Influences of time of day on teaching and learning of adolescents in secondary school

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Abstract

This study uses a mixed methods approach to explore the possible influences of time of day on the teaching and learning of adolescents in secondary school. School scheduling has always been an issue within schools with problems mainly centring on the availability of teachers as well as other factors such rooming issues, part-time staff, etc. and is usually considered as an administrative duty with very little focus on the effects it may have on student behaviour and learning. Many researchers consider that students' performance varies during different times of the day and research also indicates that this varies between age groups (Allen, 1991; Barron, Henderson & Spurgeon, 1994; Dunn, 1995). This idea provided the starting point for this investigation into how the time of day affects student attention and achievement. This study was split into four phases. Phase 1 reviews the importance of sleep and the possible effects it may have on the school day. Through the use of quantitative methods, the average sleep duration, bedtimes and wake up times were identified and the impact it may have on student's alertness, behaviour and learning during the school day. The finding from phase 1 reveal that overall the students in this study are getting significantly below the recommended amount of sleep needed for adolescents, especially the older students, suggesting that students may face issues to a greater extent than indicated in previous studies, and as a result their performance in school could be affected. Phase 2 reviews the effects time of day has on short-term memory and problem-solving activities and whether the period (time of day based on school timetable) can influence the performance in these two areas. Based on the findings in this phase, students' performance significantly varied at different times of the day. In both the short-term memory and problem-solving tests students were able to recall more information and perform better in the afternoon in all age groups as compared to the morning. Phase 3 investigated the time of day and its effects on behaviour and 'perceived learning' (perceived learning refers to the learning taking place during a lesson as perceived by the classroom teacher, it includes factors such as behaviour, participation and amount of work completed). For this research, we explored whether the time of day can influence the way students learn as perceived by both students and teachers. Firstly, students completed a learning style inventories at different times of the day. Based on the findings there were significant discrepancies in the way students completed the inventories in the afternoon as compared to the morning. The second part of this phase was completed by the teacher. Using a coding system teachers recorded the perceived learning scores of students during every lesson throughout the academic year. Results indicated significant changes in perceived learning at different times of the day for all year groups. Finally, phase 4 was a collaborative study involving participants in focus groups. The focus groups

discussed and compared the results from the previous three phases and along with the data collected in the student and teacher interviews, to help understand and identify any connections and draw conclusions from the findings. This phase included some qualitative methods. The overall findings in this study reveal that students' academic performance, behaviour and 'perceived learning' significantly varied at different times of the day, indicating that there is a strong correlation between time of day and students' academic performance for different age groups, and therefore every effort is needed to incorporate these findings into the planning and scheduling of lessons to help maximise students' potential.

Chapter 1: Introduction

School scheduling has always been an issue within schools with problems mainly centring on the availability of teachers as well as other factors such as rooming issues, part-time staff, etc. and is usually considered as an administrative duty with very little focus on the effect it may have on student behaviour and learning. Many researchers consider that students' performance varies during different times of the day and research also indicates that this varies between age groups (Allen, 1991; Barron, Henderson & Spurgeon, 1994; Dunn, 1995). This idea provided the starting point for this investigation into how the time of day affects student attention and achievement. If students were found to perform better at certain times of the day, there would be major implications for school scheduling. Such a conclusion would warrant studies of the feasibility of different types of scheduling such as half-day schools, rotating timetabling (for example a 2-week timetable) or school schedules in which core subjects were concentrated at peak times while other non-core subjects could be taught at a time when alertness was not as high.

Throughout the years there have been various research studies that focused on adolescent sleep patterns, time of day learning preferences and student learning styles (Carskadon 1993; Smith 1995; Dinges & Kribbs 1991). All of these have shown to be closely related to academic achievement. This inquiry takes a similar mixed method approach using a combination of qualitative and quantitative data to effectively take into consideration various factors such as sleep patterns and learning styles to assess whether there is a practical and set time that core subjects should be taught so to maximise students' learning.

Timetabling and student attention have troubled teachers for years. In after lunch classes, for example, students, in general, can be hyperactive, and in early morning classes, students are often still tired (Black 2000; Dexter et al 2003; Wahlstrom 2002a). All these factors contribute to the learning of students, and with core subjects such as maths, it is crucial that students are learning at their maximum potential. As a mathematics teacher in a large mixed comprehensive secondary school, I have come across various behaviour and learning difficulties in my lessons that seem to vary throughout different times of the day and with the same students. During my time as a teacher and upon examining various observations of how students learn in different lessons, students' overall focus and attentiveness varied throughout the day and from lesson to lesson. Teachers in my school as well as in other schools are aware that different times of the day can have both a

positive and negative impact on students' learning. I became interested in this study as I need to understand why students behave and learn differently, and how teachers can use this knowledge to help improve their practice. Therefore, to understand the effect of time of day on teaching and learning it is important to consider the external factors such as sleep, behaviour, learning preferences and learning styles.

This literature in chapter 2 will evaluate some of the most crucial factors which have been identified through literature that can influence a student's behaviour and attainment.

1.1 Purpose of study

The overall aim of this research is to determine the influences of time of day on teaching and perceived learning of adolescents in secondary school?

To address the research question four sub questions were formed based on repeated factors that regularly appeared in this field of literature. The first sub question *Are students getting enough sleep during the school week?* was used as a starting point to provide baseline data. Sleep was a fundamental issue in all similar research studies involving time of day in schools and academic performance. Sleep is associated in almost all studies that discussed school start times and therefore in order to be able to compare this study with findings in previous studies it was important that data around sleep was collected to see whether students in this study had similar issues (Allen 1992, Epstien; Chillag & Lavie 1998; Wahlstrom 2001).

The second and third question *Does the performance of students vary at different times of the school day?* and *to what extent does behaviour and perceived learning preferences vary throughout the day?* aims to address the overall research question, focusing on key measures in a secondary school such as performance in test, which rely on problem solving skills and memory recall as well as behaviour and perceived learning (see section 4.10.3) and whether these factors fluctuate during the school day.

The findings from the first three questions were established through quantitative methods, however as a researcher and teacher it is important to reflect on your own experience and how this may impact the interpretation of data, therefore the fourth and final question *How can a school day be adapted to improve students' academic achievement?* was formed to offer a broader understanding,

taking into consideration both students' and teachers' experience in understanding the findings from the previous sub questions.

This research was split into four phases in order to address each sub question which was developed through the literature review.

These phases are:

1. The importance of sleep in school timetabling- Are students getting enough sleep during the school week?

   Sleep was a common and important factor in a large number of studies as a key influencer to school timings (Carskadon et al., 1998; Wolfson and Carskadon 1998; Wahlstrom, 2002a). However, in order to effectively utilise finding in these studies it is important to obtain baseline data within this study before comparing with findings in previous studies. *In this phase, we will be looking at the importance of sleep, and the possible effects it may have on the school day. Through the use of quantitative methods such as questionnaires and surveys, we will identify the average sleep duration, bedtimes and wake up times and the possible effects it may affect student's alertness, behaviour, and learning during the school day.*

2. Time of day and its effects on Perceived learning: Memory and attainment – Does the performance of students vary at different times of the school day?

   In this phase we will be looking at the effects time of day has on short-term memory and problem-solving activities and whether the period (time of day based on school timetable) can influence the performance in these two areas.

3. Learning preferences and behaviour vs school timings- To what extent does behaviour and perceived learning preferences vary throughout the day?

   In this phase, we will be investigating the time of day and its effects on behaviour and perceived learning. For the purpose of this research, we will be exploring whether the time of day can have an effect on the way students learn as perceived by the student and teacher. Students will be completing a learning style inventory (LSI) at different times of the day, the data gathered will be compared and analysed to identify if the questions were completed differently and if the time of day had an impact in the way students answered the learning style inventories. The purpose of these LSI were used to assess whether students answered the inventories differently at different times of the day and were not used to assess the learning styles of the

students. Secondly, we will look at the results from the school management system (SIMS) to identify behaviour trends and the perceived learning which was recorded by teachers at different times of the day throughout the year.

