back on again was when they changed out of their school uniform and put their Physical Education uniform on. As the skin temperature was not being recorded, the ActiGraph accelerometers were able to be worn over the children’s clothing.

(Figure 1 and 2 are presented on the next page)
Figure 1 – Example of accelerometer used.

Figure 2 - Example of accelerometer within pouch on a belt for wearing around the hip.
3.5.1.1 Data collection and analysis of the accelerometer data

Prior to the start of each day of the data collection (throughout both the pilot and main phases of the research), the ActiGraph accelerometers were calibrated and initialised using the ActiSoft analysis software. Welk et al. (2004) suggested that calibration was necessary for repeated measurements. For each day that the children’s physical activity was measured, the time period for data collection was from 9.00am until 3.10pm, which is a total of 371 minutes and represented the whole school day. The accelerometers were programmed to record activity counts using a 60 second cycle time sampling interval (as discussed previously in this section). This sampling interval would identify sustained physical activity and would also filter out the children’s sporadic ‘fiddling’ with the accelerometer which was predicted to happen due to the age of the children. Nilsson et al. (2002) recommended a shorter sampling frequency, as this may provide a better resolution, but acknowledged that it may not be possible to do so when observing physical activity patterns over a longitudinal period. The 60 second cycle was also used within the Health Survey England (NHS Information Centre for Health and Social Care, 2008), for objectively recording physical activity levels in children. This 60 second cycle time sampling interval was also used so that the physical activity could be categorised into different intensities of activity: static, light, moderate and vigorous activity. The 60 second activity counts were downloaded into a personal laptop and converted into a Microsoft (MS) Excel file for initial analysis of the accumulation of the different intensity levels and then imported into SPSS 17.0 for further statistical analysis. The data for the pilot phase of the research was collected during the ‘school autumn term’ from September 2008 – December 2008, three days that included Physical Education lessons (referred to within the results as PE days) and 3 days that did not include Physical Education lessons (referred to within the results as Non PE days). The data for the main phase of the research was collected during the ‘school spring and summer terms’ from January to June 2009. Fifteen days were PE days and fifteen days that were Non PE days.

In terms of data processing and analysis, the ActiGraph ActiSoft analysis software 3.2 (MTI Health Services, 2005) tracked the physical activity levels of the children, enabling for the creation of an activity file for each day and for each child. The data were converted from activity levels categorised by ActiSoft, which
records activity levels in counts and epochs, then converted into METs, the widely accepted and valid units of recording physical activity (WHO Europe, 2006). This conversion from epochs into METs was completed through a linear calculation. The main focus within the analysis was to identify how physically active the primary school children were during the school day. The total number of minutes at different physical activity intensity levels were identified and analysed. The accelerometer data were expressed in minutes per day. During data processing, spurious data that were above and beyond the range of biological and physiological plausibility, or missing data were screened for to ensure that the outcomes variables were not contaminated by extreme, erroneous values. However, no extreme or missing data occurred during this data collection and processing, within this thesis research.

The different intensities were recorded according to the different levels of METs recorded. All METs at and over 3 METs were identified as moderate to vigorous (referred to as MVPA). All METs at and over 2 METs and under 3 METs were identified as light physical activity (referred to as LPA) and all METs identified as under 2 METs were identified as static activity (referred to as SA). All METs at and over 2 were identified as all physical activity (referred to as APA) and this intensity level is illustrated in Appendix 20. The total number of minutes accumulated at each of these physical activity intensity levels were recorded per child per day. The data were averaged for each individual child, for each part of the school day, to explore where and when the physical activity occurred within the school day. There were 5 parts of the day (are identified in the Glossary) on a PE day: curriculum time, morning break, lunch time, afternoon break, and Physical Education lesson. There were 4 parts of the day on a Non PE day: curriculum time, morning break, lunch time and afternoon break. The results were analysed for variations in physical activity levels according to type of day, (PE days / Non PE days), year group (infants / juniors) and gender (boys / girls).

The MVPA data would be identified to examine research question one, how physically active were the primary school children during the school day. These will be further analysed to answer research question two, and compare the data for infants and juniors to identify if there are any differences in the physical activity levels of the different aged children. The extent to which the primary school
setting contributes to children’s recommended levels of physical activity (DH, 2005; WHO, 2010) will be examined in question three, by comparing how close to the sixty minute target the children are able to reach. The data will also be analysed to examine the contribution Physical Education lessons makes to the children’s physical activity levels, by comparing the different types of days and the specific time of day that Physical Education lessons occur between year groups and gender.

The different parts of the day as identified above were examined to see where physical activity occurred (see Table A for the total number of minutes possible within each part of the school day). Curriculum time included all parts of the day that the children were engaged in curriculum school work and which did not include Physical Education lessons. For infants, curriculum time was 236 minutes on PE days and 276 minutes on Non PE days. For juniors, curriculum time was 251 minutes on PE days and 291 minutes on Non PE days. Morning break was the same duration (20 minutes) for all children regardless of year group and type of day. It was a time when the children had a break from the classroom; this took place on the playground. Break time was unstructured, child initiated, informal play time and may also include eating a snack. Lunch time involved eating school dinners or packed lunches, in the school hall, as well as playing in the playground or on the field. Lunch time was 60 minutes for both infants and juniors on both types of days. Afternoon break was for infants only and was 15 minutes for both types of days. This was a child initiated play time that was informal and unstructured; it did not include any eating and took place on the playground. Physical Education lessons lasted 40 minutes for both year groups, and took place in the school hall, the playground or on the field.

(Table A is presented on the next page)
### Table A – Time in minutes for each part of the school day.

(~ indicates that afternoon break only occurs for infants;  
* indicates that there is no data as Physical Education does not exist on Non PE days)

<table>
<thead>
<tr>
<th>Year Group</th>
<th>Time (mins)</th>
<th>Time (mins)</th>
<th>Time (mins)</th>
<th>Time (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Infants</td>
<td>Infants</td>
<td>Juniors</td>
<td>Juniors</td>
</tr>
<tr>
<td>Part of day \ Type of day</td>
<td>PE days</td>
<td>Non PE days</td>
<td>PE days</td>
<td>Non PE days</td>
</tr>
<tr>
<td>Curriculum time</td>
<td>236</td>
<td>276</td>
<td>251</td>
<td>291</td>
</tr>
<tr>
<td>Morning break</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Lunch time</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Afternoon break~</td>
<td>15</td>
<td>15</td>
<td>~</td>
<td>~</td>
</tr>
<tr>
<td>Physical Education</td>
<td>40</td>
<td>*</td>
<td>40</td>
<td>*</td>
</tr>
</tbody>
</table>

A repeated measures 3 factor analysis of variance (ANOVA) was used to analyse the effects of factors including the following: type of day (days including a Physical Education lesson (PE days / Non PE days), gender (male / female), year group (infants / juniors), and parts of the day (curriculum time / morning break / lunchtime / afternoon break). For the Physical Education lesson part of the day, a 2 factor Univariate ANOVA (year group and gender) was completed as the type of days could not be compared as there was no equivalent time within Non PE days. The analysis for afternoon break included just infants as juniors did not have an afternoon break during the school day. P values of <0.05 were taken as the value for statistical significance ± one standard deviation. Statistical analysis was completed using SPSS 17.0.

Further analysis was also completed on the data. To ensure that a fair comparison could be made, in particular between the MVPA that occurred within the curriculum time part of the school day, the data were converted from minutes to percentage number of minutes. This was due to the differences in this part of the school day that occurred within the two different year groups, as infants had an extra 15 minutes afternoon break time, whilst the juniors did not. This allowed for direct comparison in the physical activity levels of the children in different year groups (infants and juniors). The overall percentage of MVPA for the whole school
day was also identified and statistically analysed, again to ensure a fair comparison. This was completed in MS Excel and the statistical analysis was completed in SPSS 17.0.

Once the MVPA data analysis had been completed it was possible to fully explore the contribution of the Physical Education lesson at different physical activity intensity levels and how this contributes to the school day. Therefore, by analysing also the LPA and SA it was possible to fully understand what was happening within the Physical Education lesson at all physical activity intensity levels. By completing this analysis for LPA and SA within the whole school day, it allowed for full mapping of the children’s physical activity levels at the different intensities within the different parts of the school day.

3.5.2 Qwizdom

The technology that was used to record the children’s answers to the physical activity questionnaire was an interactive learning system called Qwizdom. Johnson (no date, no page number) defined Qwizdom as “an interactive learning system that uses two way infrared communications to provide instant assessment”. It allowed for individual participation of the questionnaire within a group situation. All the children were gathered in one of 2 groups, one for the infants and one for the juniors. The handsets were explained to the children as the same tools that are used in the television programme *Who wants to be a Millionaire* (ITV). This was a programme that the children were familiar with and often used in the classroom as an interactive game on the white board in the classroom. Hammersley and Atkinson (2007) emphasised the importance of familiarity, in particular when introducing new tools within children, familiarity helps them engage quickly.

The children were asked the questions from the questionnaire as a whole group whilst the questions were displayed on a Qwizdom presentation and the children used their own individual handset (see Figure 3) to answer the questions. For the infant children, the questions were also discussed, so as to ensure that they understood what was being asked of them, which is vital to assure that the answers were as accurate as possible. This allowed for a large amount of data to be collected within a short period of time (Menter et al., 2011). As the researcher,
I posed the questions on the screen of a laptop that the whole group could see. For the infants, the questions were read out to the children to ensure that they all could understand, regardless as to whether their literacy skills in particular reading levels were at a level where they could fully read the questions. Each child had an individual handset (see Figure 3) which allowed them to record their answers and at the same time allowing them to be engaged and motivated (Guo et al. 2010) as the equipment was new and exciting to the children. The handset is durable (Qwizdom Ltd, 2009) and can instantly display the answers for each child. The children were not able to see their own or others’ responses therefore, they were not influenced by others in terms of their responses (Greig et al., 2007). This was important as at this age children can be easily influenced by the answers of others. The ‘display all answers’ function, was turned off so that Qwizdom handset just recorded and collected the data, without showing the children their answers. This was implemented to prevent any subjective bias occurring and to preclude any child from thinking that there was a right or a wrong answer. These two precautions were undertaken to prevent subjective bias. The Qwizdom software allowed for all the data from each child to be collected, recorded and converted within the MS Excel programme.

![Figure 3 - Example of a Qwizdom handset.](image)

The children found using an unfamiliar system very exciting and were fully engaged throughout the questionnaire (see Figure 4); they were aware of and used to a world full of modern technology, they will for example, not know a world
without a mobile phone. In their classes, they regularly use technologies such as the Nintendo DSi to promote learning in Mathematics. The Qwizdom handsets, though unfamiliar, had familiar buttons that the children were able to understand easily and were similar to those on a mobile phone. They were required to press a button that represented their answer (see Appendix 19, for the questionnaire). The children were informed if they wanted to answer the question with the response ‘a’ then they would need to press the letter A on the handset. Bonwell and Eison (1991) suggested that strategies such as using interactive handsets (like Qwizdom) promote active learning as it allows the pupils to be interactive and to think about what they are doing. Horowitz (2004) agreed with Bonwell and Eison (1991) who proposed that interactive processes (such as Qwizdom) increase children’s attentiveness, which was needed for the children to stay focused whilst answering the questions within the physical activity questionnaire.

Questionnaires are an “excellent way of obtaining… factual data ….and also opinions” (Greig et al., 2007, p.124). Marshall and Rossman (1995) suggested that questionnaires bring order, structure and meaning to a mass of information so that conclusions can be made and communicated. The questionnaire was used to “find out information that cannot be ascertained otherwise” (McNiff et al., 2003, p.122). Questionnaires elicit information through a written or electronically recorded response of the participants (Munn and Drever, 1990). The purpose of using questionnaires included the production of useful information relating to the children’s perceptions of their own physical activity. They can also be administered to a large number of people at the same time, in one setting. Opie and Sikes (2004) highlighted that questionnaires can be advantageous as they allow the questions to be standardised, ensuring precise results from what is being investigated. This is important to consider to prevent bias being introduced through leading questions (Greig et al. 2007). One of the weaknesses of questionnaires is that participants often do not like them (Edwards and Talbot, 1994). This is why the Qwizdom handset system was used so as to ensure that the children were motivated and excited about completing the questionnaire (see Figure 4) by engaging them through the use of technology. Figure 4 illustrates, through their body language and facial expressions, how excited the children were. The quantitative accelerometer data provided evidence of what the children were doing within the school day, but within the questionnaire
data it was possible to know whether the children thought they were being as physically active as the recordings stated, therefore, this information was essential to the thesis research (McNiff et al., 2003). The questionnaire type used was recall-based which “seeks to quantify physical activity patterns in the recent past” (Matthews, 2002, p.115) as the questions related to the physical activity patterns of the children over the past 7 days. This was chosen for two reasons: It was the length of time that was used by Kowalski et al. (2004) and; it ensured that the children, in particular the younger children, were able to recall, as accurately as possible, recall their physical activity over this time period.

Figure 4 – Juniors using the Qwizdom handsets.

Questionnaires and diaries have been used as self reporting methods and tools and were used in this thesis research to record the children’s perceived amount of physical activity over the previous week. Schneider et al. (2004) acknowledged that physical activity has been successfully assessed using questionnaires. However, there are limitations associated with the participants’ ability to recall this type of information accurately, due to the highly complex cognitive tasks mentioned in the questions (Bloom, 1956). It is most probable that
these limitations may be more prevalent with young children, in particular the infant children in this thesis research, who may not fully understand the nature of physical activity, or who may over-exaggerate their levels of physical activity due to wishing to please the researcher (Berg and Latin, 2008). The questionnaire consisted of both open ended and closed questions which the children would be familiar with from their classroom setting (Goodwin, 2001; Grugeon et al., 2005). This meant that the questionnaire could elicit quick and simple responses from the participants whilst discovering their perceptions of their own physical activity levels and intensities.

Berg and Latin (2008) emphasised the importance of a clear questionnaire that follows a “logical sequence” (p.235); this was considered when developing the questionnaire within the thesis research. Silverman (2006) also previously highlighted the idea of a logical sequence through the questionnaire by saying that the aim of such qualitative research is to gather “authentic understanding of people’s experiences” (p.292) which in his opinion was best obtained through open ended questions. The questionnaire provides a “straightforward approach to the study of attitudes, values, beliefs and motives” (Robson, 2002, p.233). However, Robson (2002) also stated that it is not necessarily safe to rely on the respondent’s answers due to the risk of a “social desirability response bias” (p.233), meaning that some answers may be given to suit the needs of the researcher. Another limitation with the use of questionnaires may lie in the participant’s interpretation of a question. This could be combated through the use of interviews in which the “interviewer can clarify questions” (Robson, 2002, p.234). For the infants involved in the thesis research, clarification was given to all children when it was deemed necessary or requested.

The questionnaire used in the thesis research was based on a physical activity questionnaire for children (PAQ-C) designed by Kowalski et al. (2004). Their questionnaire was self-administered, examined the previous seven days and was used to measure “general moderate to vigorous physical activity levels during the school year” (p.3). The questionnaire examined the physical activity of the child, for the whole week, as Bowles (2012) had highlighted that exploring the physical activity of the whole week for the child was valuable in terms of information gained. Therefore, the questions include asking about the children’s
physical activity on the way to school, during different parts of the school day and after school, both in the context of home and club situation. It also questions them about their overall impression of how physically active they felt they were. The questionnaire in the thesis research was adapted so that the questions and the language of the questions were more children friendly and could be used with younger children than Kowalski et al. (2004) had used (see Appendix 19 for the questionnaire).

The questions were read to the children and if they did not understand any of the questions then the questions were explained to them, using language and vocabulary they did understand. This was particularly important as Kowalski et al. (2004) suggested that their questionnaire was suitable for children aged 8 and over, therefore, it was essential to ensure that the infants understood what was being asked of them. While reading out the questions to the infants it was important that “social desirability” (Greig et al. 2007, p.125) factors were avoided. Therefore, the tone, pitch and volume of the researcher’s voice were consistent to ensure that the researcher remained neutral (McNiff et al., 2003). This was particularly important as Bassett et al. (2000) had previously highlighted that if children misunderstood the questions, they could provide erroneous recollections of their physical activity and Welk et al. (2000) question whether children understand questions that include the phrase ‘regular activity’. However, even with these potential limitations in mind, Kowalski et al.’s (2004) questionnaire was used as it had previously been shown to be a valid and reliable measure of physical activity levels due to its ability to obtain the “difficult to precisely measure intensity, frequency and duration” (p.3) of activities when children are self reporting on their activities (Kowalski et al., 1997).

The questionnaire was recorded in a quantitative way using a Likert scale. Anderson (2004) stated that the “Likert scale is one of the most useful question forms” (p.174) it was used to record and compare the children’s opinions on statements and ideas that were included in the physical activity questionnaire. It was used to find factual self recalled information and to seek responses (Woods, 2006) from the children focused on their perceptions of their physical activity levels. The data were collected through subthemes, these included: travelling to school; break time; lessons; activities within Physical Education lessons; activities
that were completed in the last seven days; activities that were completed during the last weekend; and how they would describe themselves. By using the Likert scale, the children were able to indicate their level of agreement with the statements; however, the middle option of neither agree or disagree was not used within Kowalski et al.'s (2004) physical activity questionnaire, this therefore, prevented over use of this middle option which can often occur in questionnaires (Thomas, 2009). The number of responses for each of the answers per question was recorded and the data were then calculated into percentages to be illustrated in graphical form and presented in chapter 5.

The sample size for the questionnaire was the same as that for the accelerometer data collection and this included all twenty children. All the children were sampled as it was possible to complete the questionnaire whilst the researcher was in school. Also due to the ease of using the Qwizdom equipment (as previously discussed), the results could be quickly recorded and the ease of access to the children allowed for all children to participate within a short space of time. This minimised disruption to the class setting. It also ensured that there was a full response rate to the questionnaires. Polit et al. (2001) highlighted that purposive sampling is the most common method used for selecting a sample for questionnaires, they suggested that it is assumed that a researcher’s knowledge about the population can be used to ‘hand pick’ the cases for inclusion. It was also important to ensure that all of the children’s opinions and perceptions of their own physical activity were recorded, so as to be able to compare them to the accelerometer physical activity results recorded, this required that the same sample size for both the questionnaire and accelerometer remained and was not delimited, a key aspect that Thomas et al. (2005) highlighted. Using the Qwizdom equipment ensured that all questionnaires were completed and that there were no issues surrounding a low percentage of return of the questionnaires in the manner that Cohen et al. (2007) had emphasised as being a drawback arising from the use of questionnaires.

Dempsey and Dempsey (1996) suggested that the sample size should be sufficient to represent the population for adequate data analysis. Polit et al. (2001) proposed that there is no set sample size when using questionnaires, but that a guiding principle of data saturation can be used. Cormack (1996) confirmed that
the sample size is critical and that clear criteria for inclusion or exclusion should be specified. The ‘sufficient number’ was recognised as that of all children within the thesis research, as all the children were accessible (as previously discussed) and eager to participate. This involvement of all the children in completing the questionnaire was supported by Diemert Moch and Gates (2000) who suggested that participation should be a positive experience, including a sense of self awareness and empowerment. The appearance and design of the questionnaire using the Qwizdom handset recording facilities ensured that the questionnaire was interactive and allowed for the children to remain engaged throughout. Polit et al. (2001) emphasised the importance of purposive sampling (in the thesis research, choosing to involve all the children) when using newly developed instruments (such as Qwizdom). This prevented negative attitudes towards the questionnaire (Thomas et al., 2005). This was particularly important to consider for children who may have difficulty focusing on a task whereby they are required to answer questions.

Cormack (1996) and Helewa and Walker (2000) propose that the use of questionnaires and qualitative studies are influenced by a branch of philosophy known as phenomenology. A phenomenological approach concentrates on people’s experiences of the world and their subsequent interpretations (Dempsey and Dempsey, 1992; Helewa and Walker, 2000). In the thesis research this would be the children’s experiences of their physical activity within the school day and their interpretation of the level of physical activity that they had completed over the past seven days. This approach was used within the thesis research. Dowswell et al. (2000) agreed with Smith and Hunt (1997) who believed that utilising such a phenomenological approach allows for practitioners to bridge the gap between theory and practice, therefore, emphasising the need to not only map what is happening with the children’s physical activity but to understand their perceptions as well, which is currently unknown.

3.6 The research setting
3.6.1 The school
Radford (2006) implied that schools were “complex and chaotic” (p.182) settings, but he emphasised the importance of evaluating the school and classroom through a holistic approach that considers the “process orientated view”
This view describes how a process works in a pragmatic sense within the school day; in terms of the thesis research the process is the physical activity that occurs within the school day. According to Hammersley and Atkinson (1995), one of the main problems faced by researchers is locating a suitable setting for the research and gaining access to it. This was interpreted as the difficulty in finding the gate keeper and, in particular, being able to approach the gate keeper, negotiating access to the setting and receiving “informal permission for research to proceed” (Greig et al., 2007, p.177). Thomas et al. (2005) considered the idea of entering the setting as mundane, yet vital. When considering a suitable setting for the thesis research, many schools were considered where I had links within the local cluster area. Even the possibility of making a comparison between several schools within the cluster was considered. In terms of practical issues, including ensuring a manageable amount of data, if more than one school was chosen, the time I could have devoted to each school would have been limited and therefore, it would not have been possible to gain as in depth knowledge of the children’s physical activity levels. Therefore, the decision was made to choose one school, within which a considerable amount of time could be spent so ensuring that the children would become familiar and comfortable with me as a researcher.

The time spent becoming a familiar face is an important factor in the initial stages of gaining access to and becoming accepted within the setting (Hammersley and Atkinson, 1995). “Rapport is everything” according to Thomas et al. (2005, p.349) and thus time was spent building rapport during this early phase. During these times, initial encounters and observations shape the form of the research and provide the opportunity to select samples for detailed investigation. It was during the first round of conversations with class teachers within the school that “an opportunity arose to investigate an interesting setting” (Hammersley and Atkinson, 2007, p.28); they became interested in my proposals and keen to be a part of the thesis research. Hammersley and Atkinson (1995) suggested that “the precise nature of the setting” (p.29) is difficult to specify before starting research, but the sort of setting that would be most appropriate is important. I initially approached the school that was chosen with the intention of gaining access to a range of different primary school aged children within the case study school itself, including within this range, both infants and juniors. Yet “access is not simply a matter of physical presence” (Hammersley and Atkinson,
2007, p.43). In this instance, approaching the gatekeeper, entailed meeting with the acting head teacher and discussing, the thesis research with her in depth, to gain “official permission” (Hammersley and Atkinson, 2007, p.49). This was further expanded to include discussions on how the information collected from the data would also benefit her school. Permission was consequently granted by her (see appendices 5, 6 and 7 for permission forms from parents, head teacher and children). Gaining initial access was possible due to my familiarity and work within the school prior to the acting head teacher taking up this role within the school.

Familiarity was one of the main reasons I was able to approach the case study school. I was familiar with the school because I had worked within it in a variety of different capacities for the previous three years prior to data collection. I had in fact been, as Hammersley and Atkinson (2007) phrased it, “casing the joint” (p.29). Over a period of three years, on three different occasions, I had taken three different groups of thirty of my year one BA Primary Education undergraduate degree students, who were training to be primary school teachers, into the school for six days as part of their Teaching and Planning module. On these occasions, the students worked in each class, taking responsibility for both a variety of lessons and also a whole school winter sports day. Consequently, I was familiar with all of the class teachers, having had regular contact and negotiation during this module to ensure that the children were learning effectively and that my students had every opportunity available to them to improve their teaching skills. My role also incorporated being a link tutor to every student teacher who had a placement within the school for the past three years. This meant supervising and supporting over twenty five students on their varying lengths of practice from four to eight weeks. As part of this, I had to visit the school to monitor the students, which involved observations of the students both solo and alongside the lead mentor or the class teacher to assess the students’ progress. This has meant that I was and continue to be, at the time of writing, in regular contact and dialogue with all members of the teaching staff.

According to Hammersley and Atkinson (1995) familiarity allowed for “pragmatic considerations” (p.30) which in the thesis research included the ability to gain access to the classroom to observe and record data throughout the school year. The familiar relationship that I continue to have, at time of writing, with the
class teachers enabled me to move in and out of the class with ease and without disturbing their lessons or the children. I have also assisted in mentoring some of the newer members of staff who were not Physical Education specialists in order to develop their knowledge and understanding of physical development and Physical Education in the primary school setting. This meant that I led and aided in some of the Physical Education lessons of these particular teachers, so much so that the children often asked me ‘which hat am I wearing today’ and ‘which role am I undertaking today?’ It did, however, mean that the children and staff were very familiar and relaxed with me being in the school.

Having this familiar relationship meant that I was able to enter the natural setting of the primary classroom and observe the children there without them realising that I was observing them, because they were used to me being in the classroom in a variety of different roles. This has removed the ‘white coat effect’, from a researcher either coming into an unfamiliar setting or from the children coming into a laboratory setting both of which may affect their natural behaviour by causing anxiety, or creating a novel situation, which in turn would affect the overall results. This way of collecting the data were supported by Bell (2005) who stated that, “the researcher has to be accepted by individuals or groups being studied.... for a lengthy period” (p.17). Bell (2005) did however question the typicality of the group, that is if “the researcher is studying one group over a period of time, who is to say that group is typical of other groups that may have the same title” (p.17). This is a limitation of this style of research however; it is valuable to examine the thesis research questions in depth for one particular case study before widening this to other schools and children. (The use of case studies was discussed previously in section 3.4.1).

Another reason that the school was chosen was because it had been awarded the healthy school mark (Healthy Schools, 1999). According to Harris (2005) a healthy school; “seeks to achieve healthy lifestyles for the entire school population by developing supportive environments conducive to the promotion of health” (p.88). In discussion with the assistant head teacher, she felt that the class teachers and school were providing every possible opportunity for the children to be physically active. She identified break times and Physical Education lessons as possible places for the children to be physically active, she also predicted that
infants would be more physically active than juniors due to their curriculum, however she did not know how physically active the children were over the school day.

The school is geographically set just outside a large town in the South East of England. The school is a rural village Church of England school which is relatively small with less than 200 children within seven classes and the school day runs from 9.00am until 3.10pm. The opportunities for the children to be physically active within the school day were as follows: the juniors had a morning break time and lunchtime, whilst the infants had an additional afternoon break time. There were also potential opportunities to be physically active within curriculum time, this pertained to any time where lessons were being taught, other than Physical Education (see also Glossary).

3.6.2 The teachers

I wanted the classes that were used within the thesis research to each have a class teacher who had specialised in Physical Education during their training. To clarify the primary Physical Education specialist is a graduate professional who has expertise in three domains (Carney and Howells, 2008) (see Figure 5). Firstly, the specialist requires sound knowledge and understanding of the primary phase of education. Secondly, the specialist must have a strong command of Physical Education, including knowledge of appropriate pedagogy as well as activity specific knowledge. Thirdly, the specialist must be an advocate of Physical Education within the school community, be willing to share good practice and to act as an agent for change in the face of new knowledge or initiatives. A specialist teacher of primary Physical Education can be considered crucial in ensuring that the Physical Education experience for primary school children is high and engaging. As Price (2008) proposed, a specialist can support other teachers in the school and act as a model of good practice. The specialist teacher of primary Physical Education will be both an expert in Physical Education and in the education of primary age children. The primary school Physical Education specialist needs to understand the children with whom they are working and how to plan the holistic, developmental Physical Education experience that all children require and deserve (Carney and Howells, 2008). Not all schools have Physical
Education specialists, but this case study school has two such teachers and this is why these two classes were selected.

Having the two class teachers as Primary Physical Education specialists meant that they had similar knowledge and understanding of how primary Physical Education should be planned, taught and evaluated. They were also both advocates for Physical Education and often shared their practice with each other (see Figure 5). This was important when comparing physical activity levels within the Physical Education lessons and any potential contribution that Physical Education lessons may have made to the overall physical activity levels of the children. One of the teachers was the Physical Education co-ordinator within the school and was regularly updated with new knowledge and understanding of Physical Education which she then shared with the rest of the staff. The other teacher was a graduate from Canterbury Christ Church University where he specialised in Physical Education. Within his training, he gained a depth of knowledge and understanding of both primary education, the developmental process of the young child and how to implement all this into practice within Physical Education. This is another reason why these two class teachers were regarded as appropriate teachers and facilitators of primary Physical Education for inclusion within the thesis research. To clarify the focus of thesis research was on the physical activity levels of the children within the Physical Education lessons, not on what or how the Physical Education lessons were taught.

