

Schools Energy Audit Final Report

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SHARPENS YOUR THINKING



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Schools Energy Audit - Final Report

Executive Summary

The importance of physical activity for young people and its impact on lifelong health is being increasingly recognised. Inactivity in childhood is linked with obesity, decreased bone and mental health. More worryingly, being inactive at a young age sows the seeds for a lifetime of inactivity, with obvious consequences such as an increased incidence of heart disease, diabetes and some cancers. The case for getting today's young people more active is compelling.

Current government recommendations state children and young people should achieve at least 60 minutes of moderate intensity physical activity each day. Surveys suggest that progressively fewer young people are meeting these requirements and that levels of activity are lowest amongst girls and those living in deprived communities. Strategies are needed to reverse this trend and schools are one setting where changes are necessary.

Young people spend up to 39 weeks a year at school, thereby offering an excellent opportunity for regular physical activity. PE, break time and the school commute providing ideal opportunities.

This project aimed to examine aspects of physical and mental activity during the school day in girls and the effect that restructuring the timetable would have on each. A total of 45 pupils and 15 teachers from 3 South London schools (1 primary, 2 secondary) participated. Physical activity levels were monitored using both recall diaries and accelerometers, providing both subjective and objective activity measures. Participants were monitored for 5 days, initially during a normal school week and later a restructured week.

Due to the exploratory nature of the research, direct comparison of the two weeks was problematic, with initial data collection taking place during the summer term and the follow-up in the winter.

Key accelerometer findings suggested that although as a whole, the restructured timetable not always more active; the specific interventions introduced produced increased activity, with dance at the start of period 1, sport in morning break, better access to activity at lunch time and registration activities such as cheerleading proving particularly successful. This provided a better balance of physical activity levels across the school day, with periods of high activity when appropriate at break, lunch and PE, and periods of low activity during lessons when a calm concentration is required. It was also evident that PE does not necessarily mean activity, with large variations between lessons. Diary data demonstrated that young people appear to be unaware of what moderate activity is and are not participating in many out of school activities. Therefore the school may also play an educational role in fostering active lifestyles amongst their pupils.

1. Introduction

The importance of physical activity for children and adolescents is increasingly being recognised in government policy. The recent government Public Health White Paper (Department of Health, 2004a) outlined the lifelong health benefits of physical activity in young people, recognising the important role that schools and colleges could play in encouraging participation in sports and activities and supporting young people in active travel through walking to school. This is further supported by the National Healthy Schools programme (Department for Education and Skills and the Department of Health, 2005), which recognises physical activity as 1 of its 4 core themes.

In a systematic review on adolescent physical activity and health, Hallal et al. (2006) summarised that 'the lifelong benefits of adolescent physical activity on adult health are unequivocal'. Positive evidence was reported linking adolescent physical activity with adult activity and thus an indirect link to the reduced incidence of illnesses such as heart disease, osteoporosis, type II diabetes and some cancers that manifest themselves in adulthood. In addition, more short term benefits on bone and mental health of young people was reported. The case for getting young people more active is compelling.

Current government recommendations state that children and young people should achieve a minimum of 60 minutes of at least moderate intensity physical activity each day (Department of Health, 2004a). Questionnaire based surveys suggest progressively fewer young people are meeting these minimum requirements, with only 16% of boys and 10% of girls participating in exercise or sport on at least five days of the week (Department of Health, 2004a), with over a quarter of girls aged 11 to 15 being obese (Department of Health, 2004b). This situation is worse amongst those living in deprived communities (Anderson et al., 1998). However, further research utilising more objective measures such as accelerometers is required to fully understand this issue (Travers et al., 2006). Strategies are needed to reverse this trend and schools are one setting where changes could have an impact, through providing a range of opportunities to be

more physically active. Improving pupil understanding of the link between physical activity and health, and how physical activity can improve and be part of every day life are important (Department of Education and Skills, Department of Health, 2005).

Young people spend up to 39 weeks of the year at school, providing a good opportunity to engage children in regular physical activity. The two main periods within which this can be achieved are in Physical Education and at playtime (Ridgers, Stratton, Fairclough, 2006). Active commuting through cycling and walking to and from school might also contribute towards accumulating the recommended 60 minutes of moderate activity (Sirad et al., 2005).

Traditional sport orientated approaches to solve the problem of physical inactivity in girls have struggled. Therefore, this project sought to provide a fresh approach looking at how girls use and respond to energy.

This study was developed in partnership between the Women's Sports Foundation, Creative Partnerships South London, the Helen Storey Foundation, and Sheffield Hallam University (SHU). SHU were commissioned to carry out the analysis of physical activity and energy expenditure in accordance with the project aims and objectives.

The aim of this study was to examine aspects of physical and mental activity during the school day in girls, and determine the effect of re-structuring the timetable upon these. The Energy Audit took a holistic approach; this report focuses on the physical aspects of the study. The physical objectives of the study were;

- To assess physical energy expenditure of teachers and pupils during the school day (Phase 1);
- To analyse the data and develop methods to increase energy expenditure (Phase 1);
- To re-assess physical energy expenditure of teachers and pupils during a re-structured school day (Phase 2).

2. Methods

2.1 Participants

Three schools from South London agreed to participate in this study. The schools were;

- Charles Edward Brooke, a secondary school in the Vassall ward of the London Borough of Lambeth.
- Harris Girls Academy, a specialist sports college in the Peckham Rye ward of the London Borough of Southwark.
- Dog Kennel Hill, a primary school in the South Camberwell ward of the London Borough of Southwark.

The initial sample was made up of 15 female pupils and 5 members of teaching staff from each of the 3 schools. A total of 42 female pupils and 15 teachers were used in the final analysis. A breakdown for each school is provided below.

Table 1. Breakdown by school of pupils and staff included in the final analysis (DKH = Dog Kennel Hill, CEB = Charles Edward Brooke, HGA = Harris Girl's Academy).

School		Week 1		Week 2	
		Numbers	Missing data	Numbers	Missing data
DKH	Pupil	n=15		n=14	Pupil left school (n=1) Unknown, pupil (0.5 day)
	Teacher	n=5		n=5	Unknown, teacher (2 days)
CEB	Pupil	n=15	Pupil absence (1 day)	n=14	Pupil left school (n=1) Pupil absence (2 days)
	Teacher	n=5		n=5	Unknown, teacher (1 day)
HGA	Pupil	n=14	Lost accelerometer (n=1)	n=13	Unknown, pupil (7 days)
	Teacher	n=5		n=5	Unknown, teacher (1 day)
Total	Pupil	n=44		n=42	
	Teacher	n=15		n=15	

Height was measured to the nearest 0.1 cm using a free-standing stadiometer (Seca, Leicester height measure), whilst body mass was measured to the nearest 0.1 kg using portable scales (Tanita, HD327). A breakdown by school and gender

of the anthropometric characteristics of the sample is provided below. Body Mass Index (BMI) was also calculated for adults and Standard Deviation Scores (SDS) for children to give an indication of the participant's health status in terms of their body weight. A normal BMI for adults is 18.5 to 24.9 (WHO), whilst an SDS of ± 1.3 is considered normal (Cole, Freeman and Preece, 1995). It is important to note that approximately 20% of pupils from the sample at Dog Kennel Hill Primary were either overweight or obese, a number which rose to approximately 50% at the two secondary schools, thus demonstrating a need for the intervention.

Table 2. Anthropometric data for pupils in each school, taken at the start of week 1.

	Overall (n=42)		Dog Kennel Hill (n=14)		Harris Girls Academy (n=14)		Charles Edward Brooke (n=14)	
	M	SD	M	SD	M	SD	M	SD
Age (yrs)	11.9	1.8	9.6	0.5	13.2	1.2	12.7	0.4
Height (cm)	154.1	10.7	141.2	6.0	160.2	5.6	161.1	5.0
Weight (kg)	52.9	17.0	36.4	7.9	59.2	12.0	63.1	15.9
BMI (kg/m ²)	21.8	5.1	18.1	3.0	23.1	4.7	24.1	5.3

Table 3. Anthropometric data for female teachers in each school, taken at the start of week 1.

	Overall (n=12)		Dog Kennel Hill (n=5)		Harris Girls Academy (n=4)		Charles Edward Brooke (n=3)	
	M	SD	M	SD	M	SD	M	SD
Age (yrs)	35.5	8.4	36.6	7.5	33.8	1.9	36.6	16.1
Height (m)	165.3	5.1	165.2	4.7	165.2	4.4	163.8	8.0
Weight (kg)	71.3	22.3	61.3	7.9	69.6	5.5	90.2	42.2
BMI (kg/ m ²)	26.0	7.4	22.5	3.6	25.2	1.8	33.0	12.9

Table 4. Anthropometric data for male teachers in each school taken at the start of week 1.

