AN INVESTIGATION INTO PHYSICAL ACTIVITY AND CLASSROOM BEHAVIOURS IN CHILDREN WITH INTELLECTUAL DISABILITIES

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Abstract

In typically developing children, research indicates that physical activity has positive influences not only on health but also academic attainment and classroom behaviour. Children with intellectual disabilities appear to exhibit less activity levels than their peers without disability. Coronary diseases are also more frequent within this group, as is challenging behaviour in the classroom environment. This study investigated habitual physical activity in 21 children with intellectual disabilities. Recess physical activity and classroom behaviour pre- and post- lunch recess were assessed in 17 of these participants. Objective methods (accelerometers) were used to measure physical activity whilst classroom behaviour was assessed using teacher ratings. Results showed that a large proportion of children (73% of the cohort) achieved 60 minutes or more of moderate to vigorous physical activity per day. Percentage time spent sedentary and in moderate to vigorous physical activity were not significantly different from weekday to weekend. Percentage time spent sedentary was significantly higher before (73.4%) and after (70.5%) school in comparison to during the school day (65.6%). During recess 6.4 minutes (SD = ± 4.4) of moderate to vigorous physical activity was accrued and habitual physical activity levels did not significantly predict recess physical activity. Classroom behaviour differed significantly from pre- to post- recess, with the total amount of physical activity and time spent in moderate to vigorous physical activity during recess negatively correlating to behaviour ratings regarding disruptive behaviour post-recess. It appears that the special educational needs classroom setting allowed for reduced sedentary behaviour. However, physical activity during lesson time was not associated with better behaviour. Activity during lessons may not always be deemed appropriate by teachers; children with intellectual disabilities who struggle to stay on task for long periods of time may need regular structured activity breaks in lessons and to accrue more moderate to vigorous physical activity during recess.

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List of Abbreviations

ADHD	Attention deficit hyperactive disorder
ASD	Autistic spectrum disorder
BMI	Body mass index
DS	Down syndrome
ID	Intellectual disabilities
LPA	Light intensity physical activity
Min	Minutes
MPA	Moderate intensity physical activity
MVPA	Moderate to vigorous physical activity
PA	Physical activity
PE	Physical education
SEN	Special educational needs
SLD	Severe learning difficulties
TD	Typically developing
VPA	Vigorous intensity physical activity

Glossary of Terms

Sedentary behaviour	A behaviour which has a MET value between 1 and 1.5, such as sitting or lying down (Owen *et al*., 2000).
Physical activity	Defined as 'any bodily movement produced by skeletal muscles resulting in energy expenditure.' (Caspersen et al., 1985, p. 126).
Intellectual disabilities	Defined as 'a significantly reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence). This results in a reduced ability to cope independently (impaired social functioning), and begins before adulthood, with a lasting effect on development' (WHO, 2015). This term is often used interchangeably with learning difficulty.
Learning difficulties	'A person has a learning difficulty if – (a) He has a significantly greater difficulty in learning than the majority of persons of his age, or (b) He has a disability which either prevents or hinders him from making use of facilities of a kind generally provided in pursuance of the duty under subsection (1) for persons of his age. (1) A local education authority shall secure the provision for their area of adequate facilities for further education.' (Education Act, 1996, p. 7).

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Introduction

Physical activity (PA), defined as any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen *et al*., 1985), can lead to substantial health benefits (Janssen & LeBLanc, 2010) such as lowered cardiometabolic disease risk (Anderson *et al.*, 2011; Boddy *et al*., 2014) in children as well as reduced adiposity and increase bone health (Biddle *et al.*, 2004). However, evidence suggests that few children and young people are sufficiently active based on recommended PA guidelines (Ekelund *et al*., 2011). The most recent Chief Medical Officers' (CMO) recommendations suggest children and young people aged 5-18 should engage in moderate to vigorous PA (MVPA) every day for at least 60 minutes (Department of Health, 2011). These guidelines also make recommendations in regards to sedentary behaviour stating that "all children and young people should minimise the amount of time spent being sedentary for extended periods" (Department of Health, 2011). There is a substantial amount of evidence regarding PA behaviours in typically developing (TD) children and young people which suggests that few are sufficiently active based on guidelines (Ekelund *et al*., 2011). A UK-wide study of mainstream children's objectively measured PA levels found 51% of 7-year-olds to achieve guidelines (Griffiths *et al*., 2013). Whilst in special populations such as children with intellectual disabilities (ID) there is a lack of research. This is despite evidence which shows that when compared with the general population individuals with ID experience significantly higher rates or morbidity, mortality, and health inequalities (Phillips & Holland, 2011). Furthermore, in the existent literature there is an indication that youth with ID exhibit significantly lower activity levels than their peers without disability (Hinckson & Curtis, 2013).

Qualitative studies have described barriers to participation in PA which children with ID experience. In structured activity lessons for example football, swimming, and gymnastics children may struggle to follow instructions within these different situations (Downs *et al.* 2013). There is also a lack of programmes suitable for children with additional needs which take into consideration their difficulties in

following instruction, with parents believing that mainstream programmes lacked adequate staff or time for their children (Downs *et al.* 2013).

Taking into consideration the external barriers to participation and limited opportunities available, the school environment is an important setting to provide children with ID the opportunity to be sufficiently active (Pate *et al*., 2006). It is believed the freedom of movement allowed during the recess period can have additional benefits for children with ID such as improved social interactions, cognition, motor skills, language and reduced stereotypic behaviours (Lang *et al*., 2011). On the whole, ID literature provides more of a focus surrounding the play behaviours shown by children during recess including how to improve their social interactions for example, rather than their PA levels per se during this period (Boddy *et* al., 2015a; Harper *et* al., 2008; Machalicek *et al*., 2009).

It is also important to understand PA behaviours and patterns throughout the full week (weekday and weekends). Studies which have attempted to compare students with autistic spectrum disorder (ASD) for example, with their TD peers has indicated significantly lower levels of PA participation during the school day amongst those with ASD (Pan *et al*., 2015a).

Accurate measures are needed in order to assess levels of PA (Sirard & Pate, 2001). Accelerometers are deemed to be valid and reliable for use with children (Ekelund *et al*., 2001). Recommendations for their use to accurately measure sedentary behaviour have also been made (Loprinzi & Cardinal 2011). Overall, methodology across ID studies is not consistent. Only a small number of studies have utilised objective monitoring techniques which appear to be the most credible in order to capture PA levels in children with ID (Hinckson & Curtis, 2013).

Other benefits of PA which have been identified include positive influences on academic attainment and classroom behaviour (Fedewa & Ahn, 2011). This may be particularly important due to the significance of classroom behaviour in the Special Educational Needs (SEN) school setting where challenging behaviour is common (Parmenter *et al*., 1998). Challenging behaviours are frequently associated with the

presence of ID and interventions to reduce the development and maintenance of these are deemed to be important (Lloyd & Kennedy, 2014), particularly as research indicates that the prevalence of aggression for example, increases from childhood and teenage years into adulthood (Davies & Oliver, 2013). SEN classrooms typically have less students than in a mainstream setting. There are also additional teaching assistants due to the individualised nature of each student and to also help manage the challenging behaviours displayed. Learning is either on a group or individual one to one basis, unlike in a mainstream school setting in which learning can occur on an independent basis from an assigned task.

Significant and positive effects of PA on children's achievement and cognitive outcomes have been found with greater improvements observed for children with learning disabilities (Fedewa & Ahn, 2011). It was therefore concluded that time allocated for PA in the school day should not be viewed as impeding, but enhancing for children's academic achievement (Fedewa & Ahn, 2011). The influence of PA on the behaviour of children with ID is perhaps a more complex subject area, and as with most areas of ID specific PA research, this topic has not been comprehensively investigated. However, challenging behaviour has been shown to decrease following an exercise programme throughout the school day in children with developmental disabilities, this included exercises such as arm and leg stretches, periods of jogging or fast walking as well as hula hoop and trampoline jumps (Cannella-Malone *et al*., 2011).

Knowledge of the activity levels of children with ID both habitually and specifically during recess is scarce and should be improved. In a population which exhibits higher health inequalities compared to their TD peers (Phillips & Holland, 2011), alongside challenging behaviours which can negatively influence the quantity and quality of academic learning, the use of PA as a tool to positively impact both important aspects of their lives should be further investigated.

The following sections of this thesis will include a literature review that examines existing knowledge has been gained from both ID and TD population research in relation to the levels of PA exhibited by children and its associations with classroom

behaviour. The purpose of the study will then be to investigate the links between habitual PA and recess PA behaviours with academic outcomes such as classroom behaviour and attention in the special school setting. This will be achieved through objective measures of habitual and segmented PA levels and teacher ratings of behaviour. Parametric statistics will explore associations between PA and classroom behaviour and the findings of this study will be discussed drawing on empirical evidence. Finally the thesis will provide some recommendations for future research and practice.

Literature Review

Physical Activity

PA can be defined as any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen *et al*., 1985). Insufficient PA is one of the top ten leading risk factors for global mortality (Lim *et al*., 2012). Evidence suggests that even modest amounts of PA can have substantial health benefits in high risk youngsters such as those who are obese (Janssen & LeBlanc, 2010). The health benefits resulting from PA in childhood include lowered cardiometabolic disease risk (Boddy *et al*., 2014), improvements in self-esteem, depressive symptoms, and anxiety/stress (Calfas & Taylor, 1994), as well as positive associations with academic achievement (Fedewa & Ahn, 2011).

The most recent Chief Medical Officers' (CMO) recommendations suggest children and young people aged 5-18 should engage in MVPA every day for at least 60 minutes (Department of Health, 2011). Evidence varies, but seems to suggest that few children and young people are sufficiently active based on these guidelines (Ekelund *et al*., 2011). A study of British 9-10 year old children found on average, children accumulated 74.1 minutes of MVPA per day, with 69.1% of their participants being classified as sufficiently active according to guidelines (van Sluijs *et al*., 2008), although much lower percentages have been previously found. Only 2.5% of children met guidelines in a study of over 5,000 11 year olds (Riddock *et al*., 2007). Furthermore, research indicates that PA levels decline rapidly from childhood through to adolescence (10-19 years old), with a mean decline of 7% per year in PA levels found (Dumith *et al*., 2011). Consequently, there is even greater importance for the improvement of youth PA in order for this to track into adulthood and reduce the age-related decline in activity. The health benefits, prevalence, correlates and determinants of PA in TD children and young people are well established however evidence related to disability groups is limited.

Sedentary Behaviour

In addition to the PA levels of children and young people, there is growing concern over the effects which sedentary lifestyles can have on health (Biddle *et al.,* 2004).

PA guidelines make recommendations in regards to sedentary behaviour stating that "all children and young people should minimise the amount of time spent being sedentary for extended periods" (Department of Health, 2011). This is a result of research which has identified high levels of sedentary behaviour as a possible risk factor for obesity in children (Rennie *et al*., 2005). Sedentary behaviour is defined as having a MET value between 1 and 1.5, such as sitting or lying down (Owen *et al*., 2000). This behaviour has become a common aspect of the daily lives of most adults and children alike due to the dependence on cars and trends in electronic entertainment (Salmon *et al*., 2011). The Health Survey for England (HSE) (2012) measured the sedentary levels of children and young people aged 2-15 years in England through self-report methodology, therefore potentially under estimating levels. Average total sedentary time on weekdays was 3.3 hours for boys and 3.2 hours for girls which increased to 4.2 hours for boys and 4.0 hours for girls on weekend days. There is also evidence to show that sedentary behaviour tracks from childhood to adolescence through into adulthood (Biddle *et al*., 2010).

Intellectual disabilities and physical activity

The term ID is defined as:

> a significantly reduced ability to understand new or complex information and to learn and apply new skills (impaired intelligence). This results in a reduced ability to cope independently (impaired social functioning), and begins before adulthood, with a lasting effect on development. (World Health Organization, 2015).

This refers to a spectrum of individuals, with examples of syndromes and conditions associated within this including, but not limited to, attention deficit/hyperactivity disorder (ADHD), ASD, Down syndrome (DS), fragile X syndrome, and Klinefelter syndrome (Pitetti *et al.,* 2009). PA guidelines do not make any recommendations for individuals with ID and it could conceivably be difficult to do so because of this wide spectrum which covers individuals with many varying needs under one term. Furthermore, methodological issues surround the research of children with ID and PA levels such as small sample sizes, and a lack of population-specific measurement research (McGarty *et al*., 2014). This leads to a varied methodological quality of

existing research thus providing inconsistent results and an overall lack of evidence on which to base ID specific guidelines.

In comparison to the lack of evidence in regards to the PA of children with ID, there is a substantial amount of research available surrounding PA in TD children and young people. This is despite evidence which shows that when compared with the general population individuals with ID experience significantly higher rates of morbidity, mortality, and health inequalities (Phillips & Holland, 2011). Furthermore, cardiovascular diseases, such as hypertension, diabetes and obesity are more frequent within this group (Sohler *et al*., 2009). It has also been postulated that one of the main contributing factors for a shorter life span and higher mortality rate among these individuals could be due to poor cardiovascular fitness (Pitetti & Campbell, 1991). These findings provide a rationale for strategies and interventions designed to raise the levels of PA for individuals with ID as well as further research into PA behaviours within this group.

In the existent literature there is an indication that youth with ID exhibit significantly lower activity levels than their peers without disability (Hinckson & Curtis, 2013), particularly over specific time points of the weekend, after school, during recess and in physical education (PE) (Foley *et al*., 2008). Phillips and Holland (2011) found none of their 152 participants with ID aged between 12 and 70 to meet PA guidelines of ≥60 minutes MVPA/day. Furthermore, Einarsson *et al.* (2015) reported none of their participants met PA guidelines, compared to 40% of their non-affected participants who did so. In a study by Boddy *et al*. (2015a), children with ID were not sufficiently active to benefit their physical health and the proportion who met guidelines (23%) was lower than would be expected in mainstream children in the UK.