4. Collaborative study: How can a school day be adapted to improve students' academic achievement?

   In this phase, we will be comparing the results from the previous three phases and along with the data collected in the student and teacher interviews, and we will attempt to identify any connections and draw conclusions from the findings.

These four phases were formed based on the findings from the literature review with the key factors sleep, preferred learning times and learning styles having important roles in school timetabling (See Literature review).

In the following section is a summary of each of the chapters in this paper

- Chapter 1- Introduction
- Chapter 2- Literature review

  This literature review chapter will focus on the key factors that directly or indirectly seem to impact this research. Firstly, it is important to focus on the question of what time the school day should start as there are a vast number of studies based on school timing and whether or not school times should be changed. Although the main focus is on school timetabling, the timing of lessons is directly affected by school start times. I will also consider student preferences of the best time of day to learn and its influence on academic achievement: do students have preferred learning times? And if so, to what extent does this have a positive impact on their learning? In this section will take an in-depth exploration of various studies that address these factors in order to understand the whether there are any connections between the time of day and students learning.

- Chapter 3- Reflexivity

  In this chapter, I will be taking a reflexive analysis to unravel the motivations, methodological approach and the decisions taken in this study. Reflexivity can be an important methodological tool as my experience as a teacher, my social environment, assumptions, behaviour, and position may impact the research process in this study, therefore, to increase validity, it is important to reflect on this study.

- Chapter 4- Methodology

  In this chapter, I will be discussing the methodological approach that was taken during this research. Since the nature of this study requires an analysis of various factors that can affect school scheduling such as sleep, learning preferences, time of day, etc. the approach taken was mixed methods using a combination of both qualitative and quantitative methods as it was essential to use a range of methods such as surveys, questionnaires, observations and interviews in order to collect data effectively and efficiently. This chapter was split into 4 sub sections in order to discuss the methods used for each phase of this study.

- Chapter 5- Phase 1- The importance of sleep in school timetabling

  In the first phase data linked to sleep was collected and analysed. Based on the literature review (section 2.8) there are many risks that adolescents may face if they do not get enough sleep, apart from daytime sleepiness there are a lot of behavioural issues that could arise (Dinges & Kribbs, 1991, Nilsson et al., 1989, Carskadon 1990). Students were given a range of questionnaires regarding their sleep quality and duration.

- Chapter 6- Phase 2- Time of day and its effects on Perceived learning

  For this phase, students were given short memory and problem-solving tests at different times of the school day and week. In this chapter, we will be analysing the findings and discussing whether there are any connections between the time of day and student's performance.

- Chapter 7- Phase 3- Timetabling Vs. Learning preferences and behaviour

  In this chapter, we will be investigating whether the time of day can have an effect on the way students learn. In order to investigate this, students had to complete a learning style inventory which was adapted from Middlesex community college's LSI in order to identify which type of learning students were and whether the time of day had an impact in the way, they answered the learning style inventories. The data collected from these inventories was analysed alongside school data which was collected on the school information management system (SIMS) which is a school management system which contained information about students perceived learning (as recorded by teachers) and behaviour for over 1700 students on a day by day, lesson by lesson basis over the course of the year.

- Chapter 8- Phase 4- Collaborative study

In this chapter, we will be comparing the results from the previous phases and along with the data collected in the student and teacher interviews, and we will attempt to identify any connections and draw conclusions from the findings. The questions used in the focus group interviews were formed based on the finding from the previous phases to help understand and analyse the data gathered. This phase attempts to use the students and teachers as co-researchers to help gain an in-depth understanding as to the importance school scheduling can have through the experiences of the students and teachers.

- Chapter 9- Conclusions and summary.

  In this chapter conclusions of the study are outlined, and implications for practice and further study are discussed.

Chapter 2- The Literature Review

2.1 Introduction

This literature review chapter will focus on some key factors that may directly or indirectly impact this research. To fully understand the influence time of day has on teaching and learning, in-depth reading into aspects that revolve around the time of day, learning capability, adolescent sleep patterns as well as any other factors that may arise were essential. During the initial reading revolving around the influences of time of day on teaching and learning factors that were recurrent in a range of studies were noted and were considered in this literature review.
The following factors were considered:

- School start times - Firstly, it is important to focus on the question of what time the school day should begin as there are a number of studies based on school timing and whether or not school times should be changed (Mirabile 1989; Brown et al., 1995; Hansen et al., 2005). Although the main focus is on time of day, the timing of lessons is directly affected by school start times.

- Time of day preference vs. academic achievement – I will also consider student preferences of the best time of day to learn and its influence on academic achievement: do students have preferred learning times? And if they did, to what extent does this have a positive impact on their learning? In this section, I will take an in-depth exploration of various studies that address these factors to understand the whether there are any connections between the time of day and students learning.

- Learning preference vs. academic achievement – A number of studies will be discussed that review the relationships between academic achievement and time of day learning preferences, with one of the first studies undertaken by Murray (1980). Besides the need for an adequate amount of sleep for cognitive processes to function properly, is there a certain time of day where students learn best?

- School scheduling vs. sleep needs – In this section I will critically review the implications of school timings against the sleep needs of students. The literature on the biology behind

sleep needs was reviewed to help provide an in-depth understanding of sleep and the possible effects it may have on student learning.

A large part of this literature review will concentrate on sleep since the majority of research on time of day and academic performance have always identified sleep patterns as a crucial factor which is inseparable from the time of day. It is apparent from some of these studies (Carskadon et al., 1998; Wolfson and Carskadon 1998) that sleeping very late and waking up early will consequently affect student's attentiveness first thing in the morning but to what extent will this impact their results?

Since changes in student sleep patterns have been a key issue in the educational field for many years, the extensive literature on the effects of sleep loss on learning is necessary to help understand the possible consequence students currently are facing. This literature will break down this subject in order to allow the reader to understand the importance of sleep and how it may affect a student's school life.

- Student sleep need/loss and its effects on learning – in this section we review literature around student sleep needs and the possible impacts it may have on learning. There is a great deal of literature available that shows a strong relationship between cognition and sleep loss. It has been revealed that sleep deprivation is directly linked with memory loss (Dinges & Kribbs, 1991; Nilsson et al., 1989), as well as poorer performance and alertness (Carskadon & Roth, 1991).

- Consequences of Unmet Sleep Needs - During adolescence, significant changes in sleeping and waking behaviours occur. It is clear that over the years, students have been getting less sleep but to what extent is this impacting the students academically? The literature in this section centres on the consequences students face when their sleep is neglected.

- Student attentiveness and awareness – Student attention is crucial during lessons for learning to take place, studies on student attention and awareness at different times of the day were reviewed and were found to be linked with academic performance.

- Influence of Time-of-Day on Memory – Memory is a key factor when discussing learning as throughout a student's life, assessments are used as a tool to measure academic achievement. A number of literature which used both short and long-term memory tests as a tool to measure performance and different times of the day were reviewed in this section.

2.2 School start times

School start time has a major influence on students' sleep pattern and their wake-up times. For the vast majority of teenagers waking up and going to school is neither spontaneous nor is it negotiable. Szymczak et al.'s (1993) study on sleep/wake rhythms in children followed Polish students between the ages of 10 and 14 years old for more than one year and found that all of them slept much longer during weekends and holidays by extending their sleep by waking up later. This research concluded that the school schedule was the principal determinant of wake times for these students (Szymczak et al., 1993).

Adolescence starts with the onset of puberty and ends in the early 20s. During this period, adolescents are driven to later wake/sleep times by their biological clock. Because education start times do not adjust for this change, early school start times effectively limit sleep in adolescents. Researchers have found that students lose as much as an average of 2.7 hours of sleep on school days. This is why sleep loss in adolescence is greater than at any period in our lives. (Kelley & Lee 2015).

It is not a simple matter of forcing adolescents to go to bed earlier as circadian rhythms or biological sleep patterns amongst teenager are thought to be different from those of adults and children. Teenagers tend to go to sleep later at night and wake up later in the day. This could be due to a number of factors, including changes in the circadian body clock as well as behavioural and social factors that may promote and propagate the delayed bedtime and wake up time (Carskadon and Acebo 1997). This pattern is not typically seen among children and adults, and with early school start times it is increasingly difficult for teenagers to stay alert in school which is why adolescent sleep has seen growing attention over the past decade (Carskadon et al., 1998; Wolfson and Carskadon 1998; Wahlstrom, 2002a).