(Figure 5 is presented on the next page)
It is acknowledged that other factors such as the teaching styles used by the teachers, identified by Mosston and Ashworth (2001) could have had an impact within a Physical Education lesson. Other factors such as: the activity area of Physical Education; the gender of the teachers; their philosophies and attitudes (Duda, 1989); and their teaching approaches would also influence their teaching of Physical Education lessons. The factors that were regarded as key to the thesis research were that the class teachers were both Primary Physical Education specialists and that the focus of the thesis research was on the physical activity levels within the lessons rather than the other elements that contribute to the lesson.

3.6.3 The children

The children, apart from who three were not available due to other commitments within the school at the time of the photograph, can be seen in Figure 6. It should be noted that the children, parents, class teachers and head teacher gave their ethical approval for their photographs to be shared in the thesis.
research as they wanted to celebrate their participation and to show this to the reader.

All the children in the two classes, (infants and juniors) had both the pilot and the main phases of the thesis research explained to them by me. They were then asked if they wanted to volunteer to take part. Children volunteered to take part in both the pilot and main phases of the thesis research, twenty were selected, ten boys and ten girls (N = 20). The selection process was completed by the class teachers supporting me to help remove any possible anxiety that the children may have experienced from me, the researcher, explaining the thesis research to them, although I feel this was reduced due to my familiarity with the classes. The class teachers selected names out of two different hats, one for boys and one for girls of those who volunteered, to ensure equal numbers of each gender. This method of choosing was a familiar method to the children that they understood would give them the opportunity to take part in the thesis research, if they had placed their own name in the hat. The children saw this method as fair and a transparent way of selecting the children randomly. This method prevented
selection bias (Berg and Latin, 2008) of the class teacher or myself choosing children who might provide potentially interesting results. However, it is acknowledged that the sample selected, such as a class in a school (Smith, 2010), is not fully random or stratified therefore, it does not necessarily reflect the entire population (Gorard, 2001), but does reflect the population of the two classes in the school.

Table B illustrates the number of children within each year group, the number of each gender and their mean age in years and months at the start of the pilot phase of the thesis research data collection.

<table>
<thead>
<tr>
<th>Number</th>
<th>Year Group</th>
<th>Gender</th>
<th>Mean Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Infants</td>
<td>Boys</td>
<td>6 years 4 months</td>
</tr>
<tr>
<td>5</td>
<td>Infants</td>
<td>Girls</td>
<td>6 years 6 months</td>
</tr>
<tr>
<td>5</td>
<td>Juniors</td>
<td>Boys</td>
<td>9 years 4 months</td>
</tr>
<tr>
<td>5</td>
<td>Juniors</td>
<td>Girls</td>
<td>9 years 4 months</td>
</tr>
</tbody>
</table>

*Table B – Number of children within each year group, gender and their mean age.*

Consent forms were sent home to ask the parents permissions (see Appendix 5 and section 3.7 on ethical approval). The children were told the aims of the thesis research and why they were wearing the accelerometers to record how physically active they were during the school day. When wearing the accelerometers, the children were asked to pretend and imagine that they were not wearing the belt and to try not to touch and to fiddle with the accelerometer throughout the day. The children were encouraged to look upon the wearing of the accelerometers as a game rather than a test and I explained to them that they were not being judged on their movement.

I have provided a brief profile of each child (below). The information provided on academic, Physical Education ability levels and physical activity levels are the assessments and reflections of the class teachers. These were provided at the start of the thesis research when the children’s physical activity levels had not previously been tested by measurement tools. The Physical Education ability levels were assessed according to levels of National Curriculum for Physical Education (DfEE/QCA, 1999) and the physical activity levels were assessed
according to personal observations made by the class teachers against the rest of the class.

**Infants**

**Infant Girl A** was 6 years and 6 months at the start of the pilot phase of the thesis research. She has an above average ability academically (for her class), she was an extrovert child who talked constantly and who was perceived as of average physical activity level and an average ability within Physical Education lessons (when compared to the rest of the class).

**Infant Girl B** was 6 years and 8 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was currently working on academic work that is at least a class year above her own. She was very extroverted and has an opinion on most things. She was perceived as of above average physical activity level in school. She has above average ability within Physical Education lessons.

**Infant Girl C** was 6 years and 6 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was very extroverted and was particularly talented in singing and acting. She was perceived as of below average physical activity level in school and she has below average ability within Physical Education lessons.

**Infant Girl D** was 6 years and 10 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was very introverted and was very shy. She was perceived as of average physical activity level in school and average ability within Physical Education lessons.

**Infant Girl E** was 6 years and 5 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was very extroverted and in particular enjoyed sharing her day with me and telling me all the things the class had done since I was last in with them all. She was perceived as of average physical activity level in school and average ability within Physical Education lessons.
Infant Boy A was 6 years and 3 months at the start of the pilot phase of the thesis research. He has a below average ability academically. He is extroverted, and when I visited his class he would in particular enquire “what hat did I have on today?” He was very inquisitive, needing to know what my role was each time I came into the classroom. He was also quite disorganised and often seemed forgetful, or as if he was daydreaming. He was perceived as of average physical activity level in school and found it difficult to concentrate on tasks unless he had constant input, yet has average ability within Physical Education lessons.

Infant Boy B was 6 years and 2 months at the start of the pilot phase of the thesis research. He has a below average ability academically. He was very shy with me during the pilot phase of the research and took longer than anyone else to become familiar with me. He put himself in charge of collecting the accelerometers and making sure they were all in the right boxes at the end of a data collection day. He took this responsibility very seriously and became upset if someone else did this. He was perceived as of above average physical activity level in school and above average ability within Physical Education lessons.

Infant Boy C was 6 years and 6 months at the start of the pilot phase of the thesis research. He has a below average ability academically. He, like infant boy B, was relatively shy with me during the pilot phase of the research but became more extroverted as the time progressed. He also sits next to infant boy B in class. He was perceived as of above average physical activity level in school and above average ability within Physical Education lessons.

Infant Boy D was 6 years and 8 months at the start of the pilot phase of the thesis research. He has an above average ability academically and sits next to infant girl B in class. He was an introvert and was relatively shy throughout the research, though was articulate when speaking to me on a one to one basis. He was perceived as of average physical activity level in school and average ability within Physical Education lessons.

Infant Boy E was 6 years and 5 months at the start of the pilot phase of the thesis research. He has an average ability academically. He was an extroverted child
and was perceived as of above average physical activity level in school and above average ability within Physical Education lessons.

**Juniors**

**Junior Girl 1** was 9 years and 7 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was a particularly gifted child both academically and physically. She was on the talent register for her tennis ability. She was perceived as of above average physical activity level in school and above average ability within Physical Education lessons.

**Junior Girl 2** was 9 years and 3 months at the start of the pilot phase of the thesis research. She has an average ability academically. She was an extroverted child and she was perceived as of average physical activity level in school and average ability within Physical Education lessons.

**Junior Girl 3** was 9 years and 2 months at the start of the pilot phase of the thesis research. She has an above average ability academically. She was particularly introverted child and was very shy. She was perceived as of average physical activity level in school, with above average ability in Physical Education lessons.

**Junior Girl 4** was 9 years and 9 months at the start of the pilot phase of the thesis research. She has an average ability academically. She was particularly introverted and was very shy. She sat next to junior girl 3 in class. She was perceived as of average physical activity level in school and average ability within Physical Education lessons.

**Junior Girl 5** was 9 years and 4 months at the start of the pilot phase of the thesis research. She has an average ability academically. She was an extroverted child and has an opinion on most topics and enjoys expressing her view. She was perceived as of average physical activity level in school with average ability within Physical Education lessons.

**Junior Boy 1** was 9 years and 5 months at the start of the pilot phase of the thesis research. He has an average ability academically. He was an extroverted child who would always come and ask about me, whenever he saw me. He was
perceived as of above average physical activity level in school, with above average ability in Physical Education lessons.

**Junior Boy 2** was 9 years and 6 months at the start of the pilot phase of the thesis research. He has an average ability academically. He was an extroverted child, who is particularly competitive in all sporting situations. He was perceived as of above average physical activity level in school, with above average ability in Physical Education lessons.

**Junior Boy 3** was 9 years and 0 months at the start of the pilot phase of the thesis research. He has above average ability academically. He was an extroverted child, who was particularly inquisitive and would often ask when would he be wearing the accelerometer next? This was even the case sometimes when he was already wearing it. He was particularly enthusiastic **about** being included in the research. He was also particularly competitive in all aspects of school. He was perceived as of above average physical activity level in school, with above average ability in Physical Education lessons.

**Junior Boy 4** was 9 years and 8 months at the start of the pilot phase of the thesis research. He has below average ability academically. He was a relatively quiet child, but would ask many questions about the research and how could he improve his score. He was perceived as of average physical activity level in school and average ability within Physical Education lessons.

**Junior Boy 5** was 9 years and 6 months at the start of the pilot phase of the thesis research. He has above average ability academically. He was an introverted and thoughtful child. He was perceived as of average physical activity level in school, with average ability within Physical Education lessons.

### 3.7 Ethical approval

Ethical approval was sought and gained from the Faculty of Business and Sciences Research Ethics Committee at Canterbury Christ Church University. Permission and informed consent was sought and gained from the children’s parents (see permission form 1 in Appendix 5) of those who had volunteered and been chosen (as described in section 3.6.3). Permission and informed consent
was also gained from the school (see permission form 2 in Appendix 6) and assent was gained from each child before commencing the research (see permission form 3 in Appendix 7). The right to withdraw at any time was discussed with all three parties. The parents were also kept up to date with newsletters throughout the pilot and the main research (see newsletters one and two in Appendices 8 and 9). The aim of these newsletters was to keep the parents informed of the research. Greig et al. (2007) stated that it is important to maintain a good relationship with the gatekeepers of the children. The gatekeepers are the parents or carers. I also ensured that I did this through an update letter after the pilot phase (see Appendix 8); and as a summer update at the end of the data collection (see Appendix 9) so the results could be disseminated to the parents. Interestingly, I received little or no reaction to the updates.

In terms of the sampling method used, all the children understood the strategy that was used to select the children who were wishing to volunteer. This was important to ensure not only that children were not upset by being excluded but also to ensure perceived transparency within this sampling strategy, a consideration taken when examining ethical considerations (Berg and Latin, 2008). Other ethical considerations included the data collection instruments: there were no potential physical, psychological, social or emotional risks to either the participants or to those close to them. Greig et al. (2007) suggested these considerations as being important so as to ensure that no harm would be done to the participants. Ethical permission was sought and gained from the children, parents, teachers and school for use of photographs which include the children’s faces. Codes were assigned to the children’s records to protect their anonymity, a process suggested by Berg and Latin (2008) as good practice.

### 3.8 Power calculations

Power calculations were also completed to ensure that the sample size was deemed adequately powerful, and of an appropriate size so that rejection of the null hypothesis could occur (Howell, 1995, p.267). Robson (2002) suggested that the sample size was important as this lowers the possible errors in generalising. Being able to reject the null hypothesis in this thesis research would require that the results show that Physical Education lessons had significant increase in the overall levels of children’s physical activity.
For the thesis, research power calculations derived by Julious (2004) were used. The significance level (alpha) was 5%, the power (1-beta) was 90%, the mean outcome in the control group (physical activity on days that do not have Physical Education lessons) was 164.72 and the mean outcome in the experimental group (physical activity on days that have Physical Education lessons) was 248.1, where the standard deviation of the outcome was 51.04. This resulted in a required total sample size of 16 participants. Therefore, the involvement of 20 children was a more than adequate sample size, according to Julious (2004). Having more children involved than the required 16 participants allowed for a potential dropout of children due to factors such as the children moving schools or succumbing to peer pressure. However, within the research, no children dropped out, and all 20 completed all of the collection days within both the pilot and main phase of the thesis research.

3.9 Pilot phase

A pilot phase was completed prior to the main phase of the research; this was a preliminary reliability study to ensure that there could be a consistency and repeatability of the data (Berg and Latin, 2008). Hammersley (1992) emphasised the importance of reliability and of completing a pilot phase so as to ensure that the techniques for recording were consistent. This is particularly important with accelerometers so as to ensure both the consistency in the recording of the intensity levels of physical activity and the activation of the calibrated start time. Also by completing a pilot phase it ensured that the children had time to overcome any inquisitive behaviour from using the accelerometers: Guo et al. (2010) suggested that children will want to play with new technologies. The pilot phase included analysis of the initial data that was collected from the children. It also examined and explored any practical or logistical issues that the children had in using and wearing the accelerometers highlighted in the field notes (see Appendix 1). This informed any changes that needed to be made prior to the main research. It was particularly important that the children become familiar with the accelerometers so that the accelerometers could collect “normal locomotor movements” as stated by Welk (2002, p.126). The pilot phase also ensured that children were consistently able to take the accelerometers off and on correctly, under the supervision of myself, the class teachers and the teaching assistants. Welk (2005) and Fairweather et al. (1999) emphasised the importance that
consistent placement of the accelerometer had on the consistency of the results, (as discussed in section 3.4.1).

Within the pilot phase the children were able to correctly put on and take off the accelerometers with supervision, they did this within the natural environment of their classroom (Hastie and Sidentop, 2009). The accelerometers consistently started and finished at the set calibration times, there were no erroneous or non physiologically possible data and the accelerometers were able to distinguish between the different physically activity levels of: static activity (SA); light physical activity (LPA); and moderate to vigorous physical activity (MVPA). Also, data on all physical activity, (APA) was collected from all activities registering at and over 2 METs and this was analysed within Appendix 20 for the main phase.

3.9.1 MVPA key findings of the pilot phase

In response to the first research question, how physically active were primary school children during the school day?: The children completed, on average, 44 ±18 minutes of MVPA during PE days and 40 ± 14 minutes of MVPA during Non PE days. In terms of the differences that occurred between juniors and infants: Juniors completed more MVPA during both morning break and during Physical Education lessons than infants. During lunch time all groups other than junior girls completing more MVPA on PE days, yet junior girls completed more MVPA during lunch time on Non PE days. This leaves the question as to whether the junior girls were potentially saving energy for themselves on PE days, in readiness for the Physical Education lesson that occurred after lunch time. This will be further discussed in chapter 6. During afternoon break; more MVPA was also completed during Non PE days, again questioning the impact of the Physical Education lesson on the children as this lesson occurred just prior to the afternoon break. Were the children too tired to continue with MVPA into break time? This will be further discussed in chapter 6.

In terms of the differences that occurred between boys and girls: during morning break, lunch time and Physical Education lessons, boys were found to complete more MVPA than girls. Boys also completed more MVPA on PE days than Non PE days during lunch time. Overall boys completed more MVPA than girls. It was also found that the inclusion of Physical Education lessons may have
had a particular influence over the boys. The concept of gender and in particular masculine ‘appropriate’ behaviour will be considered within the discussion chapter.

The children were not able to reach the recommended physical activity levels of 60 minutes of MVPA (DH, 2005; WHO, 2010) within the school day, although these recommendations are not solely set to be met during the school day. There was no significant differences between the type of day, although PE days did contain, on average, more MVPA than Non PE days. When different parts of the day were analysed separately there were no significant difference in the levels of MVPA within curriculum time. This was also reflected in the percentage number of minutes of MVPA (as explained in 3.5.1.1) within curriculum time.

### 3.9.2 LPA key findings of the pilot phase

For LPA there were no overall significant differences for the type of day, nor were there any significant differences during the afternoon breaks. However, there were significant differences between year groups, with infants completing, on average, 21 minutes more LPA than juniors. This year group difference was also found within curriculum time and was reflected in the percentage number of minutes of curriculum time being higher for infants. This may be due to the free flow movement that occurs in the infants’ curriculum and learning environment (Werner et al., 2012). The differences in the curriculum will be discussed within chapter 6. Also during lunch times the infants completed more LPA during PE days when compared to Non PE days, whilst the juniors completed more LPA on Non PE days when compared to PE days. The impact and influence of the speed of eating and in particular the motor skills involved in cutting up food will be discussed further within chapter 6. During Physical Education lessons, infant boys completed significantly more LPA than infant girls.

In terms of differences that occurred between boys and girls Also, during curriculum time the children completed significantly more LPA on Non PE days; this could be the influence of the class teachers’ planning being more focused on increasing activity on Non PE days. Although, the class teachers reported that they did not think about the type of day when planning the curriculum time. During morning break, girls completed significantly more LPA on PE days than Non PE
days. During lunch time, boys significantly completed more LPA on Non PE days than PE days.

3.9.3 **SA key findings of pilot phase of the pilot phase**

Overall the children were completed more SA on Non PE days in comparison to PE days, indicating that having Physical Education lessons within the school day contributed to the children's overall physical activity and opportunities to be physically active.

In terms of differences that occurred between juniors and infants: overall, juniors completed more SA than infants, this finding may have been influenced by the differences found within the curricula and the impact of the class teachers, both of these will be considered in further depth within chapter 6. During curriculum time there was more SA on Non PE days when compared to PE days and juniors completed more SA than infants. During morning break, the children completed more SA on Non PE days, and juniors also were at more SA than infants. It was found that juniors were at more SA on Non PE days during morning break in comparison to PE days. During lunch time, infants were at more SA on Non PE days in comparison to PE days whilst juniors were at more SA on PE days compared to Non PE days. During afternoon break the infants were at more SA on PE days.

Within the Physical Education lessons there were no significant differences for year group or gender, implying that the Physical Education lessons involved as much SA for all groups. It was noted that infant girls were at the highest SA within the Physical Education lessons, although this difference was not significant.

3.9.4 **Field note reflections of the pilot phase**

Fields notes were taken during the pilot phase research (see Appendix 1) which outlined notes taken on the children’s behaviour and the opportunity to highlight any possible implications on the main phase accelerometer data. Other factors that impacted on the levels of physical activity recorded during the day were also noted. For example, day 4 was a day without a Physical Education lesson in it, yet three children achieved well beyond the recommended guidelines, this was however a day that it rained and the children were not allowed out during
break time and they had what is known in school as ‘wet play’. For these three children having ‘wet play’ increased their physical activity within the classroom setting during break time, rather than potentially decreasing it. Thus for these three children ‘wet play’ had a similar effect as having a Physical Education lesson. This suggested that during the main phase of the research, details of the school day needed to be recorded so as to account for potentially unpredictable recordings. A reflective account of the research experiences was therefore, kept to consider how these types of occurrences impacted on the results of the research. This would allow for explanations of any skew in the data. The type of weather and any other reason for unusual or irregular levels of physical activity or inactivity was also recorded during the main phase of the research.

The specific impact of the time of year was highlighted when the children, in particular the infants discovered that the pouches that held the accelerometers were a good storage place for dead leaves. To overcome this and to ensure that having extra items in the accelerometers’ pouches did not alter the results, a dead leaf box was provided for the children in the classroom. This encouraged the children to continue to collect leaves, but not to store them in their pouches. Subsequently the infants could keep their dead leaves in a dedicated area, where they could celebrate their findings. Having such a box overcame the children’s need to store dead leaves on their person.

Another irregular event in the pilot phase data collection period was the presence of extra rehearsals for the school ‘end of term’ Christmas ‘Nativity Play’ meaning that some children were doing either more or less physical activity than usual. There were no other school plays throughout the rest of the academic year so this phenomenon would not cause any potential discrepancies in the main phase of the research and therefore, the days on which ‘Nativity Plays’ took place were not included within the pilot phase. This explains why it took a whole ‘school term’ to record the pilot phase data. The extra rehearsals also impacted on the days that included Physical Education lessons, as some activities within the Physical Education lessons were either changed to outdoor activities due to the hall being used for rehearsals, or totally cancelled. Again this would not occur within the main research. This may be considered one disadvantage of completing this research within the natural setting of the school, a place that has a
constantly changing environment, and has activities linked to different times of the year. Yet this type of physical activity recording would not have been possible within a laboratory situation. However, Brewer (2000) suggested that full immersion into the natural setting would allow for a full understanding of what is happening and why within this setting. By experiencing and observing, I was able to know about these disruptions to the normal school timetable. These highlighted how important it was to identify and record any changes within the school day that might have impacted or influenced the results and to also do this if they were to occur during the main research.

The children were also very keen to please me as a researcher and an adult and would at times play with the accelerometer to produce ‘better results’ when I was in the classroom. This play included such activities as swinging it round their heads or doing star jumps. The older children also expressed emotions and feelings of wanting to beat each other. I addressed this by explaining to the children that it was important that the research recorded their natural movements. I asked them to pretend they were not wearing the accelerometers. With regard to the need to compete with each other, it was explained that the research was not a competition and that the children would not be compared with or rated against each other. Once these discussions were had with the children, they soon lost interest in trying to be the best and continued with trying to pretend they were not wearing the accelerometer, allowing for a more accurate recording of their physical activity to be made.
Chapter 4
Accelerometer Results (Main Phase)

4.1 Introduction

The purpose of this chapter is to present the results from the main data collection phase of the research and by doing so assess how physically active the children are within the school day and whether the children were able to reach the recommended physical activity target of 60 minutes of MVPA (DH, 2005; WHO, 2010). Although the physical activity target was not limited to the school day, the data were only recorded during the school day. The results are presented thematically linked to the research questions (see section 1.4), and will examine how physically active the children were during the school day. The results chapter also investigates the contribution that Physical Education lessons made to children’s overall physical activity levels. This chapter also examines where else within the school day the children were physically active and also to what level. This will allow for suggestions of potential opportunities for increased physical activity and situations where physical activity could be introduced.

4.2 Results - MVPA
4.2.1 MVPA for whole school day

The number of minutes of MVPA (see Appendix 10 for summary data) was recorded and the overall average number of minutes calculated for all children over the entire school day. This allowed for an exploration into whether there was any difference in the amount of physical activity that occurred on PE and on Non PE days and an examination of whether the presence of a Physical Education lesson within the day had an impact on the children’s overall MVPA.

During PE days, the children completed, on average, 53 ± 19 minutes of MVPA and on Non PE days the children completed, on average, 43 ± 15 minutes of MVPA (see Figure 7, presented on the next page).
During the days that included a Physical Education lesson, the children, on average, were physically active at a MVPA (at and over 3 METs) for 10 minutes more. There was a significant difference ($F = 92.32, P < 0.05$) between the types of day, with, on average, the children completing more physical activity on PE days when compared to Non PE days.

### 4.2.2 MVPA for year and gender

The MVPA data were filtered according to year group, gender and type of day. Figure 8 illustrates the overall mean number of minutes ± SD of MVPA within the school day for year group, gender and type of day.

(Figure 8 is presented on the next page)
There was a significant main effect ($F = 9.04$ and $P < 0.05$) for gender. On average, boys completed 5 minutes more MVPA (50 ± 17 minutes) when compared to girls (45 ± 13 minutes).

There was a significant interaction ($F = 4.47$, $P < 0.05$) between gender and type of day. On average, boys completed 11 minutes more MVPA on PE days (55 ± 19 minutes) when compared to Non PE days (44 ± 15 minutes).

There was also a significant interaction ($F = 6.77$, $P < 0.05$) between type of day and year group. On average, juniors completed 13 minutes more MVPA on PE days (53 ± 15 minutes) when compared to Non PE days (40 ± 13 minutes). When children were assessed according to year group and gender, junior boys did reach the recommended target of 60 minutes a whole day (DH, 2005; WHO, 2010) whilst at school, however this only occurred on PE days.
4.2.3 MVPA during different parts of school day

The school day was categorised into 5 different parts, curriculum time, morning break, lunch time, afternoon break and Physical Education lessons. The number of minutes of MVPA was calculated for each child during the different parts of the day (see Appendix 11 for summary data). Table C illustrates the overall mean number of minutes ± SD of MVPA for different parts of the school day for all children.

<table>
<thead>
<tr>
<th>Parts of Day</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum time</td>
<td>17 ± 7</td>
<td>16 ± 7</td>
</tr>
<tr>
<td>Morning break</td>
<td>9 ± 3</td>
<td>8 ± 3</td>
</tr>
<tr>
<td>Lunch time</td>
<td>17 ± 7</td>
<td>17 ± 7</td>
</tr>
<tr>
<td>Afternoon break ~</td>
<td>3 ± 1</td>
<td>3 ± 1</td>
</tr>
<tr>
<td>Physical Education lessons</td>
<td>8 ± 3</td>
<td>*</td>
</tr>
</tbody>
</table>

Table C - Overall mean number of minutes ± SD of MVPA for the different parts of the school day for all children

(~ indicates that afternoon break only occurs for infants; * indicates that there is no data as that part of the day does not exist for that type of day)

4.2.4 MVPA for year and gender during different parts of the school day

The MVPA for the different parts of the school day were analysed for year group and gender. Statistical analysis was completed for the different parts of the school day.
4.2.4.1 Curriculum time

Figure 9 illustrates the overall mean number of minutes ± SD of MVPA during curriculum time for year group, gender and type of day.

![Graph showing mean minutes of MVPA for different year groups, genders, and PE/Non-PE days.]

Figure 9 – Overall mean number of minutes of physical activity ± SD of MVPA during curriculum time for year group, gender and type of day

There were no significant main effects (P > 0.05) indicating that, on average, similar levels of MVPA were completed regardless of year group, gender and type of day.

There was a significant interaction (F = 41.62, P < 0.05) between year group and type of day. On average, infants completed 3 minutes more MVPA during curriculum time on Non PE days (20 ± 7 minutes) when compared to PE days (17 ± 9 minutes), whilst, on average, juniors completed 5 minutes more MVPA during curriculum time on PE days (17 ± 6 minutes) when compared to Non PE days (12 ± 3 minutes).

There was also a significant interaction (F = 5.36, P < 0.05) between gender and type of day. On average, on PE days, boys completed 1 minute more MVPA (17 ± 7 minutes) when compared to girls (16 ± 5 minutes).
4.2.4.2 Morning break

Figure 10 illustrates the overall mean number of minutes ± SD of MVPA during morning break for year group, gender and type of day.

![Figure 10 – Overall mean number of minutes ± SD of MVPA during morning break for year group, gender and type of day](image)

There was a significant main effect \((F = 18.96, P < 0.05)\) for type of day. On average, during morning break, 1 minute more MVPA was completed on PE days (9 ± 3 minutes) when compared to Non PE days (8 ± 3 minutes).

There was also a significant main effect \((F = 22.02, P < 0.05)\) for gender. On average, during morning break, boys completed 1 minute more MVPA (9 ± 3 minutes) when compared to girls (8 ± 3 minutes).

There was also a significant interaction \((F = 14.60, P < 0.05)\) between type of day and year group. On average, during morning break, on PE days, infants completed 2 minutes more MVPA (10 ± 4 minutes) when compared to juniors (8 ± 3 minutes).
4.2.4.3 Lunch time

Figure 11 illustrates the overall mean number of minutes ± SD of MVPA during lunch time for year group, gender and type of day.

There was a significant main effect \((F = 4.89, P < 0.05)\) for year group. On average, during lunch time, juniors completed 4 minutes more MVPA \((19 ± 7\) minutes\) when compared to infants \((15 ± 6\) minutes\).

There was also a significant main effect \((F = 24.34, P < 0.05)\) for gender. On average, during lunch time, boys completed 2 minutes more MVPA \((18 ± 7\) minutes\) when compared to girls \((16 ± 7\) minutes\).
### 4.2.4.4. Afternoon break

Afternoon break occurs only for infants. Figure 12 illustrates the overall mean number of minutes ± SD of MVPA during afternoon break for gender and type of day.

![Figure 12](image)

*Figure 12 – Overall mean number of minutes ± SD of MVPA (for infants only) during afternoon break for gender and type of day.*

There was a significant interaction ($F = 12.57, P < 0.05$) between gender and type of day. On average, during afternoon break, infant girls completed 1 minute more MVPA on Non PE days (3 ± 1 minute) when compared to PE days (2 ± 1 minute).
**4.2.4.5 Physical Education lessons**

Figure 13 illustrates the overall mean number of minutes ± SD of MVPA during Physical Education lessons for year and gender.