Research has aimed to discover why the PA levels of children and young people with ID are significantly lower than their TD peers. It has been questioned whether the limited cognitive capabilities of those with ID influences their ability to cope with stressful situations such as those induced during participation in certain physical activities as well as the demands for more advanced social skills in such

situations (Bramston & Mioche, 2001). Thus perhaps providing an insight in to why individuals with ID may chose not to participate in activities of a physical nature. Downs *et al.* (2013) conducted interviews with parents aiming to explore PA amongst children and young people with DS. The findings of the study explained how participation in structured activity lessons for example football, swimming, gymnastics and dance is difficult for children with DS as they can struggle to follow instructions within these different situations. In addition to this, the study identified that there was a lack of programmes suitable for children with additional needs which take into consideration their difficulties in following instruction, with parents in the study believing that mainstream programmes lacked adequate staff or time for their children. Other practical issues such as transport to and from clubs act as barriers towards participation, because parents were identified as often being the only means of transport for these children who were not able to travel independently (Downs *et al*., 2013). The nature of the behavioural issues of children with ID means that one-on-one supervision is required for children to participate in PA. Further interview data has revealed how parents think that they themselves may act as a barrier towards their children's participation in activities, with sedentary activities encouraged at home if parents do not have the time to supervise (Barr & Shields, 2011).

Overall, research indicates that children and young people with ID are not sufficiently active to benefit health and there are multiple barriers to participation influencing their PA levels (Frey *et al*., 2008). Gaining an understanding of the optimum PA-promoting environment for children with ID is crucial for the health of this population. Taking into consideration the external barriers to participation and limited opportunities available, the school environment could be the primary and most important setting to provide children with ID the opportunity to be sufficiently active (Pate *et al*., 2006). Furthermore, previous research has shown that when given the opportunity, children with ID can and will participate in PE classes and recess (Pitetti *et al*., 2009) and by doing so the necessary MVPA essential for the promotion of their health could be achieved. In addition to this, the types of PA which have been mentioned to be key facilitators to PA participation include

unstructured activities and those of a casual nature with no defined rules that are enjoyable and fun (Downs *et al.,* 2013). Recess in the school setting provides children with the time, space and opportunity to participate in these types of unstructured physical activities on a daily basis.

Physical activity measurement

It is important that accurate measures are used when assessing levels of PA or determining effectiveness of PA intervention programmes (Sirard & Pate, 2001). Self-report methods are frequently used due to their practicality, low cost and low participant burden (Dishman *et al*., 2001), however these are not often well validated (Biddle *et al*., 2011). In studies documenting the PA levels of adults with ID, self-report methodologies have been used (Barnes *et al.*, 2013), however this method would be more challenging for child participants due to problems with conceptual skills such as understanding language, reading and writing (Weis & Denison, 2013). Key elements of any measurement is that they are reliable, PA should be classified in the same way on repeat administration, and valid, assessing what the measure intended to (Bauman *et al*., 2006). Accelerometers are deemed to be valid and reliable for use with children (Ekelund *et al*., 2001). Recommendations for their use to accurately measure sedentary behaviour have also been made (Loprinzi & Cardinal 2011).

Overall, methodologies in ID studies are not consistent and small number of studies have utilised objective monitoring techniques (Hinckson & Curtis, 2013). The number of research studies involving groups of children and young people with ID using objective accelerometer devices has however begun to increase (Foley & McCubbin 2009; Phillips & Holland, 2011; Esposito *et al.,* 2012; Boddy *et al*., 2015a). Shortcoming have been identified in accelerometer use for children and adolescents with ID (McGarty *et al*., 2014), particularly as validity and reliability studies for quantifying PA specifically in children with ID are scarce (Hinckson & Curtis, 2013). In TD children, accelerometers have been found to be valid (r = 0.27 to 0.89) and reliable (ICC = 0.49 to 0.98) for measuring PA (De Vries *et al.*, 2009), however such research and figures do not exist in children with ID. Despite this it appears that objective measures are most credible in order to capture PA in

children with ID and establish the patterns of PA across segments of time (Hinckson & Curtis, 2013).

To fully understand PA behaviour the context in which it occurs must be considered (McKenzie & van der Mars, 2015). One measurement of PA which exceeds all other measures in identifying the physical and social contexts of participation also giving an understanding on the type of activities occurring, is systematic observations (McKenzie & van der Mars, 2015). With appropriate training, observers can record data that is both reliable and valid (McKenzie & van der Mars, 2015). This methodology is however limited in that habitual PA cannot be measured and it is only useful is specific periods related to a child's participation in PA. For example, the System for Observing Fitness Instruction Time (SOFIT) allows for systematic observations of P.E lessons (McKenzie *et al.*, 1991). The System for Observing Children's Activity and Relationships During Play (SOCARP) allows for PA during recess periods of a school day to be observed and has been deemed both valid and reliable (Ridgers *et al.*, 2010). However, research using SOCARP with ID populations has indicated that it does not provide sufficient details related to the type of activities which such participants engage within (Boddy *et al.*, 2015a). Furthermore, it can be difficult in practice to observe the playground behaviours of ID participants as normal recess is often not followed. Many children within the SEN setting follow individualised timetables with specific activities throughout the day which is most stimulating to them, lunch recess may not always occur on the playground.

Physical activity during recess

Investigations in TD children have indicated that PA during school recess can contribute towards up to 40% of a child's recommended daily PA (Ridgers *et al*., 2006a). Research focussing on recess PA in children and young people with ID is relatively scarce. Of the research that has been completed findings show that children with mild ID are more active during recess than during PE for example (Faison-Hodge & Porretta, 2004). Research also indicates that the activity levels of children with ID during recess can and should be improved as children in ID schools are more sedentary in comparison to those in schools for different special needs

(Sit *et al*., 2007). A systematic observation of the playground environment in SEN schools revealed children with ID rarely engage in large group play (Boddy *et al*., 2015a), which within the mainstream literature is associated with MVPA (Ridgers *et al*., 2012). However, the same observational study revealed time spent alone was negatively correlated with sedentary time and positively correlated with light PA and moderate PA (Boddy *et al*., 2015a). This therefore would suggest that the PA behaviours during recess for children with ID are specific to their condition, such as their preference for playing alone (Boddy *et al*., 2015a), and are different to those observed in mainstream recess (Ridgers *et al*., 2012). On the whole, ID literature provides more of a focus surrounding the play behaviours shown by children during recess including how to improve their social interactions for example, rather than their PA levels per se during this period (Boddy *et* al., 2015a; Harper *et* al., 2008; Machalicek *et al*., 2009). It is an area requiring more research and interventions to target these important periods of the school day in order to promote health enhancing PA within this population, particularly as it is believed the specific freedom of movement allowed during this period can have additional benefits for children with ID such as improved social interactions, cognition, motor skills, language and reduced stereotypic behaviours (Lang *et al*., 2011).

Physical activity and academic attainment/classroom behaviour

Other benefits of PA which have been identified include positive influences on academic attainment and classroom behaviour (Fedewa & Ahn, 2011). This may be particularly important due to the significance of classroom behaviour in the SEN school setting where challenging behaviour is common (Parmenter *et al*., 1998). Challenging behaviours are frequently associated with the presence of ID and interventions to reduce the development and maintenance of these are deemed to be important (Lloyd & Kennedy, 2014), particularly as research indicates that the prevalence of aggression for example, increases from childhood and teenage years into adulthood (Davies & Oliver, 2013). Other examples of ID associated behaviours which may prove to be disruptive during classroom based learning include limited social awareness and hyperactivity, or uncooperativeness as well as self-injury which results from interest in sensory stimulation (Murphy *et al*., 2005).

School based research has suggested that low PA levels can have detrimental effects on brain structure and function, with these effects being related to cognitive performance and academic achievement (Chaddock *et al*., 2011). Academic achievement or attainment refers to performance at each key stage and although there is no generally used definition of low attainment, a Department for Education and Skills (DfES, 2005) statistical bulletin defined low attainment as the bottom quartile (25%) of pupils in terms of average points at each key stage. Cross-sectional and longitudinal associations between objectively measured PA, in particular MVPA, and academic attainment in adolescents has revealed that the percentage of time spent in MVPA was positively associated with performance in English and Maths (Booth *et al*., 2014).

Research has also compared traditional inactive lessons to physically active lessons to assess influence on classroom behaviour. Students' time on task has been found to decrease significantly after a traditional lesson whereas a physically active lesson prevented this reduction whilst also providing a small increase in on-task behaviour (Grieco *et al*., 2009). Likewise, short classroom-based "energizers" allowing students to stand, move and have the opportunity to increase daily PA levels showed improvements in on-task behaviour from pre to post-energizers (Maher *et al*., 2006). Furthermore, a comprehensive synthesis of the literature found a significant and positive effect of PA on children's achievement and cognitive outcomes and greater improvements were observed for children with learning disabilities (Fedewa & Ahn, 2011). It was therefore concluded that time allocated for PA in the school day should not be viewed as impeding, but enhancing for children's academic achievement (Fedewa & Ahn, 2011).

The effect of recess and its impact on classroom behaviour has also been investigated within the mainstream literature. A study compared the classroom behaviour of participants on recess and non-recess school days. The effect of recess was highly significant and observations showed children worked more, and were less fidgety when they had recess (Jarrett *et al*., 1998). Another study utilised teacher ratings of behaviour with a scale of 1 to 5 (1 being very frequent misbehaving, 5 being behaving exceptionally well) in order to compare the group

classroom behaviour of children receiving daily recess with that of children not receiving daily recess (Barros *et al*., 2009). Better classroom behaviour scores were associated with having recess in the school day of at least 15 minutes or more among 8 to 9-year-old children (Barros *et al*., 2009), suggesting recess is positively associated with classroom behaviour.

The influence of PA on the behaviour of children with ID is perhaps a more complex subject area, and as with most areas of ID specific PA research, this topic has not been comprehensively investigated. For example, a systematic review of interventions using exercise, PA or P.E, in order to reduce stereotypic behaviour of children with ASD which may be detrimental towards their academic learning identified only seven relevant articles (Petrus *et al*., 2008). Research from this review suggested a short-term effect on reductions of stereotypic behaviours (Petrus *et al*., 2008). Other existing evidence has often focussed on a specific type of ID in isolation, for example ADHD. One investigation assessed the effect of a moderate intensity 20 minute bout of treadmill based exercise on aspects of cognition in preadolescent children with ADHD (Pontifex *et al*., 2012). Overall enhancements in inhibitory control and allocation of attentional resources were exhibited following the moderate intensity aerobic exercise, suggesting that this could be used as a tool in the non-pharmaceutical treatment of the behaviour of children with ADHD (Pontifex *et al*., 2012). Furthermore challenging behaviour has been shown to decrease following an exercise programme throughout the school day in children with developmental disabilities, this included exercises such as arm and leg stretches, periods of jogging or fast walking as well as hula hoop and trampoline jumps (Cannella-Malone *et al*., 2011). Studies involving children with ASD have described improvements in academic responses in young children aged 3-6 years following 15 minutes of running/jogging (Oriel *et al*., 2011) and increases in observed academic engagement also following participation in jogging, with more consistent levels of running or walking subsequently increasing classroom involvement (Nicholson *et al.*, 2010). These studies defined engagement and involvement as giving correct academic responses to a directive given by the teacher and showing seated on-task behaviour (Oriel *et al*., 2011). Whereas reading

and looking at the teacher was seen as passive engagement and writing, answering questions or raising one's hand was active engagement (Nicholson *et al*., 2011). Despite this evidence, there are methodological limitations within these and other research examples such as their small sample sizes (Cannella-Malone *et al*., 2011 - 3 participants; Nicholson *et al*., 2010 – 4 participants). Often research procedures also lack ecological validity due to unrealistic activity protocols of running or jogging for 15 minutes continuously for example, and as explored in previous research this structured nature of PA may be detrimental towards children's motivations to participate. ID children's usual activity has been characterised by short, sporadic bouts of high intensity activity interspersed with periods of light activity (Downs *et al*., 2015).

An alternative and important perspective related to children with ID's PA is that of the teachers within SEN schools. A recent PA intervention study for children with ID implemented across two SEN schools involved teacher interviews (Boddy *et al*., 2015b). These teachers had implemented an educational intervention and interviews aimed to explore their thoughts and feelings towards PA within their school day. Teachers perceived children to be calmer, more concentrated, and ready or prepared to learn as a result of participation in PA (Boddy *et al*., 2015b). Teachers from another PA intervention for children with ID made similar comments in regards to their students who appeared to be more focused on class work following the implemented PA sessions; this was supported by the study's assessment of academic work and progress in language arts and mathematics which saw improvements following PA dictated by dance and 'TaeBo' DVD's (Everhart *et al*., 2012). Interviews with teachers and other members of staff involved in the classroom environment could prove to be an important area of research for children with ID. The difficulties facing researchers who wish to quantify changes in children with such individualised behaviour patterns following implemented interventions for example, means that utilising the knowledge and experience of people who know and work with these children everyday could be key. In-depth interviews can provide rich and comprehensive information about the

experiences of individual which may not be possible via quantitative methods (DiCicco-Bloom & Crabtree, 2006).

Segmented day and week physical activity

Taking into consideration the barriers to participation which may be more apparent in the lives of children and young people with ID, it is important to understand their PA behaviours and patterns throughout the full week (weekday and weekends). Thus providing an understanding of the influence these barriers have on activity levels and when they are most apparent. Research has indicated that the PA behaviours of TD children are influenced by the environment in which activity takes place, with observed decreases in most children's PA during weekends for example (Fairclough *et al*., 2015). However research is not consistent, with indications that participation in higher intensity activity i.e. VPA, is not different from weekday to weekends (Steele *et al*., 2010). Instead, this study of 9-10 year olds found the difference between weekdays compared to weekends was that less time was spent sedentary (Steele *et al*., 2010).

Research looking at more discrete segments of the weekday rather than the whole week has further reinforced the significance of schools as a key environment for MVPA participation (Fairclough *et al*., 2008). Fairclough *et al*. (2008) found that the majority of daily MVPA was accrued during school-related time in primary school aged TD children, with engagement contributing to over 56% of total daily MVPA. An important source for MVPA engagement in a segmented day study of 11 year old boys and girls included the school transport period of the day (Bailey *et al*., 2012). This however presents an apparent difference between the structure of the school day for children with ID and their TD peers. The majority of children attending SEN schools are transported to and from school via buses, there is even greater reasoning for PA promotion in SEN schools to compensate for this source of MVPA which does not occur. Studies which have attempted to compare students with ASD for example, with their TD peers has indicated significantly lower levels of PA participation during the school day amongst those with ASD (Pan *et al*., 2015).