	Overall (n=3)		Dog Kennel Hill (n=0)		Harris Girls Academy (n=1)		Charles Edward Brooke (n=2)	
	M	SD	M	SD	M	SD	M	SD
Age (yrs)	34.0	7.2	-	-	-	-	35.0	9.9
Height (m)	182.2	11.0	-	-	-	-	178.8	13.0
Weight (kg)	77.1	3.4	-	-	-	-	75.5	2.6
BMI (kg/ m ²)	23.3	2.0	-	-	-	-	23.7	2.6

Written informed parental consent was gained by the respective schools for all participating pupils.

2.2 Physical Activity Measures

Physical activity was monitored during waking hours using a combination of accelerometers and recall diaries to provide both subjective and objective measures of physical activity.

The accelerometers used were Actigraph GT1M uni-axial (vertical) accelerometers. These are small units worn on the hip (attached to an elastic belt) that capture normal human movement, whilst filtering out higher frequency vibrations such as travel. Filtered frequencies are then converted to a digital signal and summed over a period of 1 minute (Epoch period). These summed values are known as accelerometer counts. These are recorded by the unit, minute by minute for the time period specified. Using the ActiLife lifestyle monitor software (version 1.0) the data can be downloaded and exported to other forms of data analysis software. This type of accelerometer has been reported to correlate well with direct measures of energy expenditure in adolescent girls and is suggested as a useful tool in determining the effects of physical activity interventions (Treuth et al., 2004).

The 'Previous day physical activity recall' questionnaire (PDPAR) was used to assess the mode, frequency, intensity and duration of out of school activity (Weston, Petosa and Russell, 1997). The PDPAR asks children to record activities in 30 minute blocks and rate their intensity as very light, light, medium or hard. The PDPAR has compared favourably against other self-report activity measures (Welk, Dzewaltowski and Hill, 2004) and accelerometers (Anderson, Hagerströmer and Yngve, 2005). Although it has been reported to potentially over estimate the amount of vigorous activity, due to the 30-minute blocks used to record data, as this type of activity often takes place over a shorter time period.

2.3 Data Collection

Initial data collection took place on five consecutive school days (Monday to Friday) in the respective schools during three separate weeks in the summer term (April - June), with testing of the restructured week taking place as above in the winter term (September - December). Previous research has shown that with adolescents at least 4 to 5 days of objective monitoring are required to provide reliable estimates of physical activity (Troost et al., 2000).

A researcher from SHU was present in each school on the Monday morning of all data collection weeks to record the stature and body mass of all participants, and distribute the accelerometers and PDPAR diaries. A record of participant names and accelerometer numbers was kept by both the researcher and the school. At

the end of each day, all pupil accelerometers and diaries were returned to the lead teacher in each school, to be handed out again the following morning. This helped to minimise the risk of losing equipment and data. The teachers taking part in the study were asked to wear the accelerometers as much as possible from Monday morning until Friday night (including out of school) and only remove them during sleeping.

All participants were asked to complete a daily timetable of lessons and activities during school and a diary of activities out of school each evening. Unfortunately this latter diary could not be completed by staff at DKH due to OFFSTED inspection commitments. Upon completion of the week, all equipment was collected by the lead teacher and returned to SHU by courier (organised by SHU) by Tuesday of the following week.

2.4 Data Analysis

Upon receipt of the equipment at SHU, accelerometer data was downloaded into Excel, in accordance with the manufacturer guidelines. For each lesson, accelerometer counts (Epoch 1 minute) were calculated to determine the mean accelerometer count for each period analysed. These were displayed in a separate worksheet for each participant, with each copied into a single file for analysis. Superfluous data was removed (i.e. outside school hours for pupils; between 12am and 6am for staff) and the file split to include lesson details. Mean accelerometer counts for each lesson were then transferred to SPSS for analysis. To analyse the activity trace of a single lesson (e.g. PE) the accelerometer counts for each minute of that lesson, for each participant, were copied into Excel for analysis. When analysing time spent in sedentary, light, moderate, hard and very hard physical activity zones, cut-offs as outlined in the Actilife lifestyle software were used (very hard > 9498, hard 5725 – 9498, Moderate 1953 – 5724, Light (upper) 926 – 1952, Light (lower) 100 – 925, Sedentary <100 Counts.min⁻¹). These are similar to those cut-offs set by Treuth et al. (2004), with a group of girls of similar age to those used in this study. However, it is recognised that exactly where these cut-offs are set is currently under debate in the literature and will impact on how the data is perceived.

3. Results

Due to the exploratory nature of the study and the uniqueness of each school's approach to the project, results will be written as individual school case studies. Although where appropriate some cross school comparisons will be made.

The data can be classified into two main groupings: accelerometer data collected during the in-school hours (pupils) and whole day (staff), and diary data collected from all participants during out-of-school hours.

It is important to note that due to the small sample size and the large number of uncontrolled variables the aim was to examine data trends, rather than actual statistics, as much statistical analysis was inappropriate and would lack sufficient statistical power to be meaningful.

3.1 Accelerometer Data

School Comparisons

Figures 1 and 2 show the mean pupil and teacher accelerometer counts during the school day, for both the initial week (1) and the restructured week (2).

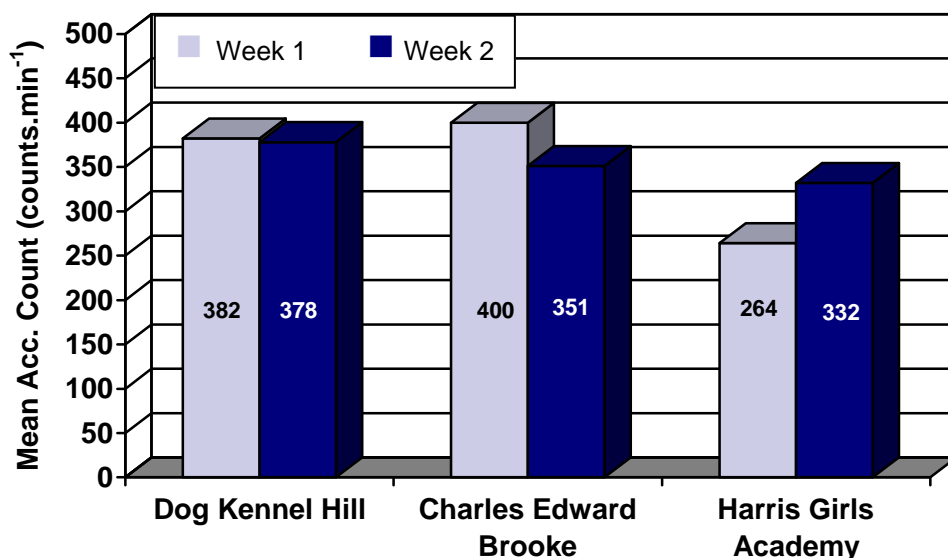


Figure 1. Mean pupil accelerometer count (counts·min⁻¹) during the school day for week 1 and 2.

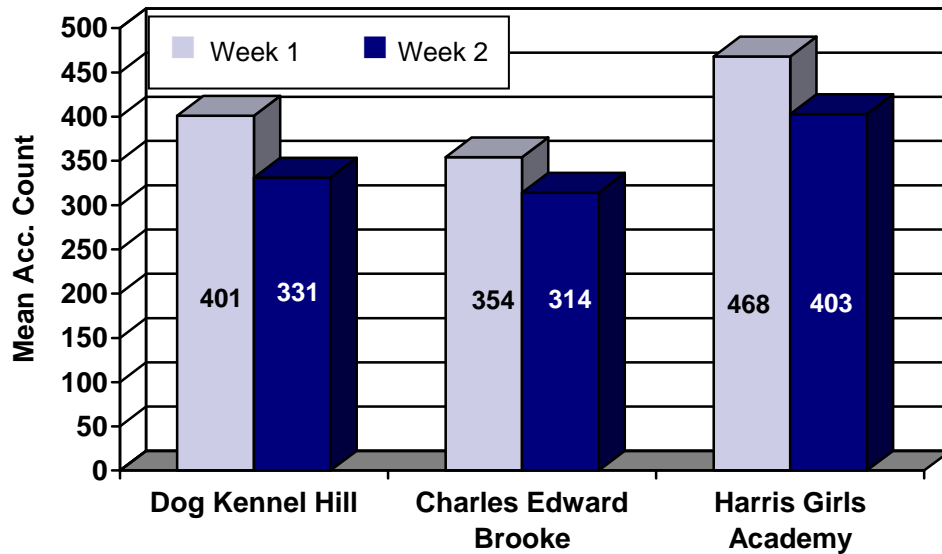


Figure 2. Mean teacher accelerometer count (counts·min⁻¹) during the school day for week 1 and 2.

Mean data for the whole week as displayed in figures 1 and 2 showed Charles Edward Brooke to be the most active pupils in week 1, with Harris Girls Academy the least active. Whilst in week 2 this changed to Dog Kennel Hill being the most active pupils, with despite being the only pupils to show a slight overall improvement in mean accelerometer counts (counts ·min⁻¹) Harris Girls Academy remained the least active. For the teachers Harris Girls Academy were the most active in week 1 and 2, with Charles Edward Brooke the least active. All teachers showed a trend towards less activity in phase 2. However, due to the small teacher sample size this data was heavily influenced by individual teacher roles.