![Graph showing mean number of minutes of MVPA during PE lessons](image)

*Figure 13 - Overall mean number of minutes ± SD of MVPA during Physical Education lessons for year and gender*

There were no significant main effects or interactions ($P > 0.05$), indicating that, on average, there were similar levels of MVPA during Physical Education lessons regardless of year group and gender.
4.3 Results - Percentage of MVPA

4.3.1 Percentage of MVPA for whole school day

The number of minutes of MVPA within the school day was converted into a percentage, (see Appendix 12 for summary data) which allowed for direct comparison between the different year groups and parts of the school day. The differences were discussed in section 3.5.1.1. The overall mean percentage of MVPA on PE days was 14% ± 5% of the whole school day whilst the mean percentage of MVPA on Non PE days was 11% ± 4% of the whole school day (see Figure 14).

![Figure 14 – Overall mean percentage number of minutes ± SD during the whole school day for type of day, for all children](image)

There was a significant main effect \((F = 80.79, P < 0.05)\) for type of day. On average, the percentage number of minutes of MVPA that the children completed was 3% more on PE days when compared to Non PE days.
4.3.2 Percentage of MVPA for year and gender

Figure 15 illustrates the overall mean percentage number of minutes ± SD of MVPA during the whole school day for year group, gender and type of day.

There was a significant main effect \( (F = 9.86, P < 0.05) \) for gender. On average, the percentage number of minutes of MVPA that boys completed was 1% more (13 ± 5%) when compared to girls (12 ± 3%).

There was a significant interaction \( (F = 6.49, P < 0.05) \) between type of day and gender. On average, the percentage number of minutes of MVPA that boys completed was 3% more on PE days (15 ± 5%) when compared to Non PE days (12 ± 4%).

There was also a significant interaction \( (F = 7.30, P < 0.05) \) between type of day and year group. On average, the percentage number of minutes of MVPA that juniors completed was 3% more on PE days (14 ± 4%) when compared to Non PE days (11 ± 3%).
4.3.3. Percentage of MVPA during curriculum time

Figure 16 illustrates the overall mean percentage number of minutes ± SD of MVPA during curriculum time for year group, gender and type of day.

There was a significant main effect \((F = 18.75, P < 0.05)\) for type of day. On average, during curriculum time, the percentage number of minutes of MVPA completed on PE days was 1% more \((7 ± 3\%)\) when compared to Non PE days \((6 ± 3\%)\).

There was also a significant main effect \((F = 5.87, P < 0.05)\) for gender. On average during curriculum time, the percentage number of minutes of MVPA that boys completed was 1% more \((7 ± 3\%)\) when compared to girls \((6 ± 2\%)\).

There was also a significant main effect \((F = 21.28, P < 0.05)\) for year group. On average during curriculum time, the percentage number of minutes of MVPA that infants completed was 2% more \((7 ± 3\%)\) when compared to juniors \((5 ± 2\%)\).
4.4 Results - LPA

4.4.1 LPA levels for whole school day

The number of minutes of LPA was recorded for each child (see Appendix 13 for summary data). The LPA of the children was considered to examine where within the school day the children were at a LPA level, and whether the children were involved in more LPA during a PE day or a Non PE day (see Figure 17).

![Graph showing mean number of minutes of LPA for PE and NON PE days]

Figure 17 - Overall mean number of minutes ± SD of LPA within the whole school day for all children

There was a significant main effect \((F = 49.7, P < 0.05)\) for type of day. On average, there was an 8 minute difference between the two types of day. On PE days, 101 ± 20 minutes of LPA was completed and on Non PE days 93 ± 24 minutes of LPA was completed.


4.4.2 LPA for year and gender

The number of minutes for each child at a LPA level was recorded. The data were then filtered according to year group and gender. Figure 18 illustrates the overall mean number of minutes ± SD of LPS for whole school day, for year group, gender and type of day.

![Chart](image)

Figure 18 – Overall mean number of minutes ± SD of LPA within the school day for year group, gender and type of day

There was a significant main effect ($F = 22.01, P < 0.05$) for year group. On average, infants completed 32 minutes more LPA (113 ± 16 minutes) when compared to juniors (81 ± 15 minutes).

There was also a significant main effect ($F = 49.71, P < 0.05$) for type of day. On average, 8 minutes more LPA was completed on PE days (101 ± 20 minutes) when compared to Non PE days (91 ± 24 minutes).

There was also a significant interaction ($F = 12.12, P < 0.05$) between type of day and year group. On average, juniors completed 13 minutes more LPA on PE days (88 ± 14 minutes) when compared to Non PE days (75 ± 14 minutes).
4.4.3 LPA different parts of school day

The school day was separated into different parts, (as for MVPA) (see Appendix 14 for summary data). The overall mean number of minutes ± SD of LPA during different parts of the school day, for all children are presented in Table D.

<table>
<thead>
<tr>
<th>Type of Day and Time in Minutes</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum time</td>
<td>54 ± 14</td>
<td>60 ± 18</td>
</tr>
<tr>
<td>Morning break</td>
<td>8 ± 2</td>
<td>8 ± 3</td>
</tr>
<tr>
<td>Lunch time</td>
<td>21 ± 3</td>
<td>21 ± 4</td>
</tr>
<tr>
<td>Afternoon break ~</td>
<td>6 ± 1</td>
<td>6 ± 1</td>
</tr>
<tr>
<td>Physical Education lessons</td>
<td>14 ± 2</td>
<td>*</td>
</tr>
</tbody>
</table>

Table D – Overall mean number of minutes ± SD of LPA during different parts of the school day for all children
(~ indicates that afternoon break only occurs for infants; * indicates that there is no data, as that part of the day does not exist for that type of day.)

4.4.4 LPA for year and gender during different parts of the school day

The LPA for the different parts of the school day were analysed for year group and gender. Statistical analysis was completed for the different parts of the school day.
4.4.4.1 Curriculum time

Figure 19 illustrates the overall mean number of minutes ± SD of LPA during curriculum time for year group, gender and type of day.

![Graph showing overall mean number of minutes ± SD of LPA during curriculum time for year group, gender and type of day](image)

**Figure 19 - Overall mean number of minutes ± SD of LPA during curriculum time for year group, gender and type of day**

There was a significant main effect ($F = 23.30$, $P < 0.05$) for type of day. On average, during curriculum time, children completed 6 minutes more LPA on Non PE days ($60 ± 18$ minutes) when compared to PE days ($54 ± 14$ minutes).

There was also a significant main effect ($F = 12.84$, $P < 0.05$) for year group. On average, during curriculum time, infants completed 20 minutes more LPA ($67 ± 14$ minutes) when compared to juniors ($47 ± 12$ minutes).

There was a significant interaction ($F = 14.19$, $P < 0.05$) between type of day and year group. On average, during curriculum time, infants completed 9 minutes more LPA on Non PE days ($72 ± 15$ minutes) when compared to PE days ($63 ± 12$ minutes).
4.4.4.2 Morning break

Figure 20 illustrates the overall mean number of minutes ± SD of LPA during morning break for year group, gender and type of day.

There was a significant main effect ($F = 6.16$, $P < 0.05$) for year group. On average, during morning break, infants completed 2 minutes more LPA (9 ± 3 minutes) when compared to juniors (7 ± 2 minutes).

There was also a significant main effect ($F = 7.02$, $P < 0.05$) for gender. On average, during morning break, girls completed 1 minute more LPA (8 ± 2 minutes) when compared to boys (7 ± 3 minutes).

There was a significant interaction ($F = 14.81$ $P < 0.05$) between year group and type of day. On average, during morning break, infants completed 2 minute more LPA on Non PE days (10 ± 2 minutes), when compared to PE days (8 ± 3 minutes).
4.4.4.3 Lunch time

Figure 21 illustrates the overall mean number of minutes ± SD of LPA during lunch time for year group, gender and type of day.

![Bar chart showing mean number of minutes of LPA during lunch time for different year groups and genders.](image)

Figure 21 – Overall mean number of minutes ± SD of LPA during lunch time for year group, gender and type of day

There was a significant interaction (F = 6.05, P < 0.05) between type of day and gender. On average, during lunch time, girls completed 1 minute more LPA on Non PE (22 ± 4 minutes) when compared to PE days (21 ± 3 minutes).

There was also a significant interaction (F = 4.96, P < 0.05) between type of day, gender and year group. On average, during lunch time, infant girls completed 2 minutes more LPA on Non PE days (23 ± 3 minutes) when compared to PE days (21 ± 2 minutes), whilst junior girls completed during lunch time, 1 minute more LPA on PE days (21 ± 4 minutes) when compared to Non PE days (20 ± 4 minutes).
4.4.4.4 Afternoon break

Afternoon break occurs only for infants. Figure 22 illustrates the overall mean number of minutes ± SD of LPA during afternoon break for gender and type of day.

![Chart showing mean number of minutes ± SD of LPA for infants during afternoon break, by gender and PE/Non PE day.](chart)

Figure 22 – Overall mean number of minutes ± SD of LPA (for infants only) during afternoon break, for gender and type of day

There were no significant main effects or interactions \((P > 0.05)\), indicating that, on average, during afternoon break, there were similar levels of LPA completed for boys and girls on both PE and Non PE days.
4.4.4.5. Physical Education lessons

Figure 23 illustrates the overall mean number of minutes ± SD of LPA during Physical Education lessons for year group, gender and type of day.

![Bar chart showing mean number of minutes of LPA during Physical Education lessons for infants and juniors by gender.](image)

**Figure 23 – Overall mean number of minutes ± SD of LPA during Physical Education lessons for year group, gender and type of day**

During Physical Education lessons, there was a significant main effect ($F = 6.29, P < 0.05$) for year group. On average, infants completed 2 minutes more LPA (15 ± 2 minutes) when compared to juniors (13 ± 2 minutes) during Physical Education lessons.
4.5 Results - Percentage of LPA

The number of minutes of LPA within the school day was converted into a percentage number of minutes of LPA (see Appendix 15 for summary data). This allowed for direct comparison between the different year groups for both the whole school day and curriculum time.

4.5.1 Percentage of LPA for whole school day

The overall mean percentage number of minutes for PE days was 27% ± 5% and Non PE days was also 25% ± 6% (see Figure 24)

![Figure 24 - Overall mean percentage number of minutes ± SD of LPA during whole school day for type of day for all children](image)

There was a significant main effect for type of day; \( F = 49.71, \ P < 0.05 \). On average, the percentage number of minutes of LPA that the children completed was 2% more on PE days when compared to Non PE days.
### 4.5.2 Percentage of LPA for year and gender

Figure 25 illustrates the overall mean percentage number of minutes ± SD of LPA during whole school day for year group, gender and type of day.

![Bar chart showing mean percentage number of minutes ± SD of LPA during whole school day for year group, gender and type of day.](image)

*Figure 25 - Overall mean percentage number of minutes ± SD of LPA during whole school day for year group, gender and type of day*

There was a **significant main effect** \( (F = 22.01, P < 0.05) \) for year group. On average, the percentage number of minutes of LPA that infants completed was 8% more \( (30 \pm 4\%) \) when compared to juniors \( (22 \pm 4\%) \).

There was a **significant interaction** \( (F = 12.12, P < 0.05) \) between year group and type of day. On average, the percentage number of minutes of LPA that juniors completed was 4% more on PE days \( (24 \pm 4\%) \) when compared to Non PE days \( (20 \pm 4\%) \).
4.5.3 Percentage of LPA during curriculum time

Figure 26 illustrates the overall mean percentage number of minutes \( \pm SD \) of LPA during curriculum time for year group, gender and type of day.

<table>
<thead>
<tr>
<th>Year and Gender</th>
<th>Mean percentage number of minutes of LPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants Boys</td>
<td>30( \pm 5)</td>
</tr>
<tr>
<td>Infants Girls</td>
<td>32( \pm 4)</td>
</tr>
<tr>
<td>Juniors Boys</td>
<td>22( \pm 5)</td>
</tr>
<tr>
<td>Juniors Girls</td>
<td>24( \pm 4)</td>
</tr>
</tbody>
</table>

There was a significant main effect \( F = 16.99, P < 0.05 \) for year group. On average, during curriculum time, the percentage number of minutes of LPA that infants completed was 10% more \( (27 \pm 5\%) \) when compared to juniors \( (17 \pm 4\%) \).
4.6 Results - SA

The number of minutes of static activity (SA - less than 2 METs) performed by each child (see Appendix 16 for summary data) was recorded to provide a total mapping of SA that occurred within the school day. The SA time that each of the children was involved at, within the school day was compared in order to see if there were any differences between the SA that children demonstrated on PE days and on Non PE days.

4.6.1 SA for whole school day

The mean number of minutes of SA on PE days was 215 ± 19 minutes, whilst the mean number of minutes of SA on Non PE days was 236 ± 32 minutes (see Figure 27).

![Figure 27](image)

*Figure 27 – Overall mean number of minutes ± SD of SA for whole school day according to type of day for all children*

The 21 minute difference between the types of day was significantly different \( (F = 69.23, P < 0.05) \). On average, more SA occurred on Non PE days when compared to PE days.
4.6.2 SA for year and gender

The number of minutes of SA was recorded for each child and filtered according to year group and gender. Figure 28 illustrates the overall mean number of minutes ± SD of SA for whole school day, for year group, gender and type of day.

![Bar chart showing mean number of minutes of SA for whole school day, for year group, gender and type of day.](image)

There was a significant main effect \( (F = 12.25, P < 0.05) \) for year group. On average, juniors completed 34 minutes more SA \((242 ± 25 \text{ minutes})\) when compared to infants \((208 ± 29 \text{ minutes})\).

There was also a significant main effect \( (F = 5.97, P < 0.05) \) for gender. On average, girls completed 7 minutes more SA \((229 ± 29 \text{ minutes})\) when compared to boys \((222 ± 31 \text{ minutes})\).

There was also a significant interaction \( (F = 9.51, P < 0.05) \) between day and year group. On average, juniors completed 29 minutes more SA \((257 ± 20 \text{ minutes})\) on Non PE days when compared to PE days \((228 ± 21 \text{ minutes})\).
4.6.3 SA during different parts of the school day

The school day was separated into different parts, as mentioned previously. The mean number of minutes of SA within the different parts of the school day is presented in Appendix 17. The purpose of this analysis was to examine when the children were attaining SA values and also to compare PE days and Non PE days. Table E illustrates the overall mean number of minutes of SA ± SD during different parts of the school day for all children.

<table>
<thead>
<tr>
<th>Parts of the day</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum time</td>
<td>168 ± 23</td>
<td>206 ± 30</td>
</tr>
<tr>
<td>Morning break</td>
<td>4 ± 2</td>
<td>5 ± 2</td>
</tr>
<tr>
<td>Lunch time</td>
<td>22 ± 6</td>
<td>22 ± 5</td>
</tr>
<tr>
<td>Afternoon break ~</td>
<td>6 ± 2</td>
<td>7 ± 1</td>
</tr>
<tr>
<td>Physical Education lessons</td>
<td>17 ± 4</td>
<td>*</td>
</tr>
</tbody>
</table>

Table E – Overall mean number of minutes ± SD of SA during different parts of the school day for all children

(~ indicates that afternoon break only occurs for infants; * indicates that there is no data, as that part of the day does not exist for that type of day.)

4.6.4 SA for year and gender during different parts of the school day

The SA for the different parts of the school day were analysed for year group and gender. Statistical analysis was completed for the different parts of the school day.
4.6.4.1 Curriculum time

Figure 29 illustrates the overall mean number of minutes ± SD of SA during curriculum time, for year group, gender and type of day.

There was a significant main effect \((F = 27.66, P < 0.05)\) for year. On average, during curriculum time, juniors completed 39 minutes more SA \((206 ± 28\) minutes) when compared to infants \((167 ± 25\) minutes).

There was also a significant interaction \((F = 13.79, P < 0.05)\) between year and type of day. On average, during curriculum time, juniors completed 46 minutes more SA on Non PE days \((229 ± 15\) minutes) when compared to PE days \((183 ± 15\) minutes).
4.6.4.2 Morning break

Figure 30 illustrates the overall mean number of minutes ± SD of SA during morning break, for year and gender according to type of day.

There was a significant main effect ($F = 23.19, P < 0.05$) for year group. On average, during morning break, juniors completed 3 minutes more SA (6 ± 2 minutes) when compared to infants (3 ± 2 minutes).

There was also a significant main effect ($F = 26.34, P < 0.05$) for gender. On average, during morning break, girls completed 1 minute more SA (5 ± 2 minutes) when compared to boys (4 ± 2 minutes).

There was also a significant interaction ($F = 17.33, P < 0.05$) between type of day and gender. On average, during morning break, girls completed 1 minute more SA on Non PE days (5 ± 2 minutes) when compared to PE days (4 ± 2 minutes).
4.6.4.3 Lunch time

Figure 31 illustrates the overall mean number of minutes ± SD of SA during lunch time, for year group, gender and type of day.

Figure 31 – Overall mean number of minutes ± SD of SA during lunch time, for year group, gender and type of day

There was a significant main effect (F = 22.77, \( P < 0.05 \)) for gender. On average, during lunch time, girls completed 1 minute more SA (23 ± 5 minutes) when compared to boys (22 ± 6 minutes).
4.6.4.4 Afternoon break

Afternoon break occurs only for infants. Figure 32 illustrates the overall mean number of minutes ± SD of SA during afternoon break, for gender and type of day.

![Bar chart](chart.png)

Figure 32 – Overall mean number of minutes ± SD of SA during lunch time, for year group, gender and type of day

There were no significant main effects or interactions \((P > 0.05)\), indicating that, on average, there were similar levels of SA completed for boys and girls on both PE and Non PE days.
4.6.4.5 Physical Education lessons

Figure 33 illustrates the overall mean number of minutes ± SD of SA during Physical Education lessons, for year group, gender and type of day.

![Graph showing mean number of minutes of SA during Physical Education lessons](image)

**Figure 33 – Overall mean number of minutes ± SD of SA during Physical Education lessons, for year group and gender**

There were no significant main effects or interactions ($P > 0.05$), indicating that, on average, similar levels of SA were completed during Physical Education lessons regardless of year group and gender.
4.7 Results - Percentage of SA

4.7.1 Percentage of SA within the whole school day.

The number of minutes of SA was converted into a percentage (see Appendix 18 for summary data). The mean percentage of SA on PE days was 58% ±8% of the whole school day, whilst the mean percentage of SA on Non PE days was 64% ±9% (see Figure 34).

![Figure 34 - Overall mean percentage number of minutes ± SD of SA for whole school day, for type of day for all children](image)

There was a significant main effect \( (F = 69.23, P < 0.05) \) for type of day. On average, the percentage number of minutes of SA that the children completed was 6% more on Non PE days when compared to PE days.
4.7.2 Percentage of SA for year and gender

Figure 35 illustrates the overall mean percentage number of minutes ± SD of SA during whole school day for year group, gender and type of day.

![Figure 35 – Overall mean percentage number of minutes ± SD of SA for whole school day, for year group, gender and type of day]

There was a significant main effect ($F = 12.35, P < 0.05$) for year group. On average, the percentage number of minutes of SA that juniors completed was 9% more (65 ± 7%) when compared to infants (56 ± 8%).

There was a significant main effect ($F = 5.97, P < 0.05$) for gender. On average, the percentage number of minutes of SA that girls completed was 2% more (62 ± 8%) when compared to boys (60 ± 8%).

There was also a significant interaction ($F = 9.51, P < 0.05$) between type of day and year group. On average, the percentage number of minutes of SA that juniors completed was 8% more on Non PE days (69 ± 5%) when compared to PE days (61 ± 6%).
### 4.7.3 Percentage of SA during curriculum time

Figure 36 illustrates the overall mean percentage number of minutes ± SD of SA during curriculum time for year group, gender and type of day.

![Bar chart showing mean percentage number of minutes ± SD of SA during curriculum time for year group, gender and type of day.](image)

**Figure 36** – Overall mean percentage number of minutes ± SD of SA during curriculum time, for year group, gender and type of day

There was a significant main effect ($F = 26.79, P < 0.05$) for year group. On average, during curriculum time, the percentage number of minutes of SA that juniors completed was 15% more ($81 ± 6\%$) when compared to infants ($66 ± 8\%$).

There was a significant main effect ($F = 12.67, P < 0.05$) for type of day. On average, during curriculum time, the percentage number of minutes of SA that was completed on Non PE days was 3% more ($75 ± 11\%$) when compared to PE days ($72 ± 10\%$).

There was also a significant interaction ($F = 5.52, P < 0.05$) between type of day and year group. On average, during curriculum time, the percentage number of minutes of SAT that juniors completed was 6% more on Non PE days ($84 ± 5\%$) when compared to PE days ($78 ± 7\%$).
4.8 Key Findings

This section summarises the key findings presented within this chapter. It focuses on the different physical activity intensity levels: MVPA; LPA and SA. Particular reference will be made to the differences found between the type of days: (PE and Non PE days); the year groups (infants and juniors) and genders. Comparisons of the results from the main phase and the pilot phase are also summarised.

4.8.1 MVPA key findings of the main phase

In response to the first research question, (How physically active were primary school children during the school day?) the children completed, on average, 53 ±19 minutes of MVPA during PE days and 43 ±15 minutes of MVPA during Non PE days. This was an increase in the number of minutes of MVPA on both PE and Non PE days, when compared to the pilot phase. However, the key finding was that, on average, junior boys completed 60 minutes of MVPA on PE days. This key finding indicated that it was possible for the children to reach the recommended levels of MVPA (DH, 2005; WHO, 2010) within the school day, although limiting the time to the hours within the school day is not stipulated within the recommendations (DH, 2005; WHO, 2010).

In terms of the differences that occurred between juniors and infants, during curriculum time, juniors completed more minutes of MVPA on PE days than on Non PE days, whilst infants completed more minutes of MVPA on Non PE days than on PE days. The influence from differences in the curricula will be further examined within chapter 6. During morning break infants completed more MVPA than juniors. This result is in opposition to that found in the pilot phase. Also, during morning break more MVPA was completed by the children on PE days than on Non PE days. This was, again, not found in the pilot phase. During lunch time, juniors completed more MVPA than infants. This may be due to the juniors’ skill level from fine motor skill development, indicating that they were able to complete eating their lunch quicker or with more vigour during lunch time, although the children’s fine motor skills were not examined specifically. This will be explored in more detail within chapter 6. On average, juniors completed more MVPA on PE days than on Non PE days, that the inclusion of the Physical Education lesson for
juniors was an important opportunity within the school day for physical activity to take place.

In terms of the differences that occurred between boys and girls, these were similar to the pilot phase, where boys completed, on average, more MVPA than girls. This was particularly found in PE days. This indicated that the inclusion of Physical Education lessons may have an increased influence on boys. Within curriculum time, the boys completed more MVPA than girls. This was not previously found in the pilot phase. During both morning breaks and lunch times, boys completed more MVPA than girls, as was found in the pilot phase. The concept of masculine ‘appropriate’ behaviour will be discussed within chapter 6.

In terms of the contribution that Physical Education lessons made to the primary children’s physical activity levels, unlike the pilot study, no significant differences in levels of MVPA were found within the Physical Education lessons. This potentially indicates that the Physical Education lessons within the ‘school spring and summer terms’ had a similar impact on all groups of children. However, it should be noted that the total amount of MVPA within Physical Education lessons was considerably higher in the main phase compared to the pilot phase. The influence of the activity areas of the National Curriculum for Physical Education will be discussed as possible reasons for this variation within chapter 6.

**4.8.2 LPA key findings of the main phase**

As with the pilot phase results the examination of the LPA and SA, allowed for full exploration of the children’s physical activity within the school day. However, unlike the pilot phase, there was a significant difference between the types of day, with more LPA being completed on PE days when compared to Non PE days. This result was also reflected in the percentage number of minutes of LPA.

In terms of the differences that occurred between juniors and infants, juniors completed more LPA on PE days than on Non PE days. Similar to the pilot phase, infants completed more LPA than juniors. During curriculum time, infants (as in the pilot phase) completed both more LPA. These results may be due to the
differences in the curriculum between the different year groups and will be explored in more detail in chapter 6. Also, during curriculum time it was found that children completed more LPA overall on Non PE days, as was found in the pilot phase and again the influence of the class teachers will be discussed in chapter 6. Infants completed more LPA on Non PE days than on PE days; this differs from the results gained from the pilot phase. During morning break, infants completed more LPA than juniors, and infants also completed more LPA on Non PE days than on PE days, this again was not previously found in the pilot phase. During Physical Education lessons, infants completed more LPA overall than juniors. Issues of skill development and ability levels between the year groups will be discussed during chapter 6 and how they may have influenced these results.

In terms of the differences that occurred between boys and girls: during morning break, girls completed more LPA on PE days than on Non PE days (as in the pilot phase) but, unlike the pilot, during lunch time, girls completed more LPA on Non PE days than on PE days. During lunch time, there was more variation for the girls with infant girls completing more LPA on Non PE days than on PE days, whilst junior girls completed more LPA on PE days than on Non PE days. During afternoon break, there were no differences for gender or type of day.

4.8.3 SA key findings of the main phase

SA identified where, within the school day the children were not involved in any physical activity. Overall, the children were involved in more SA on Non PE days than on PE days, as also highlighted in the pilot phase. This indicates that having Physical Education within the school day contributes to the children’s overall physical activity, as this type of day appears to be more physically active.

In terms of the differences that occurred between juniors and infants: juniors recorded more SA than infants, similar to the pilot phase and again may have been influenced by the differences in the curricula and the possible impact or influence of the class teachers; both of these will be examined further in the discussion chapter. Juniors also recorded more SA on Non PE days when compared to PE days. During curriculum time, juniors recorded more SA than infants, this also occurred during morning break. Also, during curriculum time,
juniors recorded more SA on Non PE days than on PE days, as also found in the pilot phase.

In terms of the differences that occurred between boys and girls: girls recorded more SA than boys. During morning break and lunch time, girls recorded more SA than boys, which differs from the results found in the pilot phase. It was also found that girls recorded more SA on Non PE days than on PE days, during morning break. During afternoon break, unlike the pilot phase, there were no significant differences indicating that there were similar levels of SA for gender and type of day during this time period. Similarly, during Physical Education lessons there were no significant differences for year group or gender, again indicating that Physical Education involved similar levels of SA for all groups, although it should be noted that both infant and junior girls recorded the most number of minutes of SA within Physical Education lessons.

4.8.4 Field note reflections of the main phase

This chapter has presented the accelerometer data. Other field notes were completed during the research which allowed for recording of notes on the children’s behaviour (see Appendices 2 and 3). Findings were as follows: There were no ‘wet play’ days as experienced in the pilot phase therefore, the potential influence of weather on the results was not a factor. Each recording day was sunny, or overcast, but these did not prevent the children from going out at break times, lunch times or during Physical Education lessons. During the main phase of the research, the children had access to the field during lunch time as well as the two playgrounds whilst in the pilot phase only the playgrounds were accessible due to the field being too muddy. Physical Education lessons that were scheduled to be completed outside were not cancelled due to the weather during the main phase.

No further items such as leaves were found to be stored within the accelerometer pouches. However the leaf box (see section 3.9.4) did have to be extended into an ‘interesting items found at lunch time’ box, to ensure that the children could continue to explore and enquire, both key learning skills as described by Ward and Roden (2008) without hoarding items within their accelerometer pouches. This was a precautionary measure that was particularly
focused on the infants and reflected the change in the outdoor environment as it moved from autumn leaves to spring flowers. The ‘interesting items’ box was also used with the juniors. This was to ensure consistency and allow for availability of similar opportunities for both of the year groups.

The children did not have rehearsals for any school plays during the main phase of the data collection (unlike the pilot phase) so no Physical Education lessons were cancelled for this reason, unlike during the pilot phase. The children were still keen to please me but this manifested in them showing me that they had been able to put their accelerometer on in the right place, rather than swinging the accelerometer round their heads or doing star jumps, as they had done in the pilot phase. I believe this was due to them not receiving any results on how well they had performed during the pilot phase. As they were unaware of the physical activity levels that they were achieving and, as their previous behaviour (of start jumps, swinging the accelerometers) was not rewarded, they were not motivated to continue with these actions. Bindra (1974) suggested this as a method to prevent this type of behaviour continuing.