Summary

The small amount of ID specific qualitative data available, alongside the limited quantitative data surrounding PA and classroom behaviour would appear to support the positive impact of PA on behaviour seen in mainstream literature. In a population which exhibits higher health inequalities compared to their TD peers (Phillips & Holland, 2011), alongside challenging behaviours which can negatively influence the quantity and quality of academic learning, the use of PA as a tool to positively impact both important aspects of their lives should be further investigated. Research into the links between objectively assessed PA recess behaviours with academic outcomes such a classroom behaviour and attention in the special school settings would provide both original and impactful results. Knowledge of the PA levels of children with ID both habitually and specifically during the lunch time recess would be improved, whilst this period in the school day also presents itself as the clearest opportunity to assess behaviour before and after the opportunity to be active.

Aims and Objectives

The aims of this study were to: 1. Investigate objectively assessed PA both habitually and specifically during the lunch recess period of the school day. 2. Assess classroom behaviour in lesson periods before and after lunch recess and 3. Discover any associations between activity and classroom behaviours.

Objectives

1. To objectively assess habitual and segmented PA levels using accelerometers.
2. Gain an insight into the classroom behaviours of children with ID in lesson periods before and after lunch recess.
3. Examine any associations between PA and classroom behaviour.

Methodology

Participants

Ethical approval was granted from Liverpool John Moores University Research Ethics Committee (reference number; 14/SPS/045). School gatekeeper consent was gained from two special educational needs (SEN) primary schools both based in the city of Liverpool, North-West region of England, UK. Each school received 50 information packs and consent forms to send home to potential participants. Informed parental consent and participant assent was provided for 25 participants (25% response rate). Four participants were not however included in the study as their consent forms were returned so late on in the school year that arrangements for data collection could not be made. Therefore the study included 21 5- to 11-year-old children (mean age 7.05 years, *N* = 16 boys, 5 girls). Schools provided details in relation to the children's main intellectual disability. The Local Authority provided the school with a statement of each child's disability. All participants had severe learning difficulties and 10 participants had further diagnosis of Autistic Spectrum Disorder (ASD) (*N* = 10 boys). Data collection of PA levels and classroom behaviour for this study took place from March to July 2015.

Measures

Anthropometric data collection sessions were conducted on school sites by trained research personnel using standard techniques (Lohman *et al*., 1988). Measurements included stature and sitting stature to the nearest 0.1 cm using a portable stadiometer (Leicester Height Measure, Seca, Birmingham, UK) and body mass to the nearest 0.1 kg using calibrated scales (Seca, Birmingham, UK). Body mass index (BMI) was calculated as body weight in kilograms divided by height in meters squared.

Physical Activity Monitoring

Objective assessments of PA were conducted using uniaxial accelerometers (ActiGraph GT1M, MTI Health Services, Pensacola, FL). ActiGraph accelerometers are deemed to be valid and reliable for use with children (Ekelund *et al*., 2001). Also, previous research studies involving groups of children and young people with ID

have used these devices (Foley & McCubbin 2009; Phillips & Holland, 2011; Esposito *et al.,* 2012; Boddy *et al*., 2015a). Accelerometers are small sealed units that are often worn on an elastic belt at various locations on the body, most commonly the right hip. They are devices which use piezoelectric transducers and microprocessors that convert recorded accelerations from body movement into quantifiable digital signals referred to as 'counts' (Sirard & Pate, 2001). These dimensionless activity counts produced in specified time intervals termed epochs typically ranging from 1 second through to 60 seconds can be determined as engagement in sedentary, light, moderate, or vigorous activity with the use of established thresholds known as cut points (Pulsford *et al*., 2011).

Participants were shown how to wear the monitor and when to remove it and put it back on, as were teachers and other members of staff as children regularly participate in swimming lessons during school time. Similar information was also sent home to parents. The instructions were for the monitor to be worn on the right hip for seven consecutive days during waking hours, removed for engagement in water based activities (e.g. swimming, bathing) and when going to bed. Research has indicated that among children and adolescents the number of monitoring days required to reliably estimate habitual PA ranges from 4 to 9, therefore a 7-day monitoring protocol was used (Trost *et al*., 2005). Participant compliance in wearing the monitor is a critical factor for obtaining accurate PA measurement. In this study parents/guardians were made aware of a £10 Amazon voucher incentive that children would receive from the university after the accelerometer had been worn and returned after seven days to encourage wear and increase the likelihood of monitors being returned.

The monitors were set to record using 1-second epochs of data collection, in order to capture the sporadic nature of children's PA (Baquet *et al.,* 2007; Downs *et al*., 2015). Data were downloaded using ActiLife Data Analysis Software Version 6, and initially checked for compliance to monitoring protocol. Bouts of 20 minutes or more of consecutive zero counts (1-minute spike tolerance) were used to define periods when the monitor had been removed (non-wear time), and were subtracted from daily wear time (Catellier *et al.*, 2005). A valid day was defined as 9

hours or more of monitor wear time on a week day and 8 hours or more on a weekend day (Wells *et al.*, 2013). Participants required any three valid days to be included within analysis, research has indicated that this gives good reliability (*R* = .7) (Mattocks *et al.*, 2008). This wear time criteria has also been used in previous ID research examining PA patterns between week and weekend days (Downs *et al*., 2015). PA data was classified into sedentary time, light PA (LPA), moderate PA (MPA), and vigorous PA (VPA) using empirical cut points (Evenson *et al*., 2008). In an evaluation study of the accuracy of different sets of cut points using energy expenditure as a criterion, it was recommended that the cut points of Evenson *et al*. (2008) are used to estimate intensities of activity in children and adolescents (Trost *et al*., 2011). Moderate to vigorous PA (MVPA) was calculated as the sum of MPA and VPA. Participants were classified as meeting or not meeting PA guidelines on the basis of accruing a mean of 60 minutes or more MVPA per day.

Using the ActiLife data scoring function, analysis of segmented periods of the day and week allowed for patterns of activity to be identified. The whole week was separated into whole weekday and weekend days (00:00 – 23:59p.m.). Weekdays were then further separated into school time weekday (9.30a.m. – 3.15p.m.) and out of school weekday (before 7.00-9.30a.m. and after school 3.15-9.00p.m. combined). Weekday activity was then further analysed in five segments: before school (7.00-9.30a.m.), morning lesson period (9.30a.m.-12.00p.m.), school lunch (12.00-1.30p.m.), afternoon lesson period (1.30-3.15p.m.), and after school (3.15-9.00p.m.). Both schools had the same lunch periods as well as starting and ending their school days at same time. Children would arrive into school at various times each day, from 9.00/9.15a.m. onwards, therefore lesson start time (9.30a.m.) was chosen as the most appropriate time to filter for the start of school day activity.

Recess Activity Monitoring

On days that behaviour ratings were planned, accelerometers were handed out to the participants being observed at 9.30a.m. This was completed separately to the habitual PA monitoring therefore monitors had previously been worn for 7 days and returned by participants. This separate and additional day of monitoring was to ensure that devices would be worn during lunch recess on the day of classroom

observations. Researchers were based on the school site from the beginning of the lesson pre- recess until the end of the lesson post- recess when the monitors were then collected from participants. The specific time periods spent on the playground were noted by the researchers allowing individual recess time to be identified.

Pilot Study

Individual classroom behaviour was assessed pre- and post- lunch recess period in 'normal' class time. Participants with individualised timetables in which it was not possible for there to be a direct comparison between lesson content, and therefore behaviour, pre- to post- recess were not included. Behaviour was assessed using teacher ratings. Initially, a classroom observation tool was created for researchers to conduct systematic observations of behaviour. The tool created was based on the work of Ridgers *et al*. (2010) in which the System for Observing Children's Activity and Relationships during Play (SOCARP) has been designed for the simultaneous observation and recording of children's PA levels, social group sizes, activity type, and social interactions during play. The same time sampling techniques during which a 10-second observation interval is followed by a 10-second recording interval for each child was also planned for the classroom observations in which recorded behaviours were adapted to suit the classroom including: on or off task behaviour; positive or negative approach to learning; positive or negative social interactions with other children, adults or a group; interactions required to get back on to task including verbal, persuasive or none. Teacher's also provided information regarding the characteristics which would indicate on and off task behaviour for each individual child. Whilst TD children may be characterised as on task by actively or passively attending to instruction or assigned work (Amato-Zech *et al*., 2006), this often isn't as simple in children with ID. Therefore, the information provided by teachers was to aid researchers in the appropriate and accurate scoring of behaviour. Where consent was gained from parents/carers to video record a participant during lesson time, one researcher would record 10 minutes of classroom behaviour per child for a maximum of 2 children per class, per day. If consent was not provided to video record classroom behaviour this was scored live by one researcher with the same procedures. Due to

the flexibility of the teaching techniques used in the SEN setting, including children learning via free play and often not having a specific task assigned to them which requires their attention and focus throughout a lesson period, the tool was deemed inappropriate for use after piloting the method. Problems arose with the difficulty of researchers establishing what the learning task was that children were involved in and therefore whether their behaviours towards this were either positive or negative.

Individual Classroom Behaviour

Individual classroom behaviour was assessed pre- and post- lunch recess period in 'normal' class time. Participants with individualised timetables in which it was not possible for there to be a direct comparison between lesson content, and therefore behaviour, pre- to post- recess were not included. Behaviour was assessed using the alternative method to observation of teacher ratings. This method was chosen as assessments and evaluations of behaviour is something teachers regularly complete using similar techniques, particularly in the SEN setting. Teachers were asked to rate 5 target behaviours using a 0-10 scale of 0 being never and 10 being always. This was adapted from the established tool named 'Direct Behaviour Rating (DBR)' (Chafouleas *et al*., 2009). The description of the use of the DBR scale directly compared to the methodology of this study and was therefore deemed appropriate for use: "The rating occurs in close proximity to the pre-specified observation period, is completed by an individual who has first-hand experience with the student who has demonstrated the behaviour, and requires minimal inference to discern the target of measurement." (Chafouleas *et al*., 2009, p. 196). The DBR can be used as a daily rating of engaged behaviour for students, with resulting data displaying change in behaviour in response to supports designed to decrease problematic behaviour and/or increase prosocial behaviour (Chafouleas *et al.*, 2009). This example of its use relates directly to this study in which any potential rating of behaviour change from before to after lunch could be displayed in response to recess activity.

The DBR tool has been widely used in behavioural research studies (Chafouleas *et al*., 2012; Kilgus *et al*., 2012). Furthermore, in a study examining the agreement of

the DBR tool and systematic direct observation data for on-task and disruptive behaviour, results suggested that DBRs completed by classroom teachers were significantly correlated with observation data complete by trained observers (Riley-Tillman *et al*., 2008).

DBR forms available include a "Single Item Scale" with a focus upon one target behaviour, or a 3 standard behaviour form of academic engagement, respect and disruption. "Fill-in Behaviour" forms are also available in which the target behaviours can be determined by the user, which was the method utilised in this study. Information regarding lesson start and end time and its content were followed by the 5 questions, these were: 1, followed instruction; 2, showed disruptive behaviour; 3, was respectful towards other class mates; 4, was respectful towards members of staff; 5, stayed on task without distraction. These questions were based on classroom observations conducted prior to construction as well as previous qualitative research with SEN specific teacher interviews (Boddy *et al*., 2015b). In both instances it appeared that it was important to teachers that students were able to remain on task without distraction, which was also linked to their ability to follow instructions, both of which were also reliant upon non-disruptive behaviour. Furthermore, negative interactions with class mates and staff also appeared to have adverse effects on classroom cohesion.

For four of the five behaviour questions a rating of 10 given by the teacher represented the most positive available score in which the student always displayed this behaviour, for example a rating of 10 for question 1 would mean the teacher believed the student always followed instruction during the lesson period which had just ended. For the one question in which the rating given was the opposite and 10 represented the most negative score, participant scores were reversed so that a higher score reflected better behavioural ratings.

Teachers were familiarised with the tool prior to the assessments. To achieve this, teacher's received example sheets and some information on when they would be asked to complete the behaviour ratings. Teachers were provided with the lead

researcher's email address to contact should they have wanted to ask questions or ask for clarification about the tool or research project.

On the day of assessment only 2 children maximum per class were assessed to ensure the amount of time required for teachers to complete forms was minimal. Liaising with members of staff, the behaviour rating data collection was arranged based on the specific timetables for each class who had participating students with written consent from parents/carers to participate. This ensured that the lessons pre- and post- lunch recess on the day of assessment were as similar as possible, were both classroom based learning and were also completed on a day which suited the class teacher. For classes who had more than 2 participating students, multiple days of assessment were arranged to accommodate this. On the morning of assessments, teachers were reminded of the children they would be rating behaviour for.

SEN classes are typically smaller than mainstream classes, with 12-15 children in each with a further 2 to 3 teaching assistants in addition to the class teacher. A lot of the supervision provided by these members of staff can regularly be on a one to one basis due to the needs of the children. It is likely that on occasions participating children received one to one supervision from teaching assistants during the classroom periods of interest for this study. Despite this one to one supervision and potentially asking support staff who had the most interaction with the participating child to complete the rating form, class teachers were kept as the consistent members of staff to complete the behaviour ratings. Class teachers have an overall lead on lesson time and should therefore have a better concept of how individual students behaved regardless of any one to one supervision given by other members of staff.

Data Analysis

Multiple analyses of covariance (ANCOVA) examined the differences in behaviour pre- and post- recess controlling for recess length, as well as differences in behaviour of those who did and did not achieve activity guidelines controlling for wear time. Associations between activity in the different segments of the day/week,

between activity during recess and habitually, as well as between behaviour and PA during different day/week segments were examined using partial correlation and regression. Multiple analyses of variance (ANOVA) were conducted to examine differences in PA across segments of the week/day, accelerometer wear time was accounted for through the use of percentage time spent in each PA intensity. Tests for normality were completed to establish that the data were normally distributed. When conducting parametric tests there is an assumption of normaility and if the assumption of normality is violated, interpretation and inference may not be reliable or valid (Razali *et al*., 2011). However, when running such tests for normality with small sample sizes it can result in low power (Razali *et al*., 2011). As a result of this, non-parametric tests which do not rely on the restrictive assumptions of parametric tests such as, that distribution is normal are appropriate when difficulties are faced when establishing the distribution of a small sample size (Field, 2013). Ultimately, the choice to conduct parametric tests within this study, despite the problems outlined associated with small sample sizes, was due to the need to assess and control for covariates which influence PA behaviour, which is possible with the use of parametric tests. The Statistical Package for the Social Science V22 (SPSS Inc, Chicago, IL, USA) was used to carry out these analyses and an alpha value of $p < 0.05$ was used to represent statistical significance.