In the USA the combination of delayed sleep phase and early start times has had a huge negative impact on teenagers with issues such a decrease in cognitive performance as well as mood and health issues (Kraemer et al., 2000). Due to the growing evidence of adolescents' sleep patterns and the struggle with early school start times, the Minneapolis Public School District altered the start times of seven schools from 7:15 a.m. to 8:40 a.m. in 1997. This change resulted in school classes ending at 3.20 p.m. as opposed to 1.45 p.m. and the school board along with The Centre for Applied Research and Educational Improvement examined the impact of this change over the long term (Wahlstrom, 2002b). Results indicated that with the school start times being delayed by 1 hour and 25 minutes there were several positive changes in the school (Centre for Applied Research and Educational Improvement, 1998a, 1998b; Wahlstrom, 2002b). The extra time in the morning enabled students to gain more sleep which for students in Grades 9, 10 and 11 improved attendance and concentration in classes. Parents and teachers noticed significant improvements in student behaviour and performance, and there was a reduction in disciplinary problems (Centre for Applied Research and Educational Improvement, 1998a; Wahlstrom, 2002), which was unsurprising considering that on average students slept 5 or more hours per week. These results support the conclusion that students are emotionally and cognitively better suited for the later start time.

2.3 Time of day preference and academic achievement

There are many studies that have shown the relationships between academic achievement and time of day learning preferences, with one of the first studies undertaken by Murray (1980). Murray's study reviewed the learning styles of low achievers in the seventh and eighth grade in a public middle school; she revealed that a lot of the female low achievers favoured learning in the evening, as opposed to the low male achievers who preferred learning in the afternoon. Similarly, Carskadon's (1993) study of the relationship between biologically-based time preferences and school achievement showed comparable results. Carskadon took a biological approach and focused on the reasons why adolescent bodies had later sleep times and wake up times and what the effects were on learning. It was through this initial data that she suggested the need to further examine the relationships between student time preferences and school achievement (Carskadon l993).

Over the years, studies in Europe and in the USA examined the learning preferences of a range of multicultural groups and found differences amongst a number of countried (Dunn & Griggs, 1990). According to Lam-Phoon (1986), Asian students preferred early morning learning as opposed to Caucasians, similarly in another study by Dunn et al. (1990) revealed that Mexican-Americans also shared preference for learning in the early morning but ostracized afternoon learning, and later in the day was preferred by African-American, Caucasian, and Greek students (Dunn, et al., 1990).

Similar studies of highly able students in Canada, Egypt, Brazil, Israel, Korea, the Philippines, and in the USA revealed that fewer than 10 percent preferred learning early in the morning, the majority preferred learning late in the morning and afternoon, and a minority were evening learners (Milgram, Dunn & Price, 1993).

According to Dunn's (1995) research on time of day and its effects on learning, Dunn's Learning Styles Inventory supported a school in changing the time of day that various lesson was taught and, consequently, significantly improved learning and reduced behaviour problems (Stone, 1992).

Kraft & Martin (1995) have shown that student performance typically peaks in the afternoon, though various studies believe this depends on the individual. Anderson et al. (1991) revealed different types of learner, "morning-types" achieved better on measures of speed and response in the morning, while "afternoon-types" performed better in the afternoon.

Barron et al. (1994) found that afternoon reading instruction produced the greatest increase in reading scores as compared to morning instruction. Taking this into consideration, it is suggested by Callan (1995) that administering exams at certain times of the day may discriminate against some students.

Lynch's (1981) study on the relationship between time-of-day preferences and the achievement in English of eleventh and twelfth graders with low attendance, found that students achieved better test scores, and were absent remarkably fewer times when their English course periods corresponded with their preferred learning time. And, having had broad experience with low auditory/visual learners i.e. students who do not prefer learning through listening, discussions or by observing the teacher, Gardiner (1986) conducted experiments with Multisensory Instructional Packages (MIP) which is a self-contained teaching unit which helps a student learn a set of objectives, containing a variety of instructional resources designed to teach one objective through

each of the four perceptual strengths, with fourth-grade underachievers at specific times of the day. Results demonstrated significantly higher social-studies test scores during late morning and afternoon, compared with early morning teaching.

Virostko (1983) studied the reading and mathematics attainment of approximately 300 primary school students over a 2-year period. Timetables were designed to offer one subject at the student's preferred time of day and the other at their non-preferred time. At the end of the first year, the students achieved statistically higher scores in the subjects that matched their time preference compared to the subjects that mismatched their preferred learning time on the New York State Professional education program (PEP) Tests. The following year the students reversed the subjects and 98% of the students achieved statistically higher scores on the subject that was reversed. Missouri and Cramp (1990) simulated Virostko's research with a smaller group and revealed essentially similar findings.

In a similar research in the USA, Andrews (1990) identified the time preferences of his underachieving elementary population. From his sample population, he found that 55 of the students preferred learning early in the morning, 41 students preferred late morning, 70 preferred evening learning and 100 were virtually non-functional in the morning but became more alert in the afternoon. This indicated that the majority of the students should have been taught core academic subjects in the early afternoon and late morning, and the evening typed students should be taught how to study at home in the evening.

In 1986 Andrews changed the reading schedules for his students who had only performed at the 30th percentile in math and reading on the California Achievement Tests. After only one year, his school improved up to the 40th percentile and continued to improve over the next few years rising to the 83rd percentile after only the 3rd year. These were the same children, but their reading and mathematics achievement had been negatively affected as their preferred learning times and styles were not met during lessons.

According to Dunn (1985), only 20% of elementary school students are highly alert in the early morning, 30% only after 10:00 to 10:30 a.m., and another 30% not until the afternoon.
As students get older and reach middle school, their ideal times are usually late morning or afternoon. For high school student's peak times shift more to the extremes of early morning and late night.

Numerous studies also report a similar pattern in preferred time of day and the link with age, but there are substantial differences in individual preferences for all age groups.
Whilst group averages are relevant to note; it is difficult to say that all students within a particular age group will learn best at one certain time of day.

Several researchers have suggested that the traditional school schedule favours students who are most alert in the mornings (Dunn, 1979, Marcus, 1979, Price et al., 1981). In a study designed to test whether or not students with high reading achievement scores showed a preference for certain learning styles, and preferred times of the day. Results found that students with the highest reading achievement scores indicated a preference for learning at different times to the traditionally acknowledged morning time.

Students with lower scores showed a preference for later morning learning. A number of studies also reported that when students are matched with their time of day preferences, they significantly perform better in school. In a similar study conducted by a school in New York, elementary students were put into a two-year programme for their reading and math classes where they were matched with their peak learning time for one of the subjects and mismatched for the other each year. Results demonstrated that in both years students performed significantly better in subjects that matched with their preferred time of day (Bruno and Dunn, 1985).

Some researchers have gone as far as to suggest the optimal times of day for teaching certain subjects based on students short and long-term memory retention. Morton and Kreshner 1985 devised a study in which thirty-six mixed ability students were randomly assigned to morning and afternoon lessons revolving around topics which require memorisation. Both normal and learning impaired students were able to recall more information processed incidentally in the afternoon group.

Other studies examining time-of-day influences on reading instruction offer additional evidence that the time of day of instruction also impacts student achievement. Reading achievement was found to have benefited more students whose lessons were in the morning than in the afternoon (Davis, 1987, Barron, Henderson, Spurgeon, 1994). Davis' (1987) study comprised over one school year, and although it did not state the exact times of instruction, it compared the first (a.m.) and the last (p.m.) period of the day and Barron, Henderson & Spurgeon's 1994 study was over

two years. These studies found that long-term memory is better for those taught in the afternoon. Davis' (1987) report is not clear on whether the test questions assessed areas that required short-term memory recall or long-term memory recall or whether it was a combination of both. However, since reading skills are developed over a long duration of time, the majority of skills used in reading rely on long-term memory, and therefore these findings favour having reading lessons in the afternoon rather than in the morning.