Dog Kennel Hill Primary School

Following on from the initial phase of data collection and the feedback provided to the school, the following changes were made to the school timetable for the restructured week.

- 5 to 10 minutes of aerobics/dance after morning registration at the start of period 1.
- 5 to 10 minutes of yoga after lunch at the start of period 7.
- Brain gym type activities during each day.
- Less PE lessons over the second week.

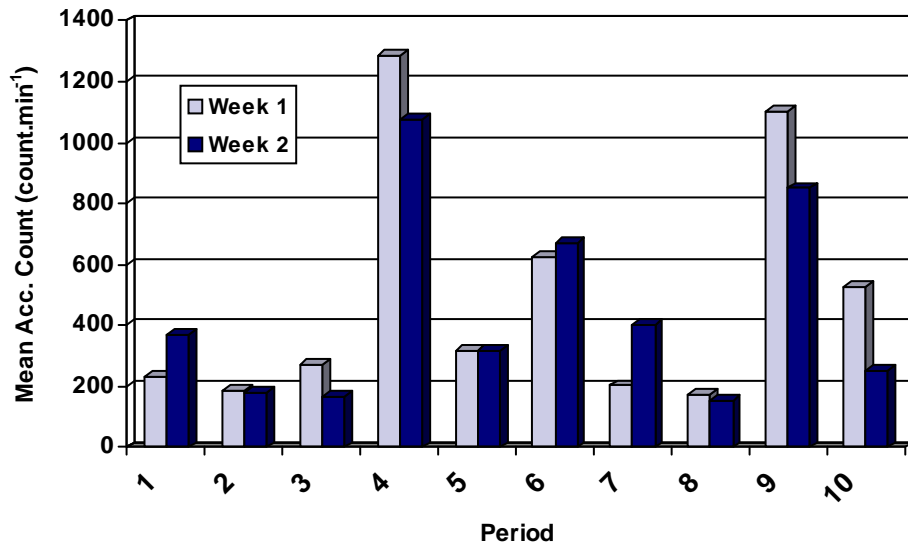


Figure 3. Mean accelerometer count (Count.min⁻¹), by period across the school week (1 = dance/yoga and lesson, 2 = lesson, 3 = assembly, 4 = break (am), 5 = lesson, 6 = lunch, 7 = Yoga and lesson, 8 = lesson, 9 = break (pm), 10 = lesson).

Figure 3, using mean accelerometer counts (count.min⁻¹) shows that the two periods with the highest activity were break (am) and lunch for both weeks. Whilst periods 1 and 7, where the dance and yoga intervention occurred (week 2), both demonstrate increases in physical activity. Figure 4 shows mean accelerometer counts (counts.min⁻¹) for period 1 minute by minute, demonstrating an increase in activity at the start of the lesson where the dance activity was introduced.

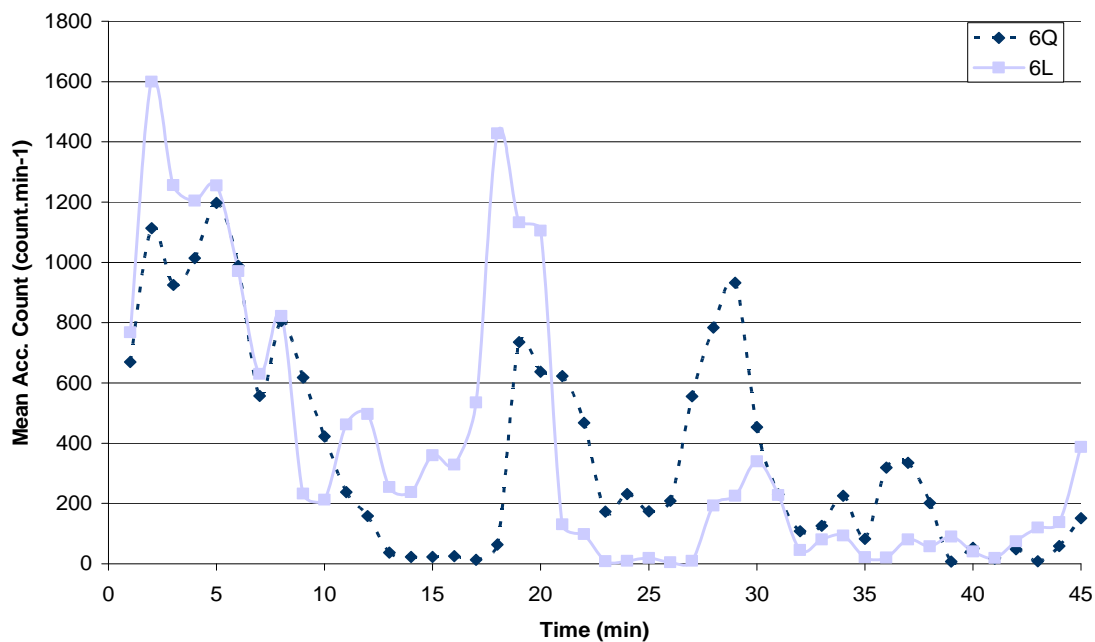


Figure 4. Mean minute by minute accelerometer counts for period 1 (5-10 minute dance activity at start), for tutor groups 6Q (n=8) and 6L (n=7) during the restructured week (Tuesday – Friday).

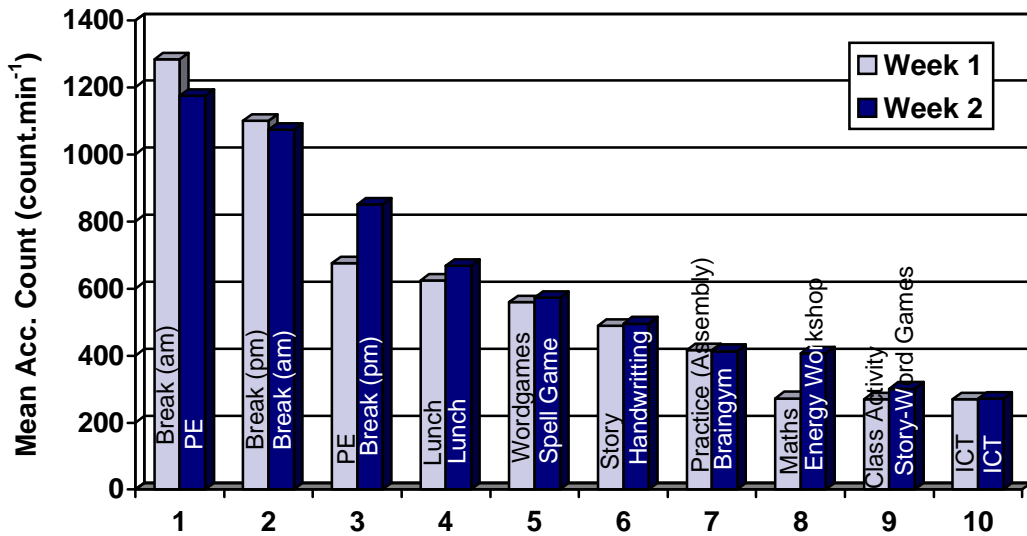


Figure 5. The top 10 most active lessons by mean accelerometer count (count·min⁻¹) for weeks 1 and 2.

Figure 5 shows that although there was less time in the second week devoted to PE, on the whole it was a more active lesson. It can also be seen that some of the word games and brain gym activities introduced also fall within the top 10 most active lessons. Figure 6 shows the PE lesson that took place in week 2. Pupils on average spent 2-minutes at the hard intensity, 9-minutes at the moderate and 78-minutes in the light category over a 90-minute PE lesson.