Results

Complete anthropometric data was available for 16 participants (Table 1). Five participants did not complete anthropometric measures due to being absent from school on three attempted collection occasions.

Table 1. Descriptive anthropometric and whole week PA data for participants (mean ± SD).

	Girls (*N* = 4)	Boys (*N* = 12)	Whole group (*N* = 16)
Age (years)	8.2 ± 2.6	6.9 ± 1.5	7.1 ± 1.8
Height (cm)	134.6 ± 12.9	127.2 ± 12.6	129.0 ± 12.7
Body mass (kg)	34.5 ± 12.4	30.4 ± 10.9	31.4 ± 11.0
Body mass index (kg/m^2)	18.8 ± 5.8	18.2 ± 3.7	18.3 ± 4.1
	Girls (*N* = 2)	Boys (*N* = 9)	Whole group (*N* = 11)
Accelerometer wear time (min/day)	607.5 ± 6.0	658.9 ± 50.6	649.5 ± 49.8
MVPA (min/day)	52.5 ± 12.4	73.8 ± 16.1	69.9 ± 17.3
Sedentary (min/day)	416.4 ± 40.1	442.7 ± 50.5	437.9 ± 48.1

Physical Activity Data

Habitual physical activity

Twenty-one participants wore accelerometers to measure habitual PA, 1 accelerometer failed to collect data resulting in 20 accelerometers with data to download. Eleven participants (*N* = 9 boys and 2 girls) met the accelerometer wear time inclusion criteria resulting in a 55% compliance rate to the accelerometer protocol of any 3 valid days. Out of the 11 participants, 8 (*N* = 7 boys and 1 girl, 73% of the cohort) achieved the guidelines of ≥60 minutes of MVPA/day (Table 1).

Segmented week/day physical activity

A segmented view of the week showed both time in minutes and percentage time of participation in sedentary activities and MVPA were higher on weekend days

than on weekdays (Table 2). However, percentage time spent sedentary (%SED) on a weekday (68.3%) was not significantly different to weekend percentage time (68.9%) (p = 0.79). The percentage time spent in MVPA (%MVPA) on a weekday (10.1%) was also not significantly different to weekend %MVPA (10.2%) (p = 0.89). Analyses also showed that %SED was significantly higher before school (73.4%) than during school (65.6%) (p = 0.036), and %MVPA was significantly higher during the school day (11.6%) than before school (6.9%) (p = 0.016). Additionally, %SED after the school day (70.5%) was significantly higher than during school (65.6%) (p = 0.043), although %MVPA was not significantly different between the two time periods (p = 0.06). There were no significant differences in before and after school %SED (p = 0.346) and %MVPA (p = 0.086). Furthermore, weekday %SED and %MVPA behaviour was not significantly different to weekend activity. The only significant difference found between weekend and segmented weekday periods was significantly greater %MVPA during weekend days (10.2%) than the before school period (6.9%) (p = 0.009).

Linear regression analysis showed that time in minutes of participation in MVPA during school did not significantly predict before and after school MVPA (r = 0.39, p = 0.052). Looking at the before and after school periods in isolation showed that whilst after school minutes of participation in MVPA (r = 0.66, p = 0.026) predicted school day minutes of participation, before school minutes of participation did not (r = 0.01, p = 0.97). Whole weekday minutes of MVPA (r = 0.18, p = 0.22) and school weekday minutes of MVPA (r = 0.14, p = 0.28) were not significant predictors of weekend minutes of MVPA. An additional segmented view of the habitual weekday showed that during school hours participants accrued the largest amount of minutes in MVPA during the morning lesson period of 9.30 a.m. – 12.00 p.m. (Table 3). However, analysis of variance showed that %MVPA during this morning lesson period was not significantly different to lunch period (p = 0.535) or afternoon period (p = 0.086).

Table 2. Mean habitual mean and PA time for weekdays, school, non-school periods and weekends.

	Sedentary time (mins)	% of period spent sedentary	Total PA (mins)	MVPA (mins)	% of period spent in MVPA
Whole weekday	355.2	68.3%	166.6	52.9	10.1%
School time weekday (9.30a.m.-3.13p.m.)	172.6	65.6%	91.9	30.6	11.6%
Out of school weekday (Before & after school)	220.3	71.4%	88.3	25.9	8.4%
Weekend (*N* = 10)	361.4	68.9%	171.4	57.1	10.2%

N.B. School time weekday and non-school weekday are not equal to whole weekday values due to wear time differences.

Recess physical activity

The 17 participants with behaviour ratings also had their recess PA measured on the day of observation. One participant wore the accelerometer which failed to collect data therefore specific recess activity data was available for 16 of the participants. Mean lunch recess duration was 37.2 minutes (SD = ± 10.2, range = 30-60 minutes) on the monitored days. Research conducted by Ridgers *et al*. (2005) with TD children indicated that 40% of recess time spent in MVPA is a realistic health-promoting target for schools. In this study 1 participant (*N* = 1 boy) achieved this during lunch recess period. The mean percentage of recess spent in MVPA for the group was 17.9%, which equated to 6.4 minutes of activity. MVPA accrued during this recess period contributed on average 9.3% to habitual MVPA levels. Conversely, participants spent on average 19.9 minutes in sedentary activities, taking up more than half of the lunch recess period (51.0%).

Linear regression analyses explored the relationship between habitual PA and recess PA. These indicated that habitual levels of sedentary behaviour ($r = 0.05$, $p =$

0.54) did not significantly predict recess sedentary behaviour. All habitual intensities of PA also did not significantly predict PA levels during recess (LPA r = 0.13, p = 0.30; MPA r = 0.003, p = 0.88; VPA r = 0.02, p = 0.72; MVPA r = 0.002, p = 0.89; total PA r = 0.02 p = 0.69). Therefore, levels of activity during recess were not significantly associated with participants' habitual PA levels.

Table 3. Mean habitual sedentary and PA times for segmented periods of the school weekday, including the mean percentage contribution of MVPA in each period to habitual MVPA.

	Sedentary time (mins)	% sedentary	Total PA (mins)	MVPA (mins)	% MVPA	% contribution to habitual MVPA
Before school (7.00-9.30am)	68.6	73.4%*****	25.2	6.5	6.9%***^**	9.7%
Morning lesson period (9.30am-12.00pm)	81.6	64.4%	45.3	15.2	12.0%	21.4%
School lunch (12.00-1.30pm)	53.5	64.8%	29.1	10.7	12.9%	14.6%
Afternoon lesson period (1.30-3.15pm)	60.9	68.3%	28.7	8.5	9.4%	12%
After school (3.15-9.00pm)	151.7	70.5%*****	63.1	19.4	9.2%*****	28.4%

*: Significantly different to school time weekday (p <0.05) ^: Significantly different to weekend (p <0.05)

Behaviour Data

Behaviour ratings were completed for 17 (N = 13 boys and 4 girls) out of the 21 participants. A repeated measures ANCOVA controlling for recess length found a significant difference between students' pre- recess average behaviour rating and

post- recess average behaviour rating ($F(1,14) = 2.61$, $p = 0.006$). For the group of participants as a whole, the pre- lunch mean behaviour rating score was 7.15 and the post- lunch score was 8.26, representing a 15.5% increase in positive behaviour from pre- to post-lunch lesson period. Mean rating scores for every component of behaviour examined improved from pre to post-recess. Looking at each question separately showed significant differences between pre- and post- ratings for four out of the five questions (Table 4). The largest percentage increase in ratings was 20.2% for question 5 in which students were rated for staying on task without distraction.

Table 4. Estimated marginal means [SE] after adjustment for the length of recess for pre- and post- recess behaviour rating scores for each question.

Question	Pre-Recess	Post-Recess	Mean Difference	*P*-value
1.) Followed Instruction	7.25 [0.62]	8.44 [0.56]	1.19	**0.036**
2.) Showed disruptive behaviour (reverse scored)	7.06 [0.68]	8.44 [0.45]	1.38	**0.016**
3.) Was respectful towards other class mates	7.38 [0.73]	8.06 [0.58]	0.69	0.088
4.) Was respectful towards members of staff	7.44 [0.67]	8.44 [0.54]	1.0	**0.037**
5.) Stayed on task without distraction	6.19 [0.68]	7.75 [0.56]	1.56	**0.004**

Physical Activity and Behaviour Associations

Habitual physical activity

Participants were grouped into an active or inactive group based on whether they accrued ≥60 minutes of MVPA/day or <60 minutes of MVPA/day as per the activity guideline recommendations. There was no significant difference in pre- recess or

post- recess average behaviour ratings between the groups (pre- recess, *p* 0.61, post- recess *p* = 0.41).

Segmented week/day physical activity

There were no associations between the activity levels in segmented periods of the week (whole weekday, school weekday, non-school weekday, weekends) and behaviour pre- and post-recess. Conversely, analysis of the PA levels during the morning period of 9.30am – 12.00pm on the day of behaviour rating showed sedentary levels during this period were positively associated with post- recess behaviour ratings (r = 0.67, *p* = 0.005). Therefore, increased sedentary behaviour during the morning was associated with better behaviour post- recess. MPA during the morning period was negatively associated with post- recess behaviour ratings (*r* = 0.55, *p* = 0.028) suggesting that higher MPA was associated with poorer behaviour ratings post-recess. Other intensities of PA during the morning were not associated with post- recess behaviour (light *r* = 0.30, *p* = 0.254; vigorous *r* = 0.17, *p* = 0.525; MVPA *r* = 0.34, *p* = 0.195). Looking specifically at the ratings for disruptive behaviour post-recess, sedentary levels (r = 0.51, p = 0.042) were positively associated with better ratings for disruptive behaviour. Conversely, levels of MPA (*r* = -0.77, *p* = <0.005), and levels of MVPA (*r* = -0.56, *p* = 0.023) were negatively associated with post- recess disruptive behaviour. Other intensities of PA were not associated with post- recess disruptive behaviour (light *r* = 0.09, *p* = 0.748; vigorous *r* = 0.12, *p* = 0.659).

Recess physical activity

Associations between recess PA and behaviour were established through partial correlation analysis. The total amount of time spent in PA during recess was negatively correlated with the behaviour rating scores for question 2 regarding disruptive behaviour (*r* = -0.56, *p* = 0.032), time spent in MVPA during recess was also negatively correlated with the ratings for this question (*r* = -0.52, *p* = 0.048). Ratings given for this question were negatively scored so that a higher score represented better behaviour, consistent with the other 4 questions of the rating form. This negative correlation would therefore appear to suggest that higher levels

of activity during recess were associated with more disruptive behaviour in the subsequent classroom period.

Additional regression analysis also aimed to establish relationships between classroom behaviour and recess PA levels. Similar to the habitual and segmental analysis, total PA *(r* = 0.53, *p* = 0.037), and MPA (*r* = 0.58, *p* = 0.019) during recess were both negatively associated with post-recess disruptive behaviour score. Other intensities of PA during recess were not associated with post- recess behaviour (light *r* = 0.42, *p* = 0.104; vigorous *r* = 0.36, *p* = 0.17; MVPA *r* = 0.47, *p* = 0.064).

Discussion

The aims of this study were to: 1. Investigate objectively assessed PA both habitually and specifically during the lunch recess period of the school day. 2. Assess classroom behaviour in lesson periods before and after lunch recess and 3. Discover any associations between activity and classroom behaviours. Due to difficulties in participant recruitment and compliance to monitoring protocols, this study and its results are limited by the small sample size. The impact on the results gained will be discussed and acknowledged throughout.

Habitual physical activity data

The results of this study suggest that a large proportion of children (73%, 8 out 11 participants who met wear time criteria) involved were sufficiently active to benefit their health. The 73% of children involved in this study participating in ≥60 minutes/day of MVPA represents a higher proportion than that previously reported in mainstream and ID specific studies. From the ID specific literature using similar methodologies, Boddy *et al*. (2015a) found only 23% of their 34 participants of a similar age group (5-15 years) and from the same geographical area, achieved ≥60 minutes/day of MVPA. A study with a focus on children with ASD established similar findings to that of Boddy *et al*. (2015a), with 23% of children participating (53 participants, 3-11 years) in the recommended amount of PA a day, measured through accelerometers (Bandini *et al*., 2013).

A UK-wide study of mainstream children's objectively measured PA levels found 51% of 7-year-olds to achieve guidelines (Griffiths *et al*., 2013). Although this mainstream data is a lower percentage than found in the current study, there is a difference in the sample sizes involved. The UK-wide study by Griffiths *et al.* (2013) included 6,497 participants, whereas ID specific research usually involves much small sample sizes (Boddy *et al.*, 2015a) and poor compliance to monitoring protocols are described (Hinckson & Curtis, 2013). An absence of consistent methodologies across studies, and small number of studies that have utilised objective monitoring techniques also makes comparisons between studies difficult (Frey *et al*., 2008). Lack of consensus amongst researchers as to the methods used

to collect, process, and score accelerometer data has been said to be "preventing acceptable interpretation of results and undermining the value of using objective measures" (Cain *et* al., 2013, p. 447). Overall, the absence of published research specifically in this population has led to a call for the use of consistent methodologies to further understand the PA level of children and young people with ID (Downs *et al*., 2015).

The high levels of activity reported in this study could be attributed to many different influential factors. The low sample size will have been influential and therefore sampling bias and a lack of representativeness is perhaps the most likely explanation. However other potential reasoning includes the participants being from two SEN schools which had recently participated in a PA intervention study implemented by the same university (Boddy *et al*., 2015b). Therefore, perhaps participant/parental/teacher awareness of the importance of PA increased due to this research and the university involvement with the schools and its effects altered behaviour in a positive manner. The Child and Adolescent Trial for Cardiovascular Health (CATCH) P.E. intervention (Luepker *et al*., 1996) is an example of a PA intervention which has been analysed for sustainability over time. Five years post intervention gains from CATCH included maintained MVPA during PE and increased levels of teacher training (McKenzie *et al*., 2003). However, this example is an intervention of a much larger scale implemented over a longer period of time, and as it stands this is a speculative explanation for the findings of the current study.