Davis (1987b) specifically looked at the time of day effects on mathematics instruction. Davis (1987b) examined time of day effects on the instruction of eighty students in eighth grade in the areas of mathematics. Students were assigned to a morning session (8:10 a.m.-9:10 a.m.) or an afternoon mathematics session (1:00 p.m.-2:00 p.m.) for the duration of the school year. The same teacher taught both of these mathematics classes. The Comprehensive Test of Basic Skills (CTBS) which is a nationally standardised achievement test administered to all students in Reading, language and math was used as a pre-test at the beginning of the year and again as a post-test nine months later. Davis' findings state "the fact that there was no apparent difference in achievement between morning and afternoon math groups is interesting and more difficult to interpret" (Davis 1987b p. 79). Davis concludes that perhaps mathematics requires a balance of both short-term memory and long-term memory and may not strictly fall into a short-term memory task or a long-term memory task.

2.4 Time of day Vs. Learning preferences

The aforementioned literature mainly examined underachieving students; Although Smith's (1987) study examined the effects of learning-style time preferences on average and high achieving students during mathematics lessons. When students' time preferences (timings where students felt they learnt best) match their mathematics schedules, even high achieving students demonstrated an increase in attainment scores (Milgram et al., 1993). Although time preferences affected underachieving students considerably more than achieving students, this is mainly due to underachievers finding it more difficult to focus during mismatched timing as opposed to the higher achieving students.

Gadwa and Griggs' (1985) study revealed that high-school failure in the state of Washington by students who had low motivation preferred studying in the evening and found it difficult to learn

during the morning. In addition to this, these students needed a diverse range of learning strategies during lessons in order to meet their learning styles. When taking into account different learning styles, it is important to keep in mind that students learn in different ways. Research indicates that all students retain and learn more from a variety of instructional strategies. For example, faculty who mainly teach using a lecture format need to be aware that the average student will retain only 10–20% of what they hear (Arthurs 2007).

The majority of research involved with the way in which time of day affects students' academic achievement have mainly focused on learning styles and preferences which includes when student prefer to learn along with various other factors.

A learning style is defined as the way in which a person learns. However, there are various variables that may contribute and affect the way in which a person may learn:
(a) Environmental (location, noise levels, temperature, class size etc.);
(b) Emotional (Motivation, behaviour, responsibility etc.);
(c) Sociological (Group work, peers, self);
(d) Physical (attention levels, need for intake, time of day) preferences (Dunn et al., 1981).

Educators have come to realise that each and every student carry around a distinct set of these preferences that can define his or her optimum mode of learning. Traditionally, educational researchers have tried to determine the best system of education for all students. Although recently research has shifted towards focusing on individual students rather than one universal method for all students. Advocates of the learning styles theory have established that one type of learning format cannot meet the needs of all students because every student learns best through an educational approach that suits his or her unique learning style.

It can be argued amongst researchers whether students have the ability to identify their own best style for learning. Rita Dunn, one of the leading advocates for learning styles based education, when testing more than 175,000 students in grades 3-12, found that most students not only can tell you how they learn but are eager to identify and express their learning styles (1983). However, Dunn does find that 15% to 20% of students who do not have a significant change in levels of alertness during the school day are incapable of identifying their peak times. This portion of the students includes those who are fortunate enough to learn equally well at all times of the day; thus, their incapability to identify this learning style does not affect them (Dunn, 1985). Numerous

studies support the notion that students can, in fact, identify their preferred learning style. In a 1971 study, seventy-two college students showed that when questioned they could predict the learning style in which they would display their optimal performance (Dunn, 1983).

A similar study also revealed that students who had a preference towards a particular learning style performed better during testing on topics taught in a way that matched this preference rather than when they mismatched (Dunn, 1983).

Another study conducted in a secondary school showed similar findings when teachers implemented teaching styles which corresponded to students with a strong preference to a particular learning preference had high-grade point averages, whereas students whose learning preference didn't match teaching methods had significantly weaker grade point averages (Dunn, 1983).

Pizzo (1982) studied the effects of matching and mismatching students' learning style using a self-reported learning style inventory. He found that when students' learning styles matched with teaching styles their reading scores were much higher than those whose learning styles mismatched.

Overall these studies suggest that students are capable of identifying the way in which they learn best, and that when students' learning preferences are matched accordingly with teaching styles, the academic achievement can further improve. Studies have also suggested that learning styles remain consistent throughout the lifespan so that by identifying a student's learning style early in education, educators can use this information to help inform teaching and improve students' performance (Sperry, 1973).

Teachers who are against taking student learning preferences into account when planning lessons may argue that a number of learning methods promoted by learning styles theorists require students to work independently or in small class sizes and that larger class sizes require a more teacher centred approach to maintain classroom behaviour and teacher control. However, Dunn and Dunn believe that matching teaching styles and students' preferences should help improve classroom behaviour as it is precisely those students who find the lessons most difficult that use up most of the teachers' attention as their learning styles do not match the kind of instruction to which they are being exposed and as a result may misbehave in lessons (Dunn and Dunn, 1979).

Numerous additional studies have reported that when matching teaching to learning style there are positive effects in areas other than achievement.

Price et al (1977) tested over three hundred twenty students from different grades using Learning Styles Inventories and the How I See Myself self-concept scale. Results showed a strong relationship between the students who reported high self-concepts and whose learning styles were most closely associated to traditional schooling. Findings revealed that students with high self-concepts scores preferred studying in warm and quiet environments, were motivated by teachers, persistent learners and were capable of learning in several ways i.e., individual, peer, group work and had more than one learning style. On the other hand, students with low self-concepts were the opposite, they preferred studying with music or interacting with others in a cool environment and were less motivated by teachers or adults (Price et al, 1977).

In another study by Dunn (1981), a teacher selected 20 of the most disaffected students in a high school and adapted the curriculum so that it was able to cater for each students' individual learning style. After a short period of time not only did the academic performance of students improved but also their attitude towards learning and school significantly improved also. In addition at the time of the study, no student had dropped out of the school and attendance was regular.

A principal in another school in which learning styles information was implemented noted that a young female student who was a chronic truant changed from making F's to A's and soon began attending school regularly when teachers began to provide lessons that promoted her preference for tactual/kinaesthetic learning (Cavanaugh,1981).

Such improvements in both achievement and attitude demonstrate the importance of taking learning styles into account when designing educational programs.

Therefore, based on the above literature, learning styles and learning time preferences can have a significant impact on the overall academic achievement of secondary school students. These studies suggest that if schools continue to pay minimal attention to mismatched time preferences students will be unable to perform to their best potential and may even fail subjects that can have huge impacts on the future, as well as having a negative impact of the schools' credibility in teaching (percentage pass rates).

2.5 Learning styles Vs academic achievement

Before looking into the different types of learning styles and possible effects it can have on academic achievement it is important to attempt to define what is meant by learning styles.

According to Keefe (1987), learning is an interactive process, the result of student and teacher activity within a certain learning environment. These activities are key elements of the learning process, showing vast differences in pattern, style and quality (Keefe, 1987). Gregorc and Ward (1977) believe that before teachers are able to address the needs of individual students they first must understand what "individual" actually means and must adapt their teaching styles to the students learning style.

Over the years, educational research exploring the issues of academic achievement has extended far beyond 'simple' issues of intelligence and prior academic achievement. There are a number of learning related concepts, such as perception of academic control and achievement motivation which have been a focus of attention when attempting to identify factors affecting learning-related performance (Cassidy and Eachus 2000). One concept in particular which has provided valuable insights into learning in academic settings is 'learning styles'. It is generally accepted that the learning style, as in the way an individual chooses to or is prone to learning in a particular way can have either a positive or negative impact on the academic performance of that individual.

Learning styles research originated in the field of psychology and has been ongoing for a very long time, although over the past decades there has been increased interest in learning styles outside of psychology in various fields but especially in education. Cassidy (2004) sees this interest as understandable as the concepts that are being explored pertain to any human within a learning environment. As such a disparate body of work on learning styles has developed from several disciplines with slightly different objectives, goals and focus.