Within the next chapter, the accelerometer data will be compared to the data obtained using the physical activity questionnaire via Qwizdom, to see if, in particular, the accelerometer recorded intensity levels of the children’s physical activity was reflected in the children’s perceived self recall of their own physical activity levels.
Chapter 5
Physical Activity Questionnaire Results (Qwizdom)

5.1 Introduction
The purpose of this chapter is to present the results from the physical activity questionnaire. The results will be presented within the following subthemes: Travelling to school; break times; lessons; activities within Physical Education lessons; activities that were completed in the last seven days; activities that were completed during the last weeks; and how the children described themselves.

5.2 Results
5.2.1 Travelling to school questions
Figure 37 illustrates the different ways children travelled to school.

![Chart showing different ways children travelled to school]

The majority of children travelled to school by car (70%). 5% of children travelled by bus and 25% of children walked to school.
Figure 38 illustrates the length of time it took for children to travel to school.

**Figure 38 – Time take to travel to school by the children.**

Overall, 50% of children described their journey time to school as taking 5 minutes, 15% of children described it as taking 10 minutes, 30% of children described it as taking 15 minutes and 5% of children described their journey as taking more than 20 minutes.
5.2.2 Break times activity questions

For clarification break times activity questions referred to activities that took place during the morning and afternoon break times and not during lunch times. This was explained to the children within the questionnaire presentation. Figure 39 illustrates how active the children thought they were during break times.

![Figure 39 – Activity levels of the children during break times.](image)

40% of children described themselves as very active, 50% of children described themselves as active, 5% of children described themselves as not being sure about their activity level during break time and 5% of children described themselves as not very active.
Figure 40 illustrates the children’s favourite activities that they completed for the longest time during break times.

Figure 40 – Children’s favourite activities that were completed for the longest time during break times.

85% of children reported that their favourite activity that they completed for the longest time during break times was running or playing hard most of the time. 10% of children reported that their favourite activity and the activity they completed for the longest during break time was running or playing a little bit. 5% of children reported that their favourite and longest activity during break times was running or playing quite a bit.
Figure 41 illustrates the children’s least favourite activities that were completed for the shortest amount of time, during break times.

![Bar chart showing least favourite activities completed for shortest time during break time.](image)

**Figure 41 - Children’s least favourite activities that were completed for the shortest time during break times.**

65% of the children reported that their least favourite activity that they completed for the shortest length of time during break times was being sat down. 25% of children reported that their least favourite and shortest activity during break times was standing or walking and 10% of children reported that their least favourite and shortest activity during break times was running or playing a little bit.
5.2.3 Lunch times activity question

Figure 42 illustrates the children’s responses to what activities they thought that they normally participated in during lunch times, other than eating lunch.

![Activities participated in during lunch time](image)

Figure 42 - Activities participated in during lunch time.

50% of the children stated that they ran and played hard most of the time during lunch time. 25% of children reported that they ran around and played quite a bit during lunch time. 15% of children described their normal activity, other than eating at lunch time as sitting down (talking, reading or doing school work). 5% of children stated that they stood / walked around. 5% of children stated that they ran or played a little bit during lunch times.
5.2.4 Lessons related questions

Figure 43 illustrates the children’s favourite lesson. They had a choice of the following lessons: Science, Numeracy, Literacy, Topic, Art, Physical Education and French, which are specific to a primary school setting.

![Bar Chart: Children's favourite lesson]

40% of children described Physical Education as their favourite lesson, 30% of children described Numeracy as their favourite lesson, 25% of children described Art as their favourite lesson and 5% of children described Topic as their favourite lesson. No children chose Science, Literacy or French as their favourite lesson. Overall juniors, more than infants, chose Physical Education as their favourite lesson, whilst infants chose Art and Numeracy as their favourite lessons. More girls chose Physical Education as their favourite lesson when compared with boys. The girls’ second most popular choice was Art for their favourite lesson. Boys chose Numeracy as their favourite lesson when compared with girls.
The children were asked what their second favourite lesson was. The choices of subjects were the same as in the previous question. Figure 44 illustrates these findings.

![Figure 44 - Children's second favourite lesson](image)

The results for the second favourite lesson were more varied than for the favourite lesson. 25% of children described Science as their second favourite lesson, 25% of children described Art as their second favourite lesson, 20% of children described Numeracy as their second favourite lesson, 20% of children described Literacy as their second favourite lesson, 5% of children described Topic as their second favourite lesson and 5% of children described Physical Education as their second favourite lesson. No children chose French as their second favourite lesson.
The children were asked what their third favourite lesson was. The choices were the same as in the previous two questions. Figure 45 illustrates these findings.

![Bar chart showing children's third favourite lesson percentages](image)

**Figure 45 – Children's third favourite lesson**

These results provided great variation. 30% of children described Art as their third favourite lesson, 25% of children described Topic as their third favourite lesson, 15% of children described Literacy as their third favourite lesson, 10% of children described Physical Education as their third favourite lesson, 10% of children described Science as their third favourite lesson and 10% of children described Numeracy as their third favourite lesson. No children chose French.
The children were asked what their least favourite lesson was. The choices were from the same as in the previous three questions. Figure 46 illustrates these findings.

![Bar chart showing least favourite lessons](chart.png)

**Figure 46 – Children’s least favourite lesson**

25% of children described Numeracy as their least favourite lesson, 20% of children described Topic as their least favourite lesson, 20% of children described Science as their least favourite lesson, 15% of children described Physical Education as their least favourite lesson, 15% of children described Literacy as their least favourite lesson and 5% of children described Art as their least favourite lesson. No children chose French, which is interesting as this subject lesson was also not chosen at all, previously. Overall, junior girls’ least favourite lesson was Topic; junior boys’ least favourite lesson was Literacy; infant girls’ least favourite was Numeracy and, interestingly, infant boys’ described their least favourite lesson as Physical Education.
5.2.5 Activity areas in Physical Education lessons related questions

The children were asked what their favourite type of activity within the Physical Education lesson was. They had a choice of six; these were National Curriculum (DfEE/QCA, 1999) activity areas and consisted of: Invasion games, striking and fielding games, dance, gymnastics, swimming and athletics. The children were all familiar with these terminologies as the class teachers would use this language with the children. Figure 47 illustrates these findings.

Infant aged children have to complete as part of the National Curriculum programme of study for Physical Education: dance, gymnastics and games, however, the case study school also does swimming and athletics for the infant aged children. This is why all the children, both infants and juniors, were asked to choose from the six activity areas. It is, however noted that games was split into the two different types; invasion games (examples were given to the children of football, hockey and rugby) and striking and fielding games, (again examples were given to the children of rounders and cricket). The case study school does not undertake net and wall games such as badminton, volleyball, or tennis so the children were not asked about these.

![Favourite activity within Physical Education lesson chart]

Figure 47 – Children’s favourite activity area in Physical Education lessons.
30% of children chose swimming as their favourite activity area in Physical Education lessons. 25% chose invasion games, 25% chose striking and fielding games, 10% chose dance, and 10% chose athletics. Infants’ most chosen favourite activity was swimming, whilst juniors’ most chosen favourite activity was invasion games and striking and fielding games.

Children were asked which activity area within Physical Education lessons, they thought they were the most physically active in. The same list of activity areas was used as in the previous question. Figure 48 illustrates these findings.

30% of children stated that they were most physically active in invasion games, 30% of children stated striking and fielding games, 25% of children stated swimming, 10% of children stated athletics, 5% of children stated dance. These results indicated that the children were not necessarily the most physically active in their favourite activity area.

Figure 48 – Most physically active, activity area within the Physical Education lessons
The children were asked about their physical activity levels in Physical Education lessons in general, and then specifically asked how often they thought they were very active. Examples of being very active that were given to the children were: Playing hard, running hard, jumping or throwing. Figure 49 illustrates these findings.

![Bar graph showing frequency of being very active in Physical Education lessons]

**Figure 49 – Children’s frequency levels of being very active within Physical Education lessons**

60% of children felt that they were quite often very active during Physical Education lessons, 35% of children described themselves as always being very active in Physical Education lessons and 5% described themselves as hardly ever physically active within Physical Education lessons. Overall, boys mostly described themselves as always very active or quite often very active. Overall, girls described themselves as being quite often very active. When the accelerometer data were considered (see chapter 4), boys did reach a higher number of minutes of MVPA than girls during Physical Education lesson, though this difference was not significant. Girls also reached a higher number of minutes of static PA than boys during Physical Education lesson which could link to their perceived state of being quite often very active, though the differences between boys and girls in the accelerometer data were not significant.
5.2.6 After school activity questions

The children were asked about the number of after school sports clubs that they attended at school. Figure 50 illustrates the findings.

![Bar chart showing the number of after school sports clubs attended by children at school.](image)

*Figure 50 – Number of after school sports clubs, children attend at school*

Overall, 40% of children did not attend any after school sports clubs. 30% of children attended one after school sports club, 15% of children attended two after school sports club, and 15% of children attended 3 after school sports clubs.
The children were asked about the number of sports clubs that they attended in the evenings, which were not organised or held at the school. Figure 51 illustrates the findings.

![Bar chart showing the number of evening sports clubs attended by children.](image)

**Figure 51 – Number of sports clubs that children attend in the evening outside of school.**

30% of children attended one sports club in the evening outside of school. 25% of children attended five sports clubs in the evening outside of school. 25% of children attended no sports clubs in the evening outside of school. 10% of children attended two sports clubs in the evening outside of school and 10% of children attended three sports clubs in the evening outside of school.

Overall, infant girls mostly stated that they attended one external sports club in the evening, whilst junior girls mostly attended 5 of these sports clubs in the evening. Infant boys mostly attended no sports clubs in the evening that were not organised or held at the school, whilst junior boys mostly attended one sports club outside school, in the evening.
Children were asked about the activities that they did when they got home and which one they completed the most often. They were given a list of activities to choose from, which included: Playing on the computer; playing musical instruments; playing sports (but not in an organised school or club setting); playing outside with friends; reading and doing arts and crafts. Figure 52 illustrates the findings.

45% of children stated that straight after school at home they most frequently played outside with friends. 20% of children played on the computer. 15% of children played sports, 5% read and 5% of children did arts and crafts.

Overall, all of the junior girls stated that they played outside with friends, whilst none of the infant girls played outside with their friends. Infant boys, like junior girls, played outside with friends, whilst junior boys either played sports or played on the computer straight after school.
The children were asked, if they were able to choose one activity, what they would like to do after school, when they got home. They were offered the same list of activities as in the previous question. Figure 53 illustrates these findings.

![Figure 53 – The types of activities at home the children would choose to do straight after school](image)

30% of children would choose to play on the computer, 30% of children would play sports, 30% of children would play outside with friends and 10% of children would do arts and crafts. The results indicated that the children would not choose, as their first choice of activity, the activity that they indicated in the previous question (that being the activity that they actually did when they got home). For example, reading and playing instruments were activities that were completed when the children got home, but this answer indicated that it was not their first choice of activity upon arrival at home.
5.2.7 Activities completed within the last 7 days questions

The children were asked to consider the last seven days and determine the number of days during this time that they had participated in sports, dance or very active game playing, straight after school. This question was asked to see how physically active the children felt they were in their activities straight after school. Figure 54 illustrates the findings.

Figure 54 - Children’s frequency levels in the last 7 days when they were physically very active straight after school

65% of children described themselves as being very active for 5 or more days, 20% of children stated one day, 10% of children stated 2 or 3 days and 5% of children stated zero days.
The children were asked to consider the last seven days and determine the number of evenings during this time that they had participated in sports, dance or very active game playing. This question was asked to see how physically active the children felt they were in their activities in the evening. Figure 55 illustrates the findings.

![Bar chart showing frequency of being very active in evening]

**Figure 55 – Children’s frequency levels in the last 7 days of the evenings when they were physically very active**

During the evening times, 55% of children described themselves as being very active for 5 or more days, 25% of children stated that they achieved this level of activity for four days, 10% of children stated 1 day, 5% of children stated two or three days and 5% of children stated zero days.
5.2.8 Personal description question

The final question asked children to describe themselves and their levels of physical activity over the previous 7 days during their free time. They were given the following five statements and asked to choose the one that best described them:

a) All or most of my free time was spent doing activities that involve little physical effort

b) I sometimes (1 — 2 times last week) did physical activities in my free time (e.g. played sports, went running, swimming, bike riding, aerobics)

c) I often (3 — 4 times last week) did physical activities in my free time

d) I quite often (5 — 6 times last week) did physical activities in my free time

e) I very often (7 or more times last week) did physical activities in my free time.

Figure 56 illustrates these findings.

![Graph](image)

**Figure 56 – Time spent by the children being physically active during their free time**

45% of children described themselves as doing physical activities very often during their free time. 35% of children described themselves as doing physical activity quite often in their free time. 10% of children described themselves as
doing physical activity often in their free time, whilst 10% of children described themselves as doing very little physical activity within their free time.

5.3 Questionnaire data and accelerometer data reflections

The children’s physical activity questionnaire perceived self recall data has numerous links to the accelerometer data. 40% of children described themselves as very active during break times, and 85% of the children described their favourite activity as running or playing hard most of the time. The accelerometer data showed that children were, on average, at a MVPA level for 50% of the time during break time. Juniors reported their least favourite activity during break time as sitting down, but infants recorded more physical activity at a LPA level and a MVPA level, during break time than juniors, when the accelerometer data is considered, indicating that infants may have underestimated slightly how much physical activity they did (a feature of self recall, that Craig et al. (2008) highlighted as common with younger children). This will be discussed further within chapter 6.

At lunch time, only 50% of children described their favourite activity as playing hard most of the time via the questionnaire and this is reflected in the accelerometer data which indicated that 25% of all the children’s lunch time was spent, on average, at a MVPA level. 15% of children described their favourite activity as sitting down; this again is reflected in the accelerometer data, with 38% of lunch time being spent, on average, at a SA level.

Junior girls chose Physical Education as their favourite lesson; although this may be due to their need to please me as the researcher or them being familiar with me. As Hammersley and Atkinson (1995) indicated, familiarity was an important factor. In this case it may have led to bias in the junior girls’ answer. Their response could also be due to the excitement of completing the questionnaire, which they knew was on the topic of physical activity. Again this could have shown that they were trying to please me, as the researcher. Indeed, it was possible to see how much the children were enjoying the experience of using the Qwizdom handsets (as indicated from Figure 4, chapter 3), by their facial expressions and body language, although this is just one snapshot of their feelings.
It could have been predicted that the junior girls would complete more physical activity within Physical Education lessons, due to this being their favourite lesson at the time, however when the accelerometer data were considered, there was no significant difference between their levels of physical activity and any other group. However, it could be suggested that this level of enjoyment or favouritism had enabled and encouraged this group to be as active as they usually were. Meanwhile, the opposite occurred for infant boys, whose least favourite lesson was indicated to be Physical Education, yet, again there are no significant differences in terms of physical activity levels within the Physical Education lessons when compared to any other group. It could have been predicted wrongly that, due to the lesson not being a favourite there might have been a decrease in the level of physical activity completed within the Physical Education lessons by this group. It could therefore, be suggested that the class teachers were able to inspire even those who are not keen on the lesson to be as physically active as other groups. This could potentially be seen as a positive aspect of the school Physical Education programme.

Boys reported via the questionnaire that they felt that they were always active or quite active within Physical Education lessons. When the accelerometer data were analysed, 23% of the time was spent at a MVPA level and 60% of the time was spent at a LPA level. Therefore, it could be suggested that boys were able to recall their activity levels within the Physical Education lesson relatively accurately. As for the girls, they reported themselves quite active within the questionnaire responses and when the accelerometer data were considered, 55% of the time was spent at a LPA level, again reflecting quite closely, their recalling of their own physical activity levels.

In terms of types of activity area within the Physical Education lesson, this was interesting and could be linked to potential skill level and skill development. Infants voted for being most active within swimming which involved them working as individuals. They told me that they were most active in swimming because they did widths of the pool, they all went at once, and that they felt tired and hungry when they had finished. The juniors meanwhile were most active during invasion games and striking and fielding games, which involved the children working in teams. They reported that this was due to them having to constantly work
together and move up and down the pitch or playground. These perceived differences in the intensity levels of physical activity in the activity areas within the National Curriculum programme for Physical Education (DfEE/QCA, 1999) need further research and will be discussed in chapter 6, it would also require waterproof accelerometers to be able to record the children’s swimming activities.

With reference to after school sports clubs, there was a significant difference between the infant girls’ and the junior girls’ levels of participation. The infant girls only participated in either zero or one after school club, this after school club was the same for all the infant girls who attended and was multi skills. The junior girls completed in two or three after school clubs. This difference was partly due to the availability of after school clubs at the school and partly due to the fact that the infants were still developing physically and progressing skills and techniques within the multi skills sports clubs. The implications of these parts of the findings were discussed with the class teachers who (as discussed in chapter 6) at time of writing were going to introduce more after school sports clubs for the infants.

Overall, the children found using the Qwizdom measurement tools a fun and interactive activity. The juniors highlighted how easy it was to use in terms of answering the questions and how quick it was to do. The infants stated that they found some of the questions difficult, but understood once I had clarified them and they too liked being able to record their ideas electronically.
Chapter 6
Discussion

6.1 Introduction.

The purpose of this chapter is to provide a discussion of the accelerometer and the physical activity questionnaire (Qwizdom) results presented in chapter 4 and 5 respectively. Within this chapter, alongside the accelerometer and the physical activity questionnaire results, the discussion will also draw on field notes (see Appendices 1 – 3). These included: Reflections and notes made during the data collection and following discussions regarding dissemination of the findings with the class teachers. These field notes were taken throughout the thesis research, to aid with the action research. This was in keeping with the comments from Kirk (1995) who indicated that “action research has begun to emerge as one strategy for improving teaching and learning in Physical Education” (p.4). Also, Walton (2011) suggested that action research is about improving the world and improving practice, not just about explaining and interpreting the practice that is occurring. I shall therefore, refer to the class teachers’ thoughts and reflections and also the elements that the head teacher and class teachers within the school have put into an action plan, following this sharing of the data analysis. This allowed for the action research cycle to be completed.

McNiff (2002) emphasised the importance of reflecting on the enquiry. The aim of me providing the feedback loop, and completing the action research cycle, as described by Bell (2005), was to “generate possibilities to change” (p.9). It was important to feedback to the class teachers involved in the thesis research and their responses are referred to within this chapter and within Appendices 1 - 3. This action research cycle was supported by Radford (2006) who suggested that the type of research completed within the thesis research would be specific and useful. In the case of the thesis research the people for whom this was specific and useful were the case study school’s class teachers, children and parents and myself as a teacher educator. The class teachers’ reaction to the results were important especially as one of them was the Physical Education co-ordinator for the school and the recording of their reactions followed Hargreaves’ (1999) notion of the teacher being a “habitual tinker” (p.242). Completing the cycle allowed for their views to be examined and for them to express their opinions as to what they
felt needed to be ‘tinkered’ with. Similarly McKernan (1996) suggested that systematic self-reflection of the practice that was occurring within a teacher’s own classroom setting was an important aspect of teaching. For clarification, the focused areas for discussion will be as follows:

- The physical activity levels of primary school children during the school day
- The differences between the physical activity levels of infants and juniors
- The differences between the physical activity levels of boys and girls
- The differences in self reporting between boys, girls, infants and juniors
- The extent to which Physical Education lessons affect primary school children’s physical activity levels
- The class teachers reactions to the children’s different physical activity levels
- The influence of break times as opportunities for physical activity and the use of playground equipment

6.2. Physical activity levels of children during the primary school day

This section will focus on answering the first and the third thesis research questions, - how physically active are primary school children during the school day? And to what extent does the primary school setting contribute to children’s recommended levels of physical activity (DH, 2005, WHO, 2010). The data showed that MVPA was possible within the primary school day and occurred on both PE and Non PE days. These findings were contrary to Dale et al.’s (2000) findings who stated the “opportunities for children to be physically active during school time are sparse” (p.240). Table F illustrates the overall average number of minutes that the children were involved in MVPA for during the school day. Unlike the pilot phase, there was a significant difference during the main phase between the types of days, with the children being involved in more MVPA on PE days (see Figure 7). The duration of physical activity at a MVPA level has not been previously recorded in the field of children’s physical activity, for juniors nor infants, within the different parts of the primary school day (see Table G).
<table>
<thead>
<tr>
<th>Year / Gender</th>
<th>Type of day</th>
<th>PE (n = 15)</th>
<th>Non PE (n = 15)</th>
</tr>
</thead>
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<tr>
<td>Infants</td>
<td>Boys (n = 5)</td>
<td>53 ± 22</td>
<td>46 ± 17</td>
</tr>
<tr>
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<td>Girls (n = 5)</td>
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<td>38 ± 11</td>
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<tr>
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<td>Girls (n = 5)</td>
<td>53 ± 13</td>
<td>40 ± 13</td>
</tr>
</tbody>
</table>

*Table F – Overall mean number of minutes ± SD of MVPA during whole school day for year group and gender.*

Ridgers et al. (2010) suggested that studies on physical activity have reported that there was a wide range in the proportion of children who were able to reach the recommended guidelines, specifically; the range went from “2.5 to 97%” (p.638). Within the thesis research 25% of the children were able to reach the recommended guidelines (DH, 2005; WHO, 2010). The junior boys were the only group to complete, on average, 100% (60 minutes) of the guideline MVPA within the school day (from 9am until 3.10pm) on a PE day (see Table F). On Non PE days junior boys were able to complete 77% of the recommended MVPA. The results showed that neither junior girls nor infants reached the recommended MVPA levels within the school day, although their results were close to 100% of the recommended MVPA levels for health benefits (DH, 2005; WHO, 2010). The junior girls reached 88% of the recommended MVPA levels on a PE days and 67% on Non PE days. The infant boys also completed 88% of the recommended MVPA levels on PE days and 77% on Non PE days, whilst infant girls completed 70% of the recommended MVPA levels on PE days and 63% on Non PE days. It was also important to acknowledge again that the DH (2005) and WHO (2010) recommendations for MVPA were not for the school day, but for the children’s whole day. From the findings, all of the children were, on average, only 7 minutes short of the recommended MVPA levels on PE days and 17 minutes short on Non PE days (see Figure 7). Therefore, the fact that it was potentially possible to achieve these recommendations within the primary school day and having almost reached the MVPA recommendations (DH, 2005; WHO, 2010) for all children, specifically for junior boys presented a new finding (at time of writing) in the field of children’s physical activity.
Oliver et al. (2007b) proposed that physical activity and in particular physical activity of children should include both fine and gross motor skills. For example, painting and sculpting, alongside running and skipping. Therefore, it was necessary to consider the different physical activity intensity levels to provide a full overview of how physically active the primary school children were being during the school day. It also enabled the opportunities within the school day where children were involved in MVPA, LPA and SA to be identified. This mapping of the school day allowed for new knowledge (at time of writing) to be brought to the field of primary aged physical activity from a case study perspective. The mapping of the children’s physical activity linked back to Goran et al. (1999), notion of exploring more about what happens with children’s physical activity levels. As they suggested that children’s levels of physical activity were highly variable and may be influenced by a multitude of factors including physiological, psychological, socio-cultural and environmental determinants. All the children within the case study came from the same socio-economic backgrounds; they were exposed to the same opportunities within the school environment and school day. It is possible to consider, from mapping the opportunities within the school day, other than those in the Physical Education lessons, where physical activity could occur elsewhere. Examples of these included curriculum time for infants and for both the infants and the juniors break times, particularly lunch times. Shaljean’s (2011) views are in line with this and he suggested that children needed to do physical activity in addition to the Physical Education lessons, which highlights the importance of such mapping. Table G illustrates the summary map of the different intensity levels of the children’s physical activity within the school day.

(Table G is presented on the next page)
<table>
<thead>
<tr>
<th></th>
<th>MVPA</th>
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<th>LPA</th>
<th></th>
<th></th>
<th>SA</th>
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<td>PE</td>
<td>Non PE</td>
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<td><strong>Curriculum time (%)</strong></td>
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<tr>
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<td>26 ± 5</td>
<td>65 ± 8</td>
<td>66 ± 7</td>
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</tr>
</tbody>
</table>

*Table G – Overall mean number of minutes and mean percentage number of minute ± SD for different physical activity intensity levels during different parts of the primary school day (n = 5 in each Gender / Year group and n = 15 PE days and n = 15 Non PE days).*
Findings from the physical activity questionnaire highlighted that the children felt that they were being physically active during break times in particular. This is reflected in the MVPA and LPA that was recorded (see Table G). Only 10% of the children described themselves as completing LPA during lunch time (see Figure 42) and all children described their least favourite activity at lunch time to be SA or LPA. Also, only one child reported themselves as not being very active during morning break. This is reflected in the physical activity that was recorded, as during morning break, SA was the activity that was recorded as happening for the shortest duration. Only three children described themselves as sitting down at lunch time. An overwhelming 65% of children described their least favourite activity as SA (see Figure 41) during lunch time and no children identified SA as their favourite or longest activity during break time (see Figure 40). Further elements of the table will be expanded when discussing the differences between the physical activity levels of year groups (see section 6.3) and gender (see section 6.4).

6.3 The differences between the physical activity levels of infants and juniors

This section will focus on answering the second of the thesis research questions – what are the differences in the physical activity levels during the school day between children aged six – seven years (infants) and aged nine – ten year (juniors)? The results demonstrated various differences between the physical activity levels of infants and juniors. The infant age group is an area in the field of children’s physical activity that had not previously been researched the identification of differences in physical activity levels of infants and juniors brings new knowledge to the field. The thesis results will be examined in terms of differences in intensity levels and within the physical activity questionnaire. The variations could, to a large degree be explained by the ages of the children. Infants are at a developmental stage where they are more ‘fidgety’ than juniors (Gallahue, 1996). Also from a physiological perspective, it could have been due to their motor, social, cognitive and emotional stages of development (Gallahue, 1996; Doherty and Brennan, 2007). The infant curriculum also allowed the children to be able to move from one learning environment to another and indeed encouraged movement. This will be discussed further in conjunction with the thesis results in the next sections.
6.3.1 Differences in MVPA between infants and juniors

During curriculum time, infants were, on average, significantly more (3 minutes more) physically active at a moderate to vigorous level, than juniors, in particular on Non PE days (see Figure 9). Also, for the infants, the Physical Education lessons did not contribute to their overall physical activity levels as much as the lessons did for the juniors. For juniors Physical Education lessons were particularly important for contributing to their overall physical activity levels. Infants, however, were more active within all parts of their curriculum. Within curriculum time, there was also more LPA and less SA experienced by infants when compared to juniors, so overall within curriculum time the infants were more physically active at both MVPA and LPA. These differences could have been due to the variations that occurred both in the curriculum and within the learning environments. As Pica (2003) suggested, this active play within curriculum time, as identified in the thesis research, contributes to the development of young children's self, cognition, movement, confidence and the ability to socialise and interact with others. Alexander (1995) highlighted the ideological and pedagogical differences between the key stage curricula. Infants were allowed a free flow of movement in and out of both indoor and outdoor learning environments, therefore, having more access and opportunities within their learning activities, to complete in more LPA and less SA than juniors. Ward and Roden (2008) encouraged this strategy of free flow of movement within the classroom for children to develop life skills through them choosing an area for the completion of their work and learning. It is also suggested that this free flow helps to enhance the children's learning physically and socially (Vygotsky, 1962) and encourages them to be active agents in their own learning (Piaget, 1951; Baynes, 1996).

Juniors on the other hand, have less free flow and are more restricted to one chair and one area of the classroom (as discussed in section 1.1). This type of learning environment and classroom set up occurred within the case study school. Therefore, the learning environment needs to be considered if future physical activity opportunities are to be available to juniors in particular within the school day. Conversely, the juniors were involved in more MVPA (5 minutes more) during curriculum time on PE days than on Non PE days (see Figure 8). Theoretically it could be possible that the juniors experienced excitement during PE days, knowing that they would be going outside their normal classroom.
learning environment, and that this produced more MVPA. Duda (1989) proposed that this kind of excited behaviour could occur. This behaviour presented itself as the children wanting to be rewarded, through positive praise and feedback from the class teacher (or from me), and were recorded in the field notes.