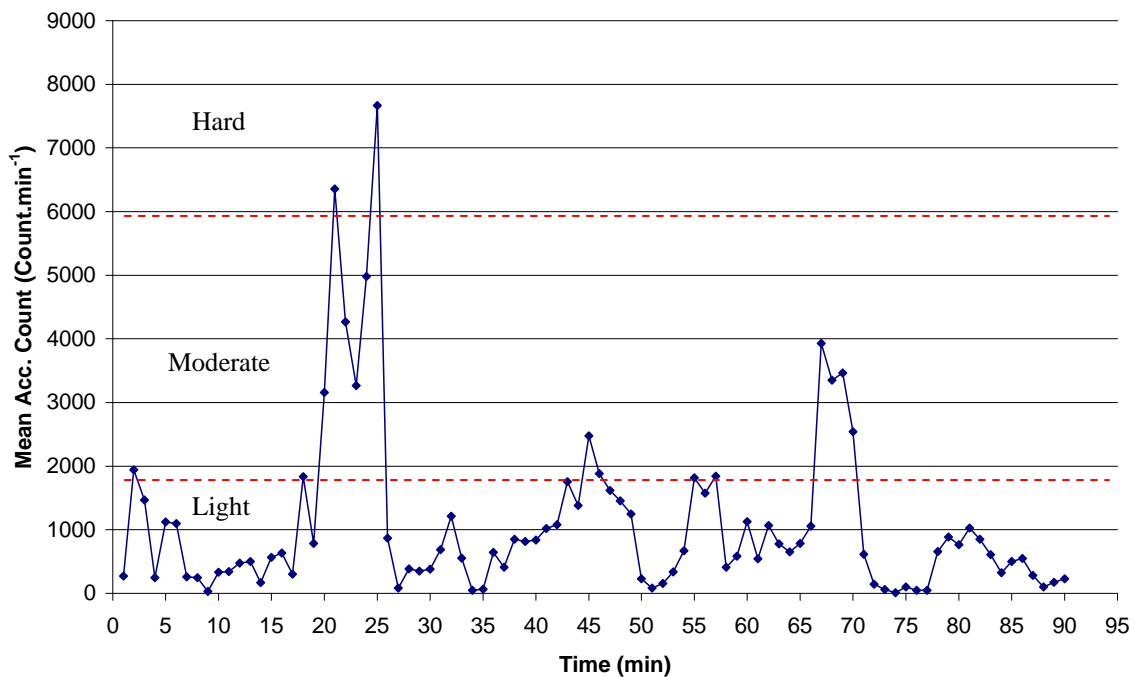


Figure 6. Mean minute by minute accelerometer count (count.min⁻¹) for 6L's PE lesson in week 2.
Charles Edward Brooke Secondary School

Following on from the schools initial phase of data collection and the feedback provided to them, many positive changes to the school timetable were introduced for the restructured week, including breakfast provided at school for the pupils, and water and fresh fruit made available throughout the week. Below is a summary of the specific physical activity related changes introduced.

- All days (Tuesday to Friday) started with breakfast, followed by a 25-minute activity (Tuesday: Tai-chi, Wednesday: Cheerleading, Thursday: Pilates / Cricket / Sport), Friday: Gospel).
- Break (am) consisted of structured sport.
- No actual PE lessons
- Tuesday had Tai-chi for 5-minutes at the start of English and Science.
- Wednesday they started late and finished late (i.e. period 1 was added on to the end of the day).
- Friday they started early and finished early (i.e. last period took place before normal school hours).
- Pupils were asked to come in kit Thursday and Friday.

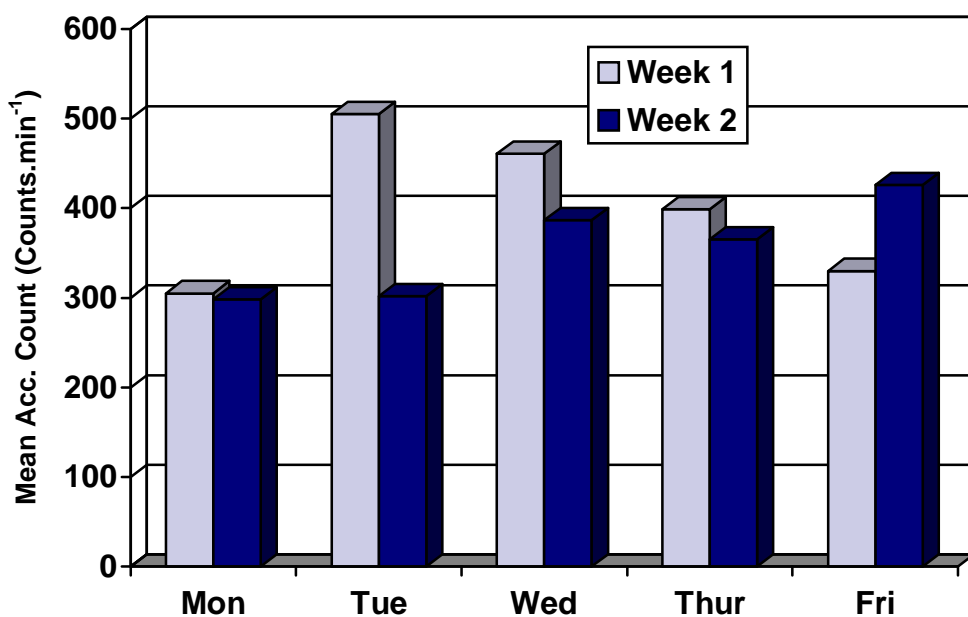


Figure 7. Comparison of mean accelerometer counts (counts.min⁻¹) for days of the week in week 1 and 2.

Figure 7 shows mean accelerometer counts (Count.min⁻¹) on a day by day basis. It can be seen that Friday when the pupils started and finished early seemed to be the most active day in week 2.

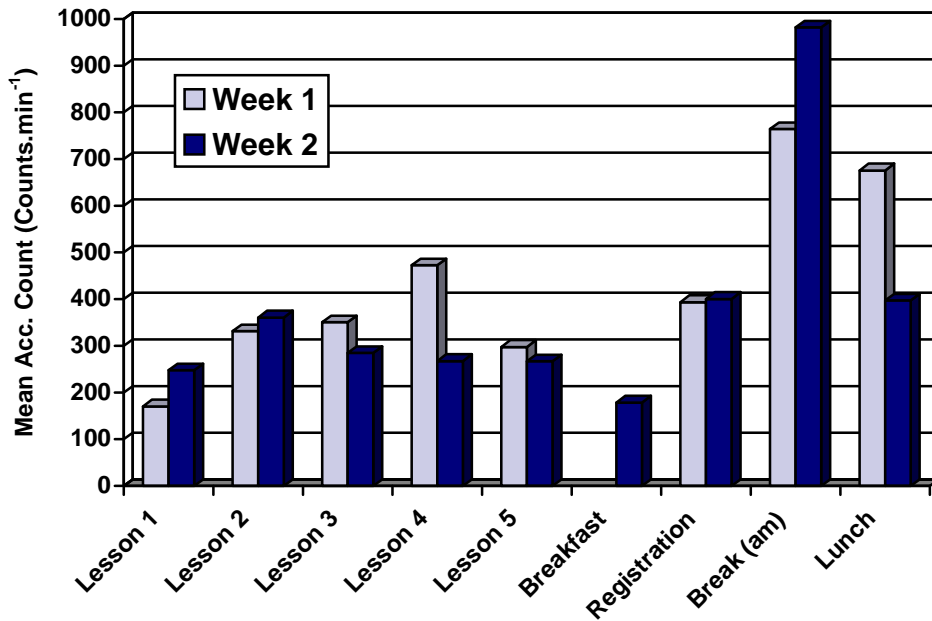


Figure 8. Comparison of mean accelerometer counts (Counts.min⁻¹) across periods of the day for week 1 and 2.

Figure 8 shows mean accelerometer counts for the pupils across the periods of the day. As the time at which breakfast, registration, break and lunch occurred varied between weeks and days in week 2 this graph has not been displayed in exact chronological order. However, it can be seen that the sport break (am) introduced in week 2 appears to have had a positive impact, with the registration activity introduced in week 2 being fairly similar to a normal registration in week 1.

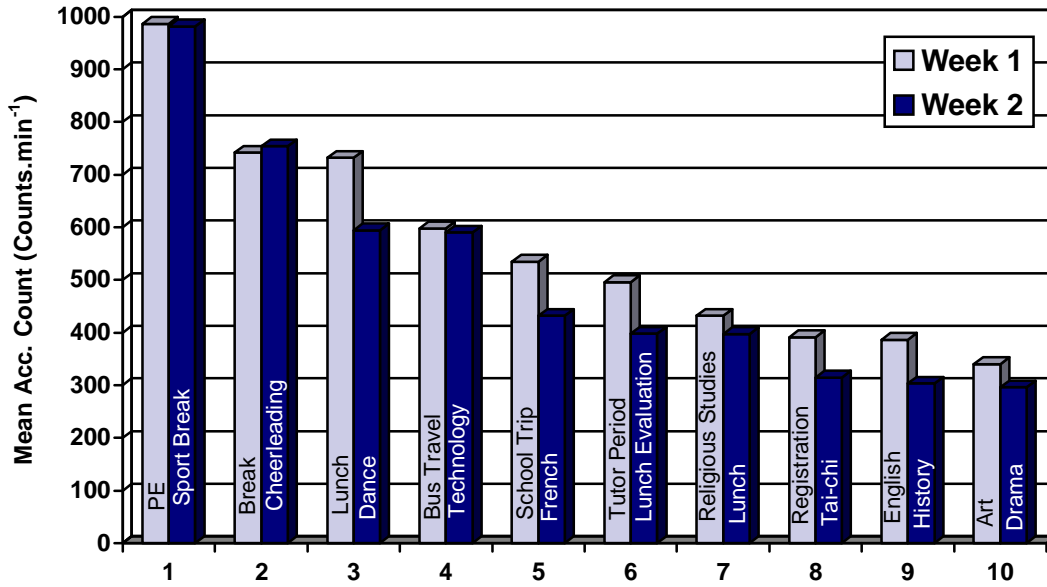


Figure 9. The top 10 most active lessons by mean accelerometer count (count·min⁻¹) for weeks 1 and 2.