Ellis (2005) describes learning style as "the characteristic ways in which individuals orientate to problem-solving". (p.4) Ellis cites Keefe's (1979) definition of learning style as the characteristic cognitive, affective and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with and respond to the learning environment (Keefe 1979). Learning style is a consistent way of operating, which reflects primary causes of behaviour. Cornett (1983)

defines learning style as the overall patterns that will give general direction to learning behaviour while according to Dunn and Griggs (1995) they describe learning styles as the biologically and developmentally imposed set of characteristics that make the same teaching method a positive experience for some and a negative experience for others.

Ellis' (2005) research states seven factors of learning styles whilst explaining individual learner differences, these factors are; beliefs, affective state, age, aptitude, learning style, motivation, and personality. Although categorizes these learning styles into three broad types: perceptual learning styles, cognitive learning styles, and personality learning styles.

Keefe (1991) defines learning style a combination of a student's attribute and as an instructional strategy. As a student attribute, learning style is the way a student learns and likes to learn. Every student has different and consistent ways of perception, organization and retention. These learning styles are attributes, cognitive, affective, and physiological behaviours that serve as an indicator of how learners perceive relate with and respond to the learning environment (Keefe, 1987).

Reiff (1992) believes that learning styles not only influences how students learn, but how teachers teach and interactions in a classroom. Every individual is born with certain preferences toward particular styles, but these preferences are influenced by environmental factors such as culture, experience and development.

According to Ellis (2005), learning styles are usually fixed, it is not easy to change someone's learning style as it is not easy to change personalities, habits, or cognitive style. However, the classroom environment, school and peers can influence one's personality and in turn can alter a student's learning style. In this sense, it is important for teacher to understand different types of learners and to get to know the student's learning style. As educators, it is important to note that students' learning styles cannot be the same and due to the range of learning styles that can be found in a classroom can make the teaching difficult. Cook (2000) states that *"all successful teaching depends upon learning; there is no point in providing entertaining, lively, well-constructed language lessons if students do not learn. The proof of the teaching is in the learning."* (Cook 2000 P.23).

In every classroom regardless of the subject being taught, there will be students with learning styles that may or may not complement the way in which a subject is being taught. A valuable means of

accommodating these learning styles is for teachers to adapt their teaching styles in order to meet the needs of the students. This way all students will have at least some activities that appeal to them with respect to their learning styles, and as a result will be more likely to be successful in these activities (Aditya and Chaudhary 2004).

Overall due to students having various learning styles it is apparent that depending on the type of lesson certain students can learn better than other students, in addition depending on the learning environment some students may adapt their learning styles to which as a result could have both a positive or negative effect on academic achievement.

2.6 School Scheduling Vs Sleep needs

At around the age of puberty, teenagers tend to become more ‘‘evening typed’’, preferring later bedtimes, and wake times. Preference for ‘phase delay’ has a biological basis, with circadian phase also referred to as the ‘human clock’ becoming increasingly delayed in young people relative to pre-teens (Carskadon & Acebo, 1997; Altun & Ugur-Altun 2007).

The circadian phase is measured by the circulating levels of the hormone melatonin in a daily cycle; this allows the entrainment of the circadian rhythms of several biological functions which are responsible for genetic success such as the immune system and evolution. Although circadian rhythms are self-sustained they are adjusted to the environment by external cues called zeitgebers, with the primary one of which is daylight but also include temperature, social interactions, pharmacological manipulation and eating/drinking patterns (Toh, 2008). Due to this shift in the circadian phase teenagers become more attentive in the evening and do not feel tired until much later, therefore finding it difficult to get enough sleep during school term due to having to wake up early for school.

Kelley et al.’s (2015) study discusses the ‘sleep-wake’ cycle which arises from the relationship of the circadian rhythm generated by the SCN pacemaker which is the alertness of an individual and a homeostatic sleep cycle which increases the pressure to go to sleep. These processes work in opposition to maintain consolidated wake during the day, and a consolidated sleep during the night. Their interaction also generates a ‘wake maintenance zone’ (WMZ) which, generally, occurs

several hours before sleep is typically initiated (Dijk and Czeisler 1995; Shekleton et al. 2013). This is a major factor in the sleep difficulties experienced by adolescents. In the early evening, the homeostatic drive for sleepiness is usually too low to fully counteract the circadian drive for alertness, resulting in several hours where it is very difficult to fall asleep. In adolescence the timing of the circadian clock shifts later, delaying the phase at which sleep can be instigated, and pushing the WMZ later into the evening These biological changes in the timing of sleep tendency bring about the conflict with education start times; the brain will not allow students to go to sleep early but education times still require adolescents to wake (or be woken) too early in their circadian cycle, systematically restricting the time available for sleep and causing severe and chronic sleep loss.

According to Kelley and Lockley (2013) synchronizing education start times to adolescent biology is the obvious way to address the problem of chronic sleep deprivation currently experienced by adolescents on school days. Astronomical time data and changes in sleep patterns from international studies show at the age of 10 biological wake time is about 06:30, so synchronized school starting times would be 08:30-09:00. At the age of 16 biological wake time is about 08:00, and synchronized school start times 10:00–10:30, and at 18 biological wake time is about 09:00, and synchronized education start times 11:00–11:30).

There have been studies in Poland. France and in America that compare holiday and school sleep times, results have shown that the impact of school schedule negatively affects the sleep duration of teenagers (Hansen, Janssen, Schiff et al., 2005; Palazzolo et al., 2000; Szymazak et al., 1993). Since student sleep patterns during holidays represent the natural circadian rhythm of students, teenagers sleep considerably longer during school holidays and weekends than they do during school weeks maintaining a sound pattern of later bedtimes and wake up times (Hansen et al., 2005; Palazzolo et al, 2000).

Lack of sleep in adolescents during school term has been connected with mood swings, tiredness in class, decreased functioning during the day, accidents, increased substance use and lowered academic grades in cross-sectional studies. Furthermore, irregular sleep patterns only add to these outcomes (Giannotti et al., 2002; Wolfson & Carskadon, 1998).

Carskadon points out that social pressures, as well as biological factors, play a major role in determining adolescent sleep. The key factors that directly affect adolescent sleep patterns are

puberty, parental control and influence in setting bedtimes (this tends to decrease as teens get older), curfews, substance use, employment, school schedules and finally the development of circadian rhythms (Carskadon, 1990). It is common for parents' of teenagers to stop enforcing bedtimes whilst still enforcing a wake-up time which as a result is reducing crucial hours of sleep that puberty is demanding (Carskadon, 1993).

According to Wolfson and Carskadon (1998) most teenagers have different sleep patterns during the weekend than they do during the school week. Usually teenagers sleep much longer over the weekend, which to some extent can be due to the insufficient hours of sleep they get during the weekdays. In Wolfson and Carkadons' study on the relationship between adolescent sleep/wake habits and the characteristics of students' daytime functioning, more than 3000 adolescents had an average of 1 hour and 50 minutes more sleep over the weekend than they have during a school week. A sleep habits survey was administered in the homeroom classes of high school students in 4 different schools from Rhode Island school districts. Self-reported sleep times during school weeks and weekend had decreased by 40-50 min across ages 13-19 with sleep loss mainly due to later sleep times with 91% of the surveyed students going to bed until after 11 p.m. during the weekends and 40% sleeping after 11pm during school weeks.

An earlier study by Allen and Mirabile (1989) had similar findings, 61 students from two different schools with start times of 8am and 7.30 a.m. had their sleep durations examined. Results from both schools reported remarkably short sleep durations of 7 hours with bedtimes of 11pm during the week and 9 hours of sleep from 1 a.m. during the weekends.

Finally, in a small-scale study, Brown et al (1995) examined 14 ninth grade students during their transition to 10th grade, which had a 1-hour earlier school start time. Results indicated negative changes in sleep patterns due to students having to wake up earlier. Consequently, students are getting less sleep during the week which not only may affect student academic performance but also may have negative psychological and health issues.