Other factors may have contributed to the high levels of activity reported, for example a biased sample. Parents who gave consent may have done so because they know their child enjoys or has an interest in participating in physical activities and does so on a regular basis. Resulting in a sample of the most physically active children involved in the study. This is an issue comparable to those associated with the use of questionnaires in which similar bias can occur. People who have a particular interest in topics being surveyed are often more likely to respond than those who are less interested (Groves *et al*., 2004). Also, the findings of a study which investigated the factors associated with non-participation in a PA promotion trial suggested that high-risk groups most likely to benefit from interventions are

the least likely to take part in them (Chinn *et al*., 2006). Although this was in relation to adult participation in an intervention study, parents/guardians and children alike who did not participate in the current study may have negative attitudes towards PA which Chinn *et al*. (2006) believed to be apparent in the non-volunteers of their study.

The results of this study were also influenced by compliance to the accelerometer protocol. A 55% compliance rate in this study shows an improved rate in comparison to the recent Boddy *et al*. (2015a) study, in which there was a 47% compliance rate in a similar ID population. On the other hand, 55% is a lower compliance rate in comparison to a study of children with ASD in which 66% of participants met a minimum criterion of 3 valid weekdays and 1 valid weekend day (Bandini *et al*., 2013). Additionally, a study involving participants with Down syndrome showed an even greater compliance rate of 82.6% for a longer minimum wear of 6 days (Shields *et al*., 2009). A shortcoming in not only ID specific but also within TD peer PA literature is the lack of information regarding accelerometer compliance rates. A great difficulty associated with the use of accelerometers is ensuring participants remember to put the monitor on first thing in the morning or after certain activities, thus complying with research conditions (Belton *et al*., 2013). It is unclear what compliance rate represent either 'small', 'normal', or 'large' amounts of compliance therefore it is difficult to establish within this present study. Investigations into strategies by which compliance rates can be improved, particularly amongst special populations research would prove useful particularly as the recruitment of participants can often be a more difficult process than in mainstream research.

Further, it could be argued that investigation surrounding recruitment protocols in special populations is also important as it would help to counteract the effect of low compliance rates to accelerometer wear. Despite the use of a voucher scheme within the present study, participant rates and monitor compliance was poor. Therefore, population specific methods to boost recruitment warrant investigation. Qualitative research could explore the thoughts of parents/guardians towards their child's participation in university based research aiming to discover reasoning why

they might not give consent. Qualitative methods have been deemed to be of great value to the PA field, enabling researchers to examine the way people perceive, create and interpret their world (Munroe-Chandler, 2005). Educating parents/guardians about the importance of PA could not only be influential in improving children's activity levels but could provide motivation towards giving consent for their children to participate in PA research. The work of Downs *et al*. (2013) included interviews with families including children and young people with DS and concluded that further education was required for parents, care providers and people with DS about the quantity of PA needed to benefit health.

In TD research methodological improvements have been pursued in order to increase wear time compliance. For example, a study of waist-worn accelerometers in 9-11 year old children found a 24-hour protocol produced an increase in wear time in comparison to a waking-hours only protocol (Tudor-Locke *et al*., 2015). Also, in a study of secondary school children wearing accelerometers those who received an SMS reminder messenger were significantly more likely to remember to wear their monitor than those who didn't receive a reminder (Belton *et al*, 2013). Whether such techniques in the ID specific field would be as effective is unknown. For example it would be likely that an SMS reminder messenger would be sent to a parent or carer of a child with a reliance on them to then ensure the accelerometer is worn, perhaps reducing its effectiveness.

Segmented week/day physical activity data

Segmented PA patterns from this study showed that half of the recommended 60 minutes of MVPA per day were accrued during school time. Segmented week research in TD children has also explored school time activity. Nettlefold *et al*. (2010) focused on the comparison of boys and girls during the school day. Much research of TD children examines sex differences in PA patterns. In the ID specific population the ratio of boys to girls is typically unequal, an over representation of boys is common in the research area (Hinckson & Curtis, 2013), as was the case in the current study making sex comparisons invalid. The UK Department for Education (2014) state that boys are much more likely to have SEN than girls, at primary schools boys are two and a half time more likely to have statements of SEN and in

secondary schools this rises to nearly three times more likely. Nonetheless, in Nettlefold *et al.* (2010) mean MVPA accrued for TD girls and boys (52.9 and 63.5 min respectively) during school time was higher than the ID group of participants in this study (30.6 min). A comparison study of TD adolescents and those with ASD by Pan *et al*. (2015) again found that students with ASD spent less time in MVPA compared with TD students during school time. Even though children with ID appear to participate in less MVPA during the time spent at school than their TD peers, both the ID participants from this study and that of Pan *et al*. (2015) achieved the recommended 30 minutes minimum of MVPA during school hours put forward by the American Heart Association (Pate *et al*. 2006).

More time was spent sedentary for the TD girls and boys of the Nettlefold *et al*. (2010) study (260.1 and 246.2 min respectively) in comparison to the participants of this study (172.6 min). Mean time spent in sedentary activities at school in a European study of 10- to 12-year-old children (209 min) was also higher than in comparison to the current study (van Stralen *et al*., 2014). The finding that participants in this study spent less time sedentary than TD participants of two previous studies (Nettlefold *et al*., 2010; van Stralen *et al*., 2014) is potentially an indication of the variation within classroom teaching methods. Learning in mainstream schools is typically taught through traditional methods which involve the children engaging in sedentary behaviour, such as sitting in order to cover curriculum content (Murtagh *et al*., 2013). The lower amount of sedentary behaviour of the participants in this study could be a result of the SEN classroom setting, in which students are not expected to sit still at a desk for large amounts of time. Children with ID often have poor attention skills (Dandashi *et al.*, 2015) and because of this there could be more of an acceptance from teachers to standing and moving within classroom time in comparison to mainstream classrooms. Researchers should have knowledge and awareness of the specific contexts which constitute the daily lives of children and the way in which these can influence and potentially enhance activity levels.

The largest amount of MVPA was accrued during the morning period of 9.30p.m. to 12.00p.m., although the percentage of time spent in MVPA during this period was

not significantly different to the lunch or afternoon periods. This is arguably a positive finding as it indicates that children participate in MVPA equally throughout the day and one period is not any more important than the other. However this also highlights the lack of MVPA during the longest sustained opportunity for children to engage in discretionary PA; during lunch recess. In studies of segmented days in TD children, lunchtime has been shown to be the most important daily source of PA (Tudor-Locke *et al*., 2006). Bailey *et al*. (2012) also found that recess at lunch was a key segment of the day for MPA and VPA engagement. P.E. lessons may have also contributed towards the amount of MVPA accrued during the school day in this study. Research of adapted P.E for children with ID has exhibited that participation in MVPA can be up to 43 minutes in a lesson (Pitetti *et al*., 2009). P.E. is another important opportunity of MVPA participation for all children and future research is needed to account for the contribution of P.E to overall PA within this population.

On average only 6.5 minutes of MVPA was accrued in the morning period before school started. TD peers have opportunities to be active during this period via active transport which has been shown to be significantly associated with higher MVPA levels (Aibar *et al*., 2015). In a study of 2,071 9 to 10-year-old TD children attending primary schools in the UK, most children (68.5%) either walked or cycled to school (Owen *et al*., 2012). However, the opportunities for active transport to school for ID students are greatly reduced because most children are transported to school on buses. Although the method of transport into school by participants in the current study was not discovered, it is likely that most, if not all of the participants would be transported via school buses, taxi, or car and not actively through walking or cycling. This may account for the large proportion of time (over 73%) participants in this study spent sedentary in the morning time before school. Qualitative studies with SEN teachers have highlighted concerns regarding the often lengthy transportation into school which students experience that can be “up to an hour on the bus” (Boddy *et al*., 2015b). Efforts should be made by SEN schools to ready their students for the school day following their transportation into school. One of the participating schools in the current study had implemented a “wakey

shakey" activity before lessons start in which all classes go into the school hall for different types of activities, dances, and movements to music. However, these efforts were not reflected in sedentary or MVPA data before the start of lessons. Therefore, more research is needed to focus on this concept and how influential activities in the morning could potentially be for both PA and also behaviour throughout the morning. Even though the current study focused on recess and its importance, arguably this morning period presents another important opportunity for activity.

Opportunities for children with ID to participate in MVPA after school is also limited, the lack of programmes suitable for children with additional needs to attend has been highlighted (Downs *et al*., 2013). This is in comparison to TD children who have further opportunities to actively commute home as well as attend clubs and participate in sport (Fairclough *et al*., 2012). A review that investigated which activities ID and TD children participated in outside of school found many similarities between the children (Shield *et al.*, 2014). However, the key differences in participation highlighted from this review were related to social and recreational activities, mainly PA and organised sports which ID children participated less in. This therefore enhances the argument that opportunities outside of school which infer health enhancing benefits in this population are limited. The non-significant difference between percentage times spent in MVPA before and after school supports this, showing that despite the longer period after school, children did not participate in more MVPA. In addition to this, the significantly higher levels of sedentary behaviour observed after school compared to during the school day gives an insight into the activities which may occur once children have arrived home. Research has revealed that when children attend an after school programme available to them, approximately 20 minutes of MVPA can be accumulated (Trost *et al*., 2008), slightly more than the participants in the current study participated in during the whole evening period up to 9.00p.m. (19.4 mins of MVPA). The focus after school for children with ID should be how to reduce sedentary time end encourage transition into LPA. Evidence in TD children suggests health benefits ensue when sedentary behaviour is replaced with LPA (Healy *et al*., 2008). This may

be difficult if parents or carers do not have the time to supervise participation in PA, with sedentary activities such as watching TV or playing on electronic devices requiring much less supervision (Barr & Shields, 2011; Foley & McCubbin, 2009).

Interestingly, within the present study no significant differences in weekday and weekend sedentary and PA behaviour were observed. Downs *et al.* (2015) studied a sample of 32 children with ID aged 5 to 15 years and also found few differences in PA patterns between weekday and weekend days. The authors noted that this could have been explained in part by the generally low PA levels of this population, which was not the case for the participants of the current study. Fairclough *et al*. (2015) categorised children by PA levels and found the most active group maintained their sedentary time and PA levels at weekends. A significant proportion of the PA of their high active group consisted of regular sport participation some of which may have been competitive. Previous research exploring the barriers to PA participation for children with ID has shown that their participation in structured sports is limited due to difficulties in following instructions and rules (Downs *et al*., 2013). The sample size of the current study prohibited analysis by tertiles or quartiles based on activity levels. Replicating this study with a larger sample size categorised by PA levels would be insightful to see if there are similar comparisons to the findings in TD children. Furthermore, as participation in competitive sports is an unlikely explanation for weekend MVPA in this group, qualitative research would be useful to examine the context of PA on weekends and the activities which children engage in during this period.

Sedentary behaviour also did not differ significantly from weekday to weekends (weekday mean 355.2 mins, weekend mean 361.4 mins). The Health Survey for England (2012) found that during weekdays average total sedentary time (excluding time at school) was 198 mins for TD boys and 192 mins for TD girls aged 2-15, this is similar to the amount in this study (172.6 mins). However, the survey found that weekend day sedentary time was 252 mins and 240 mins for boys and girls respectively, more than 100 mins less than the ID participants of this study. Although this survey collected data through self-report methodology, therefore potentially under estimating sedentary behaviour, self-report tools are vulnerable

to influence by cultural norms and perceived social desirability (Atkin *et al*., 2012). A comparative study of the sedentary behaviours between children with ASD and TD children, found those with ASD spent 60 mins more in sedentary behaviours on weekdays compared to TD children (312 mins vs 252 mins) (Must *et al*., 2014). The results of this study indicate that participants are sufficiently active, and sedentary behaviour in school was lower in comparison to studies of mainstream school environments (Nettlefold *et al.,* 2010; van Stralen *et al*., 2014). However sedentary behaviour was high outside of school and perhaps this behaviour and environment warrants further investigation, particularly due to evidence which suggests that decreasing any type of sedentary time is associated with lower health risk in youth aged 5-17 years (Tremblay *et al*., 2011).

Recess physical activity data

Time spent in MVPA during lunch recess for the participants in this study was a mean of 6.4 minutes. Similar results have been found in TD children, in a study of 294 primary school children an average of 6.8 minutes of recess was spent in MVPA (Kobel *et al*., 2015). Conversely, much higher average engagement in MVPA during recess has been found in other similar TD children studies. Sleap and Warburton (1996) found children engaged in an average of 18.9 minutes during lunch break. Whilst a review of 13 studies which explored the PA levels of children aged 4-12 years in school found an average engagement of 35.7 minutes during all play time (Ridgers *et al*., 2006a). Based on this research in TD children and young people, achieving 40% MVPA during school recess is a guideline deemed to be a realistic target (Ridgers *et al*., 2005). Only one participant in this study achieved this recommendation. None of the participants achieved this guideline in a study looking at the PA levels of adolescents with ID during recess (Pan *et al*., 2015). As recess is a period that has been viewed as crucial for PA participation and consequently physical health (Murray & Ramstetter, 2013), interventions targeting recess MVPA are worthy of investigation.

Despite the lack of MVPA accrued during lunch recess, a large proportion of the participants did achieve the recommended 60 minutes of MVPA/day. Regression analysis showed that habitual PA was not a significant predictor of recess PA. The

health-enhancing habitual levels of MVPA were not replicated throughout the recess period despite recess representing one of the clearest opportunities in the school day for children to be active in the mode of their choosing (Ramstetter *et al*., 2010). Other factors of recess such as the relationship between activity intensity and group size in ID children have been found to be different to that of TD children (Boddy *et al*., 2015a), showing that recess and its components differ in mainstream and SEN settings.