Figure 9 shows that in terms of activity the sport break introduced in week 2 appears to be on a par with normal PE. In addition some of the activities introduced in week 2 during registration also appear in the top 10, with cheerleading being the second most active session.

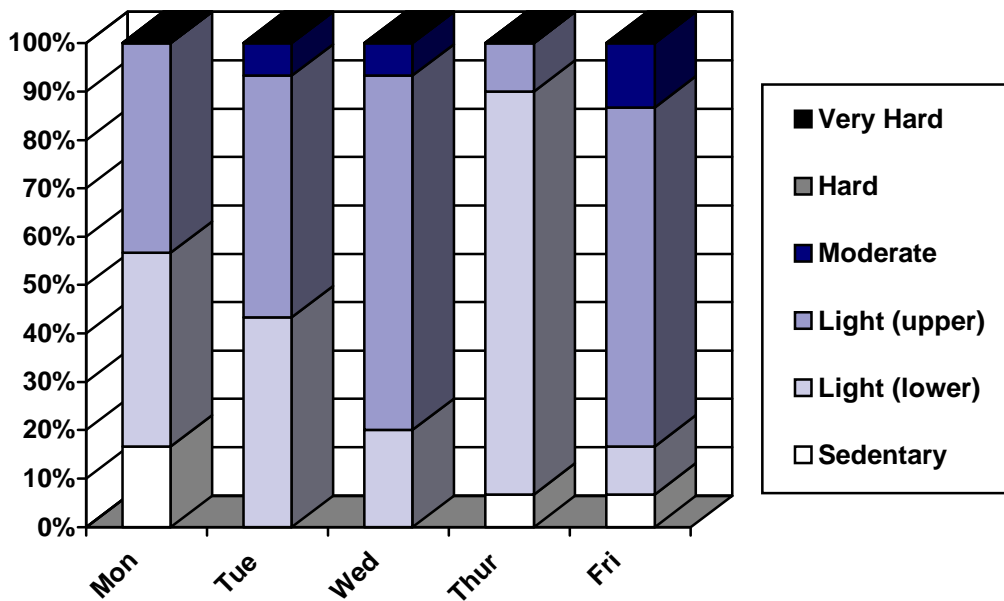


Figure 10. Percentage of time spent in each physical activity zone during the sport break in week 2.

Figure 10 shows the percentage of time in each sport break spent within each activity zone, whilst table 5 outlines what the pupils recorded as the activity that took place during this time period and the mean accelerometer count (counts.min⁻¹) recorded. It can also be seen that ball games (football) was the most physically active sports breaks. It must also be noted that from the activity diaries it appears that only half of the girls participated in the sport break, with many reporting chatting as the activity. However, on closer inspection of the activity during this period all pupils activity followed the same trends, with peaks and troughs occurring at the same time periods. However, those reporting not to have taken part did produce lower overall activity levels for the session, thus bringing the average scores down for the group.

Table 5. Activity and mean accelerometer counts (Counts.min⁻¹) for week 2 sports breaks.

	Activity	Mean Accelerometer Count (Counts.min ⁻¹)
Monday	Ball Games	762
Tuesday	Ball Games	926
Wednesday	Ball Games (Football)	1323
Thursday	Walking (Power)	539
Friday	Ball Games (Football)	1359

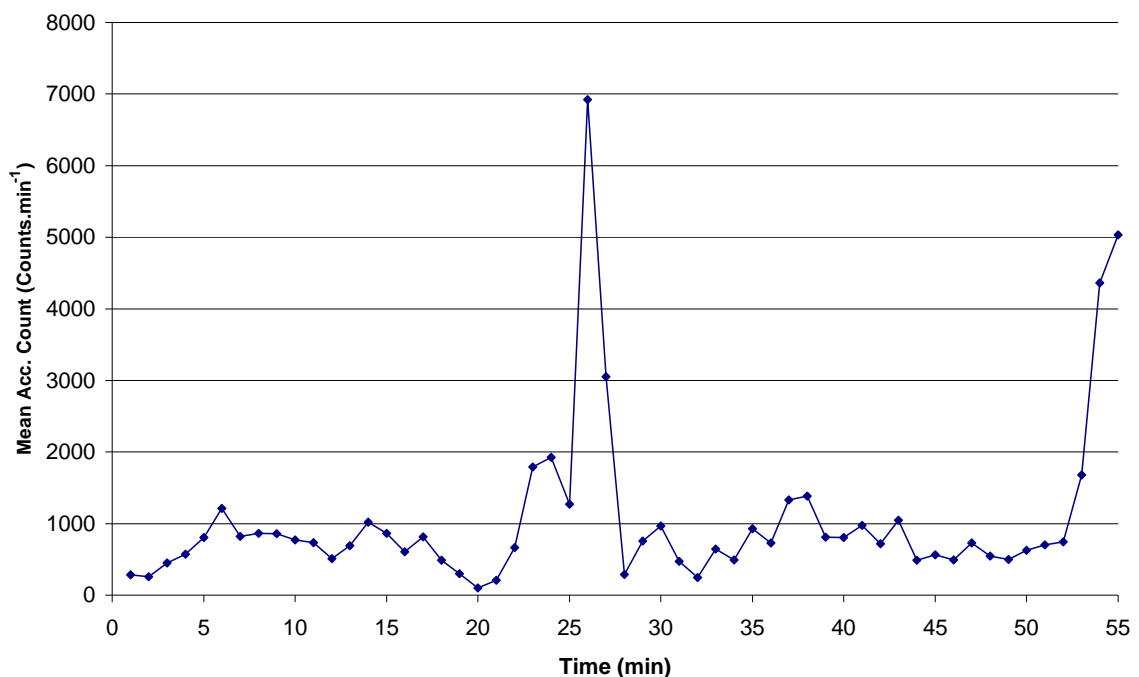


Figure 11. Mean accelerometer counts (Counts.min⁻¹) for the Physical Education lesson in week 1.

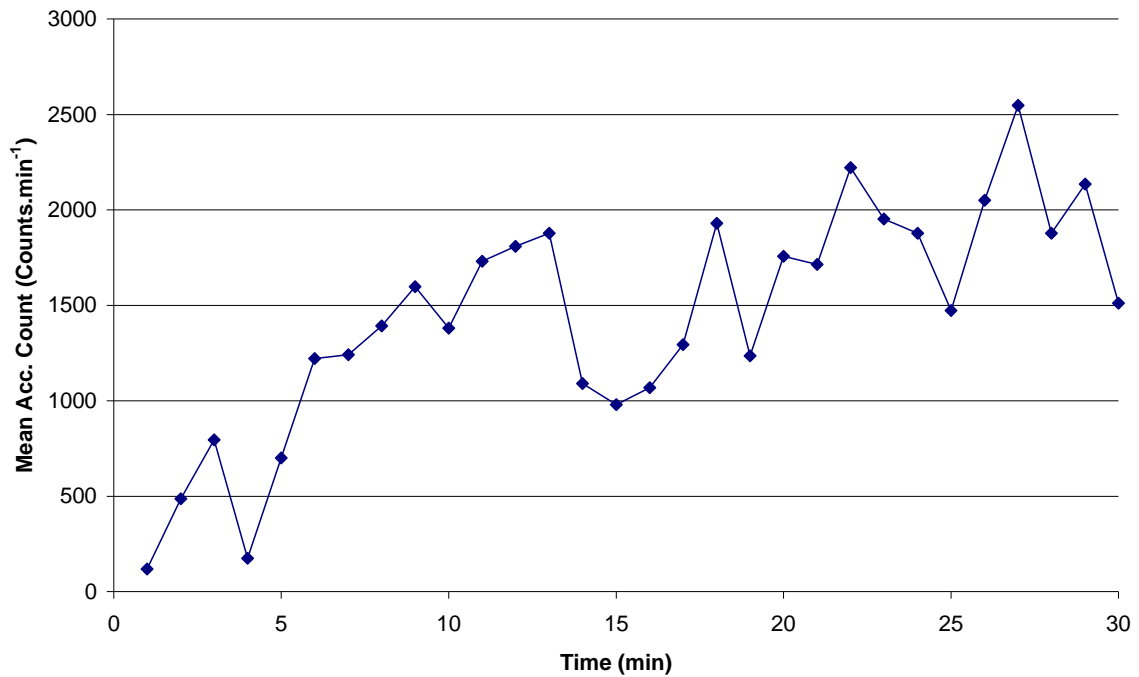


Figure 12. Mean accelerometer counts (Counts.min⁻¹) for Friday's Sport Break (ball games-football) in week 2.

Figures 11 and 12 show the PE lesson from week 1 and the most active sport break from week 2 respectively, whilst table 6 displays the amount of time in minutes spent at each activity level. This shows that although the sport break was nearly half the length of a PE lesson the pupils spent more time in the light (upper) and moderate activity zones.

Table 6. A comparison of the time in minutes spent in each activity zone in week 1 (physical education) and week 2 (Fridays sport break).