Some researchers argue that continual sleep deficiency may be a contributory factor in the development of adolescent depression (Dahl & Lewin, 2002; Wolfson & Carskadon, 1998), Wolfson and Carskason (1998) revealed that due to the biological makeup of adolescents, students are sleeping later in the evening despite the fact that they have to get up early to go to school in the morning. Therefore, it is evident that the majority of students are sleep deprived which is why they

are sleepier during the first morning lessons in school. Also taking into considerations factors such as internet, television and other entertainment available 24 hours of the day, it is not surprising that students are unable to effectively learn in the morning.

2.7 Student sleep duration and its effects on learning

There is a great deal of literature available that shows a positive relationship between cognition and sleep loss. It has been revealed that sleep deprivation is directly linked with memory loss (Dinges & Kribbs, 1991; Nilsson, et al 1989), as well as poorer performance and alertness (Carskadon & Roth, 1991). The specific loss of Rapid Eye Movement sleep has also resulted in memory loss (Smith, 1995; Li et al., 1991). REM sleep is an important stage of sleep which helps the consolidation of procedural and spatial memory and accounts for 20-25% of sleep.

Dujardin et al (1990) revealed that a decrease in REM sleep can directly affect information processing, with consequences such as: increased irritability, depression, mental fatigue with reduced memory concentration and difficulty in problem solving and other complex tasks (Maas & Robbins 2011).

Although many believe teenagers need less sleep than others, according to Carskadon (1982) teenagers actually need more sleep than others. As students move through their teenage years, increasing hours of sleep are needed. Maas & Robbins' (2011) study show that adolescents need approximately nine hours of sleep as opposed to the eight hours needed by adults. Increased sleepiness in adolescences is related to physiological changes during puberty. Carskadon et al (l993) concludes, "Daytime sleepiness increases at about the time of mid-puberty even without any change in a youngster's night time sleep length" (pg. 262). However, there can be a change in the amount of time teenagers spend sleeping, since school times has been getting earlier as the students mature despite their need for more sleep. Consequently, this can have serious physical and psychological consequences for teenager and can negatively affect their academic performance.

Adolescence demand more sleep time, even with 9 hours of sleep or more teenagers still struggle with drowsiness early in the morning. With the problem only getting worse over the years as students seem to be sleeping later due to internet, television and many other distractions that are

available 24 hours a day. In a study by Steptoe et al. (2006) on sleep duration in young adults, approximately 17500 university students were questioned on the amount of sleep that they get during the week, results found that 63% of the respondents slept around 7 to 8 hours; 21% were short sleepers (6%, <6 hours; 15%, 6-7 hours); and only 16% were long sleepers. Based on this research it is clear only a small minority (16%) of the students are getting adequate sleep and the majority of the students are unable to get the required 9 hours of sleep needed in order to be fully alert and focused in school.

2.8 Consequences of Unmet Sleep Needs

During adolescence, significant changes in sleeping and waking behaviours occur. It is clear that over the years, students have been getting less sleep but to what extent is this impacting the students academically? The following literature centres on the consequences students face when their sleep is neglected.

In a study by Wolfson and Carskadon (1996) describing the relationships between sleep/wake habits, school performance, behaviour and the characteristics of students, a sleep habits survey was administered to 3000 high school students at four public high schools from three Rhode Island school districts. Self-reported sleep times during school weeks and weekend had decreased by 40-50 min across ages 13-19 with sleep loss mainly due to later sleep times with 91% of the surveyed students going to bed until after 11pm during the weekends and 40% sleeping after 11pm during school weeks. The students who mainly described themselves as failing or finding in difficult (i.e. borderline students or below) on average slept 20 minutes less and went to bed 40 minutes later than students who were doing well in school (A and B grade students). Students who slept less than 7 hours during school nights and went to bed later in the evening reported increased daytime sleepiness, depression and sleep/wake behaviour problems as appose to students who slept 8 hours or more didn't report these issues.

According to Carskadon (2002), there is an important number of biologically based changes during adolescence in their sleep regulation. During the start of puberty, adolescents develop almost a 2-hour sleep-wake phase delay (later sleep start and wake times) in relation to their sleep-wake phases during their childhood (Carskadon 2002).

These changes are related to the naturally delayed start of the melatonin secretion which can be expressed as the natural change in the biological body clock which shifts the circadian phase, therefore as students go through adolescence there is a tendency to want to go to sleep later however, adolescent sleep needs do not decrease and according to various research the ideal sleep requirements still remain at approximately 9 to 9.25 hours per night. On a practical level, this would mean that the average teenager will have difficulty falling asleep before 11 PM, and their ideal wake time is around 8 AM.

In addition to the impact of these biological factors, students still are required to attend school early in the morning as well as other lifestyle and social demands such as homework, extracurricular activities, and technology (internet, TV etc.) can have a significant effect on their sleep patterns (Carskadon 2002, Punamaki et al., 2007, Calamaro et al., 2009).

According to sleep researchers there is a vast inconsistency in sleep-wake patterns from weekday to weekend, often associated by students sleeping longer on weekends in an attempt to address the prolonged sleep debt accumulated during the week. This phenomenon of oversleeping during the weekend only adds to the circadian disruption and decreased daytime alertness levels (Hansen el al 2005). Given these findings, a significant number of research studies have now documented that the average adolescent is frequently sleep deprived (Carskadon et al., 1998, Fredriken et al., 2004).

The National Sleep Foundation (2006) found that approximately 80% of teenagers in the United States were getting below the recommended 9 hours of sleep on school nights. Numerous studies of adolescents in different countries and from various different cultures and backgrounds have conveyed similar findings with regards to inadequate sleep durations and irregular sleep and wake patterns. (Yang et al., 2005, Gau et al., 2005, Giannotti & Cortesi 2002).

According to Patten et al. (2000), there are considerable risks that students may face as a result of insufficient sleep such as mood swings, decrease in attention and memory, negative behaviour and affects in overall quality of life. Inadequate sleep is particularly likely to take a toll on academic performance (Patten et al., 2000, Kelley et al., 2014).

There have been studies that have shown a strong relationship between decreased sleep duration and lower academic achievement for students of all ages groups (Wolfson & Carskadon 2003) as well as a lessened motivation to learn. (Meijer et al., 2000).

Danner & Phillips (2008) have identified a number of health-related consequences which are directly linked to sleep loss, these include an increased risk of weight gain obesity, an increase number of driving accidents due to drowsiness and an increased use of stimulants (e.g., caffeine, prescription medications).

As you can see from the numerous negative effects on adolescent health and well-being and the consequences of insufficient sleep in this population is a significant public health issue. Multiple studies have now recommended that the early school start times of many students may significantly contribute to insufficient sleep in adolescents (Wolfson et al., 2007, Adam et al., 2003, Dexter et al., 2003, Knutson & Lauderdale 2009).

Allen (1992) compared different schools with start times of just 30 minutes earlier against those with slightly later start times and found significant number of issues. Students at the school with earlier start times had more of a negative impact on sleep durations, drowsiness, concentration, as well as behavioural issues compared to schools with later start times. (Allen 1992, Epstien et al., 1998; Wahlstrom 2001)

There are many risks for adolescents that do not get adequate sleep such as daytime sleepiness, poorer moods as well as liability to catastrophic accidents (Dinges & Kribbs, 1991, Nilsson et al., 1989, Carskadon 1990). According to Dr. Mark Mahowald, adolescents lacking sleeping can face many problems such as poorer mood and behaviour, vulnerability to substance use (drugs and alcohol), and progression of major sleep disorders (Carskadon, 1990). Wolfson et al. (1995) found that adolescent behaviour issues were highly associated with reduced sleep times and later bedtimes. These results indicate important relationships between the quantity of sleep and behavioural difficulties in adolescents.