The length of recess for participants in this study should also be taken into consideration. The two participating schools had two recess periods a day, equalling to 45 minutes of recess for one school and 60 minutes of recess for the other. Although the first recess period for participants was not filtered to gain recess specific PA data (due to multiple start and finish times for this period which could vary daily for each class) the contribution of this recess period was accounted for within the school-day analysis. Ridgers *et al*. (2007) study of TD children's PA during school recess found a mean daily recess time of 81.1 minutes with a range of 31-140 minutes. A study which explored PA levels during recess in two schools for children with mild ID found the actual average length of a recess period was only 8 minutes, occurring either twice or three times day (Sit *et al*., 2008). This comparison of recess times in SEN and mainstream schools highlights a difference in the time available for recess and subsequent reduced opportunities for children with ID to participate in PA. Recess length is an important factor as research has shown that PA levels during recess can be influenced by its duration (Zask *et al*., 2011), schools therefore need to provide adequate time periods for recess during the school day. An intervention study which aimed to increase PA during recess through playground markings and physical structures found its effect increased as recess duration increased (Ridgers *et* al., 2007). Furthermore, discovering what recess length is appropriate specifically for children with ID is important in order for them to accrue enough MVPA to improve their health. Taking into consideration that classroom periods in SEN settings appear to be less sedentary based with more opportunities for PA than in a mainstream classroom, shorter recess periods in this setting may have a smaller impact upon overall school day activity levels.

Classroom Behaviour Data

The results of teacher ratings pre- to post- recess indicate that the lunch recess period impacted on the behaviour of the children as ratings for each question was significantly improved after lunch. This is consistent with findings in TD children (Barros *et al*., 2009). As well as for children with ID, one study found that levels of inappropriate behaviour were substantially higher on days when participants with ADHD did not have recess, compared with days when they did have recess (Ridgway *et al*., 2003). Although the current study did not allow for behaviour post-recess to be compared to behaviour on days without recess, because recess was built into every school day, the previous study only included 3 participants, limiting the generalisability of the findings. Interventions and techniques to improve challenging behaviour are important as it is something which can persist over time in people with ASD and ID (Murphy *et al*., 2005). Research has also shown that child behaviour problems are associated with emotional exhaustion and stress among teachers and teaching assistants who work in SEN schools (Hastings & Brown, 2002; Lecavalier *et al*., 2006).

The only behaviour rated by teachers which did not significantly improve post-recess was respect towards other class mates. This had the second highest score in pre- recess ratings which may indicate why changes were not significant. However, limitations in social skills are a key characteristic in the definition of ID (de Bildt *et al*., 2005). Although this is an important aspect of classroom cohesion and creating an environment which is suitable for children to learn, it is an area which something as simple as classroom breaks and PA may not be able to influence.

The behaviour component which improved the most post- recess was staying on task. This is consistent with previous research such as the study by Luke *et al*. (2014) on children attending special education pre-school classes who were classified as having significant developmental delay. Results indicated that PA engagement immediately prior to a teacher-directed activity was effective in increasing on-task behaviour. Therefore, as the research base continues to grow, consistency is appearing in regards to the ability of children with ID to stay on task for longer periods following PA stimulation and participation.

Physical Activity and behaviour associations

Although classroom behaviour was significantly different post- recess, mixed results from this study make relating these changes directly to participation in PA difficult. This may be because of the small sample size involved in the study. For example, only 10 participants who had behaviour rated also adhered to the wear time for habitual PA data and out of this 10, 7 achieved PA guidelines. Therefore, the non-significant difference in behaviour between children who achieved guidelines compared to those who did not was compromised by the small sample size. Furthermore, group overall consistency in generally low MVPA participation during recess meant improvements in behaviour post- recess because of engagement in MVPA was also unlikely. However, positively no association between sedentary behaviour during recess and subsequent improved classroom behaviour were found.

The inverse correlation between total PA and MVPA during recess and post-recess disruptive behaviour score, could potentially explain a delayed behavioural response to PA. Children with autism for example, often have difficulties with transitions which manifests itself in behaviour problems and/or refusing to transition to a new activity or environment (Schreibman *et al*., 2000). Therefore, an initial negative behavioural response after participation in PA and MVPA during recess may occur due to children refusing to transfer from recess activities into classroom activities. In interviews, SEN teachers have elaborated on behavioural improvements such as readiness to learn following participation in PA, "if children get that opportunity to have bursts of PA they seem more prepared for learning" (Boddy *et al*., 2015b). These could occur later on in the lesson period once any difficulties arising from the transition from the playground to the classroom have been overcome. Similar research in TD children has been conducted looking at the effect of PA on attention 0 minutes and 50 minutes post PA participation (Gallotta *et al*., 2015). Although improvements in attention variables were seen immediately after physical exertion, a long lasting effect was also seen with attentional improvements increasing 50 minutes post exertion. Classroom observations in which behaviour would be recorded in time intervals across the post- recess lesson

could establish when and if behaviour improves. For the methodology used in this study, immediate and perhaps short post- recess disruption from students may have influenced the rating given by teachers.

Participants in this study accumulated only 6.4 minutes of MVPA and 17.6 minutes of total PA on average during recess. Mean lunch recess duration was 37.2 minutes therefore achieving the recommended 40% would have been equal to 14.88 minutes of MVPA, substantially more than what was achieved by participants. Comments in psychology literature have supported children with specific cognitive or academic difficulties having regular opportunities for recess, in order to, "release pent-up energy" (Ormrod, 2000, p. 184). Similar comments were made in interviews conducted with teachers of SEN. Six participating teachers made comments regarding PA giving children the opportunity to "burn off some energy", or "let off some steam" (Boddy *et al*., 2015b). Arguably the amount of MVPA which was accrued during recess may have been too low to allow children to 'burn off' sufficient energy, therefore positive effects on behaviour in relation to their PA would be unlikely as a result.

Increased sedentary levels during the morning lesson period were associated with better post- recess behaviour ratings and disruptive behaviour in particular, and MPA during the same period was negatively associated with post- recess behaviour. Although participation in PA at any point during the school day is beneficial to achieving activity guidelines, these results could indicate that it may not always be beneficial to classroom behaviour. These results perhaps indicate that if PA is going to occur throughout the day it needs to be when deemed appropriate by teachers as activity during lessons was associated with disruptive behaviour as rated by the teacher. Research has looked at the use of classroom activity breaks in TD children finding they can improve student PA and behaviour (Carlson *et al*., 2015). These may also be suitable in the SEN setting; a dedicated period or break could give children the opportunity for PA participation in the classroom that isn't detrimental to behaviour or causes disruption.

Many other aspects of lunch recess should also be considered as potential influencing factors on post- recess behaviour. For example, the consumption of food and the type of food eaten at lunch (Storey *et al.*, 2011) could be influential in preparing children for learning. Another consideration is the lesson context post-recess, despite attempts which were made in the study to match lessons pre- and post- as closely as possible, often snack time took up some of the lesson content post- recess. In periods such as this, behaviour may be rated as better than during a more academic learning period. It could be that teachers do not even make attempts to teach large amounts of academic content in the afternoon as they believe that behaviour will have deteriorated by that period of the day.

In general, both the collection of PA and classroom behaviour data did not disrupt the children's school day and data was collected following normal routine. For children with ASD in particular, this is an important factor as they rely on structure and routine. Unexpected changes can cause children with ASD to become anxious and distressed displaying challenging behaviours - a factor of key importance within this study (Dodd, 2005). Additionally, results gained from such methodologies provide a truer representation of the influence which activities or the opportunity of activity has on behaviour. This is in comparison to studies which have implemented activity protocols and thus changed the school day routine in order for influence on behaviour to be assessed (for example, Everhart *et al*., 2012).

Limitations of the study

There are a number of limitations within this study. Primarily, as is common in the ID literature, the sample size was small (21 participants). This was furthermore reduced (11 participants) due to compliance with accelerometer protocol as well as eligibility to participate in the behaviour rating aspect of the study. Attempting to compare this sample size to other studies with a specific focus on the narrow age range of primary/elementary school aged children with ID proves difficult. Boddy *et al*. (2015a) had a larger sample size of 33 participants which did however include participating secondary/high schools as well as primary/elementary. Furthermore, an even larger final sample size of 152 participants in a study by Phillips and Holland (2011) had a wide age range of 12-70 years, with their youngest age range of 12-15

including only 7 participants. The PA of youth with ID literature was reviewed by Foley *et al*. (2008), in which the studies with a comparable age range to the current study (5- to 11 years) included: Lorenzi *et al*. (2000), 17 participants with mild ID aged 5-12 years; Horvat and Franklin (2001), 23 participants with mild ID aged 6-12 years; Whitt-Glover *et al*. (2006), 28 participants with DS aged 3-10 years. In comparison to other studies of a similar focus, establishing whether the sample size of the current study was inappropriately small is difficult.

The insight gained into the classroom behaviour of children with ID pre- and post-recess was again from a small sample size (17 participants) and additionally this information was only gained on one specific day per child. The assessment of behaviour on one single day could have been influenced by many aspects such as how well the child slept the night before (Robinson & Richdale, 2004), whether the child was feeling unwell, what day of the week it was, and many other daily specific features which influence how a child behaves in class. A more reliable insight into how and if the classroom behaviour of children differs from pre- to post- recess could have been gained by teacher behaviour ratings being completed on multiple occasions for each participant. This would be a lengthy process, and taking into consideration the change of methodology in this study, would not have been possible within the time available. Gaining behaviour ratings across different term times would provide insight into the different influential situations on children's behaviour such as the weather, which during the winter term could prevent outside recess in comparison to summer term when outside recess and the increased opportunity for PA is much more likely. Also, recess for each participant was not consistent, the varying activities included wet play and 'glee' club, therefore not 100% assessing the playground activities and its influence. This variation of recess activities and the activity clubs which children attend may however be specific to the SEN setting or even specific to either of the participating schools in this study. Despite this, research has indicated that assessing TD children's PA levels during recess on 1 day may be representative of typical recess activity (Ridgers *et al*., 2006b). The same study also stated that correcting for seasonal effects on PA during school recess may not be needed.

The small sample size of the study also impacted the statistical analysis conducted. Although parametric statistics were more appropriate in order to analyse the covariates which influence PA behaviour, the assumption of such statistics that distribution is normal cannot be assured with a small sample. When the assumption of normality is violated, interpretation and inference may not be reliable or valid (Razali *et al*., 2011). Despite the strong argument for parametric statistics in this study, the use on a small sample size is a limitation of this study.

The method by which classroom behaviour was assessed could also be viewed as a limitation within this study. There is a possibility of teacher bias in that the behaviour of a student could be rated based on the teachers view towards the child's usual behaviour rather than in the specific period of interest. Also, short periods of either negative or positive behaviour may have influenced ratings given by teachers even though this behaviour might not have been consistent throughout the lesson period. In a similar study which also used teacher ratings of classroom behaviour, Barros *et al*. (2009) suggested that teachers may feel differently about the behaviour of students after recess because they have also benefitted from the break they get during this period. However, in the special school setting using teacher views in order for behaviour to be rated is arguably a strength of the study. Systematic observations would have provided a more robust objective methodology, and the time sampling methodology would have provided more insightful results into behaviour across the school afternoon. For example, observations could indicate what behaviour was like immediately after recess at the start of the lesson in comparison to the end of the lesson. However, experience from pilot work within this study indicated difficulties for researchers in making decisions on the classroom behaviour of children who have very individualised behaviours and traits.

The sole use of quantitative methods in this study is also a limitation, as contextual information such as PA and recess behaviours which could have enhanced results was not gained. Six members of staff from one of the participating SEN schools in this study gave consent to participate in planned telephone interviews. However, a lot of participants became unavailable and making re-arrangements via text

message was difficult, resulting in only one successful telephone interview being conducted. Systematic observations of recess periods would have also provided information in regards to the type of activities children were engaging in, particularly as engagement in MVPA was low during this period.

Conclusion

A large number of the ID participants in this study aged 5-11 years old met PA guidelines and were sufficiently active to benefit their health. However, MVPA levels during the morning period before school started as well as during recess were low and sedentary behaviour significantly increased after school. These are three important target areas for this population. The association between classroom behaviour and PA results in this study posed more questions than they answered. It appears that the SEN classroom setting allows for reduced sedentary behaviour and increased PA, perhaps due to more of an acceptance from teachers for children to move about the classroom. However, activity in lessons was not associated with better behaviour and may not always be deemed appropriate by teachers. Low levels of MVPA were found during recess and efforts should be made to increase this in order to examine the influence it may have on subsequent classroom behaviour.

Recommendations for future research and implications for schools

Results from this study have implications for future research and SEN school policies.

1. SEN schools should aim increase total PA and MVPA during the morning before lessons start due to the extended amount of time which is spent sedentary during this period because of the methods of transportation to school.
2. SEN schools should also target improvements in PA and MVPA during recess. Although sedentary levels are not high throughout the school day this is still an important period when significant improvements to activity levels could occur.

3. Improvements to activity levels during recess could enhance knowledge regarding the influence which activity potentially has on behaviour in this population if subsequent classroom behaviours were analysed.
4. Research should explore ways in which sedentary behaviour outside of school can be reduced.
5. Future research should use mixed methodologies to gain a truer insight into the types of activities engaged in throughout the school day and also at home after school and on weekends.
6. Compliance rates to accelerometer protocols should be investigated and improved to continue to gain a robust representation of habitual PA in this population. TD research has indicated that an SMS message each morning can be effective (Belton *et al.*, 2013) and that the wrist placement of an accelerometer promotes superior compliance than the hip in children (Fairclough *et al*., 2015). Such techniques should be implemented and evaluated in ID specific research.
7. Engaging parents/carers, schools and teachers in PA promotion and research could improve sample sizes. In order to do so, the education of these people in regards to the importance of PA and the various health benefits it can have should be a key strategy going forward.

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Ethical Approval

Williams, Mandy

To: Taylor, Sarah

Cc: Boddy, Lynne

12 January 2015 10:40

Dear Sarah

With reference to your application for Ethical approval

14/SPS/045, Sarah Taylor, PGR, An investigation into habitual physical activity, recess play behaviour and classroom behaviour in children and young people with intellectual disabilities (Dr Lynne Boddy)

Liverpool John Moores University Research Ethics Committee (REC) has reviewed the above application and I am pleased to inform you that ethical approval has been granted and the study can now commence.