	Week 1 Physical Education Time (min)	Week 2 Sport Break (Fri.) Time (min)
Sedentary	1	2
Light (lower)	38	3
Light (upper)	12	21
Moderate	3	4
Hard	1	0
Very Hard	0	0
Total	55	30

Harris Girls Academy – Specialist Sports College

Following on from the schools initial phase of data collection and the feedback provided to them, changes to the school timetable were introduced for the restructured week. The main change introduced involved providing better access to physical activities at lunch time, including introduction of lunchtime activities such as football, making games equipment available and opening the gym under supervision. However, due to a number of incomplete or unreturned timetables from the school, a specific analysis on the impact of changes was problematic and we have been unable to carry out a full analysis on this group. It must also be noted due to missing data the strength of the trends reported have been compromised.

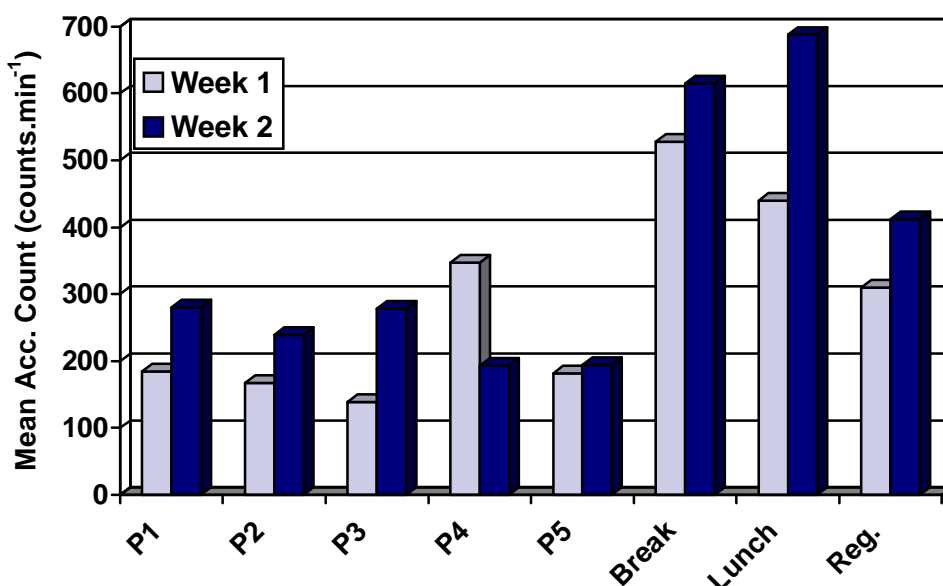


Figure 13. Comparison of mean accelerometer counts (counts.min⁻¹) in all year groups, across periods of the day for week 1 and 2.

Figure 13 shows mean accelerometer counts (counts.min⁻¹) for the pupils across the periods of the day. As the time at which registration and lunch occurred varied between weeks and year groups this graph has not been displayed in exact chronological order. However, it can be seen that in week 2 all periods except period 4 have shown an increase in activity. Period 4 for year 10 fell just after lunch break, whilst for all other years it fell just before.

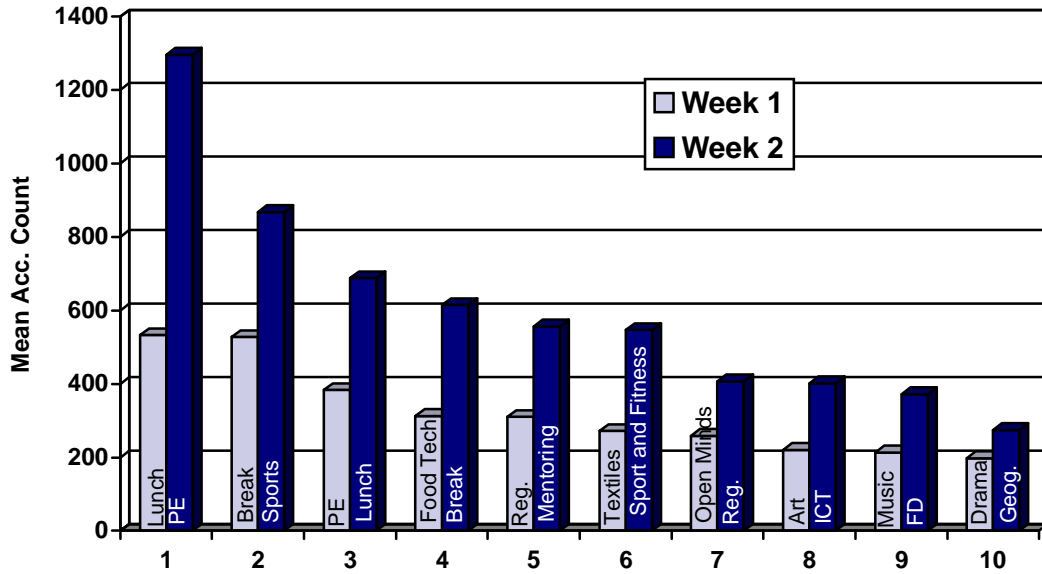


Figure 14. The top 10 most active lessons by mean accelerometer count ($\text{count}\cdot\text{min}^{-1}$) for weeks 1 and 2.

Figure 14 shows that the top 10 lessons all had higher activity levels than those in week 1, with PE showing the largest improvement. Figure 15 shows lunch time in more detail. Here nearly a complete reverse in terms of year group activity can be seen, suggesting that the two oldest age groups demonstrated an increase in their activity in week 2 over the lunch break.

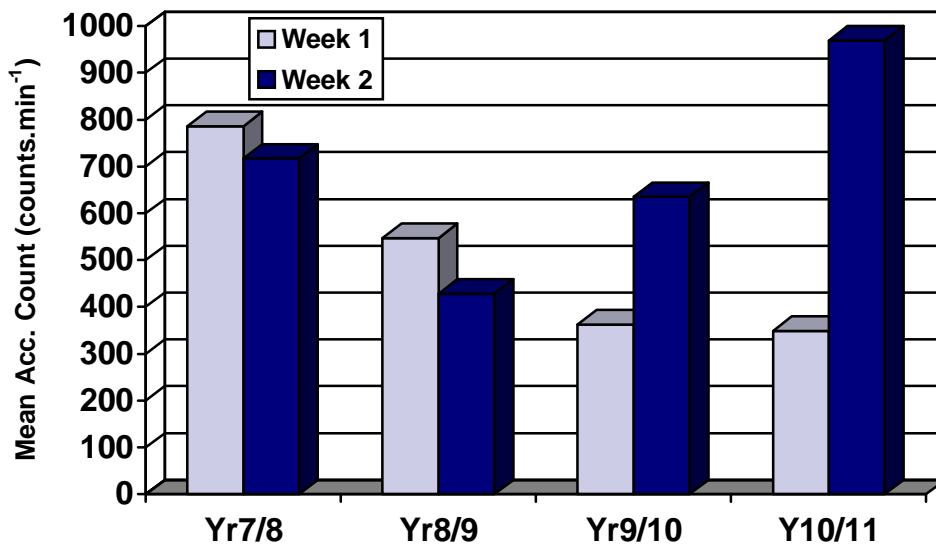


Figure 15. Lunch time mean accelerometer counts ($\text{counts}\cdot\text{min}^{-1}$) for different year groups.

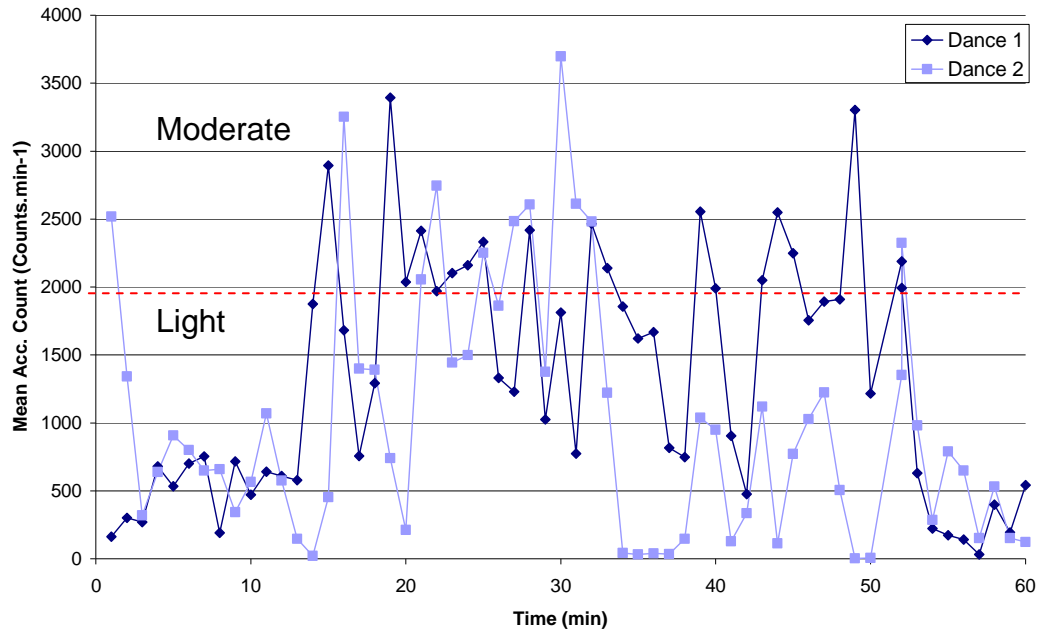


Figure 16. Mean accelerometer counts (Counts.min⁻¹) for the Physical Education (Yr 9 Dance) in week 2.