2.9 Student attentiveness and awareness

In a recent study by Noland et al. (2009) 384 ninth to twelfth grade students in three different high schools in the Midwest completed a self-administered questionnaire on sleep behaviours and perception of sleep. Noland et al. states "*Most respondents (91.9%) obtained inadequate sleep (less than or equal to 9 hours) on most school nights of the week, with 10% reporting less than 6 hours of sleep each week night. The majority indicated that not getting enough sleep had the following effects on them: being more tired during the day (93.7%), having difficulty paying attention (83.6%), lower grades (60.8%), increase in stress (59.0%), and having difficulty getting along with others (57.7%). Some students reported engaging in harmful behaviours to help them sleep: taking sleeping pills (6.0%), smoking a cigarette to relax (5.7%), and drinking alcohol in the evening (2.9%)*" (Noland et al., (2009) p224).

Finally, in study by Allen & Mirabile (1989), students were consistent when reporting their level of alertness throughout the day. On average student's alertness was at its lowest at around 10am whilst approximately 50% of students were most alert until after 3pm. Therefore, it is clear that a large number of students leave school at their utmost level of alertness and are learning when they are least focused. According to Carskadon & Dement (1987) the truly alert adolescent may be exceptional, thus student lacking sleep are not reaching their optimal level of alertness during early school hours, which may reflect the tediousness of school and the decrease in academic performances (Allen & Mirabile 1989).

When examining attention, Muyskens and Ysseldyke (1998) observed 122 students in grades 2 to 4 during a school day. Their findings revealed that students were more engaged in the mornings compared to the rest of the day. Muyskens and Ysseldyke went on to further examine the classroom dynamics, as in the factors that were present or absent in the classroom environment during the morning sessions. They found that during the morning, learning was occurring, the teacher provided individual attention and students were engaged in active tasks. During the afternoon sessions they observed more whole group teaching instructions, behaviour issues as well as students being off task. The question that arises is what came first, the negative behaviour or a classroom environment that supported this behaviour. We can assume that if the instructional style that was seen in the morning that engaged students occurred in the afternoon, students would be

equally engaged, or could it be that the level of focus slowly decreases throughout the day and as a result affects students' behaviour and attention.

In a study by Klein (2001) which examined mathematics aptitude and levels of attention in fifth and tenth grade students, found that the levels of attention for fifth grades students were highest in the afternoon and lowest in the morning regardless of what their mathematical aptitude level. However, the reverse was found for the 10th grade students. Even though there was a correlation between the math aptitude scores and the perceived level of attention, it was not clear which subjects were being studied at different times of the day. Therefore, it could be argued that during the periods where students reported higher attention levels, the subject could have been more interesting and engaging which may have raised the attention levels regardless of the time of day. Another limitation was that in this study students completed the questionnaire for only one day and therefore the findings are could merely be a snapshot and may not represent the attention levels for the remainder of the year. Based on the findings of these studies attention is an important factor in student learning and what remains unclear is whether time of day is a key influence in student attention due to vast number of confounding influences such as classroom ecology, subject matter etc. (Muyskens & Ysseldyke 1998, Sylwester & Cho, 1993).

2.10 Influence of Time-of-Day on memory

One of the earliest studies on time of day and its effects on performance was undertaken by Laird in 1925, which was then later by numerous researchers such as Blake (1967) and Hockey et al. (1972). In these studies, they acknowledged that the performance in a variety of tasks varied with time-of-day. In 1971 Blake associated those variations to the changes in body temperature. He found that the measure of mental alertness and body temperature began to increase upon waking and continues to rise until about 8:00 p.m. with the exception of a small dip at some point in the afternoon. According to Blake, there is a strong correlation between high arousal and short-term memory, arousal is high when body temperature is high and as a result may affect memory.

Sousa's (2001) definition of long-term memory has revealed a flaw in some of the earlier studies which looked at the relationship between time of day and long term memory. According to Sousa information is in long-term memory only after at least 24 hours have passed (Sousa, 2001), therefore the earlier studies that tested the acquisition of information within 24 hours was not

testing long-term memory but short-term memory. For one example, Laird (1925) research tested recall only 40 minutes after the initial reading of the text whereas Sousa states that in order to affectively test long term memory, tests should be administered the next day.

Hockey et al. (1972) researched long-term memory recovery of 40 undergraduate females using a free recall task. However, Hockey et al. only performed the memory tests after 5 hours had passed and therefore it is unclear to state whether they truly tested for long-term memory or whether a longer time interval was needed. On the other hand, these earlier studies did provide a good starting point on the effects time of day could have on memory and academic performance.

In standard tests of short-term memory using immediate recall, Baddeley et al. (1970) found that short-term memory improved from early to mid-morning and then decreased steadily over the day. However according to a study by Folkard et al. (1977) they found that short-term memory was better in the morning compared to the afternoon, these results are support the arousal theory which states that as arousal increases throughout the day short term memory begins to decrease (Blake, 1971).

Folkard (1980) and Oakhill (1988) found that information is remembered better at different times of the day depending on the significance of the information. Upon re-examining the questionnaire used to test the children's recall in a previous study (Folkard et al., 1977), Folkard (1980) found that students were mainly able to recall the information that was deemed as less important in the morning presentation whereas students who attended the afternoon presentation were able to recall bot the important and unimportant information. Similarly, Oakhill (1988) found that students who were tested in the morning remembered more superficial aspects of the text whereas students who were tested in the afternoon remembered more intricate aspects of the text. Despite studies that argue that short term memory is better in the morning, it may favour remembering less significant information. These findings may be crucial in education as the purpose of education is to enable students to have deeper understanding of a topic rather than simply memorising trivial facts to pass tests and then forgetting them afterwards.

According to Folkard et al. (1977) the time of testing does not seem to be as important at the time in which learning took place. Peters (1984) studied 131 students in first grade through fifth grade, taking the Stanford Achievement Test in reading. She also found that there was no significant difference in time-of-day effects on test-taking. Both Folkard et al. and Peters challenged the

assumption that testing students during the morning is needed to provide an accurate measure of what they know.

Studies that truly explored long-term memory retrieval where testing was done at least 24 hours after the learning took place, revealed that the ability to retrieve information stored was better later in the day (Folkard et al., 1977; Millar et al.,1995). Millar et al. (1995) tested fifty-four adults on information that had initially been learned long before the testing. There were three testing sessions: morning (9:15 am & 10:00 am), afternoon (2:15 pm & 3:00 pm) and evening (6:00 pm & 7:00 pm). Millar et al. found that the efficiency of long-term memory retrieval increased throughout the day. Although the age of the participants as well as the tasks performed varied, these studies support the notion that long-term memory retrieval may be stronger later in the day. In general, we can say that short-term memory has been found to be better in the morning and long-term memory has been found to be better later in the day.

2.11 The conceptualisation of Learning

Due to the nature of this research it is important to understand what is 'Learning' and what we mean by 'Perceived Learning" and to what extent perceived learning and learning can be related to each other.

Over the past 20 years, learning has become an important topic for both academics and professionals in education, psychology as well as in political and economic fields (Knowles, Holton and Swanson 2005).

Learning is an extremely complex matter, and therefore has various definitions. However, there are a great number of commonly accepted and/or overlapping theories of learning that are still continuously being developed, some of which are referring to a more traditional understanding, whereas others are trying to explore new possibilities and ways of thinking. It is important to note that whereas learning conventionally has been understood as the gaining of knowledge, today the notion of learning covers a much larger field that includes social, emotional and societal dimensions (Knowles et al 2005).

Over the last 10 to 15 years, many theories and understandings of learning have been instigated. They have had different epistemology foundations and different content (Topics, themes, beliefs and principles), but in general there are a good variety of learning theoretical approaches.

A simple yet generally accepted definition of learning is *"any process that in living organisms leads to permanent capacity change and which is not solely due to biological maturation or ageing"* (Illeris 2007, p. 3). This is a very general definition because the concept of learning is very complex and requires not only a comprehensive understanding of the nature of the learning process itself, but must also include all the conditions that influence and are influenced by this process. Figure 1 shows the main areas which are involved and the structure of their mutual connections.