6.3.2 Differences in LPA and SA between infants and juniors

During curriculum time, the infants were involved in 20 minutes more LPA than juniors (see Figure 19) but this may be due to the differences in curricula as highlighted earlier. In the pilot phase there were no significant differences found between the types of days. However, within the main phase results, there was significantly more LPA (8 minutes more) on PE days than Non PE days. Infants were involved at significantly more LPA when compared with juniors: 21 minutes more in the pilot phase; and 32 minutes more in the main phase results, within the whole school day. The increase in the LPA for the infants during the main phase compared to the pilot phase may be due to the door to the outside learning environment being open more frequently due to the warmer weather. This allowed more space for the children to move within their learning environment, which may have accounted for a longer period of LPA during curriculum time. Therefore, further research could be completed in analysing and tracking the infants’ movements within the learning environment in order to promote this opportunity for physical activity.

Juniors were involved in 13 minutes more LPA on PE days when compared to Non PE days (see Figure 18). This difference may be due to the children being excited about the day containing a Physical Education lesson and them being able to go to a different learning environment as highlighted previously. Overall, juniors were involved at significantly more SA than infants during curriculum time and during morning break (see Table G). Juniors were also involved at significantly more SA overall on Non PE days, 29 minutes more when compared to PE days in the main phase (see Figure 28). During curriculum time, the results from the main phase showed that juniors were involved in 46 minutes more SA on Non PE days when compared to PE days (see Figure 29). This differed from the 37 minutes difference during the pilot phase. In the pilot phase, the results revealed that during Non PE days the children were involved in, on average, 8 minutes more SA than on PE days. However, there was a much greater variation in the main phase.
and during this the children were involved in 21 minutes more SA on Non PE days than on PE days (see Figures 27). Also, overall, when the whole day is considered, juniors were involved in SA for 36 minutes more than infants in the pilot phase and for a similar duration (34 minutes) in the main phase (see Figure 28). This identification and awareness of juniors being involved in more SA than infants during the curriculum time and morning break, could allow for the class teachers, in the future to target these places as opportunities to increase physical activity.

The children’s lunch time included both eating lunch in the school dining hall and being outside in the playground or field environments. Out of the 60 minutes for lunch time, all children were involved in SA for between 20 and 28 minutes, with infants completing more SA than juniors, although this was not a significant result. This may be explained by the fact that the infants have not yet mastered the fine and gross motor skills of cutting up their lunch, which juniors may have mastered these due to their stage of motor development (Gallahue, 1996), thus speeding up their eating. There may also have been a difference in the duration of SA within the lunch hall, for those who were eating school lunches versus those who were eating packed lunch. The packed lunch items of food, due to their nature of fitting into a lunch box, may already have been in bite size pieces (such as sandwiches), making the eating process faster overall and so allowing the children to go out into the playground more quickly, where there are greater opportunities for physical activity to occur. As the differences in lunch eating habits was not the focus of the thesis research, further research would be needed to compare the physical activity intensity levels and duration of children who eat packed lunches versus those who eat school lunches, before the differences could be fully explored and commented on. Without this research we are not able to determine whether there any opportunities for increasing physical activity levels by getting children through the eating component of lunch times more quickly. Also, whilst there could be benefits from attempting to reduce the time spent actually eating, there are potential risks related to children perceiving eating quickly or eating less as a reward and these risks may subsequently not be worth the increase in potential physical activity.
6.4 The differences between the physical activity levels of boys and girls

6.4.1 Differences in MVPA between boys and girls

Sarkin et al. (1997) suggested that girls and boys have the same opportunities to be physically active. However, differences were found in the MVPA levels of boys and girls in the thesis research. There was a significant main effect for gender shown in the accelerometer data, with boys completing more MVPA than girls within the school day. This occurred during different parts of the school day including morning break, lunch time and curriculum time. Fairclough and Stratton (2005) also observed the same result of boys reaching higher physical activity levels than girls. Trost et al. (2002) proposed similar results and found that boys were involved at significantly more MVPA than girls, in particular during break times. These results and those of the thesis research may be linked to gender social constructions and male dominance in the playground. Connolly (2003) also suggested that a difference in break time activities could be due to gender segregation during break time, with the social construction of gender being evident in the active play of children during break time. He also proposed that there is a male dominance in the playground (Connolly, 2003). The children were involved in more MVPA during morning break on PE days when compared to morning break on Non PE days. These results suggested that the type of day also has an influence on the children’s overall MVPA levels during different parts of the school day. Yet, Mota et al. (2005) found the opposite result with girls completing more MVPA than boys, although they did highlight the importance of break times as opportunities for all children to be physically active, a statement the thesis research results support. To overcome the differences identified at morning break, lunch time and curriculum time, the class teachers could reflect on how the boys and girls are encouraged differently to be physically active during this time. For example, to consider what resources and equipment are available during morning break and lunch times for the children and whether these resources appeal to both genders. There would then need to be reanalysis of the physical activity levels during these times to see if there has been any influence by such an introduction (see also section 6.7).

Infant girls were involved in more MVPA during afternoon break on Non PE days when compared to PE days (see Figure 12). The latter result is particularly interesting due to the timing within the day of the Physical Education lessons,
which occurred immediately before afternoon break. These results could indicate that the infant girls did not continue with the MVPA level of activity beyond Physical Education lessons. It raises the question as to whether the infant girls were tired or felt that they deserved a rest after Physical Education lessons, or whether the aforementioned male playground dominance is exerting an effect. Further research to analyse the children's thoughts and feelings following Physical Education lessons to understand, in particular, the infant girls' reasoning behind their actions would be required.

6.4.2 Class teachers’ reactions to differences in MVPA in boys and girls

Stroot (2002) proposed that boys often benefited from “more opportunities and more encouragement to participate in physical activity” (p.137) when compared to girls. Schools have a particularly strong influence, according to Andersen and Taylor (2006), on gender socialisation due to the amount of time that children spend in schools. They suggested that teachers have different expectations for the genders, with girls directed more towards more sedentary activities, whilst boys are encouraged to be more physically active. Andersen and Taylor (2006) also highlighted that previously girls were not allowed to play competitive sports in school and only allowed to participate in activities that were judged gender appropriate. Although this has changed in recent times some activities, according to Andersen and Taylor (2006), are still seen as more gender dominated than others, for example, netball is stereotypically for girls and football is stereotypically for boys.

The class teachers in the case study school reported, in discussions following the sharing of the data analysis, (see Appendix 2, field notes) that they felt that there was an emphasis both genders participating to equal amounts in break times, in all the activity areas within both Physical Education lessons and after school clubs. Yet, they also acknowledged that there were wider social contexts beyond school that can not be controlled, such as parental and home influences. The case study school tried to reduce the level of stereotyping to sports that Andersen and Taylor (2006) highlighted, by not having any specific boys’ or girls’ teams. The class teachers also reported when the teachers attended local competitions that mixed gender sports teams were common in the other primary schools within the local area. The thesis research results showed
that there were no significant differences between the MVPA, during the Physical Education lessons for gender (or year group), even though Gard (2001) and Wellard (2007) suggested that Physical Education favours forms of masculinity, such as sporting prowess, dominance vs. subordination, aggression and interest in sport, whilst Koca et al. (2005) suggested that girls showed more favourable attitudes towards physical activities such as gymnastics and dance.

The physical activity questionnaire results indicated that all the junior girls chose Physical Education as their favourite lesson (see Figure 43). As this result was different to previous research (Gard, 2001; Wellard, 2007) it raises the question as to whether the junior girls were attempting to please me, as the researcher, by choosing Physical Education as their favourite lesson. This may have highlighted the effects of co-construction during the research process that Hammersley and Atkinson (1995) referred to. Or it was perhaps due to the influence of their class teacher, with the junior girls wishing to be praised. Duda (1989) indicated that this type of behaviour was a possibility in this type of circumstance. The class teacher’s gender shall be further explored in the section of the thesis research pertaining to the limitations of the research (see section 7.3.2). It could be also suggested that the lack of differences in the MVPA results, during the Physical Education lessons were due to the encouragement from both the class teachers for all of the children to participate in every activity. This especially seems to be the case as all the infant boys highlighted that Physical Education was their least favorite lesson (see Figure 46). Alternatively it could be that the forms of masculinity suggested by Gard (2001) and Wellard (2007) being seen more as the children mature and are more prevalent in a secondary school setting rather than a primary school environment. The mixed gender lessons approach found in the primary setting does not necessarily continue into secondary school where many, if not all, Physical Education lessons are taught according to gender (Whitlam, 2005). This is due to a variety of reasons including different developmental stages of boys and girls over the age of eleven and an increased risk of injury if they did play together (Whitlam, 2005). Derry (2004) suggested that single gender Physical Education environments were a particular benefit for adolescent girls’ MVPA levels and Ishee (2005) emphasised how this reduced stress, in particular for girls of secondary age. Yet, Whitlam (2005) also
highlighted that in many other European countries boys and girls continue to play in mixed teams together until they are nineteen.

6.4.3 Differences in LPA and SA between boys and girls

In the main phase, girls were involved at more LPA during lunch time on Non PE days than during lunch time on PE days (see Figure 21). This result was not found in the pilot phase results, but links to ideas from Mota et al. (2005), which suggested that break times are important for children’s physical activity, indicating that girls in this case study school accessed physical activity opportunities during lunch time at a LPA level rather than a MVPA level. In both the pilot and main phase results girls were involved in more LPA than boys during morning break (see Figure 20). Girls were also found to have significantly more SA overall during morning break and lunch time when compared with boys, although only one minute more SA in both instances (see Figures 30 and 31). This significant difference was only found in the main phase. Girls were also more involved in SA on Non PE days during morning break than break times on PE days (see Figure 30). The influence of break times is further discussed in section 6.7.

6.5 The differences in self reporting between infants, juniors, boys and girls.

The results from the junior boys’ physical activity questionnaires regarding break time physical activity levels showed that their self reporting matched quite closely with the results gained from the accelerometers. For example the junior boys described themselves as being active or very active and the accelerometer data identified that boys were involved at significantly more MVPA than girls, indicating also that they were active or very active (see Figures 10 and 11). Girls were able to describe themselves as being very active quite only often in Physical Education lessons, this was again identified in the accelerometer data (see Figure 13). These differences in self-reporting in gender have also been found by Inchley et al. (2005) who used a health behaviour questionnaire, rather than a physical activity questionnaire and accelerometer data collection as in the thesis research. They found that girls similarly reported lower levels of MVPA than boys.

Raudsepp and Päll (1999) also found similar results to those of the thesis research, in terms of self recalling, although their research was over a much
shorter time period of only two days. They found that boys recalled higher physical activity levels than girls and for the older children in their research (those aged eight and nine) this was also confirmed by the accelerometer data. Yet, for the younger children (those aged seven), Raudsepp and Päll (1999) found the recall and accelerometer data did not match, in a similar manner to the thesis research, in that infant boys recalled higher physical activity levels than was recorded by the accelerometers. Kolle et al. (2009) suggested that children have difficulty self-reporting their own behaviour because they find it difficult to recall details of their own physical activity patterns. Welk et al. (2000) highlighted that the difficulties in children recalling different intensity and duration levels of physical activity may be due to definitions of physical activity becoming ‘blurred’ as play and physical activity are often unplanned with young children and therefore, may not be fully accounted for within the self recalling.

Within Kolle et al.’s (2009) research they only focused on nine year olds (juniors) and in the thesis research this struggle with recalling was found for the juniors, the infants found it particularly difficult especially when trying to identify their physical activity levels within all parts of the school day. This may be due to the infants’ early stage of cognitive development. To overcome this potential problem within the thesis research, in the physical activity questionnaire, the different types of activities that constituted physical activity were explained to the children. Janz et al. (1995) described this type of recall as a high complex cognitive task. Perhaps it was difficult for the younger children to complete accurately due to them not having developed to this level cognitively. Craig et al. (2008) also investigated self-reporting of physical activity and found similar to the results in the thesis research and to those of Kolle et al. (2009), that children had difficulty self recalling. Craig et al.’s (2008) highlighted that whilst younger children under estimated their levels of MVPA, older children were prone to overestimating these levels. They also found similar results to the thesis research with regards to accelerometer data, in that they found that boys were more active than girls. However, they found that their girls’ activity levels decreased with age, whilst the thesis research results found that the junior girls had higher levels of MVPA than the infant girls on both PE days and Non PE days (see Table F). Craig et al. (2008) did acknowledge that their accelerometer data collection was only over four days. Brockman et al. (2011) considered children's perceptions and self recall of
play situations including both physical activity and sedentary behaviour and found that girls were less likely to provide specific activities as examples, whilst boys were able to report their individual activities. This highlighted the difficulties that some children have in self recall and interpreting what is meant by play and physical activity in a wider context. Freedson (1989) and Waring et al. (2007) also suggested in their research that primary aged children have difficulty in recalling physical activity accurately due to the patterns of physical activity fluctuating and not being an extended period of time. These ideas may explain why the children in the thesis research were able to identify their physical activity levels at only certain times, rather than throughout all parts of the school day.

Stratton and Watson (2009) warned that self recalling tools were “considered highly subjective and their results must be interpreted with caution” (p.155). They suggested using more rigorous measurements such as accelerometers. As with physical activity questionnaires, there may have been reporter bias displayed in the children’s responses, with them wanting to please me as the researcher, introducing the possibility that they may have reported on erroneous movements, as they may have misunderstood or been unable to quantify their own physical activity levels. This type of reporter bias was described by Troiano et al. (2012), as a socially desirable response and they again highlighted the difficulties in recalling sporadic activities such as those shown in children’s physical activity. Sleap and Warburton’s (1996) research also highlighted that primary aged children’s physical activity was sporadic and spontaneous. Bender et al. (2005) suggested that the spontaneous nature of young children’s physical activity makes it difficult to quantify the movement, hence them finding it even more difficult to recall, which often leads to underestimation of activity levels. Therefore, it is not surprising that this age group might have difficulty recalling exact activity levels. In the thesis research both self recall (through the use of questionnaires) and objective measurements (through the use of accelerometers) were used as a means to reduce the risks of under reporting physical activity levels, whilst still being able to gain information about the types of physical activity that were performed. The thesis results show that the children were able to identify, but only at times, their own physical activity intensity levels. To increase their awareness further, time and experience is needed for the children to be able to know and to understand how the different intensity levels feel
and when they occur. This would yield more accurate data and could then allow
class teachers to use this data in the future as a means of monitoring and
potentially improving physical activity levels.

6.6 The contribution of Physical Education lessons to primary children’s
physical activity levels

This section will focus on answering the fourth of the thesis research
questions – what contribution do Physical Education lessons make to primary
children’s physical activity? The different physical activity intensity levels during
Physical Education lessons were mapped and are illustrated in Table H. The table
indicates that there were only slight variations between year group and gender
within Physical Education lessons and therefore, it appears that the contribution of
Physical Education lessons to children’s overall physical activity levels was similar
for both genders and age groups.

<table>
<thead>
<tr>
<th>Year / Gender</th>
<th>MVPA ± SD</th>
<th>LPA ± SD</th>
<th>SA ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants Boys</td>
<td>9 ± 3</td>
<td>15 ± 2</td>
<td>16 ± 3</td>
</tr>
<tr>
<td>Infants Girls</td>
<td>7 ± 2</td>
<td>15 ± 2</td>
<td>18 ± 2</td>
</tr>
<tr>
<td>Juniors Boys</td>
<td>9 ± 2</td>
<td>13 ± 1</td>
<td>17 ± 3</td>
</tr>
<tr>
<td>Juniors Girls</td>
<td>9 ± 2</td>
<td>13 ± 2</td>
<td>18 ± 4</td>
</tr>
</tbody>
</table>

Table H – Overall mean number of minutes ± SD for different physical activity
intensity levels during Physical Education lessons (n = 5 in each Year / Gender, n
= 15 Physical Education lessons recorded).

Within the main phase results all the children achieved a significantly higher
number of minutes of MVPA on PE days. It is possible to see from the results
that, on average, between seven and nine minutes of MVPA within Physical
Education lessons was completed for all children. The total time for the Physical
Education lesson was 40 minutes; the amount completed at a MVPA level equates
to between 18% and 23% of the total time. This also represents between 9% and
15% of the total daily recommendation of MVPA to achieve health benefits (DH,
2005; WHO, 2010). This result was much higher than that found by Simons-Morton et al. (1994) who observed levels of physical activity in Physical Education lessons for children aged ten and eleven in primary and middle schools in America, which had identified themselves as having excellent Physical Education programmes. Their study found that only 8.6% of time was at a MVPA level within Physical Education lessons. This much lower result highlighted the difficulties in identifying what physical activity is occurring within the classroom, indicating that perhaps recall and perceptions of physical activity are not just difficult for children to quantify, but also for adults too. The Physical Education programmes used within Simons-Morton et al.’s (1994) research were perceived by the head teachers themselves as excellent and show the importance of not just assuming, but using empirical research to examine the physical activity that is occurring within the school day. This again, highlights a particular strength of the case study approach.

Other researchers, such as Fairclough and Stratton (2006b), have found similar percentage number of minutes of MVPA within Physical Education lessons. In their review of physical activity levels within elementary school, Physical Education lessons indicated that pupils were at a MVPA level for 27 – 47% of lesson time. Fairclough and Stratton in their previous research (2005) examined the physical activity of older children aged between eleven and fourteen years, using heart rate measurements, and found that 32.9% of Physical Education lessons were spent at a MVPA level. They also considered the ability levels of the children and found that the high ability children were more active than those who were regarded as having lower ability levels. This may be due to the mechanical efficiency of the children, the suppleness, stamina, coordination and control that they have learnt previously. These differences in ability were not noticeably present within the thesis research. This may be due to the children’s age and them not yet reaching this stage of motor development. Yelling et al. (2000), found a much higher percentage of time at MVPA levels during Physical Education lessons than the thesis research did. They too, like Fairclough and Stratton (2005), used heart rate as a measurement of physical activity and found 60% of the lessons were at a MVPA level, yet they only involved six girls, all of whom were “able and interested” (p.49). Therefore, it is difficult to generalise to all children and to make a valid comparison to the thesis research. Mersh and
Fariclough (2010) also found similar results to Yelling et al. (2000) within secondary school children aged eleven and twelve. They found MVPA levels varied from 38.7% to 63% of the lesson time and found that lessons which focused on outwitting opponents produced the highest MVPA. If these latter results are compared with the physical activity questionnaire results in the thesis research, then similar results can be found, 30% of children indicated that they felt they were most physically active during invasion games and 30% of children indicated that they felt that they were most physically active during striking and fielding games. Both these types of games included outwitting opponents, or at least the beginning of developing tactics to outwit opponents due to the early stages of development in the curriculum. Further research is needed into the physical activity levels during different activity areas within Physical Education as these activity areas change over the school terms and may have an impact on the different intensity levels experienced (see section 7.4.4).

Fairclough and Stratton (2005) proposed that Physical Education lessons had the potential to make a “significant contribution” (p.14) if lessons were planned and delivered with physical activity as the main focus of the lesson. Yet, it could be proposed that this is not the only focus of Physical Education lessons. Even without a specific focus on physical activity, the Physical Education lessons within the case study school did make a significant contribution to the children’s overall daily physical activity levels. However, the class teachers in the case study school may have planned and delivered the Physical Education lessons with a physical activity focus in mind, as they knew the subject of the research, this could be regarded as a limitation of the thesis research. Gard (2004a) questioned the validity of all physical activity research because the participants know that their physical activity is being measured. In these cases, Gard (2004a) maintained that the results may be altered by the children and class teachers. In terms of the thesis research, this possible problem was partially countered by the children not knowing the results from their accelerometer or questionnaire data, until after the end of the data analysis. To also overcome the limitation of the teachers knowing the focus of the research, the teachers were intentionally not given any formative feedback as to how physically active the children were, within their lessons, until the end of the research. This was done in order to prevent subjective bias occurring. This was suggested as being advantageous by Oliver et al. (2007a),
particularly when using accelerometers. Also, as the thesis research was completed longitudinally over the whole school year, it would have been extremely difficult for the children to keep up an ‘unnatural level’ of physical activity for such a length of time.

It was a possibility that the use of the technical measurement of the children’s physical activity levels using accelerometers could have had a significant impact on the children’s motivation for and ultimately, their enjoyment of performing more physical activity. These ideas reflected Thomas and Stratton’s (2006) views on children’s desire and need to perform, as previously highlighted in chapter 2. Guo et al. (2010) also suggested that, because children are inquisitive, they often want to play and to experiment with the technologies used within Physical Education lessons. This may ultimately increase the intensity levels and duration of the children’s physical activity. However, as the pilot and main phase of the thesis research was completed over a period of an academic year, if any initial motivation or enjoyment impacted on the results, this should have shown up in the pilot phase (from September until December) and could not have been sustained over the duration of the main phase from January to June. This highlighted the importance and strength of completing a pilot phase, as was supported by Berg and Latin (2008). Also, the excitement from the novelty of the accelerometers would wear off relatively quickly as the children did not receive any immediate feedback from the accelerometers or from me about their physical activity levels. The children would have become acclimatised to the equipment (Guo et al., 2010) which consequently would not have impacted on the results. Yet, it could also be possible to consider using the measurement tools as a way of increasing awareness and experience of the children at the different physical activity levels, which may help increase physical activity levels and help self recall of physical activity levels.

Table I illustrates the amount of MVPA recorded, on average, within Physical Education lessons and the average overall increase of MVPA within the PE days. It could be expected that the increase in PE days would be the same amount of MVPA that was found in the Physical Education lessons themselves.
Table I – Overall mean number of minutes of MVPA completed within Physical Education lessons and the increase in mean number of minutes of MVPA completed within PE days when compared to Non PE days.

<table>
<thead>
<tr>
<th>Year / Gender</th>
<th>MVPA within Physical Education lessons</th>
<th>MVPA increase on PE day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Girls</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Juniors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Girls</td>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>

Table I revealed variations between the MVPA within Physical Education lessons and the MVPA increase on PE days when compared to Non PE days. The MVPA increase was the lowest for the infant girls with only an average 4 minute increase being recorded on PE days. The most noticeable increase in MVPA on PE days was for junior boys who increased their overall MVPA by 15 minutes. Overall the contribution to MVPA that Physical Education lessons made to PE days was an increase of 9 minutes, yet overall PE days contain, on average, 10 minutes more MVPA. The 10 minutes represents a 2% difference between the total difference in MVPA on PE days and Non PE days. For juniors, the MVPA within PE days is more than that completed within the Physical Education lessons. For junior boys 6 extra minutes, and junior girls 4 extra minutes, on average, were achieved outside of the Physical Education lessons. These results indicated that Physical Education lessons did contribute to the juniors overall physical activity levels. For the infants, the MVPA increase was the lowest for the infant girls with only an average 4 minute increase being recorded on PE days. The most noticeable increase in MVPA on PE days was for junior boys who increased their overall MVPA by 15 minutes. Overall the contribution to MVPA that Physical Education lessons made to PE days was an increase of 9 minutes, yet overall PE days contain, on average, 10 minutes more MVPA. The 10 minutes represents a 2% difference between the total difference in MVPA on PE days and Non PE days. For juniors, the MVPA within PE days is more than that completed within the Physical Education lessons. For junior boys 6 extra minutes, and junior girls 4 extra minutes, on average, were achieved outside of the Physical Education lessons. These results indicated that Physical Education lessons did contribute to the juniors overall physical activity levels. For the infants, the MVPA increase was the lowest for the infant girls with only an average 4 minute increase being recorded on PE days. The most noticeable increase in MVPA on PE days was for junior boys who increased their overall MVPA by 15 minutes. Overall the contribution to MVPA that Physical Education lessons made to PE days was an increase of 9 minutes, yet overall PE days contain, on average, 10 minutes more MVPA. The 10 minutes represents a 2% difference between the total difference in MVPA on PE days and Non PE days. For juniors, the MVPA within PE days is more than that completed within the Physical Education lessons. For junior boys 6 extra minutes, and junior girls 4 extra minutes, on average, were achieved outside of the Physical Education lessons. These results indicated that Physical Education lessons did contribute to the juniors overall physical activity levels. For the infants, the MVPA increase was the lowest for the infant girls with only an average 4 minute increase being recorded on PE days. The most noticeable increase in MVPA on PE days was for junior boys who increased their overall MVPA by 15 minutes. Overall the contribution to MVPA that Physical Education lessons made to PE days was an increase of 9 minutes, yet overall PE days contain, on average, 10 minutes more MVPA. The 10 minutes represents a 2% difference between the total difference in MVPA on PE days and Non PE days. For juniors, the MVPA within PE days is more than that completed within the Physical Education lessons. For junior boys 6 extra minutes, and junior girls 4 extra minutes, on average, were achieved outside of the Physical Education lessons. These results indicated that Physical Education lessons did contribute to the juniors overall physical activity levels. For the infants, the MVPA increase was the lowest for the infant girls with only an average 4 minute increase being recorded on PE days. The most noticeable increase in MVPA on PE days was for junior boys who increased their overall MVPA by 15 minutes. Overall the contribution to MVPA that Physical Education lessons made to PE days was an increase of 9 minutes, yet overall PE days contain, on average, 10 minutes more MVPA. The 10 minutes represents a 2% difference between the total difference in MVPA on PE days and Non PE days. For juniors, the MVPA within PE days is more than that completed within the Physical Education lessons. For junior boys 6 extra minutes, and junior girls 4 extra minutes, on average, were achieved outside of the Physical Education lessons. These results indicated that Physical Education lessons did contribute to the juniors overall physical activity levels. For the infants, the
results were different to the juniors, in particular, for infant girls the opposite result occurred and the increase in MVPA completed within PE days was less than that which occurred within Physical Education lessons, therefore, indicating that although MVPA existed within the Physical Education lessons, the infant girls were able to complete MVPA within other parts of the school day within Non PE days.

For juniors, physical activity and movement within the classroom is more limited due to the nature of the curriculum (as highlighted earlier in section 6.3). Through the use of the visual timetable which is displayed within each classroom of the case study school the children could identify, as they arrived at the start of the school day, whether it was a PE day or Non PE day. Swale (2006) highlighted that the visual timetable was informative and helped focus children. Therefore, the juniors would know from the start of the day if it was a PE day and that they would not be in their classroom learning environment for the whole day and therefore, would be away from their ‘normal set seat’ for a portion of the school day. The term ‘normal set seat’ was used by McNamara (1994) to describe the assigned seat that children have to sit in according to subject and ability. Kirk (2002) suggested that juniors require discipline to sit still at their seats for lengthy periods of time and therefore, Physical Education lessons are often seen by both the children and the class teachers as a ‘release’ from the pressure other classroom based subjects. Within Physical Education lessons there would be potentially more freedom for the children to be with their friends and in groups that they have chosen (Bailey, 2001). This concept of choice within grouping was something that the class teachers and children reported to me as a reason for looking forward to the Physical Education lessons. This was particularly different to Numeracy, Literacy and Science lessons when the children have set seats and groups to work in, according to ability levels. This excitement from looking forward made the children feel positive and happy; ultimately this may help their emotional and physical wellbeing (Bailey, 1999). This level of discussion about Physical Education lessons was not found within the infants. This may be due to their age and cognitive development and the fact that they are still at an age where they are deciding on their likes and dislikes (Howells, 2012a), or it may be due to the infants having more of a free flow of movement within their curriculum (Alexander, 1995).
Previous research has examined physical activity and exercise with regards to their benefits towards emotional wellbeing, in particular to levels of depression, stress and anxiety (Greist et al., 1979; Mutrie and Hannah, 2007; Biddle and Mutrie, 2008), and self-esteem (Hills et al., 2007), but this previous research has not specifically linked emotional wellbeing to Physical Education lessons; they have focused specifically on exercise. Hills et al. (2007) suggested that physical activity has psycho-social benefits. Greist et al. (1979) discovered the positive psychological effects of daily running and physical activity on overall wellbeing and noted in particular that it has preventative and therapeutic effects on depression. Exercise in general has an antidepressant effect which may be due to the use of exercise as a vehicle to escape from the stresses and strains of everyday life. It could be suggested that some class teachers, as in the case study school, view Physical Education lessons as an escape for the children from the stresses and strains of academic work, and therefore, important for the child’s overall wellbeing in terms of a release mechanism.