Approval is given on the understanding that:

- any adverse reactions/events which take place during the course of the project are reported to the Committee immediately;
- any unforeseen ethical issues arising during the course of the project will be reported to the Committee immediately;
- the LJMU logo is used for all documentation relating to participant recruitment and participation eg poster, information sheets, consent forms, questionnaires. The LJMU logo can be accessed at http://www.ljmu.ac.uk/corporatecommunications/60486.htm

Where any substantive amendments are proposed to the protocol or study procedures further ethical approval must be sought.

Applicants should note that where relevant appropriate gatekeeper / management permission must be obtained prior to the study commencing at the study site concerned.

For details on how to report adverse events or request ethical approval of major amendments please refer to the information provided at http://www.ljmu.ac.uk/RGSO/93205.htm

Please note that ethical approval is given for a period of five years from the date granted and therefore the expiry date for this project will be January 2020. An application for extension of approval must be submitted if the project continues after this date.

LIVERPOOL JOHN MOORES UNIVERSITY

Mandy Williams, Research Support Officer
Graduate School, Research and Innovation Services
Kingsway House, Hatton Garden, Liverpool L3 2AJ
t: 01519046467 e: a.f.williams@ljmu.ac.uk

LIVERPOOL JOHN MOORES UNIVERSITY GATEKEEPERS INFORMATION SHEET

To be read by the School's Gatekeeper

Title of Project: Investigating physical activity, play behaviours and classroom behaviours in children with additional needs.

Name of Researcher and School/Faculty: Sarah Taylor, Dr Lynne Boddy, Dr Zoe Knowles (Liverpool John Moores University; Physical Activity Exchange, School of Sport and Exercise Sciences.)

We would like to invite your school to take part in a research study investigating physical activity in children and young people with additional needs. Very little research exists that has looked at physical activity within this population of children and young people, and the small amount of evidence that does exist suggests that these children may not be active enough to benefit health. We would like to learn more about the physical activity levels within this group of children as well as their recess play behaviours to increase our understanding of any associations they might have with the children's classroom behaviour. We are looking at this as the relationship between physical activity and classroom behaviour was a recurring theme from our qualitative research conducted with teachers in 2013-2014.

This information sheet will explain exactly what we're doing in the project, and how we would like your school to be involved. Please read through this sheet carefully and I would be happy to answer any questions or queries you may have.

1. What is the purpose of the study?

The study will investigate the levels of physical activity and sedentary behaviours, assess playtime behaviours, and examine how they are related to classroom behaviours.

2. Do I have to contribute?

No. It is up to you to decide whether or not you would like your school to take part. **Even after giving consent you are still free to withdraw from the study at any time without giving a reason. Testing will stop straight-away if you want to withdraw from the study.**

3. What will happen?

We will send you some parental, participant, and teacher information sheets that we would like you to hand out/forward to potential participants and their parent/guardians through the school. All students will attend school as normal. Students will be asked to take part in some testing sessions, managed and conducted by the research team, the school won't need to conduct any of the physical activity measurements. All members of the research team will have had the appropriate DBS check completed. Firstly, height, weight, sitting height and waist circumference assessments will be taken and children will also be asked to wear monitors for seven days to measure their activity. When the monitors are returned to

the research team each child who has taken part in the activity monitoring will receive a £10 Amazon gift voucher. We would also like to conduct observations of some play time and class time. The classroom observations will focus on aspects of children's behaviour such as time on task, interactions with other students, effort and affect. The classroom observations would be conducted twice, in a session before playtime and a session afterwards to allow us to observe any changes in behaviour. We would like to tailor the observations to each child by working with the class teachers.

We are also interested in teacher's perceptions related to physical activity and classroom behaviour. Therefore, after gaining teacher's consent, focus groups or interviews, managed and conducted by the research team with an audio recording taken will aim explore topics relating to physical activity, playtime and classroom behaviour. This is voluntary and teachers do not have to take part.

4. Are there any risks?

No. We are not asking participants to do any additional activities.

5. What are the benefits to the participants?

- The participant will experience what it is like to take part within a university research project.
- The participant and their family will be part of one of the few research projects that will look specifically at children with intellectual disabilities and physical activity.
- Information and research gained from this study will direct future studies and research projects of appropriate interventions to implement, if interested, your school may be invited to participate in future studies involving interventions. The findings will help future researchers to provide new opportunities for children with additional needs in relation to physical activity and further our understanding related to physical activity and classroom behaviour.

6. What is expected of the Gatekeeper/teacher/school?

The main role of the school is being the link between the research team and the parents/children. This will involve sending out recruitment information sheets and consent/assent forms to parents and children, and passing on our details. We will provide all the paperwork and documentation for the project. As you and members of staff at the school know the children well, it may be helpful if some staff can be present when completing the measurements of the participants. Further to this, staff can help us to tailor our classroom observations to each individual child.

Confidentiality

All information about your school and students including their results and findings will be treated with the strictest confidence. No identifiable information will be released by the project, and all data is securely stored by project staff, and may be accessed by approved persons only.

If you have any questions do not hesitate to get in touch and email me at any time:

Sarah Taylor - S.Taylor3@2011.ljmu.ac.uk

Dr Lynne Boddy – L.M.Boddy@ljmu.ac.uk

The Physical Activity Exchange, Research Institute for Sport and Exercise Sciences, 62 Great Crosshall Street, Liverpool John Moores University, Liverpool, L3 2AT.

Thank you for taking the time to read this.

LIVERPOOL JOHN MOORES UNIVERSITY
GATE KEEPER CONSENT FORM

Title of Project: Investigating physical activity, play behaviours and classroom behaviours in children with additional needs.

Name of Researcher and School/Faculty: Sarah Taylor, Dr Lynne Boddy, Dr Zoe Knowles (Liverpool John Moores University; Physical Activity Exchange, School of Sport and Exercise Sciences.)

1. I confirm that I have read and understand the information provided for the study. I have had the opportunity to consider and understand the information, ask questions and have had these answered satisfactorily ☐

2. I understand that any information recorded about the school will be kept confidential. ☐

3. I give consent for you to recruit participants through our school. ☐

4. I give consent for testing sessions to take place on school site using school facilities. ☐

5. I give permission if parental consent is gained for photographs/videos to be taken of children during the research, which may be used for subsequent academic/promotional purposes associated with this project. ☐

6. I agree to members of staff being present during testing sessions. ☐

Name of School …….

Name of Gatekeeper …….

Position at School …….

Signature…….

Date …….

Name of Researcher – Sarah Taylor

Signature …….

Date …….

LIVERPOOL JOHN MOORES UNIVERSITY
PARENT/GUARDIAN/CARER INFORMATION SHEET

Title of Project: Investigating physical activity, play behaviours and classroom behaviours in children with additional needs.

Name of Researcher and School/Faculty: Sarah Taylor, Dr Lynne Boddy, Dr Zoe Knowles (Liverpool John Moores University; Physical Activity Exchange, School of Sport and Exercise Sciences.)

We would like to invite your child to take part in a research study investigating physical activity in children and young people with additional needs. Very little research exists that has looked at physical activity within this population of children and young people. We have been working with children with intellectual disabilities for a number of years, and work we completed last year suggested that physical activity may be related to classroom behaviour. In this study we would like to look into this in more detail.

This information sheet will explain exactly what we're doing in the project, and how we would like your child to be involved. Please read through this sheet carefully and I would be happy to answer any questions or queries you may have.

1. **What is the purpose of the study?**

We would like to learn more about the physical activity levels within this group of children as well as their playtime play behaviours to increase our understanding of how they are related to children's classroom behaviour. We are looking at this as the relationship between physical activity and classroom behaviour was a recurring theme from the research we conducted with teachers in 2013-2014.

2. **Does my child have to contribute?**

No. It is up to you to decide whether or not you would like your child to take part. If you decide to allow your child to take part you will be asked to sign a consent form, which will need to be returned to school.

Your child will also receive information about the project and an assent form to sign if they would like to take part, if your child is not able to sign the assent form your consent will be fine. **Even after giving consent your child is still free to withdraw from the study at any time without giving a reason. Testing will stop straight-away if your child wants to withdraw from the study. Further to this, any specific measurements your child does not want done is fine, they will not be forced into anything and they can still be involved with other measures.**

3. What will happen if my child takes part?

We will collect information from your child in a number of different ways which are outlined below.

Anthropometrics	With a member of staff present we would like to measure your child's height, sitting height, weight, waist circumference
Physical Activity Monitoring	In order for us to measure how physically active the children are, we ask that they wear an accelerometer which is a small monitor; similar to pedometers. Your child will wear the monitor on their right hip for 7 days in a row, information will be sent home explaining everything you need to know. The monitor should be worn **from the moment your child wakes up until they go to bed**. Your child should continue with everyday activities as normal. It should be noted by school staff and parents if the student engages within any water based activities within this period i.e. bathing or swimming, the monitor should NOT be worn. When children have returned their monitors to the research team they will receive a £10 Amazon gift voucher to thank them for their time. We will give this to children in a sealed envelope to take home to their parents/guardians to help the children to use them.
Playtime Observations	We will observe your child at playtime and make a note of the type of activity your child is engaged in, for example walking around, talking to friends or staff, skipping etc. Your child will be encouraged to play as normal. Video recording of your child will be taken within their usual playtime setting. You have the opportunity to give your consent for your child to be video recorded, however if you do not want your child to be videoed please **do not tick** the relevant box in the consent form you receive. If you do not want your child to be videoed then observations will be scored 'live', this will involve taking notes whilst observing your child's activity this is less reliable then using video methods. Only researchers involved with the project will see the video footage and it will be stored safely.
Teacher Behaviour Ratings	We will also ask your child's class teacher to rate their behaviour at the end of the lessons before and after playtime. They will complete a short form that rates their on task

	behaviour such as how well they followed instructions as well as if and how often they displayed disruptive behaviour. Classroom interactions with members of staff and class mates will also be rated.

- Once the study is completed I will send out a letter to you and your child to explain the study's findings. This will be a summary of the research findings, no specific information about individual children will be sent out.
- We hope to complete the set of measurements by the end of June 2015.
- All the measures above will be taken in a week/2 week period.

4. Are there any risks?

No. Some participants may feel a bit apprehensive or uncomfortable during some of the measurements (e.g. height or weight). The research team will reassure participants, answer any questions or queries and we will do our best to create a positive environment.

5. What are the benefits to the participants?

Although there are no direct benefits to your child, we hope that some positives of being part of the research would include:

- Your child experiencing what it is like to take part within a university research project.
- You and your child being part of one of the few research projects that will look specifically at children with additional needs and physical activity.
- Information and research gained from this study will direct future studies and research projects of appropriate interventions to implement; your child's school may be invited to participate in future studies involving interventions. The findings will help future researchers to provide new opportunities for children with additional needs in relation to physical activity and further our understanding related to physical activity and classroom behaviour.
- Your child being interested in learning about how physically active they are and being excited by wearing the monitor.

6. Will my taking part in the study be kept confidential?

All information about your child and their results will be treated with the strictest confidence. No identifiable information will be released by the project, and all data is securely stored by project staff, and may be accessed by approved persons only.

If you have any questions do not hesitate to get in touch:

Sarah Taylor - S.Taylor3@2011.ljmu.ac.uk

Dr Lynne Boddy – L.M.Boddy@ljmu.ac.uk

The Physical Activity Exchange, Research Institute for Sport and Exercise Sciences, 62 Great Crosshall Street, Liverpool John Moores University, Liverpool, L3 2AT.

Thank you for taking the time to read this.

Feel free to email me at any time

LIVERPOOL JOHN MOORES UNIVERSITY
PARENT/GUARDIAN/CARER CONSENT FORM

Title of Project: Investigating physical activity, play behaviours and classroom behaviours in children with additional needs.

Name of Researcher and School/Faculty: Sarah Taylor, Dr Lynne Boddy, Dr Zoe Knowles (Liverpool John Moores University; Physical Activity Exchange, School of Sport and Exercise Sciences.

1. I confirm that my child and I have read and understand the information provided for the study. I have had the opportunity to consider the information, and ask any questions which have been answered satisfactorily. ☐

2. I understand that my child's participation is voluntary and that they can or I can withdraw them from the study at any time, without giving a reason and that this will not affect my legal rights. ☐

3. I understand that any personal information and all data collected about my child during the study will be anonymised and remain confidential. ☐

4. I understand that data collected and results from measurements taken may be used in the final project report and additional research articles. ☐

5. I give consent for my child to take part within the study. ☐

6. I give consent for my child to be video recorded for a maximum of 10 minutes during playtime to allow the footage to be analysed to see how active and what type of activities my child takes part in during playtime. ☐

7. I give permission for photographs to be taken of children during the research, which may be used for subsequent academic/promotional purpose associated with this project. ☐

All video recordings will be confidential, and other than researchers working on the project no one will see the footage.

Name of Participant ……

DOB of participant ……..

Name of Parent/Guardian/Carer

……

Signature…….

Date …….

Name of Researcher – Sarah Taylor

Signature…….

Date …….

LIVERPOOL JOHN MOORES UNIVERSITY
PARTICIPANT INFORMATION

Hello, my name is Sarah. I go to university at Liverpool John Moores.

I would like to invite you to be part of my research project, I will come to your school and will be looking at how physically active you are during school time and home time.

Physical activity is when you are moving around during activities. For example ball games, running, walking, jumping, dancing, riding a bike, and PE lessons.

To do this we will:

- Measure how tall you are when sitting and standing
- Measure how much you weigh on the scales
- Measure around your waist
- Measure how physically active you are over 7 days using a little monitor
- See what you and your classmates do at playtime
- See what you and your classmates do during lessons and class time

When you bring back the little activity monitor after 7 days and hand it in we will give you a £10 gift voucher to take home and spend with your mum and dad or guardian.

If you would like to do this project then ask your mum and dad or guardian and write your name on the assent form.

If you have any questions ask your mum and dad or guardian to email us:

Sarah Taylor – S.Taylor@2011.ljmu.ac.uk

Dr Lynne Boddy – L.M.Boddy@ljmu.ac.uk

LIVERPOOL JOHN MOORES UNIVERSITY
ASSENT FORM FOR STUDENTS

(to be completed by the child and their parent/guardian)

Title of Project: Investigating physical activity, play behaviours and classroom behaviours in children who attend special schools.