Figures 16 and 17 shows the patterns of activity in the physical education lessons in week 2, whilst table 7 displays the amount of time in minutes spent at each activity level. This shows that around half of all lessons were in the Light (upper) and moderate activity zones. This is much better than in week 1 when the mean accelerometer count for physical education was Light (lower).

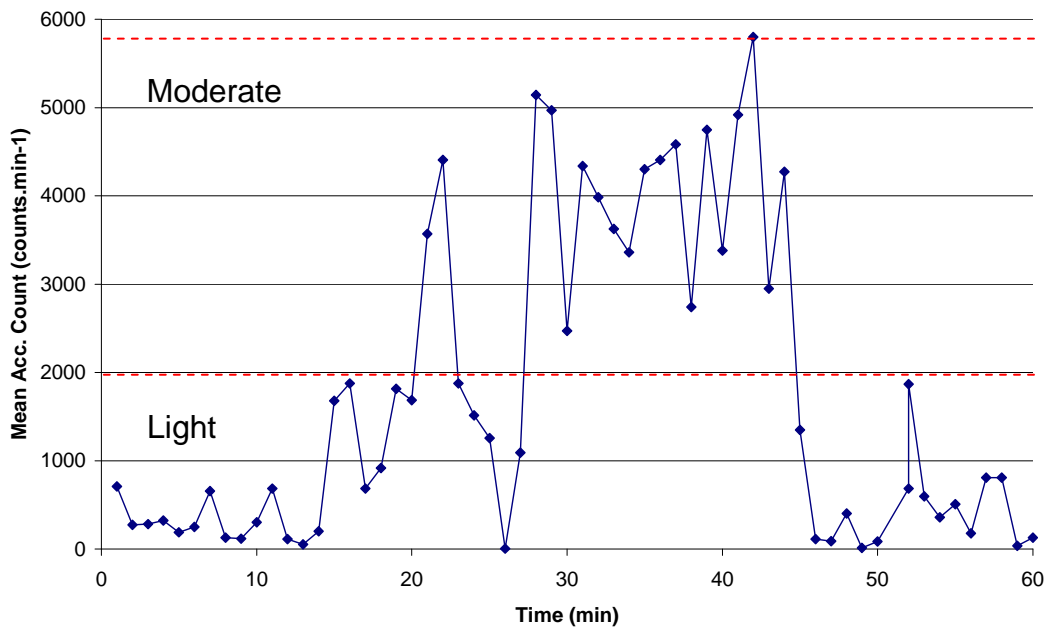


Figure 17. Mean accelerometer counts (Counts.min⁻¹) for the Physical Education (Yr 11) in week 2.

Table 7. A comparison of the time in minutes spent in each activity zone in week 2 (physical education).

	Year 9 PE (Dance 1)	Year 9 PE (Dance 2)	Year 11 PE
Mean Acc. Count (counts.min⁻¹)	1346	1019	1744
Sedentary	1	7	6
Light (lower)	26	26	25
Light (upper)	14	15	10
Moderate	19	12	18
Hard	0	0	1
Very Hard	0	0	0
Total	60	60	60

3.2 Physical Activity Diary Data

Figure 18 demonstrates that for Charles Edward Brooke and Dog Kennel Hill schools, walking was the most popular mode of transport for school, whilst for Harris Girl's Academy the bus was the most popular, with very little use of cars and bicycles in all groups.

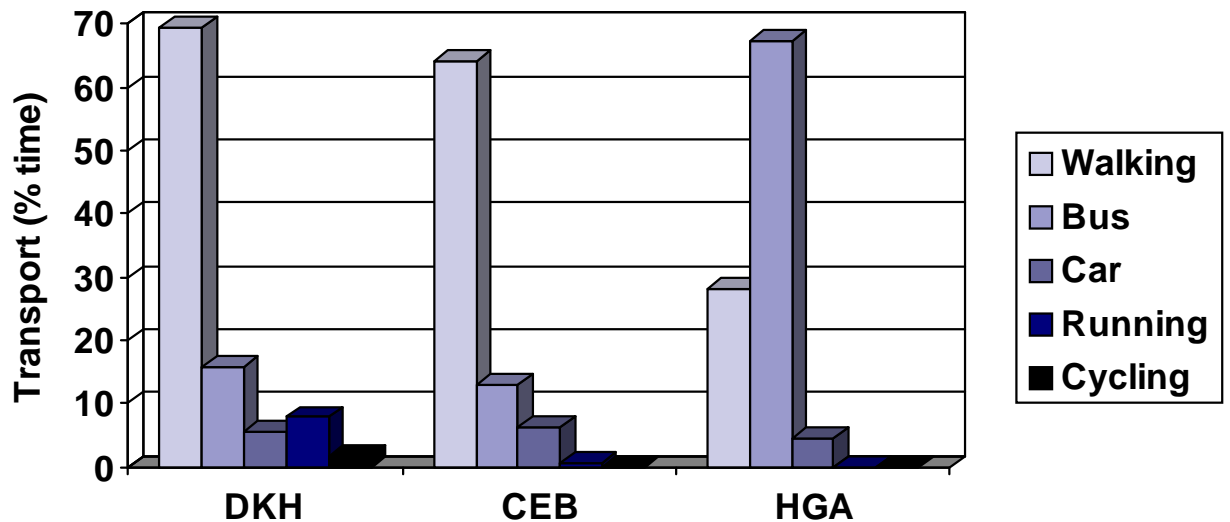


Figure 18. Percentage of time pupils spent using different modes of transport during week 2.

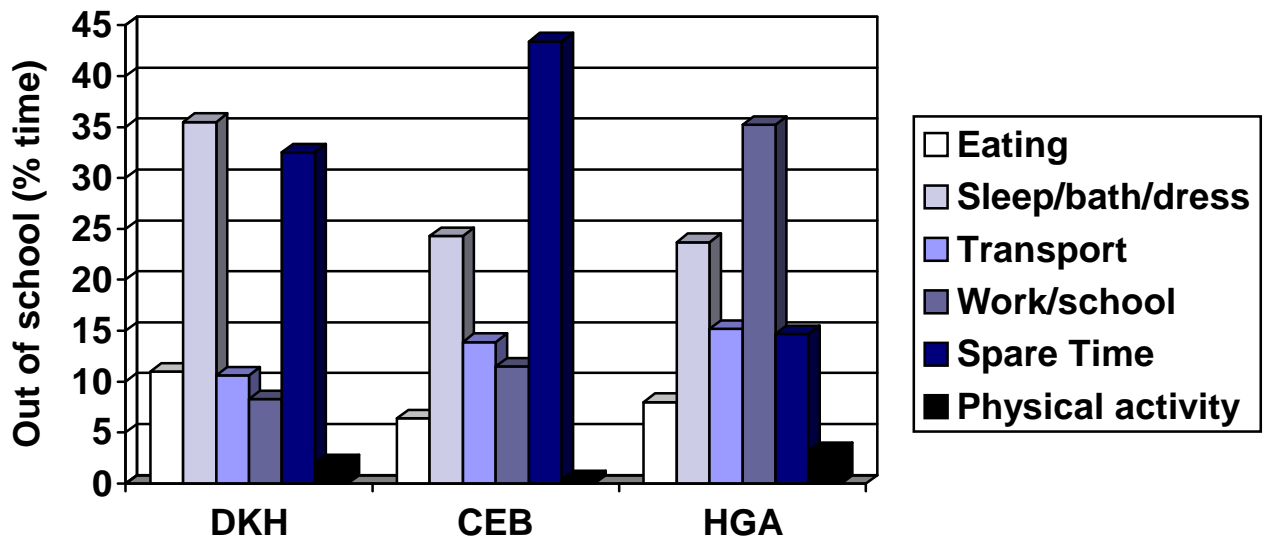


Figure 19. Percentage of time pupils spent on different types of activity during school week 2.

Figure 19 shows that all pupils had a relatively large amount of spare time out of school, of which very little tended to be spent on physical activity.