Weinberg and Gould (2010) found a correlational effect: as physical activity increases, depression levels decrease. Wellard (2012) highlighted the importance of children experiencing Physical Education lessons in a positive way to ensure they were able to reflect upon them in the same positive manner, in order not only to develop what he terms as a circuit of body reflexive pleasure, but also for them to continue with physical activity beyond the school gates and into later life. These are aspects that need to be considered when planning Physical Education lessons and in particular the holistic development within the Physical Education lessons (Doherty and Brennan, 2007) that takes into consideration the social, and emotional as well as the physical wellbeing of children. This is especially important because the social, emotional and moral developments of the child are difficult to measure and sometimes termed non-measurable, yet they still contribute to the overall wellbeing of the child. When the results from the physical activity questionnaire were considered, it was found that the infant boys’ least favourite lesson was Physical Education. It is important to ensure that all children are experiencing Physical Education positively so as to access these aspects. Wen et al. (2011) also suggested that there were health benefits to be derived from physical activity, as does Roberts (2011a) who reported on the announcement by the England’s chief medical officer (Sally Davis) that “physical
activity offers huge benefits.... that doing... physical activity every day brings health benefits" (Roberts, 2011a, no page number) as long as it is enjoyable and considered worthwhile by the individual. Therefore, there is a need for positive, motivated and enthusiastic role models, in particular the class teachers within a primary school setting (Howells, 2007).

6.6.1 The activity areas of the Physical Education lessons

Within primary Physical Education lessons, children need to: learn how to move (Jess and Dewar, 2004), how to be comfortable within their own bodies (Wellard, 2012); they also need to learn how to cope with losing (Laker, 2001). Children are able to learn from Physical Education lessons in a variety of ways: physically, socially, affectively and cognitively (Price, 2008). Cools et al. (2011) suggested that the “development of fundamental movement skill” is a “key factor in promoting long term physical activity” (p.1). Lubans et al. (2010) also proposed that there was a positive association between fundamental skill “competency and physical activity” levels (p.1019). Fairclough (2003) suggested that there are multiple aims of Physical Education lessons, including those that are similar to Lubans et al. (2010) such as development of motor skills, but also suggested that creative and artistic expression, self-realisation, moral development and social development are able to be completed through Physical Education lessons. The number of skills and areas to be developed during a Physical Education lesson seem to be numerous and ever increasing. Fairclough (2003) suggested that it is important to ensure that children are able to complete skills. They highlighted that this was particularly important for preschool children aged three to five. From a Primary Education background viewpoint all of the different activity areas within the Physical Education National Curriculum (DfEE/QCA, 1999) that occur at different times of the year, need to be consider to identify if there are differences in children’s physical activity levels according to the different activity areas of Physical Education lessons (DfEE/QCA, 1999).

During the main phase data between January and June 2009, the children completed invasion games, striking and fielding games, swimming and athletics within the activity areas of the National Curriculum for Physical Education (DfEE/QCA, 1999). Swimming, invasion games and striking and fielding games were found through the physical activity questionnaire to be the children’s favourite
activity areas (see Figure 47) and also those in which they felt that they were the most physically active (see Figure 48). These activity areas were undertaken at the school (on the playing field and the playground) and away from school (at the swimming pool). This identification of similar accelerometer recordings and perceived physical activity levels has previously been reported by Kolle et al. (2009) as being difficult for children to complete. However although regarded as difficult, the children within the thesis research were able to match their accelerometer recorded physical activity levels with their perceived physical activity levels.

During the pilot phase the children completed dance and gymnastics within the indoor school dining hall and the MVPA recorded within the Physical Education lessons was much lower than that found in the main phase. For the juniors the reasons for less MVPA that were recorded in the field notes (see Appendix 1) were due to the lack of space and therefore, the children queued for equipment, or watched performances more than in other activity areas. From the physical activity questionnaire gymnastics was described by the children as their least favourite activity area within Physical Education lessons (see Figure 47). Also gymnastics was the activity area in which they perceived themselves to be the least physically active within (see Figure 48). Yet, as Broomfield (2011) highlighted, though gymnastics was perceived as containing less MVPA than any other activity area it is important and can contribute to other activity areas. This is because each activity area of the National Curriculum for Physical Education (DfEE/QCA, 1999) is vital in its own right. Gymnastics is concerned with control, coordination and challenges, which in turn helps the children to understand strength, suppleness and stamina, and also helps to promote the children’s spatial awareness (Pica, 2004) and decision making, which can then be applied to other activity areas (Broomfield, 2011). The field notes provided a possible explanation for the pilot phase results and the lower MVPA levels during gymnastics, in particular for infants; these could be due to the juniors within gymnastics being able to perform more difficult movements compared with infants. The infants were at a stage in their development where they were only just beginning to learn how to rotate and how to move using different parts of their body. This was less mechanically efficient and much slower than observed for the juniors who were able to move with more fluidity, control, coordination and ease than the infants.
within their gymnastics sequences. These differences between the age (year) groups in relation to the curriculum have also been reported by Gallahue and Ozmun (2002) and Pickup and Price (2007).

The swimming classes were held off site at the local swimming pool which involved travelling there by bus. The infants reported this as very exciting and they looked forward to these school days that included this kind of ‘school trip’. Robison (2012) suggested that swimming is one of the best physical activities for children, as children can build confidence in the water and also can be active whilst having fun. The children referred to it as a school trip because it was so memorable, due to it involving them leaving on a bus to go to the swimming pool: subsequently it featured as a major part of that particular school day. Leeder (2003) discussed this phenomenon of trips outside the school as being “memorable” (Leeder, 2003, p.1). The children reported that after swimming they felt tired and hungry. They also stated that they liked going swimming as their mothers would put them an extra snack in their lunch box or satchel as a treat due to them getting hungry from going swimming. It is interesting to consider whether the children were actually hungry from the MVPA that they exerted during swimming, or whether they had socially constructed the idea, influenced by parents and others, that they should be hungry after swimming because they knew that they had an extra snack in their bags. This links to the concept of healthy eating which could be investigated in more detail in further research, involving the parents and their reasoning behind providing the extra snack. It was not possible to record the physical activity levels of the children whilst they swam due to the limitations of using accelerometers in water; this will be discussed further in section 7.3.3.

During Physical Education lessons (see Table H), on average, between 13 and 15 minutes of LPA (33% – 38%) was completed. Overall the total for LPA and MVPA was between 22 and 24 minutes of APA (all physical activity, see Appendix 20). This was 3 minutes more (8%) than found in the pilot phase. Together these findings indicated that the differences may have been due to the activity areas of the National Curriculum for Physical Education (DfEE/QCA, 1999) that occurred at different times of the school year. Further research is needed to differentiate between the specific activity areas other than just the time of year, and this is
acknowledged as a limitation of the thesis research (section 7.4.4 highlights this further).

During the Physical Education lessons (see Table H), on average, between 16 and 18 minutes (40% - 45%) was at a SA level for all groups during the main phase. During the pilot phase, however, a larger amount of time, on average, was spent in SA, between 27 and 32 minutes (68% - 80% of the whole lesson) for both infants and juniors. Within the ‘school autumn term’ Physical Education lessons it was recorded in the field notes (see Appendix 1) that more time was spent queuing for equipment, particularly in gymnastics, as limited apparatus was available for the children in comparison to invasion games, striking and fielding games, athletics and swimming activities where all children could be involved at the same time. This was partly due to the limited space in the school dining hall, where gymnastics was undertaken, and its effects on the amount of equipment that could be out at one time. Children were also sitting more often in order to observe and analyse performances both in gymnastics and dance when compared with the time spent during invasion games, striking and fielding games, athletics and swimming.

When the class teachers were presented with this information they were amazed at this level of SA, especially within the ‘school autumn term’, and subsequently reconsidered how the evaluation of performance, one of the strands of the National Curriculum for Physical Education (DfEE/QCA, 1999), could be completed in future for these activity areas. It is important to consider that gymnastics and dance provide more than just locomotor skill development for the children as highlighted earlier by Broomfield (2011). Swindlehurst and Chapman (2008) suggested that gymnastics and dance are also important for developing non locomotor movement skills such as “twisting, stretching, turning and bending” (Swindlehurst and Chapman, 2008, p.30). These skills help to develop basic skills of balance and coordination (Jess and Dewar, 2004). These in turn are then used within other activity areas such as athletics and games to improve the overall performance of the child. Yet in opposition to Swindlehurst and Chapman (2008), O’Neill et al. (2012) highlighted the importance of in particular dance classes in terms of activity levels. They suggested that dance provided valuable opportunities to be physically active, especially for girls. Because their research
was on adolescent girls, further research would be needed to examine this in more depth with younger children, such as the infants.

Shaljean (2011) suggested that Physical Education lessons should consist of high quality learning experiences. He predicted based on his own experience of having taught Physical Education lessons for twelve years that out of a 50 – 60 minute lesson maybe only 5 - 10 minutes were physically active. He claimed that this was due to “health and safety issues, kit checks, not to mention demonstrations and stretching exercises that all have to be gone through, before the lesson itself can kick off” (Shaljean, 2011, no page). Waring et al.’s (2007) findings were similar to Shaljean’s (2011) prediction, in that Waring et al. (2007) found very low levels of MVPA within Physical Education lessons. However, Yelling et al. (2000) within their case study investigation suggested that physical activity is “only one consideration of Physical Education lessons and the National Curriculum for Physical Education” (DfEE/QCA, 1999, p.62). Doherty and Brennan (2007) and Howells (2012b) agreed with Yelling et al. (2000) and suggested that Physical Education lessons are much more than just an opportunity to be physically active. These ideas tied in with the results from the thesis research, which showed that, on average, up to 43% of the time in Physical Education lessons was SA. The results could suggest that Physical Education lessons are about educating the whole child and not just about physical activity. This whole child education could include social, emotional, moral and cognitive developments as well as opportunities for learning how to share and take turns (as identified earlier), listening to instructions, watching demonstrations, and taking active rest.

Active rest is needed when developing and learning new skills as it allows for the skill being learnt, (particularly in young children) to move from the cognitive stage of skill acquisition into the autonomous stage, where the children are able to complete the skill with more proficiency (Fitts and Posner, 1979). Within the Early Years Foundation Stage Curriculum (DfE, 2008) and the National Curriculum (DfEE/QCA, 1999), it is acknowledged that children are developing physical skills, but it is also recognised that they need to develop communication, language and literacy. They need to be able to articulate what they and others are performing, rather than just being able to perform the action. They are sentient, interactive
beings not automatons. One of the strands of the National Curriculum for Physical Education (DfEE/QCA, 1999) is to be able to evaluate and describe performance, therefore, the children need opportunities within the lessons to be able, not only to evaluate their actions and those of others, but also to develop the key vocabulary needed to allow them to describe and analyse these performances.

In the pilot phase the average MVPA within the Physical Education lessons was $3 \pm 2$ minutes whereas in the main phase it was $9 \pm 3$ minutes (see Figure 13). The activity areas within the Physical Education lessons during the ‘school autumn term’ were, for the vast majority of the time, all indoors, whilst in the ‘school spring and summer terms’ the activity areas were predominantly outdoors. This phenomenon of lower physical activity levels within indoor activities was also found by Skala et al. (2012) who highlighted that children’s MVPA may be influenced by environmental factors such as location. They found significantly higher MVPA in outdoor classes when compared to indoor classes. Further investigation is needed to examine the impact of not only the activity areas of National Curriculum for Physical Education (DfEE/QCA, 1999) but also the environments in which these activity areas are undertaken (see section 7.4.4). To overcome this potential variation in physical activity due to environment, the location of the different activity areas could be varied more. However, completing a combination of both indoor and outdoor activities throughout the whole academic year would be dependent on the weather, so some additional flexibility would also be required.

6.6.2 School’s value of Physical Education lessons

The perceived importance of the Physical Education lessons varied throughout the academic year within the case study school and this variation was noticeable, even within the scope of the thesis research and was consequently recorded in the field notes (see Appendix 3). For example, it was noted that during the ‘school autumn term’, when the pilot phase was completed that, at times, Physical Education lessons were replaced with ‘Nativity Play’ rehearsals. This was the only subject within the primary curriculum that was replaced and disrupted by such rehearsals. This also meant that the completion of the pilot phase took longer than expected, due to this disruption.
During the ‘school spring and summer terms’ (the main research data collection period), Physical Education lessons were not substituted for any reasons and neither were they ever cancelled. The field notes (see Appendix 3) state that these lessons were seen, by both the class teachers and children, as important because they allowed the children to get outside into the fresh air. This lack of substitution during the ‘school spring and summer terms’ could be interpreted as recognition of a positive value of the Physical Education lessons, during this time of the academic year. Thus Physical Education is potentially associated, upon reflection, with summer and outdoor activity. From the thesis research results Physical Education lessons during the main phase did contribute to children’s overall physical activity levels. Indeed, for 25% of the children (junior boys), the physical activity levels reached the recommended targets to achieve health benefits (DH, 2005; WHO, 2010). This level however, was not achieved within the ‘school autumn term’ collection period, when the Physical Education lessons were, at times substituted. Yet, contrary to the thesis research results, Gard (2004b) claimed that Physical Education’s contribution to health in general is “at best, impossible to assess and at worst, marginal or zero” (p.77). His belief came from the low status that Physical Education lessons are given in school, which is also supported by Potter (2011) who suggested that Physical Education lessons were put under pressure in terms of time, from other parts of the curriculum including personalised learning, cross curricular links, health, cognition and evaluation.

The class teachers within the thesis research shared their aims (see Appendix 3) of their Physical Education lessons as: to develop the children’s fundamental motor skills; to increase physical activity levels; and also to allow the children to develop problem solving, cognitive skills. The cognitive skills included: working out how to move the ball towards the goal, for the infants; and how to move the ball effectively, using attacking and defending skills to accurately send and receive within a team situation, for the juniors. The class teachers felt that Physical Education lessons were also a time for the children to develop morally and emotionally and they gave examples of sportsmanship development such as discouraging the children from shouting ‘losers’ at each other for the rest of the day, if they won a game. They felt that they were able to support sportsmanship by the use of their own positive encouragement and feedback but also by praising
children who also encouraged each other. Laker (2001) supported the class teachers’ ideas and suggested that Physical Education lessons were ideal settings for allowing children to explore how to cope with winning and losing to develop sporting behaviour. The results from a survey performed by Richardson (2011) suggested that two-thirds of school children aged between eight and sixteen reacted badly when they lost and their parents also behaved badly when watching their children lose. Sulking, getting angry and crying (Richardson, 2011) were the most common behaviours displayed by parents and children alike. The area of emotional development clearly still needs to be worked on within both the primary and secondary school setting and therefore, an important element of the Physical Education lessons. This is currently being addressed in part via the Spirit of Cricket initiative aimed at teaching young people “how to win and lose politely” (Richardson, 2011, no page), but it does not tackle the behaviour of the parents. Yet, Fairclough and Stratton (2006b) proposed a view that was against developing sportsmanship within the role of Physical Education, as they felt that cognitive and social development were ‘hindrances’ to the physical gain and ‘less relevant’. Gilliver (2003) seemed to suggest a middle ground between Fairclough and Stratton (2006b) and Doherty and Brennan (2007) by proposing that children could learn the cognitive and social elements associated with the National Curriculum for Physical Education (DfEE/QCA, 1999) through being physically active.

6.6.3 Class teachers’ reactions to physical activity levels within Physical Education lessons

When the class teachers were presented with the thesis research data reporting the children’s MVPA within the Physical Education lessons their reactions were recorded within the field notes (see Appendix 2 and 3). They commented that the amount was not enough and that they were surprised by how little time was spent at this level, as they had been expecting more. This was because they both felt that they tried to limit the amount of static teacher talking or queuing time and therefore, they expected this to be reflected in more MVPA. As a consequence (and this was not specifically a focus within the thesis research) the class teachers are now going to examine their teaching approaches, their planning and delivery within Physical Education lessons and they will also look at how they could increase physical activity at higher levels within the lessons, without losing other important aspects of Physical Education lessons as suggested
by Doherty and Brennan (2007). This should be possible, as McKenzie et al. (2004) were able to increase the amount of MVPA by three minutes per Physical Education lesson, through a standardised programme, including curriculum materials, staff development and on site follow up over a two year period. This three minute improvement represented a large increase of 18%.

Rowlands et al. (2008) also found that it was possible to increase MVPA by 7.5 minutes, on average, within 60 minute Physical Education lessons, but they achieved this through employing the use of a specialist sports coach. The employment of specialist sports coaches could be a possible solution for the case study school, however it does not state within Rowlands et al.’s (2008) research whether or not the classroom teachers were Physical Education specialists. The increases in MVPA as suggested by Rowlands et al. (2008) could have been due to the improved expertise within that particular school setting. It could be proposed that this expertise was already present within the Physical Education lessons of the thesis research case study school, as both of the class teachers were Physical Education specialists. Carney and Howells (2008) highlighted that these specialists were needed within primary school settings. The class teachers in the case study school reported that they felt in possession of the pedagogical and activity specific knowledge and understanding that was needed for the Physical Education lessons. They also did not wish to have their Physical Education lessons taught by external sports coaches whom they felt would not have had the pedagogical understanding to help motivate the children.

The class teachers also considered the SA levels found within the Physical Education lessons and acknowledged that although they felt that Physical Education lessons were more than just an opportunity for being physically active (see Appendix 3) Their thoughts concurred with the views of Howells (2012b). The class teachers were now considering for their Physical Education lessons in future years amending how the children learn gymnastics and dance within the ‘school autumn term’. As a solution they suggested splitting the class so that a smaller number (half of the class) would undertake gymnastics or dance at one time, while the other half completed their French learning. The two groups would then change over in the previously allocated time for the French lesson, thereby not reducing the duration of the Physical Education lessons for any of the children.
This would be potentially possible as the language co-ordinator within the school currently taught all the French lessons, so the class teacher would be available to take the Physical Education lessons. The effective reduction in the number of children in the gymnastics lessons would allow for more opportunities to be physically active as fewer of the children would be using the apparatus at any one time, which dramatically reduce the queuing time. In dance lessons this would increase the space for the children to be able to move within the dining hall. The change in approach to these two activity areas would need to be re-explored in forthcoming years to evaluate the impact on the physical activity levels of the children.

6.6.4 Potential new directions of physical activity and Physical Education lessons

At the time of writing the Government is currently developing the new Primary Education National Curriculum which is scheduled for compulsory implementation from September 2014 with the possibility of opting into it, from September 2013. Also, in 2011, since data collection completion, the NHS released new physical activity guidelines. Both of these documents have the potential to impact on primary school life. Within the draft framework of the National Curriculum, physical activity is a focus within two of the aims of Physical Education. The aims state that all pupils should be “physically active for sustained periods of time” and that they should “lead healthy, active lives” (DfE, 2013a, p.179). Yet, there is no guidance, within the ‘Purpose of Study’ section of the draft National Curriculum for Physical Education (DfE, 2013a), as to how long the sustained periods of time should be or indeed, how to measure these within the school setting, in a way that ensures that all pupils are able to achieve these aims. However, these aims are, at the time of writing, within the draft format and they may change following the consultation period that has only recently been completed.

The new guidelines from the NHS (2011a) do give more detail; they recommend that children have at least an hour a day of MVPA, but also that on three days a week, children should do muscle and bone strengthening activities. Previously, activities for bone health and muscle strength had only been advised for completion twice a week (DH, 2005). The new recommendations for children
were devised by an expert advisory group in 2010. The group took advice from a scientific consultation and a web based consultation survey. The technical report which forms the NHS recommendations was led by the British Heart Foundation National Centre for Physical Activity and Health and was funded by the Department of Health in England, Health Scotland and the Welsh Assembly (Bull and the Expert Working Groups, 2010). In keeping with the above guidelines, Janssen and LeBlanc (2010) had systematically reviewed the health benefits of physical activity in children prior to the NHS (2011a) recommendations and suggested in their conclusion that, where possible, physical activity should include activities that strengthen both muscles and bones. The new recommendations also included suggested activities that could be completed within the primary school setting within Physical Education lessons or within break times. These suggestions included push ups, gymnastics, sit ups, swinging on playground equipment, rock climbing and games such as tug of war (NHS, 2011a). Beaumont and James (2010), though, suggested caution with regard to tug of war and it is worth noting that it would not necessarily be an activity completed at primary school level due to health and safety reasons.

For the purposes of bone strengthening, the NHS (2011a) suggested activities that were again accessible for primary school children particularly during playground break time and these included hopscotch, hopping, skipping and jumping, skipping with a rope, running, gymnastics, football, volleyball and tennis. Recommendations have also been made with regards to the types of activities that require moderate physical activity for most children. These included walking to school, playing in the playground, skateboarding, rollerblading, walking the dog, riding a bike on the flat or over a few hills and pushing a lawn mower (NHS, 2011a). The vigorous intensity activities that were suggested as suitable for most children included playing chase, (if allowed within the primary school setting, Daily Mail, 2007), energetic dancing, aerobics, running, gymnastics, football, martial arts such as karate and riding a bike fast or over hills (NHS, 2011a). It could be proposed that these new recommendations (NHS, 2011a) were an improvement on the previous ones, (DH, 2005) in terms of them offering specific examples of activities. These examples make the recommendations more understandable, meaningful, more applicable and therefore, potentially more achievable, especially within a primary school setting. The suggested activities included those that could
easily occur within playground time or before and after school, meaning that the focus would no longer be solely on Physical Education lessons and therefore, broadening the time in which children can successfully reach the recommended levels of daily activity. However, education on the interpretation of the NHS (2011a) guidelines is still needed, which may need to occur within Physical Education lessons. Guidance is also needed for the teachers, parents and/or carers.

6.7 The influence of break times as opportunities for physical activity and the use of playground equipment

Several outdoor environments existed within the thesis research at the case study school. At the time of data collection these included the playground and field, which were available for both infants and juniors during break times and the outdoor classroom area which was available only for the infants during curriculum times. Break time and lunch time within a primary school were unstructured opportunities for children to engage in physical activity opportunities (Johns and Ha, 1999) and for MVPA to occur (Pate et al., 1996). Ridgers et al. (2011) suggested that time spent outdoors is associated with increased physical activity. During break times and lunch time, the outdoors is where children are able to more easily participate in being physically active due to the space available and the size of the environment. It is also used for the infants during curriculum time, during which the infant children are able to ‘move’ more freely (Ward and Roden, 2008). This is important because children construct ideas relating to where they are able to, or allowed to, move. Juniors were allowed to move within the playground, field and within Physical Education lessons, whilst the infants are allowed to also do this in the classroom environment.

Wellard (2012) identified outside environments as settings for children to enjoy moving and using their bodies, beyond just being physically active. In the physical activity questionnaire, 85% of the children indicated that their favourite activity (and the one that they participated in for the longest duration during lunch time) was running or playing hard. Stratton and Leonard (2002) suggested that the playground is a key context in which children could engage physically on a daily basis for the majority of the whole school year other than wet play days (see Glossary). The accelerometer data indicated that juniors were involved at
significantly more MVPA than infants during lunch time and that boys were involved at significantly more MVPA than girls.

Ridgers et al. (2010) also found that lunch time was an important part of the school day in terms of providing opportunities for children to be physically active. On average, in the thesis research, 28% (for all groups) of the lunch time (60 minutes in total) was spent at a MVPA level. Ridgers et al. (2010) found the duration to be slightly higher, 37% of the 60 minute lunch time in their research was spent at a MVPA level. However, their research focused only on juniors. If the junior data (without infant data) for lunch time was reported for the thesis research, 34% of lunch time was spent at a MVPA level, indicating very similar results (just a 2 minute difference) to those found by Ridgers et al. (2010). Ridgers et al. (2010) suggested from their findings that the children within their particular case study school effectively used opportunities outside Physical Education lessons, such as lunch time to demonstrate MVPA; this conclusion could also be drawn for the juniors within the thesis research.

During morning break, for all children, up to 50% of the time was spent at a MVPA level; which is the equivalent of 17% of the total physical activity recommendation for a whole day (DH, 2005; WHO, 2010). Up to 34% of the time during lunch time (time that also included eating lunch in the school hall) was spent at a MVPA level, which is equivalent to 34% of the total recommendations for MVPA. Up to 20% of the time during afternoon break was spent at a MVPA level which is equivalent to 5% of the total recommendations. On average, overall, the percentage of the total daily recommended MVPA (DH, 2005; WHO, 2010), that was achievable within break times alone, was 50% for juniors and 39% for infants, although it is acknowledged again that the daily recommendations for MVPA (DH, 2005; WHO, 2010) were not limited to just the school day.

The thesis research findings showed higher percentages of MVPA than Tudor-Locke et al. (2006) reported. In fact, even though they highlighted that lunch time was the most active and important source of daily physical activity (as in the thesis research), it only accounted for only 15 – 16% of the daily physical activity. Playtime accounted for just 8 – 9%, giving a combined total of up to 25% of the recommended MVPA. This is between 14% and 25% lower than the
amount recorded in the thesis research. Tudor-Locke et al. (2006) also found that the Physical Education class accounted for only 8 – 11% of the MVPA recommendations (DH, 2005; WHO, 2010). This total was more similar to the thesis research result of between 12 – 15% of the recommendations for MVPA. The differences in the results may be due to the differences in the data collection tools used; Tudor-Locke et al. (2006) used pedometers whilst the thesis research used accelerometers. Findings from the data collected for the thesis research are also contrary to the conclusions of Trost (2007) and Waring et al. (2007) in that the thesis research results from the case study school demonstrate that a school setting could potentially provide opportunities for physical activity. The case study school delivers on its potential to promote and provide opportunities for daily physical activity for all the primary aged children and in particular the juniors.

The thesis research results also linked to Ridgers et al.’s (2006) previous suggestions concerning the contribution that playtime can make to daily physical activity, where they suggested having used similar data collection tools to the thesis research that between 5 and 40% of recommended physical activity could be achieved during playtimes. Taking into consideration all break times within the school day, on average, up to 26 minutes for juniors (lunch time and morning break) and 29 minutes for infants (lunch time, morning break time and afternoon break times) was being spent at a MVPA level within the case study school. If this time was converted into a percentage of the daily recommended physical activity time (60 minutes), the results are comparable to Ridgers et al. (2006) findings. The thesis research identified that 50% of the juniors’ and 39% for infants’ recommended physical activity is being achieved during playtimes. These results are within and beyond Ridgers et al. (2006) predictions. Ridgers et al. (2011) also recently observed physical activity during break times over a period of one academic year and found that children were physically active and engaged in MVPA for at least half of the intervals analysed.

On the other hand, Waring et al. (2007) proposed that free time during lunch time and break times was under utilised in terms of promoting physical activity, but they did not state how much physical activity they observed at break and lunch times within their research (although it is acknowledged that this was not the main focus of their research). It could be suggested from the thesis
research results that the case study has shown that these opportunities for physical activity during break times and lunch times were being utilised by the children to partake in MVPA and LPA. MVPA and LPA accounted for, on average, of almost 83% of morning break time. The children were only involved in SA for an average of 20% of morning break time and 23% of lunchtimes. The latter also included eating lunch within the school hall. When the results for both MVPA and LPA were considered the children, on average, were physically active for 68% of the time during morning break and lunch time. Ramstetter et al. (2010) supported the idea that break times could promote activity and a “healthy lifestyle” (p.524) and emphasised the importance of break times in contributing to a child’s creative, social and emotional development as well as their physical development. Yet, they warn that break times should not be a replacement for Physical Education lessons.

Nevertheless, these views on break times cannot be generalised to all school settings, especially those schools such as the Thomas Deacon Academy in Peterborough which has, at the time of writing, no playgrounds or play areas. Beckford (2007) reported that the Academy felt this absence was justified because the children would be stimulated within the classroom setting and subsequently will not need ‘to let off steam’ between or after the lessons. Unlike Blatchford and Sumpner (1998) who proposed that one of the main values of break times was to “let off steam” (p.92). Ridgers et al. (2011) found that the “majority of children’s social interactions were positive” (p.364) within the primary school setting during break times and they went on and suggested that the removal of break times could “influence both physical and social health” (Ridgers et al., 2011, p.364) in terms of children learning how to play with each other and how to develop physically. Other schools have, at the time of writing, also banned particular types of games and physical activity, such as linking arms whilst running due to health and safety fears (Daily Mail, 2007). Further research is needed to measure the physical activity levels that the children are able to achieve within these particular types of school settings. Meanwhile Pate et al. (1996) highlighted that it was important for break time to occur and for it to remain unstructured (as in the case study school), to allow children to interact with their peers. Within the case study school the class teachers felt that break times were important for developing the children socially, emotionally and physically, concepts that Dau (1999) has also suggested.
6.7.1 Class teachers’ reactions to MVPA levels during break times.