Name of Researcher and School: Sarah Taylor (Liverpool John Moores University; Physical Activity Exchange, School of Sport and Exercise Sciences.)

Child (or if unable, parent/guardian on their behalf) to circle all they agree with:

1. Have you read (or had read to you) information about this project? YES NO
2. Has somebody else explained this project to you?
   YES NO
3. Do you understand what this project is about?
   YES NO
4. Have you asked all the questions you want to?
   YES NO
5. Did you understand the answers to your questions?
   YES NO
6. Do you understand it's OK to stop taking part at any time?
   YES NO
7. Are you happy to take part?
   YES NO

If you have said no to any of these questions or you don't want to take part then don't sign your name!

If you **do** want to take part, you can write your name below

Your name _____

Date _____

Your parent or guardian must write their name here if they are happy for you to do the project.

Print Name _____

Sign _____

Date _____

The researcher who explained this project to you needs to sign too.

Print Name _____

Sign _____

Date _____

Classroom Observation Tool

RATIONALE

The importance of physical activity (PA) for the overall health of children and young people has been studied in much detail (Strong *et al*., 2005). Further research surrounding the positive impact of PA on children's classroom behaviour has also increased, including subsequent improved concentration and academic performance from PA (Grieco *et al*., 2009; Booth *et al*., 2013). There is therefore a clear rationale to use the school environment as a setting for increasing the activity levels of children and youth. However, when investigating PA in children and young people from special populations, in particular those with ID, the research is scarce, and when compared with the general population individuals with ID experience significantly higher rates of morbidity, mortality, and health inequalities (Phillips & Holland, 2011). Insufficient PA (Hinckson and Curtis, 2013; Boddy *et al*., 2015) and poor cardiovascular fitness (Pitetti & Campbell, 1991) may be contributing factors for a shorter life span and higher mortality rate among these individuals. In addition to this, classroom behaviour is a variable of key importance in the special school setting where behavioural issues are common place. As a result of this, there is a need to examine factors that may influence the classroom behaviour and classroom interactions of children with ID, with this observation tool being constructed to examine the specific influence of PA and recess activity.

TOOL SUMMARY

This observation tool allows for the recording of an individual target child's on task behaviour, approach to learning and interactions during lesson time. The tool has been designed for use in special educational needs (SEN) schools to observe children with severe learning disabilities (SLD) and profound and multiple learning disabilities (PMLD) who may have an additional diagnosis (such as autistic spectrum disorder, ASD/down syndrome, DS). Therefore due to the nature of the children, the tool requires specificity to each individual child with a general description from the teacher to better understand what would characterise their on and off task behaviour to allow for appropriate scoring.

Time sampling techniques of 10-seconds OBSERVE; 10-seconds RECORD is used. The method of momentary time sampling is also used in which a behaviour is coded if it occurs exactly at a predetermined moment, therefore at the end of the 10-seconds observation (Harrop & Daniels, 1986).

CODING

On Task Behaviour for Target Child

A small description given by the child's teacher will give a better of understanding of what behaviours would classify them as on or off task.

Child Behaviour

ON The target child is on task, sitting down and engaging in the activity set by the teacher.

OFF The target child is off task and not engaging in the activity. This could include walking away from the table they should be sat at for example.

Approach to Learning

P+ The target child has a positive approach to learning and is willing to do what the teacher has asked.

N- The target child has a negative approach to learning, is uninterested and unwilling to do what is asked by the teacher. This could include disruption such as shouting from the target child.

Interactions

TC-A The target child interacts with an adult.

TC-C The target child interacts with a child.

TC-G The target child interacts with the group.

A-TC An adult interacts with the target child.

C-TC A child interacts with the target child.

G-TC The group interacts with the target child.

NONE No interaction made.

Interactions required getting the target child back on task

V The target child requires verbal persuasion from an adult to get back on task.

P The target child requires physical persuasion from an adult to get back on task. This could include the adult holding the target child's hand and guiding them back to their seat.

NONE The target child is on task and no interactions are needed.

EXAMPLE

Date: School: Observer:

Class Time: *Pre break Post break* Lesson Time Start: Lesson Time End:

Child Time Start: Child Time End:

Target Child Number *1 2 3 4 5 6 7* Target Child Gender: *M F*

On Task Behaviour for Target Child:

Interval	Behaviour		Approach to Learning		Interactions	Interactions required to get back on task
1	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
2	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
3	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
4	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
5	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
6	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
7	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
8	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
9	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE

10	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
11	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
12	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
13	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
14	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
15	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
16	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
17	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
18	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
19	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
20	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
21	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
22	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
23	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
24	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
25	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
26	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
27	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
28	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
29	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE
30	ON	OFF	P+	N-	TC-A TC-C TC-G A-TC C-TC G-TC NONE	V P NONE

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Teacher Rating of Behaviour Tool

RATIONALE

The importance of physical activity (PA) for the overall health of children and young people has been studied in much detail (Strong *et al*., 2005). Further research surrounding the positive impact of PA on children's classroom behaviour has also increased, including subsequent improved concentration and academic performance from PA (Grieco *et al*., 2009; Booth *et al*., 2013). There is therefore a clear rationale to use the school environment as a setting for increasing the activity levels of children and youth. However, when investigating PA in children and young people from special populations, in particular those with ID, the research is scarce, and when compared with the general population individuals with ID experience significantly higher rates of morbidity, mortality, and health inequalities (Phillips & Holland, 2011). Insufficient PA (Hinckson and Curtis, 2013; Boddy *et al*., 2015) and poor cardiovascular fitness (Pitetti & Campbell, 1991) may be contributing factors for a shorter life span and higher mortality rate among these individuals. In addition to this, classroom behaviour is a variable of key importance in the special school setting where behavioural issues are common place. As a result of this, there is a need to examine factors that may influence the classroom behaviour and classroom interactions of children with ID. Classroom observations are common place within scientific research and also in the school setting for analysing behaviour patterns. However, the environment of special educational needs (SEN) schools means that for an independent researcher it can be difficult to establish what is classified as "on" or "off" task for children with varied needs and abilities. There is often a free play nature to the way in which the children learn meaning that specific work tasks are not set regularly. As a result of this, it is more viable to use classroom teachers with their knowledge and understanding of the children to give an analysis of classroom behaviour.

TOOL SUMMARY

Direct Behaviour Rating (DBR) is a tool which involves brief ratings of target behaviour(s) following a specified observation period in which a teacher uses a 0-10 gradient scale.

> The rating occurs in close proximity to the pre-specified observation period, is completed by an individual who has first-hand experience with the student who has demonstrated the behaviour, and requires minimal inference to discern the target of measurement. (Chafouleas *et al*., 2009, p. 196).

Examples for its use include a daily rating of engaged behaviour for two students with resulting data displaying change in student behaviour in response to supports designed to decrease problematic behaviour and/or increase prosocial behaviour. This example relates directly to this study in which any potential rating of behaviour change from before to after lunch could be displayed in response to playground physical activity levels.

In a study examining the agreement of the DBR tool and systematic direct observation data for on-task and disruptive behaviour, results suggested that DBRs completed by classroom teachers were significantly correlated with observation data complete by trained observers (Riley-Tillman *et al*., 2008).

DBR forms available include a "Single Item Scale" with a focus upon one target behaviour, or a 3 standard behaviour form of academic engagement, respect and disruption. "Fill-in Behaviour" forms are also available in which the target behaviours can be determined by the user, which is the focus of this tool. This tool based upon the DBR scale aims to examine the on task behaviour of children in the SEN setting such as following instructions as well as any disruptive behaviour displayed, with classroom interactions also rated.

EXAMPLE

Familiarisation of the tool can occur before assessments are carried out, with teacher's receiving example sheets and information in staff meetings for example. This would allow for teacher's to gain an understanding of the scale and for any questions or queries to be answered.

Information for Class Teachers.

As part of our research investigating the association between physical activity and classroom behaviour we would like class teachers to complete a quick rating sheet

for the behaviour of the children in our study at the end of class time before and after lunch period.

Please find attached the form that you will be asked to complete, and have a quick read over of the questions so that you are familiar with it. A student from John Moores will come into your classroom at the end of each lesson on one day (date to be confirmed) and ask you to quickly complete the forms (maximum of 2 children from one class per day).

If you have any questions in regards to any of the questions on the sheet or about the scale used please do not hesitate to email me at S.Taylor3@2011.ljmu.ac.uk.

Thank you for taking the time to read this

Teacher Rating for Classroom Behaviour

Date:..... Lesson Start Time:.....

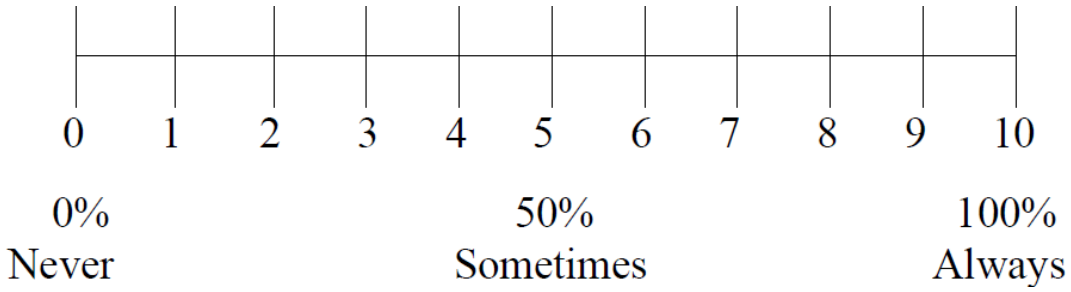
Pre/Post Lunch Lesson End Time:.....

Lesson Content:.....

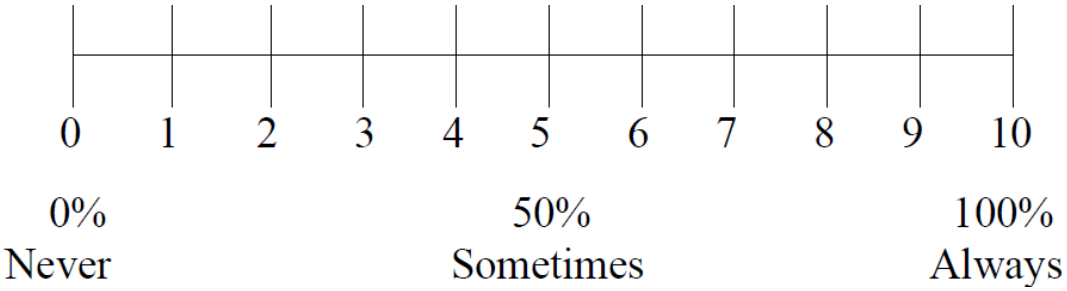
Child's Name: .....

Please circle an appropriate number to the listed behaviours below based upon the child's behaviour during the lesson which has just ended.

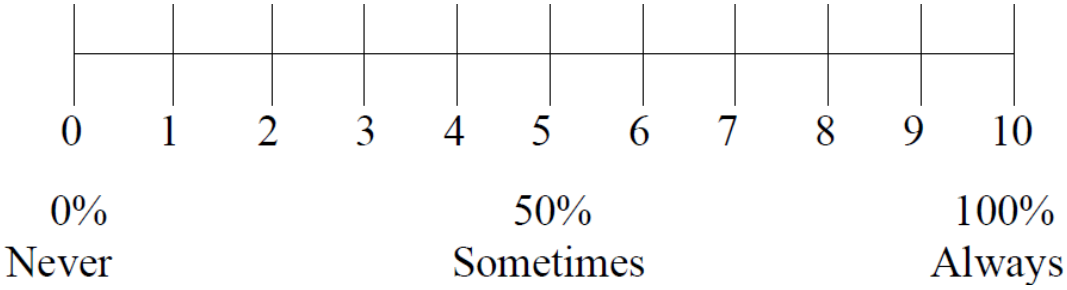
1) Followed Instruction



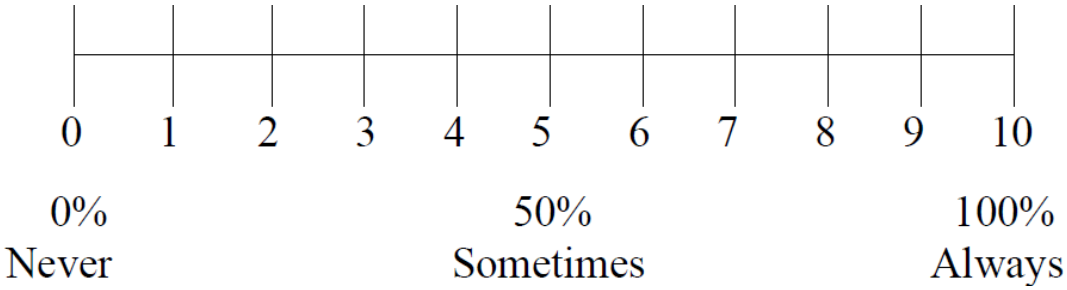
2) Showed Disruptive Behaviour



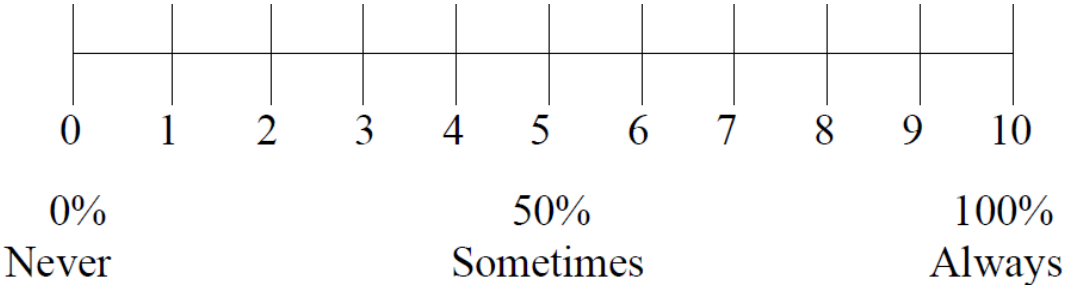
3) Was respectful towards other class mates



4) Was respectful towards members of staff



5) Stayed on task without distraction



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