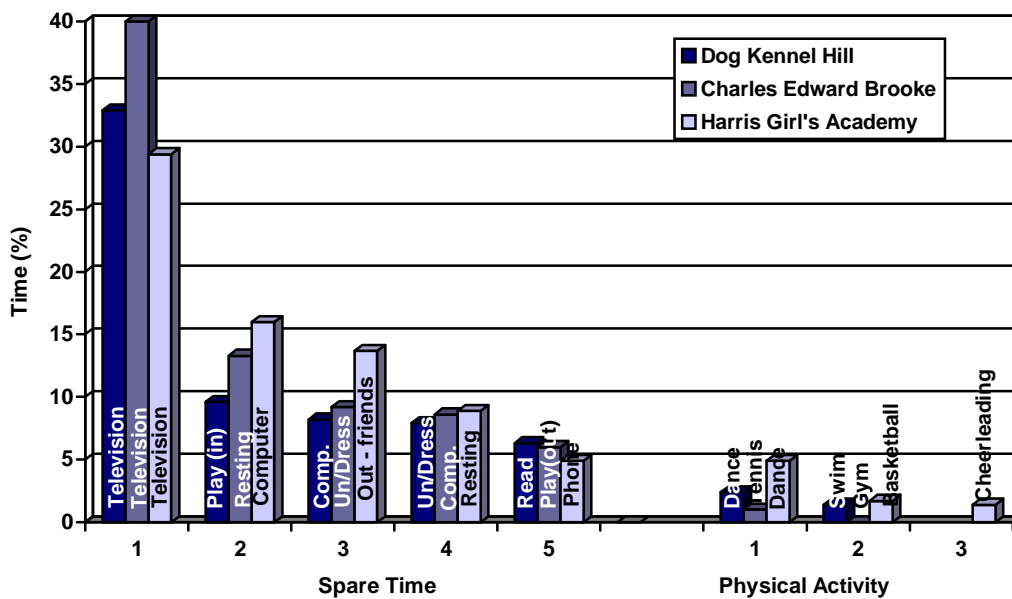


Figure 20. Percentage of time pupils spent out of school on spare time (top 5) and physical activity during the school week.

Figure 20 shows that television watching was the most popular spare time activity for all groups, with computer use also featuring in the top five for all schools. It can be seen that in comparison very little physical activity took place with Harris Girls Academy appearing to engage in the most out of school activity.

4. Summary

The positive impact on children's health and wellbeing of increasing their physical activity levels and eradicating sedentary behaviour has become increasingly apparent in government policy. With only 10% of girl's meeting the current activity guidelines (Department of Health, 2004), it is apparent that strategies to increase their involvement in physical activity is of paramount importance. Given that children and young people spend 39 weeks of the year at school and that sport focused strategies have had limited success in the past, a novel approach to physical activity promotion in schools was required. Few studies have reported such a rich tapestry of physical activity data during the school week, let alone supported it with informed changes in the school timetable to specifically explore the impact they may have had on physical activity levels.

This project used a mixed methods approach of PDPAR diaries, timetables and uni-axial accelerometers in order to gain in-depth information on the activities and corresponding physical activity levels in each school.

4.1 Project Limitations

This applied approach had its limitations, as due to the uniqueness of each schools approach few comparisons could be drawn. Therefore, each school was analysed as a separate case study. Limitations included;

- Seasonal differences between weeks 1 and 2, as week 1 took place in the summer term and week 2 in the winter term, which may have impacted on the girl's activity levels.
- The girl's were from varied classes and age groups. This in addition to missing data due to incomplete diaries/timetables meant that sample sizes for some of the data analysis were small.
- There was no control group with which to compare, as a decrease in activity may actually still be a positive if without the intervention it would have decreased further.
- Accelerometers are uni-axial therefore some activities such as cycling do not pick up as well.

4.2 Summary Points

Teacher mean accelerometer counts (counts.min⁻¹) in the follow-up week showed a decrease in physical activity for all schools. This is not entirely surprising as most changes focused around increasing pupil activity levels. Changes in mean pupil accelerometer counts (counts.min⁻¹) varied showing little change for Dog Kennel Hill, a slight reduction for Charles Edward Brooke and a slight increase for Harris Girls Academy. Possible explanations for this include the seasonal variation between data collection weeks, with week 2 being conducted in the winter term. In addition, most schools had more timetabled PE in the first week, which could have had a positive impact on the mean score.

Despite showing no improvement in the overall mean accelerometer count in week 2, the interventions (dance and yoga) introduced at Dog Kennel Hill Primary School during periods 1 and 7 had a positive impact on physical activity for these time periods. In addition, although there was less PE in week 2 the PE that the pupils did do was much more physically active.

Charles Edward Brooke Secondary School introduced many positive changes related to pupil health and wellbeing and although again the overall mean accelerometer count for the week did not increase, the physical activities introduced did appear to have a positive impact on mean accelerometer counts for the time periods at which they were introduced. The most successful physical activity interventions for this school were the early start of Friday, the sport break, in particular ball games (football) and some of the registration activities (cheerleading).

Harris Girl's Academy did show an increase in their overall weekly mean accelerometer count (counts.min⁻¹) in week 2, with increases in all periods of the day except in period 4, which for year 10 was just after lunch and for all other years was just before. Again as in all other schools the period where the intervention had taken place (better access to physical activity at lunch time) showed the greatest improvement. In addition, when looking at the lunch break by year group, week 1 demonstrates the expected trend of a gradual decrease in activity from years 7/8 to year 10/11. What is encouraging is that this trend was

nearly reversed in week 2, with the largest improvement in lunch time physical activity levels coming from the oldest age group. Other positives were a much more active PE lesson in week 2.

5. Conclusions

Each school came up with a unique set of ideas to solve the problem of how to increase physical activity and energy levels in their school. This was possible due to the integral involvement of the girl's and teachers at each school in the feedback and timetable restructuring process. When looked at as a mean across the 5 days there were only small changes reported between both weeks. However, the specific interventions that were introduced at registration, break and lunch times at each school to increase physical activity levels worked well, with sports breaks and improved access to activity at lunch time proving particularly successful. This supports the notion that we don't just have to rely on PE for activity, as break time and lunch are also excellent opportunities within which girl's can be active, without being under the constraints of the national curriculum.

It must be remembered that not all changes were designed to increase physical activity as child concentration and learning was also high on the agenda. The aim wasn't to increase mean physical activity across the whole week, but to have better quality activity at appropriate time points, with periods of calm in which to learn. It is therefore felt that we saw better patterns of physical activity levels across the day, as although over the whole week activity levels did not increase there were periods of higher activity during break, lunch and PE, counteracted by periods of lower activity, when required during lessons.

6. References

Anderson, R.E., Crespo, C.J., Bartlett, S.J., Cheskin, L. J., and Pratt, M. (1998). Relationship of physical activity and television watching with body weight and levels of fatness among children. *Journal of the American Medical Association*, **279**, 938-942.

Anderson, C.B., Hagströmer, M. and Yngve, A. (2005). Validation of the PDPAR as an adolescent diary: effect of accelerometer cut points. *Medicine and Science in Sports and Exercise*, **37**, 1224-1230

Cole, T.J., Freeman, J.V. and Preece, M.A. (1990). Body mass index reference curves for the UK, 1990. *Archives of Disease in Childhood*, **73**, 25-29

Department for Education and Skills and the Department of Health (2005). National healthy schools status: a guide for schools. London: Department of Health.

Department of Health (2004a). At least 5 a week: evidence on the impact of physical activity and its relationship to health. A report from the chief medical officer.

Department for Health (2004b). Health Survey for England. London: Department of Health.

Hallal, P.C., Victora, C.G., Azevedo, M.R. and Wells, J.C.K. (2006). Adolescent physical activity and health. *Sports Medicine*, **36**, 1019-1030

Ridgers, N.D., Stratton, G. and Fairclough, S.J. (2006). Physical activity levels of children during school playtime. *Sports Medicine*, **36**, 359-371

Sirad, J.R., Riner, W.F., Mciver, K.L. and Pate, R.R. (2005). Physical activity and active commuting to elementary school. *Medicine and Science in Sports and Exercise*, **37**, 2062-2069

Travers, T., Cooper, A.R., Ridoch, C.J., Ness, A.R., Fox, K.R., Deem, R. and Lawlor, D.A. (2006). Do children from an inner city British school meet the recommended levels of physical activity? Results from a cross sectional survey using objective measurements of physical activity. *Archives of Disease in Childhood*, **91**, 175-176

Treuth, M.S., Schmitz, K., Catellier, D.J., McMurray, R.G., Murray, D.M., Almeida, J.M., Going, S., Norman, J.E. and Pate, R. (2004). Defining accelerometer thresholds for activity intensities in adolescent girls. *Medicine and Science in Sports and Exercise*, **36**, 1259-1266

Trost, S.G., Pate, R.R., Freedson, P.S., Sallis, J.F. and Taylor, W.C. (2000). Using objective physical activity measures with youth: how many days of monitoring are needed? *Medicine and Science in Sports and Exercise*, **32**, 426-431

Welk, G.J., Dzewaltowski, D.A. and Hill, J.L. (2004). Comparison of the computerized activitygram instrument and the previous day physical activity recall for assessing physical activity in children. *Research Quarterly for Exercise and Sport*. **75**, 370-380

Weston, A.T., Petosa, R. and Pate, R.R. (1997). Validation of an instrument for measurement of physical activity in youth. *Medicine and Science in Sports and Exercise*. **29**, 138-143