The MVPA levels during break times were presented to the class teachers following data analysis and their reactions were recorded within the field notes (see Appendix 3). Children within the thesis research case study school could potentially have spent 26% of the school day in the playground or field. The class teachers revealed that they felt that break times and lunch times were areas that they still wished to target for further increasing MVPA levels within the school day. They felt that this would be possible by introducing playground equipment, for example skipping ropes, netballs and footballs, and also by adding painted lines to the playground (such as hopscotch grids) in order to help promote and engage the children in physical activity. They felt that this type of equipment would provide an element of structure, yet would remain child initiated, which they felt was an important aspect of both lunch and break time. Their suggestions were similar to those by the NHS (2011a) as examples of ways of promoting MVPA. These playground equipment ideas from the class teachers were also similar to those suggested by the Kent NHS Overview and Scrutiny Report (KNOSR, 2006). The class teachers also reported feeling that there was a need for space in both the playground and the field, for the children to explore. This exploration could also be a continuation of what they have been learning within the classroom (Barnes, 2011).

Since the research data were collected a large area including adventure equipment in the shape of a Castle, has been introduced to the field and a trim trail, which has a focus on balance and co-ordination, has been introduced to the playground (see Figures 57 – 60). The Castle has areas for climbing, swinging, sliding, and for the development of both fine and gross motor skills, as it included sand pits and a ‘noughts and crosses’ game. The increase in playground equipment was suggested by KCC (2006) as ways to increase physical activity levels within playground environments. The school had to save and fundraise for this large equipment. Since the installation of the new play equipment, the class teachers have noted that the children seem to be more physically active and engaged during break times than they had been when previously observed. The children’s physical activity levels would need to be measured again in further research, (see section 7.4.1) using accelerometers, to see if the introduction of
such equipment has increased the children’s MVPA levels during lunch and break times.

Figure 57 – Castle, new playground equipment used every lunch and break time by the children, in child initiated play.
Figure 58 – Castle, new playground equipment, side on view, photograph highlights the climbing frame, slide, and sand pits.
Figure 59 – Castle, new playground equipment, opposite side on view, photograph highlights the slide, walk way, noughts and crosses games and climbing frame.
Figure 60 – Trim trail used for focusing on balance and co-ordination.
Chapter 7

Conclusion

7.1 Introduction

The main aims of the thesis research were to examine children’s physical activity levels within the primary school setting and to explore the contribution that Physical Education lessons made to the children’s overall physical activity levels. In order to achieve these aims, the following research questions were devised: (see also section 1.4)

1. How physically active are primary school children during the school day?

2. What are the differences in the physical activity levels during the school day of children aged six – seven (infants) and aged nine - ten years (juniors)?

3. To what extent does the primary school setting contribute to children’s recommended levels of physical activity (DH, 2005; WHO, 2010)?

4. What contribution do Physical Education lessons make to primary children’s physical activity levels?

These research questions will be used to focus the concluding remarks, as the purpose of this chapter is to conclude the thesis by: answering the research questions; identifying the limitations of the research and; highlighting possible further research.

7.2 Answering the research questions

Ridgers et al. (2010) suggested that more research was needed to understand physical activity levels of children. The research in this thesis has been conducted in an attempt to bring new empirical knowledge to the field of children’s physical activity. It achieved this by mapping and identifying the areas within the primary school day that physical activity took place and by quantifying the intensity and duration of these activity levels. This was investigated among both infants and juniors and also for both boys and girls, within the case study
school. It also identified the contribution that Physical Education lessons made to the children’s overall physical activity levels.

Cox et al. (2010) proposed schools were seen to have time, in terms of the number of Physical Education lessons and utilising trained staff, for physical activity to occur within school. The thesis research findings supported Cardon and De Bourdeaudhuij’s (2002) suggestions that Physical Education lessons and playtimes should be responsible for promoting physical activity, which could then promote an active lifestyle that could continue outside of the school gate. In addition, it showed that the children were able to access and utilise opportunities that allowed them to be physically active at MVPA levels. Indeed, these opportunities occurred, not only during Physical Education lessons but also within other parts of the school day such as break time, lunch time and also within curriculum time, on both PE days and Non PE days.

7.2.1 How physically active were primary school children during the school day?

The data from the thesis research showed that the case study primary school day provided opportunities for daily physical activity that were not limited to Physical Education lessons. As highlighted in section 7.2 there were opportunities for children to attain MVPA and LPA during break time, lunch time and also MVPA in curriculum time. The data also showed that it was possible for the children to reach these intensity levels on both PE days and Non PE days, during the school day. These findings contradicted Dale et al. (2000) who suggested that “opportunities for children to be physically active during school time are sparse and becoming increasingly so” (p.240).

As, on average, 26% of the school day consisted of break time or lunch time, it was important to analyse the physical activity levels within these times. Children were involved in MVPA for, on average, 50% of morning break and were at either a MVPA or LPA level for, on average, almost 83% of these morning break times, thus indicating that the children were effectively utilising the physical activity opportunities that were available during that time. At lunch time, on average, 28% of the time was spent at a MVPA level. Similarly, Ridgers et al. (2010) concluded from their findings that children were able to be physically active at lunch time, and
that this was a key place outside of Physical Education lessons for MVPA to occur (as discussed further in section 6.7). It was found that, on average, it was possible for children to be involved in MVPA for 53 minutes and LPA for 101 minutes on PE days and to be involved in MVPA for 43 minutes and LPA for 93 minutes on Non PE days. These differences between the days were both found to be significant.

Children were found to be involved in more SA on Non PE days than on PE days; again this difference between the days was found to be significant.

It was not possible to answer the question of how physically active primary school children were during the school day without highlighting the variation in physical activity levels between infants and juniors, as well as those between boys and girls. These variations will be further addressed in section 7.2.2. In summary, on PE days, juniors were involved in 29 minutes less SA than they were on Non PE days. Juniors also were involved at more LPA on PE days in comparison to Non PE days. These findings highlighted how important PE days were to juniors in terms of their overall physical activity levels. Boys were at more MVPA than girls during curriculum time, morning break and lunch time. The possible reasons for these variations have been proposed as: the differences that occur due to age, especially in terms of developmental stage; the differences that occur within the curriculum; and differences in terms of gender social construction and of male dominance, in particular, during break time and lunch time. These have been discussed in detail within sections 6.3 and 6.4.

7.2.2 What were the differences in the physical activity levels during the school day of children aged six – seven years (infants) and aged nine – ten years (juniors)?

Infants were significantly more physically active at a MVPA level than juniors during curriculum time. The infants were also involved in more MVPA than the juniors during Non PE days. These differences (as highlighted in section 6.3) were potentially due to the variations in the curriculum, both ideologically and pedagogically, as proposed by Alexander (1995). The dissimilarities experienced within curriculum time were emphasised further when SA was considered, as juniors were involved in more SA than infants during curriculum time and also during morning break. Juniors were also found to be involved in more SA and LPA on Non PE days when compared to PE days. Infants were also involved at
more LPA than juniors during curriculum time. Again these differences were potentially due to the variations in learning environments and curriculum (see section 6.3.2).

7.2.3 To what extent does the primary school setting contribute to children’s recommended levels of physical activity (DH, 2005; WHO, 2010)?

Waring et al. (2007) suggested that the place for children to be physically active was within Physical Education lessons and that primary schools have the potential to be good settings to promote children’s physical activity. The data in the thesis research showed that the case study primary school was indeed a place for children to demonstrate physical activity, to the extent that junior boys were able to reach the recommended 60 minutes per day of MVPA and achieve health benefits as advised by government and health guidelines (DH, 2005; WHO, 2010) within the primary school day on PE days. Although, as highlighted in section 1.4, these recommendations (DH, 2005; WHO, 2010) were not intended to be limited to just the primary school day of 9am until 3.10pm. The results, however, clearly indicated that the primary school setting did contribute to the children’s recommended levels in a very positive manner, within the case study school.

The Physical Education lessons contributed to, on average, between 9% and 15% of the total recommended daily MVPA time for children to incur health benefits (DH, 2005; WHO, 2010). The findings also indicated that break time and lunch time were key opportunities for the children to be physically active. Pate et al. (1996) also highlighted these as occasions for MVPA to occur. As discussed in section 6.7, Ramstetter et al. (2010) proposed break time as an opportunity to promote physical activity. These ideas were supported by the thesis research data which found that during break times and lunch times, 50% of the juniors’ time was spent at a MVPA level, whilst the figure was 39% for the infants. Consequently, it can be stated that these areas of the school day were contributing to the recommended levels of daily physical activity (DH, 2005; WHO, 2010).
7.2.4 What contribution do Physical Education lessons make to primary school children’s physical activity levels?

The thesis data indicated that having a Physical Education lesson within the school day increased the children’s overall MVPA and therefore, the data also showed that the null hypothesis should be rejected (as described in section 3.8). At the case study school, primary Physical Education lessons made a significant contribution to the children’s physical activity levels. Hills (2010) highlighted that Physical Education was a place and “space in schools” where children can develop not only skills but also “knowledge that may form a basis for lifelong participation in physical activity” (p.104) and therefore, (as also found in the thesis research) may make a significant contribution to children’s overall physical activity levels, both currently and potentially in the future. These MVPA levels within the Physical Education lessons were similar to those previously found within elementary school Physical Education lessons by Fairclough and Stratton (2006b).

The results from mapping and identifying the different intensity levels of physical activity within the Physical Education lessons showed that in 40 minute lessons, on average, the children were involved in MVPA for between, on average, 18% and 23% of the duration, whilst they spent between, on average, 33 and 38% of the time at a LPA level and between, on average, 40% and 45% at SA. The children were able to perceive their own levels of physical activity during Physical Education lessons. They were able to identify they completed less MVPA during gymnastics and dance lessons in the ‘school autumn term’ compared to games and athletics lessons during the ‘school spring and summer terms’ (as discussed in section 6.6.1). This differed from Kolle et al.’s (2009) findings, where they proposed that due to the difficulty in recalling details of physical activity patterns, children generally struggled with this level of self recall. The information and implications of such mapping emphasised how important it was to know the children’s “existing physical activity levels” (Howells et al., 2009, p.24) “before any strategies to increase physical activity can be employed” (Harrington and Donnelly, 2008, p.66). The thesis research results have enabled the class teachers of the case study school to re-examine how they plan and teach different activity areas within the Physical Education lessons. Gymnastics and dance were highlighted as particular foci for this re-evaluation, as reported in section 6.6.3.
7.3 Limitations of the research

This section will consider some of the limitations of the thesis research, including those highlighted in chapter 6. These consist of: the potential difficulty in repeating the results due to changes in the Government’s policy and focus; the potential impact of the class teacher’s gender; and the difficulties in recording active transport within the case study school and in swimming classes.

7.3.1 Changes in focus

It could be suggested that there would be difficulty in repeating the results because of the changes from one school year to the next within the school and due to the implementation of current initiatives, at time of writing, such as the new National Curriculum (DfE, 2013a) and funding, for example, Primary Physical Education and Sport Funding (DfE, 2013b) following on from the change of Government which occurred since the data were collected. A change in focus has also arisen, due to the external impact of the Olympics and the Paralympics in London 2012 and the proposed changes to the new Primary National Curriculum, which was, at time of writing, in draft format (DfE, 2013a) and due for statutory implementation from September 2014.

If the thesis research was to be repeated, particularly within the academic years of 2012 or 2013, what with the occurrence of the Olympics and Paralympics in London during 2012 and the implications of the games ‘legacy’ following the games in 2013, different results may have been recorded. A particular focus during this year (2012) within sport and in particular within children’s sport has been on the legacy of the London games with its aim of “changing the lives of young people through sport, to inspire young people around the world to choose sport” (Coe, 2011, p.21). In 2012 many schools, including the case study school, became an Olympic Games school as part of the Get Set programme, which was the official London 2012 education programme. The programme included activities which were physical, interactive and academically linked, cross curricularly to the values of the games. These activities were different from the previously planned units of work in Physical Education and may have enhanced the overall physical activity of the children. Also, many primary schools within the local area in 2012 were involved in more sport through sport weeks and Olympics weeks, in which children tried different Olympic and Paralympic sports. Such
weeks did not occur during the time of data collection. All of these have provided additional opportunities within and outside of Physical Education lessons for the children to be physically active.

There has also been a change in focus within the new proposed (at time of writing) Physical Education programme of study in the new Primary National Curriculum (DfE, 2013a). The shift has occurred so that there is an increased focus upon competition. In the previously National Curriculum (DfE, 1999) within the breadth of study for Physical Education, for games activities it stated that children should play competitive games. In the new National Curriculum (DfE, 2013a) in the aims of Physical Education, all pupils are to engage in competitive sports and activities. This may well be linked to the London 2012 games and its legacy. Additional funding has been ring fenced by the current coalition Government for the provision of Physical Education and sport within schools until 2015 and one of the suggestions of possible uses of the funding is for “running sports competitions, or increasing pupils’ participation in School Games” (BBC, 2014). Another proposal within the Physical Education programme of study (DfE, 2013a) was that more emphasis be placed on ensuring that all children be physically active for sustained periods of time (DfE, 2013a, p.179), as highlighted in section 6.6.4. These proposed changes in the focus of the curriculum would have implications on planning and activities within Physical Education lessons, again making the thesis research difficult to repeat in the future and inaccurate for comparisons to be made with the data collected. Also since the findings were shared with the class teachers, they have implemented changes to their way of teaching for the next academic year, as highlighted in section 7.2.4.

7.3.2 Class teacher’s gender

The class teacher’s gender and the ways in which it could have impacted on the children was a potential limitation. The class teachers were of different genders, with a male teacher for the junior children and a female teacher for the infant children. This difference may have influenced the results. Skelton (2001) suggested that primary schools were often perceived to be female dominated environments and that male teachers demonstrated their masculine credentials through “laddish” behaviour “using humour” and “a passion for football” (p.138). These attributes may have externally motivated the junior children who had the
male teacher. To overcome this, the research would need to be repeated with class teachers of the same gender in both classes so as to remove this potential variable. Nevertheless, Metzler (2011) highlighted that there were a variety of ways to teach Physical Education citing variations in particular teaching styles and pedagogical approaches and he specifically noted that these may not necessarily be influenced by gender per se, but, possibly, by the broader discourses of gender both within school and in wider society (Wellard 2011). These other areas that Metzler (2011) and Wellard (2011) highlight could be analysed in further research (see section 7.4.3).

7.3.3 Recording physical activity in swimming

From the physical activity questionnaire results the children identified that swimming was one of the preferred activity areas and it was also an activity area within which the children felt they were most active. However, it was not possible to record the physical activity levels within swimming in the thesis research as the ActiGraph accelerometers model 7161 (MTI Health Systems, no date) used for data collection were not waterproof. Waterproof accelerometers do exist but only in the form and shape of a watch worn round the wrist, which would then enable swimming to be recorded. Nonetheless, there are limitations to placing the measurement tool on the wrist, particularly if within the swimming lesson only the legs were being practised. When this is the case, the full amount of physical activity may not be recorded accurately. As discussed (in section 3.5.1), Fairweather et al. (1999), Welk (2002, 2005) highlighted that the accelerometer positioned around the waist was the appropriate position for most effectively recording physical activity in primary aged children. It was also highlighted in section 6.6.1 that the children reported that they enjoyed going swimming as their mothers would put an extra snack in their lunch box or satchel as a treat because they felt hungry after going swimming. If the MVPA that the children were at in during swimming could have been recorded it would have been possible to identify whether the children were hungry due to this exertion or because they had socially constructed the idea that they should be hungry. Also further research could involve the parents, by enquiring into their reasoning behind the provision of such snacks for after swimming, but not for providing such snacks on others days that included Physical Education lessons based at the case study school premises.
7.3.4. Active transport

Nelson and Woods (2010) suggested that active transport (or commuting) to school could increase the number of minutes of daily physical activity. Pearce (2011) supported Nelson and Woods (2010) and proposed that children who travel actively to school record more daily MVPA overall. The idea of gaining minutes of physical activity from elsewhere in the child’s day is supported by Mallam et al. (2003) who suggested that the total amount of physical activity that children took part in does not depend on Physical Education lessons; they found that children compensate for the lack of activity by increasing activity in the home environment. Due to the location of the school, in a village setting with limited footpaths and surrounded by narrow country roads, only 25% of the children at the time of the thesis research data collection walked to school. This was a limitation for the thesis research in terms of exploring or researching this potential opportunity for physical activity within the children’s day. For a change to occur, the help of the local council would be required, to improve footpaths and cycle tracks to the school. As active transport for all could not be promoted or encouraged, the class teachers had decided, instead, to introduce a physical activity programme called ‘Wake Up and Shake Up’ every morning before the day started. This involved asking the children to come to school earlier, so that the school day would start at 8.45am. Consequently, all the children could have the opportunity to participate and potentially increase their daily physical activity levels, within a whole school approach. Howells (2007) suggested that a whole school approach to such programmes would increase the physical activity levels of the children.

7.4 Further research

This section will consider some of the key areas for future research within children’s physical activity. It will also consider further research specifically within the case study school due to changes that the class teachers, head teacher, parents / carers, and children have requested following the sharing and discussion of the thesis research findings.

7.4.1 After school clubs for infants, physical activity programmes and new playground equipment for all

From the results of the physical activity questionnaire, the class teachers were now considering the number of after school clubs offered to infants, because
infants participated in fewer after school clubs than juniors. The class teachers were going to ask the children what clubs they would like and ask the parents if they would be interested in allowing their children to attend. The most popular infant after school club at the time of writing was multi skills, but not many of the infant children attended any others. This may be due to the infants’ motor skill level (Gallahue et al., 2011) and their perceived ability to participate. The class teachers thought that because the children described themselves as ‘physically active quite often or very often’ in their free time (see Figure 56), they would endeavour to offer more after school club activities for all of the children in order to increase the opportunities available for physical activity to occur.

Also highlighted in section 6.7 was the introduction of the large and small playground equipment for use during break and lunch times, an idea which KCC (2006) had previously suggested as a way to increase physical activity levels within playground environments. At the time of writing the class teachers wanted to know how much more MVPA and LPA occurred at lunch times and break times due to the children using the new small and large equipment. This could be achieved by further research such as the collection of new accelerometer data. Further research would also be needed in order to evaluate whether the introduction of the physical activity programme ('Wake Up and Shake Up') has increased the children's physical activity levels within the school day. Also, it would be interesting to quantify how many children took up the physical activity opportunities presented by both the extra after school clubs and the availability of the new small and large equipment during break times. This would provide empirical data to inform not only the class teachers but also KCC on the effectiveness of the playground equipment, within the case study school. The further research could also include questioning the children as to why they choose to undertake particular physical activity or not during break times, lunch times and after school clubs. This part of the further research would link to the discussion in section 6.4.1 which found that infant girls did not continue MVPA into afternoon breaks, post Physical Education lessons, in the same way that infant boys did. This use of questioning could explore whether or not the reasoning behind their decisions could be, for example, tiredness or perhaps the possible perception that resting is a reward.
7.4.2 Infants becoming juniors

Further research could be completed within the thesis research case study school when the infants who were monitored in the original thesis research become juniors, to identify whether they continued in their ‘infant’ pattern of activity or changed to that observed in the juniors in the original thesis research. This would be of particular interest as it would allow for comparison with the data collected within the thesis research, but it would also allow the case study school to re-examine, in particular their break time activities and find out if the implementations following the thesis research had led to increased MVPA. It would also allow the case study school to investigate whether ideas such as reducing the number of children within the gymnastics activity area of Physical Education lessons had led to improvements in the children’s MVPA levels as well as developing their gymnastics skills (Broomfield, 2011). It could also investigate the levels of MVPA, LPA and SA found at lunch time and examine whether any variations were due to eating preferences such as having a packed lunch or a school dinner. It would also allow for comparison between the different physical activity intensity levels from the children’s previous infant data and these from their new junior data. As the children’s fine and gross motor skills relating to their cutting up of the lunch become more advanced (Gallahue and Ozmun, 2002), their time spent eating could decrease, allowing them more time to experience greater physical activity levels, as highlighted in section 6.3.2.

7.4.3 Teacher influence

On PE days, one of the class teachers wore a t-shirt of the same colour as the children’s Physical Education uniform. He reported that he liked to wear this as if it was his own uniform for these days. The physical influence derived from the class teacher wearing the same colour t-shirt as the children could be investigated in further research. This could examine whether such a concept inspired the children to be more physically active, perhaps by giving them a feeling of group cohesion and identity, as if both the teacher and the children were all going to be completing the physical activity together and therefore, externally motivating the children (Weinberg, 1984). It may also have impacted on physical activity levels through the process of social approval (Duda, 1989). Additional interviews would be useful to further explore these ideas, especially in light of the fact that the juniors reported, during my discussions with them that were
subsequently recorded in the field notes (see Appendix 2), that they liked wearing the same colour as their teacher during Physical Education lessons. Colour preference and colour emotion has been identified by Ou and Luo (2003) as important in terms of preferences of like and dislike, and as early as 1931, Guilford proposed that colour induced psychological effects. This further adds weight to the idea that the notion of matching colours could have impacted on the children’s physical activity levels, especially given that childhood and in particular, the primary school setting are key for children, in terms of developing their likes and dislikes (Howells, 2012a).

Other possible teacher influences are those of the infant teacher and how they teach the curriculum to the infants, during which the children are allowed free flowing in their movement from one learning experience to another (Wener et al., 2012). This extra flow of movement may have impacted on the overall daily levels of physical activity. These have been discussed further in section 6.3. It was also acknowledged that there are other teacher influences, such as teaching styles (Mosston and Ashworth, 2001), philosophies and attitudes (Duda, 1989), and planning and delivery (Bailey, 2001). These variations were limited as much as possible by completing the thesis research within one case study school. The class teachers knew their individual preferred teaching styles, attitudes, planning and delivery and had shared these practices and ideas within the school. They were also both primary Physical Education experts who had knowledge and understanding of the three domains, (see Figure 5, chapter 3) identified by Carney and Howells (2008) which are knowledge and understanding of primary education, knowledge and understanding of Physical Education and being an advocate for Physical Education sharing practice and being an agent for change. Therefore, new, further research could be completed within these areas to further identify the teachers’ influence on the children’s physical activity. Also the parents’ and or carers’ attitudes to physical activity could be explored further to examine how these social influences may impact on the children’s physical activity levels within the school day.

7.4.4 Activity areas of Physical Education lessons

The differences between the pilot and the main phase research have highlighted how the activity areas and the learning environments of the National
Curriculum for Physical Education (DfEE/QCA, 1999) can impact on the amount of MVPA, LPA and SA within Physical Education lessons. However, it was only possible to discuss the activity areas that were undertaken within each of the different time frames. This was recognised as both a limitation of the thesis research as well as an area that could be further investigated. The pilot phase was completed within the ‘school autumn term’ and included gymnastics and dance, whilst the main phase was recorded during the ‘school spring and summer terms’ and included swimming, athletics, invasion games and striking and fielding games. Therefore, there is a need for further research on the impact of the different activity areas. This could result in suggestions of how these activity areas could be implemented in the curriculum of children of different ages, particularly in terms of the time of the year that they occur. Many factors relating to the activity areas could have influenced the research results: the learning environment (as suggested above); the class teacher’s planning for different activity areas, the teaching styles (Mosston and Ashworth, 2001), and/or the teaching approaches (Swindlehurst and Chapman, 2008) that were used within different activity areas (also as suggested above). There would also need to be further research in order to distinguish the contribution from each. This research could also allow us to comment on whether, for example, the indoor hall or the playground or the field or the swimming pool provided the most MVPA within Physical Education lessons. There is also the influence of the new Primary Curriculum (DfE, 2013a) which was at the time of writing still to be fully implemented into primary schools. It has less defined activity areas than in the previous National Curriculum for Physical Education (DfEE/QCA, 1999) and also includes basic movement skills.

7.5 Final thoughts

Overall, the thesis research identified that children could be physically active within the primary school setting and that Physical Education lessons contributed to children’s overall physical activity. It acknowledged that physical activity was “not a single, simple behaviour” (Stratton and Watson, 2009, p.157). It also highlighted that the primary school was a place where early forms of socialisation, habits, likes and dislikes were developed (Howells, 2012a) and that, therefore, it was important to recognise the potential opportunities that primary schools had, to engage children in physical activity. McKenzie and Kahan (2004) extended this suggestion by proposing that the teaching profession was obliged to
provide pupils with adequate MVPA levels within Physical Education lessons, especially if this was the main source of physical activity for a child within the school day. From a teacher educator viewpoint it was important to ensure that there were positive role models such as the class teachers (Howells, 2007) who understood the importance of physical activity. The class teachers could in turn, within the primary education setting, encourage children to be physically active, ensure that they understood what physical activity was and ensure that all children were able to access opportunities for physical activity within the school day. The class teachers could have achieved this through Physical Education lessons, other curriculum time and also break times, through playground activities. This would have ensured that the primary school setting was not a “sparse” place for physical activity (Dale et al., 2000, p.240) and that it remained a key place for physical activity to occur and to be promoted.
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Appendices

Colour Key for Appendices 1, 2 and 3:
Purple = my key notes and thoughts,
Blue = notes from comments of the children
Pencil = notes from comments of the class teachers
Black = notes of the actions that are occurring or have occurred following the sharing of the results with the class teachers

(Appendix 1 is presented on the next page)
Appendix 1 – Field Notes - Pilot Phase

Day 4 included ‘wet play’<br>that is when it was raining all day and children not able to go out for break time<br>- Look at impact of this on physical activity levels<br>- Record way ‘wet play’ days in main

Pouches used for head bands<br>Infants found accelerometers in pouches great for collecting head band information<br>Dead lead box implemented in both classrooms as a place for children to put their devices in this and not the pouches.<br>Did not occur in main phase.

Mainly indoors for PE lessons.<br>

Children completing star jumps/swinging accelerometers showed heads to increase number recorded.<br>Got children to pretend not wearing accelerometers<br>Explained not a competition.
Appendix 2 – Field Notes - Main Phase 1

- No PE lessons missed for rehearsals
- No ‘Wet Play’ days recorded
- Whether sunny or stormy, always main phase.
- No holding items in water bottles
- No star jumps/swinging round heads
- Children showed me how well they were wearing sweaters.
- PE lessons contributed to physical activity
- Teachers knew aims/questions and potential plan for MVPA
- Results not shared till end.

- Evening not as prevalent:
  - All children running with a coach
  - All children running, lying, bungee jumping at same time
  - Coaches in games
  - Class teachers narrated thoughts about restructuring gymnastics
  - Possible dance for MVPA

- Differences in MVPA in big cycles
  - Equal emphasis on participation
  - More PE lessons off the school day
  - Does not have PE lessons in the school day
  - Under constant influence from computers

- Possible school teams

- Reasons to look forward to PE
  - Reported by students only
  - All to work with friendship groups
  - Able to be out of set seat
  - Liked wearing same colour as teacher.
Appendix 3 – Field Notes - Main Phase 2

Field Notes
Main Phase 2

MVPA levels in PE lessons:
- Not enough, expected more
- Surprised how little time at MVPA
- Tend to hunt SA

Going to revisit planning and delivery to become SA and to increase MVPA.

MVPA in lunch times:
- Need to target more in future
- Introduce playground equipment
- Offer structured but child-led

> castle built.
- Balance and co-ordination, trail developed.

Aims of PE:
- Develop motor skills
- Develop problem-solving/foundational skills
- Develop socially, emotionally
- "Getting physical, reducing stress"
Appendix 4 – McNiff’s (2009) action research questions and my responses
(The process of answering the questions was used to help shape my thinking).

**What is my concern?** – The contribution (if any) that Physical Education lessons makes to children’s overall physical activity levels in a primary school day.

**Why am I concerned?** – There has been increased pressure from the DH (2005), the WHO (2008, 2010) for Physical Education lessons to be physically active, but Howells (2012a) suggested that Physical Education lessons are more than just being physically active.

**How do I show the situation as it still is in many places?** – By providing an example (case study) of the levels of physical activity in one specific situation (a primary school day).

**What can I do?** – Record and analyse the current situation, work in co-construction with the school sharing an open dialogue throughout the thesis research, which will take the form of newsletters to the head teacher and the parents. Following the thesis research dissemination of the results will occur to the head teacher, class teachers, children and parents to aid their own practice. The results will also impact on my teaching of new trainee primary school teachers during their teacher education at University, so they are prepared with the latest information to help aid their own practice. I will also have to consider whether the class teachers and parents will want to know the results of the thesis research. There is the potential that they may consider the thesis research as a critical reflection on their practice. I will ensure that I work in partnership with them so that they consider the thesis research findings as constructive comments on their practice and not as judgemental.

**How do I show that I believe the situation has improved?** – By examining how physical activity is interpreted within a primary school setting the thesis research may prompt for suggestions regarding where the situation could be improved. However, caution is needed to prevent any assumptions about what the children are achieving. Mapping the children’s physical activity provides evidence as to what occurs within the primary school day for both infants and juniors.

**How do I modify my ideas and practice in light of my evaluations?** – By analysing the data collected throughout the whole school year and reassessing my ideas and practice, post completion of the thesis research. Also by disseminating the results to the class teachers and reflecting on their responses.
Dear Parents,

My name is Kristy Howells, I’m a Senior Lecturer at Canterbury Christ Church University and I am undertaking a Doctorate in Sport and Exercise Sciences.

I am looking at role of physical activity and the contribution of the physical education lesson to physical activity levels. With the question should all physical activity occur in the physical education lesson or are there other places within the day and curriculum for physical activity to occur?

Your child has been chosen to be part of my physical activity research. What this would involve would be for your child to wear an accelerometer, which will measure the amount of physical activity your child undertakes within a day. The measurement tool (accelerometer) is very small and will be worn around the waist and they are very similar to a pedometer which measures the number of steps taken in a day.

Your child would be asked to wear the accelerometer two days a week once a month for October, November and December during the pilot stage of the research and then two days a week every fortnight (during school terms only) for the main research which would last from January 2009 until January 2010.

Please complete and return the below slip to agree to your child participating in this research. I am grateful for your help and that of your child and I will keep you and the school up to date with regular results from the research.

Best wishes,
Kristy Howells


I ……………………………. (parent’s name) give permission for my child……………………………………. (child’s name) to participate in the physical activity research. Signed………………………………… (parent’s signature)
Dear Linda,

As you know I am wishing to undertake a Doctorate in Sport and Exercise Sciences within your school.

I am looking at role of physical activity and the contribution of the Physical Education lesson to physical activity levels. With the question should all physical activity occur in the Physical Education lesson or are there other places within the day and curriculum for physical activity to occur?

Your school and 20 children have been chosen to be part of my physical activity research. What this would involve would be for the children to wear an accelerometer, which will measure the amount of physical activity your child undertakes within a day. The measurement tool (accelerometer) is very small and will be worn around the waist and they are very similar to a pedometer which measures the number of steps taken in a day.

The children would be asked to wear the accelerometer two days a week once a month for October, November and December during the pilot stage of the research and then two days a week every fortnight (during school terms only) for the main research which would last from January 2009 until January 2010.

Please complete and return the below slip to agree to your school and children participating in this research. I am grateful for your help and I will keep you, the school, the class teachers and the parents up to date with regular results from the research.

Best wishes,
Kristy Howells

I ………………………………… (Head teacher) give permission for 20 children to participate in the physical activity research.
Signed…………………………. (Head teacher’s signature)
Appendix 7 - Permission form 3 - Child permission form

Kristy Howells: Physical Activity Doctorate Research in Sport and Exercise Sciences, Child Information Form (to be read to child)

My name is Kristy Howells, I'm doing a research on physical activity levels.

You've been chosen to be part of my research and your parents have given permission for you to be part of the research to measure how active you are during the day.

What I am going to ask you to do is to wear an accelerometer round your waist for the whole school day. I want you to pretend that it is there and try not to touch it. What it does is records how active you are during the day.

You will be asked to wear it two days a week during October, November and December this is part one of the research, which is called a pilot research. Then from January until January but only during school time, you will be asked to wear it two days a week every other week this part two of the research.

By signing below, it means that you have understood what the research involves and I have answered any questions that you have about the research.

Your class teacher will also sign below to act as a witness to show that I have read the above to you and you have understood what I have said.

........................................................................................................................................................................

Child's name.....................................................................................
Child's signature..............................................................................
Class teacher's signature...................................................................
Dear Parents,

I am writing to you to update you on my physical activity doctorate research.

Your child has very enthusiastically completed the 6 days of the pilot phase of the research before Christmas. They were very excited to know when they would next be wearing the accelerometers and were a joy to work with. The aim of the pilot phase of the research was to ensure that the children were comfortable wearing the accelerometers and forget that they were wearing them, also to ensure that I was able to get reliable data from the accelerometers in readiness for the main research.

With the start of the new term comes the start of the main research, we are about to start recording for day 3 and day 4 this week. As part of the main research your child will now wear the accelerometer 2 days every other week.

This table portrays the results from day 1 and day 2 of the main research. The results show the average amount of time per day spent over 3 METS. A METS is a measure of activity. As you can see the Physical Education days have a higher amount of time being spent over 3 METS than on days that do not include Physical Education.

I thank you and your child for your continued support in my research. I will update you again towards the end of this term with more results. I do however ask if your child arrives home and is still wearing their accelerometer (oops…) could I please ask that you send them back in again to school the next day with it (preferably having not worn it in the bath or whilst swimming!).

If you have any questions, please feel free to contact me on 07758225825 or via email at kristy.howells@canterbury.ac.uk

Many thanks,
Kristy Howells
Kristy Howells: Physical Activity Doctorate Project in Sport and Exercise Sciences Update

Dear Parents,

As we reach the end of the school year, I am writing to give you an update on my physical activity doctorate project. Your child has continued to be very enthusiastic and we have now completed all 30 days of the main study. The children have still been asking when they will be wearing the accelerometers, even though the project has now finished. They have been wearing the accelerometers for 2 days a week for most weeks since January.

The challenge for me now is to analyse the data. The children have produced 15 million lines of data, so as you can imagine this is taking quite a while to process. I aim to have a provisional analysis of all the data by the end of the summer and hope to be able to update you again in September.

However the data so far indicates that the days that contain physical education lessons are overall more physically active than those days that do not contain them (as seen in the table). The results show the average amount of time per day spent over 3 METS. A METS is a measure of physical activity and the UK Government recommends that children should be reaching as close as possible to an hour a day of physical activity at 3 METS.

Not only will I analyse the amount of activity that is produced on the type of day, but I also plan to compare boys versus girls, ie – is one more active than the other? Also I will be considering, whether activity levels decrease as the children age, so activity levels will be compared between the year 2 and year 5 children.

I thank you so much for your continued support by allowing your child to complete the project. As mentioned above, I will update you once all the data is analysed and I have the final results.

If you have any questions, please feel free to contact me on 07758225825 or via email at kristy.howells@canterbury.ac.uk

Kristy Howells
Appendix 10 – Summary data of the mean number of minutes recorded at MVPA during PE and Non PE days for year group and gender

<table>
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<th>Child Number</th>
<th>Gender</th>
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Appendix 11 - Summary data of the mean number of minutes recorded at a MVPA level for different parts of school day during PE and Non PE days for year group and gender (~ indicates that afternoon break only occurs for infants).

<table>
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<th>Child Number</th>
<th>Gender</th>
<th>Year Group</th>
<th>Curriculum time</th>
<th>Morning break</th>
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<th>Afternoon break</th>
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Appendix 12 – Summary data of the mean percentage number of minutes recorded at a MVPA level during PE and Non PE days for year group and gender

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Appendix 13 – Summary data of the mean number of minutes recorded at a LPA level during PE and Non PE days for year group and gender

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Appendix 14 – Summary data of the mean number of minutes recorded at a LPA level for different parts of school day during PE and Non PE days for year group and gender (~ indicates that afternoon break only occurs for infants).

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Appendix 15 – Summary data of the mean percentage number of minutes recorded at a LPA level during PE and Non PE days for year group and gender

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Appendix 16 – Summary data of the mean number of minutes recorded at a SA level during PE and Non PE days for year group and gender

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Appendix 17 - Summary data of the mean number of minutes recorded at a SA level for different parts of school day during PE and Non PE days for year group and gender (~ indicates that afternoon break only occurs for infants).

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<tr>
<td>18</td>
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<td>Juniors</td>
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<td>248</td>
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<td>195</td>
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Appendix 18 – Summary data of the mean percentage number of minutes recorded at a SA level during PE and Non PE days for year group and gender

<table>
<thead>
<tr>
<th>Child Number</th>
<th>Gender</th>
<th>Year Group</th>
<th>Type of Day</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>40</td>
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<td>2</td>
<td>Girl</td>
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<td>PE</td>
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<td>Infants</td>
<td>PE</td>
<td>61</td>
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<td>PE</td>
<td>57</td>
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<td>PE</td>
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<td>PE</td>
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<td>52</td>
</tr>
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<td>Infants</td>
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<td>53</td>
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<td>16</td>
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<td>Juniors</td>
<td>PE</td>
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<td>75</td>
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<td>19</td>
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<td>Juniors</td>
<td>PE</td>
<td>62</td>
<td>69</td>
</tr>
<tr>
<td>20</td>
<td>Girl</td>
<td>Juniors</td>
<td>PE</td>
<td>68</td>
<td>76</td>
</tr>
</tbody>
</table>
Appendix 19 - Physical Activity Questionnaire adapted from Kowalski et al. (2004) PAQ-C (physical activity questionnaire for children)

Question 1
What is your favourite food for school lunch?
- Lasagne
- Roast dinner
- Fish and chips
- Pizza
- Other

Question 2
How do you travel to school?
- a) Car
- b) Bus
- c) Bicycle
- d) Walking
- e) Other

Question 3
How long does it take you to get to school?
- a) 5 minutes
- b) 10 minutes
- c) 15 minutes
- d) 20 minutes
- e) More than 20 minutes

Question 4
How active are you at school in break time?
- a) very active
- b) active
- c) not sure
- d) not very active
Question 5
What is your favourite kind of activity and what you did for the longest time at school in break time?
   a) Sat down (talking, reading, doing schoolwork)
   b) Stood around or walked around
   c) Ran or played a little bit
   d) Ran around and played quite a bit
   e) Ran and played hard most of the time

Question 6
Which is your least favourite kind of activity that you do at school in break time and what you did for the smallest amount of time?
   a) Sat down (talking, reading, doing schoolwork)
   b) Stood around or walked around
   c) Ran or played a little bit
   d) Ran around and played quite a bit
   e) Ran and played hard most of the time

Question 7
What did you normally do at lunch besides eating lunch?)?
   a) Sat down (talking, reading, doing schoolwork)
   b) Stood around or walked around
   c) Ran or played a little bit
   d) Ran around and played quite a bit
   e) Ran and played hard most of the time

Question 8
What is your favourite lesson in school?
   Science
   Numeracy
   Literacy
   Topic
   Art
   French
   Physical Education
Question 9
What is your second favourite lesson in school?
   a) Science
   b) Numeracy
   c) Literacy
   d) Topic
   e) Art
   f) French
   g) Physical Education

Question 10
What is your third favourite lesson in school?
   • Science
   • Numeracy
   • Literacy
   • Topic
   • Art
   • French
   • Physical Education

Question 11
What is your least favourite lesson in school?
   • Science
   • Numeracy
   • Literacy
   • Topic
   • Art
   • French
   • Physical Education
Question 12
What is your favourite activity in physical education lessons?
  a) Invasion games like football, hockey, rugby
  b) Striking and fielding games like rounders and cricket
  c) Dance
  d) Gymnastics
  e) Swimming
  f) Athletics

Question 13
Which activity in physical education lessons do you think you are the most active in?
  Invasion games like football, hockey, rugby
  Striking and fielding games like rounders and cricket
  Dance
  Gymnastics
  Swimming
  Athletics

Question 14
During your physical education classes, how often are you very active (playing hard, running, jumping, throwing)?
  a) I don’t do PE
  b) Hardly ever
  c) Sometimes
  d) Quite often
  e) Always

Question 15
How many after school sports clubs do you go at school?
  a) 1
  b) 2
  c) 3
  d) 4
  e) 5
Question 16
How many sports clubs do you go to in the evenings after school (not at school)?
   a) 1
   b) 2
   c) 3
   d) 4
   e) 5

Question 17
What activities do you do when you get home after school?
   a) Playing on computer like xbox, wii
   b) Playing musical instruments
   c) Playing sports
   d) Playing outside with friends
   e) Reading
   f) Doing arts and crafts

Question 18
If you had a choice of activities to do when you get home after school what would be your first choice?
   a) Playing on computer like xbox, wii
   b) Playing musical instruments
   c) Playing sports
   d) Playing outside
   e) Reading
   f) Doing arts and crafts

Question 19
In the last 7 days, on how many days right after school, did you do sports, dance, or play games in which you were very active?
   a) None
   b) 1 time last week
   c) 2 or 3 times last week
   d) 4 times last week
   e) 5 times last week
Question 20
In the last 7 days, on how many evenings did you do sports, dance, or play games in which you were very active?
   a) None
   b) 1 time last week
   c) 2 or 3 times last week
   d) 4 or 5 last week
   e) 6 or 7 times last week

Question 21
Which one of the following describes you best for the last 7 days?
Read all five statements before deciding on the one answer that describes you.
   a) All or most of my free time was spent doing things that involve little physical effort
   b) I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)
   c) I often (3 — 4 times last week) did physical things in my free time
   d) I quite often (5 — 6 times last week) did physical things in my free time
   e) I very often (7 or more times last week) did physical things in my free time
Appendix 20 - All Physical Activity Results Main Phase

Introduction

The number of minutes recorded of all physical activity (referred to within this section as APA) for each child (see Table J for summary data) at and over 2 METs was recorded to provide a mapping of APA, within the school day during the main phase of data collection. APA that the children complete within the school day was compared on PE days and Non PE days.

<table>
<thead>
<tr>
<th>Child Number</th>
<th>Gender</th>
<th>Year Group</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boy</td>
<td>Infants</td>
<td>224</td>
<td>196</td>
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<td>2</td>
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<td>Infants</td>
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<td>172</td>
<td>175</td>
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<td>Infants</td>
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<td>156</td>
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<td>Infants</td>
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<td>179</td>
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<td>8</td>
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<td>Infants</td>
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<td>178</td>
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<td>Infants</td>
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<td>10</td>
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<td>Infants</td>
<td>152</td>
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<td>11</td>
<td>Girl</td>
<td>Juniors</td>
<td>118</td>
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<td>12</td>
<td>Boy</td>
<td>Juniors</td>
<td>176</td>
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<td>Juniors</td>
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<td>14</td>
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<td>Juniors</td>
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<td>15</td>
<td>Boy</td>
<td>Juniors</td>
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<td>115</td>
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<td>Juniors</td>
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<td>Juniors</td>
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<td>18</td>
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<td>Juniors</td>
<td>120</td>
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<td>Girl</td>
<td>Juniors</td>
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<td>20</td>
<td>Girl</td>
<td>Juniors</td>
<td>119</td>
<td>90</td>
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</tbody>
</table>

Table J – Summary data of overall mean number of minutes recorded at APA during PE and Non PE days for year group and gender (main phase).
APA levels for whole school day (main phase)

The mean number of minutes of APA on PE days was $154 \pm 29$ minutes, (out of a total possible number of 371 minutes within the whole school day) whilst the mean number of minutes of APA on Non PE days was $135 \pm 32$ minutes (again out of a total possible 371 minutes). Figure 61 illustrates these findings.

![APA levels for whole school day (main phase)](image)

Figure 61 - Overall mean number of minutes ± SD of APA during the whole school day, for type of day, for all children (main phase).

There was significant main effect ($F = 160.76, P < 0.05$) for type of day. On average, PE days included more APA when compared to Non PE days.
**APA for year and gender (main phase)**

The number of minutes of APA recorded for each child and this data were then averaged and filtered according to year group and gender. Figure 62 illustrates these findings.

![Figure 62](image.png)

**Figure 62 –** Overall mean number of minutes ± SD of APA within the school day for year group, gender and type of day.

There was a **significant main effect** \((F = 11.438, P < 0.05)\) for year group. On average, infants completed 35 minutes more APA \((162 ± 29\) minutes) when compared to juniors \((127 ± 24\) minutes).

There was also a **significant main effect** \((F = 4.797, p < 0.05)\) for gender. On average, boys completed 7 minutes more APA \((148 ± 31\) minutes) when compared to girls \((141 ± 28\) minutes).

There was a **significant interaction** \((F = 24.49, P < 0.05)\) between type of day and year group. On average, juniors completed 26 minutes more APA on PE days \((140 ± 22\) minutes) when compared with Non PE days \((114 ± 19\) minutes).
There was also a significant interaction ($F = 4.83, P < 0.05$) between type of day and gender. On average, boys completed 18 minutes more APA on PE days (157 ± 30 minutes) when compared with Non PE days (139 ± 31 minutes).
APA levels for year and gender during different parts of the school day (main phase)

The whole school day was separated into different parts of the day, as mentioned previously to compare the different parts of the school day and the PE and Non PE days (see Table K).

<table>
<thead>
<tr>
<th>Child Number</th>
<th>Gender</th>
<th>Year Group</th>
<th>Curriculum time</th>
<th>Morning break</th>
<th>Lunch time</th>
<th>Afternoon break</th>
<th>Physical Education lessons</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td>PE</td>
<td>Non PE</td>
<td>PE</td>
<td>Non PE</td>
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<td>Infants</td>
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<td>4</td>
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<td>Infants</td>
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<td>54</td>
<td>43</td>
<td>15</td>
<td>13</td>
<td>31</td>
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</table>

Table K - Summary data of the mean number of minutes recorded at an APA level for different parts of school day during PE and Non PE days for year group and gender (main phase) (~ indicates that afternoon break only occurs for infants.
The school day was separated into different parts (as for MVPA, LPA, SA) (see Table Q for the summary data). The overall mean number of minutes ± SD of APA, during different parts of the school day for all children are presented in Table L.

<table>
<thead>
<tr>
<th>Parts of the day</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum time</td>
<td>71 ± 19</td>
<td>76 ± 24</td>
</tr>
<tr>
<td>Morning break</td>
<td>17 ± 2</td>
<td>16 ± 2</td>
</tr>
<tr>
<td>Lunch time</td>
<td>38 ± 6</td>
<td>38 ± 5</td>
</tr>
<tr>
<td>Afternoon break ~</td>
<td>10 ± 2</td>
<td>9 ± 2</td>
</tr>
<tr>
<td>Physical Education lessons</td>
<td>23 ± 4</td>
<td>*</td>
</tr>
</tbody>
</table>

Table L – Overall mean number of minutes of APA ± SD during different parts of the school day for all children (main phase)
(~ indicates that afternoon break only occurs for infants, * indicates that there is no data, as that part of the day does not exist for that type of day.)
Curriculum time (main phase)

Figure 63 illustrates the overall mean number of minutes ± SD of APA during curriculum time for year group, gender and type of day.

![Bar chart showing mean number of minutes of APA during curriculum time for year group, gender and type of day](chart.png)

*Figure 63 - Overall mean number of minutes ± SD of APA during curriculum time for year group, gender and type of day (main phase)*

There was a significant main effect ($F = 11.80, P < 0.05$) for type of day. On average, during curriculum time, the children completed 4 minutes more APA on Non PE days (76 ± 24 minutes) when compared to PE days (71 ± 19 minutes).

There was also a significant main effect ($F = 10.17, P < 0.05$) for year group. On average, during curriculum time, infants completed 25 minutes more APA (86 ± 20 minutes) when compared to juniors (61 ± 15 minutes).

There was also a significant interaction ($F = 33.44, P < 0.05$) between year group and type of day. On average, during curriculum time, infants completed 32 minutes more APA on Non PE days (92 ± 20 minutes) when compared to juniors (60 ± 15 minutes).
Morning break (main phase)

Figure 64 illustrates the overall mean number of minutes ± SD of APA during morning break for year group, gender and type of day.

There was a significant main effect (F = 6.97, P < 0.05) for type of day. On average, during morning break, the children completed 1 minute more APA on PE days (17 ± 2 minutes) when compared to Non PE days (16 ± 2 minutes).

There was also a significant main effect (F = 31.91, P < 0.05) for gender. On average, during morning break, boys completed 1 minute more APA (17 ± 2 minutes) when compared to girls (16 ± 2 minutes).

There was also a significant main effect (F = 22.27, P < 0.05) for year group. On average, during morning break, infants completed 2 minutes more APA (18 ± 2 minutes) when compared to juniors (16 ± 2 minutes).

There was also a significant interaction (F = 5.82, P < 0.05) between type of day and gender. On average, during morning break, girls completed 1 minute
more APA on PE days (17 ± 2 minutes) when compared to Non PE days (16 ± 2 minutes).

**Lunch time (main phase)**

Figure 65 illustrates the overall mean number of minutes ± SD of APA during lunch time for year group, gender and type of day.

![Figure 65](image-url)

*Figure 65 – Overall mean number of minutes ± SD of APA during lunch time for year group, gender and type of day (main phase)*

There was a **significant main effect** \((F = 22.51, P < 0.05)\) for gender. On average, during lunch time, boys completed 1 minute more APA \((38 ± 6 minutes)\) when compared to girls \((37 ± 5 minutes)\).

There was also a **significant interaction** \((F = 5.27, P < 0.05)\) between type of day and gender. On average, during lunch time, boys completed 1 minute more APA on Non PE days \((39 ± 5 minutes)\) compared to PE days \((38 ± 6 minutes)\).
Afternoon break (main phase)

Afternoon break occurs only for infants. Figure 66 illustrates overall mean number of minutes ± SD of APA, during afternoon break for gender and type of day.

There were no significant main effects \( (P > 0.05) \) indicating that, on average, similar levels of APA were completed for gender and type of day.

There was a significant interaction \( (F = 7.92, P < 0.05) \) between type of day and gender. On average, during afternoon break, boys completed 1 minute more APA on PE days \( (10 \pm 2 \text{ minutes}) \) when compared to Non PE days \( (9 \pm 1 \text{ minute}) \).
Physical Education lessons (main phase)

Figure 67 illustrates the overall mean number of minutes ± SD of APA during Physical Education lessons, for year group and gender.

There were no significant main effects or interactions (P < 0.05) indicating that, on average, there were similar levels of APA during Physical Education lessons for year group and gender.
Results Percentage of APA (main phase)

Percentage of APA for whole school day (main phase)

The number of minutes of APA was converted into a percentage (see Table M for summary data) which allowed for direct comparison between the different year groups and parts of the day. The differences were discussed in section 3.8.

<table>
<thead>
<tr>
<th>Child Number</th>
<th>Gender</th>
<th>Year Group</th>
<th>PE</th>
<th>Non PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boy</td>
<td>Infants</td>
<td>60</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>Girl</td>
<td>Infants</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>Girl</td>
<td>Infants</td>
<td>39</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>Girl</td>
<td>Infants</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>5</td>
<td>Girl</td>
<td>Infants</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>6</td>
<td>Girl</td>
<td>Infants</td>
<td>44</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>Boy</td>
<td>Infants</td>
<td>53</td>
<td>48</td>
</tr>
<tr>
<td>8</td>
<td>Boy</td>
<td>Infants</td>
<td>51</td>
<td>48</td>
</tr>
<tr>
<td>9</td>
<td>Boy</td>
<td>Infants</td>
<td>43</td>
<td>39</td>
</tr>
<tr>
<td>10</td>
<td>Boy</td>
<td>Infants</td>
<td>41</td>
<td>38</td>
</tr>
<tr>
<td>11</td>
<td>Girl</td>
<td>Juniors</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>12</td>
<td>Boy</td>
<td>Juniors</td>
<td>47</td>
<td>40</td>
</tr>
<tr>
<td>13</td>
<td>Boy</td>
<td>Juniors</td>
<td>37</td>
<td>30</td>
</tr>
<tr>
<td>14</td>
<td>Girl</td>
<td>Juniors</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>15</td>
<td>Boy</td>
<td>Juniors</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>16</td>
<td>Girl</td>
<td>Juniors</td>
<td>43</td>
<td>33</td>
</tr>
<tr>
<td>17</td>
<td>Boy</td>
<td>Juniors</td>
<td>47</td>
<td>38</td>
</tr>
<tr>
<td>18</td>
<td>Boy</td>
<td>Juniors</td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td>19</td>
<td>Girl</td>
<td>Juniors</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>20</td>
<td>Girl</td>
<td>Juniors</td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>

Table M - Summary data of the mean percentage number of minutes recorded at an APA level during PE and Non PE days for year group and gender (main phase).
The mean percentage of APA on PE days was 41% ± 8% of the whole school day, whilst the mean percentage of APA on Non PE days was 36% ± 9% (see Figure 68).

![Graph showing mean percentage number of minutes of APA during whole school day for type of day, for all children (main phase).](image)

*Figure 68 - Overall mean percentage number of minutes ± SD of APA during whole school day for type of day, for all children (main phase).*

There was a significant main effect ($F = 160.76, P < 0.05$) for type of day. On average, the children reached 5% more APA on PE days when compared to Non PE days.
Percentage of APA for year and gender (main phase)

Figure 69 illustrates the overall mean percentage number of minutes ± SD of APA during the whole school day for year group, gender and type of day.

![Bar chart showing mean percentage number of minutes of APA for different year groups, genders, and PE/Non-PE days.]

**Figure 69 – Overall mean percentage number of minutes ± SD of APA for whole school day, for year group, gender and type of day (main phase).**

There was a significant main effect \( F = 11.44, P < 0.05 \) for year group. On average, infants reached 10% more APA (44 ± 8%) when compared to juniors (34 ± 7%).

There was also a significant main effect \( F = 4.80, P < 0.05 \) for gender. On average, boys reached 2% more APA (40 ± 8%) when compared to girls (38 ± 8%).

There was a significant interaction \( F; 24.49, P < 0.05 \) between year group and day. On average, juniors reached 7% more APA on PE days (38 ± 6%) when compared to Non PE days (31 ± 5%).
There was also a significant interaction \((F = 4.83, P < 0.05)\) for gender and day. On average, boys reached 5% more APA on PE days \((42 \pm 8\%)\) when compared to Non PE days \((37 \pm 8\%)\).

**Percentage of APA during curriculum time (main phase)**

Figure 70 illustrates the overall mean percentage number of minutes ± SD of APA during curriculum time for year group, gender and type of day.

There was a significant main effect \((F = 11.73, P < 0.05)\) for year group. On average, during curriculum time, infants reached 11% more APA \((34 \pm 8\%)\) when compared to juniors \((23 \pm 6\%)\).
There was also a significant interaction \((F = 8.08, P < 0.05)\) for type of day and year group. On average, during curriculum time, juniors reached 3% more APA on PE days \((25 \pm 7\%)\) compared to Non PE days \((22 \pm 5\%)\).

Summary of Key APA Findings (main phase)

The APA combines both MVPA and LPA for all the physical activity that the children completed within the school day. Unlike the pilot phase there were significant differences in the type of day with more APA being completed for all children on PE days than Non PE days. Also boys completed more APA than girls. Boys were also found to complete more APA on PE days and juniors completed more APA on PE days than Non PE days. Similarly results were found to those found in the pilot phase, infants completed more APA than juniors.

During curriculum time as in the pilot phase more APA was completed on Non PE days than PE days and infants completed more APA than juniors. Not found previously in the pilot phase, infants completed more APA during curriculum time on Non PE days compared to juniors. This may be due to the differences that the children experience within the particular curricula as discussed in chapter 6.

Within morning break the children completed more APA during PE days than Non PE days, infants also completed more APA than juniors as in the pilot phase. Not previously found were that boys completed more APA than girls during morning break, yet girls completed more APA on PE days than Non PE days. During lunch time as within the pilot phase boys completed more APA than girls. Also it was found that boys completed more APA on Non PE days compared to PE days during both lunch time and afternoon break.

During Physical Education lessons, there were no significant differences indicating that boys and girls and infants and juniors completed similar levels of APA during Physical Education lessons. This may be due to the different activity areas of the Physical Education National Curriculum (DfEE/QCA, 1999) that were completed during the main phase as opposed to the pilot phase (as discussed in chapter 6).