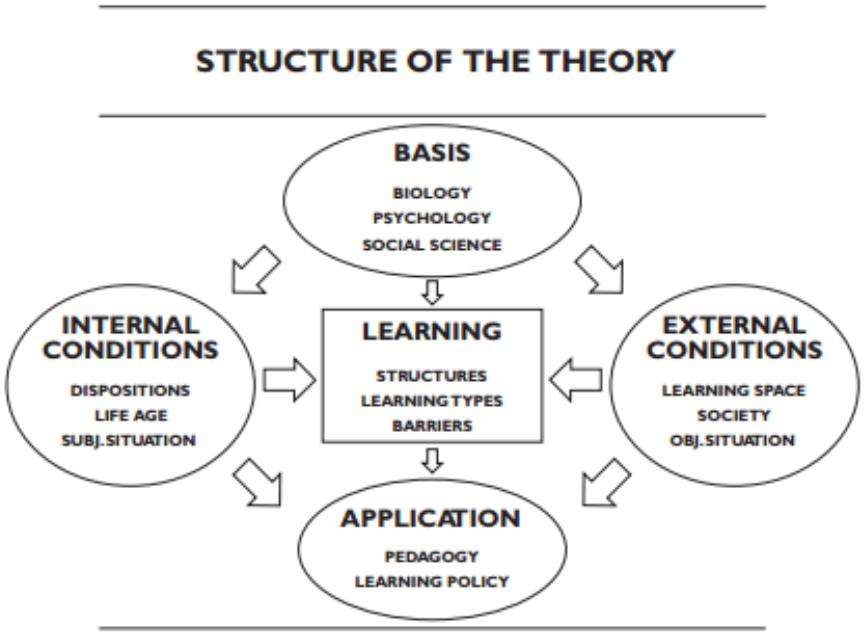

Figure 1- The main areas of the understanding of learning

2.11.1 Concepts of Learning

Before we look at some of the definitions and concepts of learning we must first consider an important and frequently made distinction between learning and education. According to Boyd et al (1980) education is an activity undertaken or initiated by one or more means that is designed to effect changes in the knowledge, understanding, attitudes, and skills of groups, societies or an

individual. Learning is the process in which behavioural change, information, skills, knowledge, and attitudes are acquired (Boyd et al 1980). Some learning theorists emphasize that defining learning is complicated, while still others uphold that there are no basic disparities about the definition of learning between the theories. Smith (1982) states that the difficulty in defining learning is due to the multiple uses of learning and as a result defies a precise definition. Smith summarises this into three sections:

"The acquisition and mastery of what is already known about something,
The extension and clarification of meaning of one's experience,
An organized, intentional process of testing ideas relevant to problems. In other words, it is used to describe a product, a process, or a function" (Smith 1982, p. 34).

However, Hilgard (1966), one of the most renowned contemporary interpreters of learning theory, concludes that the debate centres on interpretation and not definition. While it is very difficult to devise an acceptable definition of learning that includes all the activities and processes that we wish to embrace and eliminate all those which we do not wish to include. There is no disagreement between the definitions of learning except for the interpretation and fact. (Hilgard and Bower, 1966).

Learning entails change. It involves the acquisition of knowledge, skills, attitudes and habits. It allows individuals to make personal and social adjustments. Since the notion of change is expected in the concept of learning, any changes in behaviour means that learning is also taking place or has already taken place. The learning process can be referred to as learning that occurs during the process of change (Crow and Crow, 1963).

Burton (1963) defines learning as the change in an individual due to the interactions within his environment which requires a need for the individual to become more capable of dealing with things in his environment. Haggard (1963) also states that there is significant agreement upon definitions of learning as being reflected in a change in behaviour that occurs as the result of experience.

Learning is the gaining of new, or changes in existing, knowledge, skills, or preferences and may involve the production of different types of information. Progress over time tends to follow learning curves. Learning is not something that is obligatory and doesn't happen all at once instead it builds upon and is shaped by what we already know. Therefore, learning can be viewed as a

procedure, instead of a collection of factual and procedural knowledge. Learning is based on experience (Schacter, Gilbert and Wegner, 2009, 2011).

If we look at one of the earlier definitions by Harris and Schwahn *"Learning is essentially change due to experience"* (Harris and Schwahn, 1961, p.1), although similar to Schacter et al.'s definition, Harris and Schewahn then go on to differentiate among learning firstly as a product, which accentuates the outcome of the learning experience. Learning as a process, which accentuates what happens during the course of a learning experience in attaining a given learning product or outcome. Finally learning as function, which accentuates certain critical features of learning, such as retention, motivation, and transfer, which presumably make behavioural changes in human learning possible (Harris and Schwahn, 1961). Some theorists take care to differentiate between planned learning and natural growth. Learning is a change in human nature or ability, which can be retained, and which is not merely ascribable to the process of growth (Gagne, 1965).

Clearly, these learning theorists see learning as a process by which behaviour is changed, shaped, or controlled. Other theorists prefer to define learning in terms of growth, development of competencies, and fulfilment of potential. Still some believe that even this emphasis on growth, with its focus on cognitive development, is too constricted to describe what learning is really about (Rogers 1969).

Gagné (1972) identifies five areas of the learning process:
1. Motor skills, which are developed through practice.
2. Verbal information, the major requirement for learning being its presentation within an organized, meaningful context.
3. Intellectual skills, the learning of which appears to require prior learning of prerequisite skills.
4. Cognitive strategies, the learning of which requires repeated occasions in which challenges to thinking are presented.
5. Attitudes, which are learned most effectively through the use of human models and "vicarious reinforcement." (Gagné, 1972, pp. 7-9).

Bloom et al (1956) identified three areas of educational objectives: *"cognitive, which deal with the recall or recognition of knowledge and the development of intellectual abilities and skills; affective, "which describe changes in interest, attitudes, and values, and the development of*

appreciations and adequate adjustment; and psychomotor" (Bloom et al 1956, p.5). Scholars later extended on the psychomotor domain to include all the human senses and their dimensions.

As we can see there is a range of different concepts of learning indicating that we don't exactly know what learning is, but can only infer what it is. This idea is supported by Cronbach (1963), who stated, *"Learning is shown by a change in behaviour as a result of experience"* (Cronbach, 1963, p. 71).

Developing a working definition of learning is very complex. Key components of learning theorists' definitions of learning serve as the foundation for the discussion of learning is. These include change, learning as process, learning as product, learning as function, learning as growth, control, shaping, development of competencies, fulfilment of potential, personal involvement, learning as experience, self-initiated, learner evaluated, independent learning, and learning domains.

Therefore, the chosen definition for learning that I wish to pursue is learning as the process of gaining knowledge and/or expertise (Knowles et al 2005). Since learning is difficult to define let alone measure, in this research we will be using the terminology 'Perceived Learning'. Due to the constraints and demands of a secondary school environment, teachers are required to plan a deliver lessons to ensure students are engaged and gain new knowledge throughout the school day. Key factors that contribute to learning are behaviour, attention and participation in lessons. Perceived learning is the acquisition of new knowledge as perceived by the classroom teacher, which is measured and supported by standardised assessments throughout the year.

2.12 Conclusion

Clearly, several issues have emerged and there is mounting literature as well as medical evidence that the amount of sleep, time of day, and circadian rhythms do play a part in how prepared an adolescent is to learn (Wolfson and Carskadon 1998, Kelley et al., 2015). It is also the case that despite their increased need for sleep, teenagers get less than they did as children. There are serious risks adolescents face when they are sleep-deprived, and simply getting more sleep on weekends does not appear to be the answer (Dunn 1995, Kelley & Lockley 2014).

In the current school climate of examinations and testing in a substantial standardised curriculum, teachers need to allocate classroom time effectively especially for core subjects due to social/educational demands to ensure student are learning to their maximum potential. Despite the notion that students learn better in the morning, empirical studies and an increasing body of research indicate that some students learn better later in the day. This can be due to a variety of reason with the main reason pointing towards the shift in technology over the last decade which as a result provides 24-hour entertainment and distractions.

Given that the principal focus of education is to help each student maximize his or her potential, more research on the relationship between time of day and student learning is clearly needed. However, the research to date does point the way toward options that might be explored in these areas, including offering instruction in the evening, utilizing distance/online education for certain courses and students, attempting to match each individual student's time-of-day preferences with his or her more difficult subjects, or creating flexible scheduling arrangements.

Based on the findings from the literature we found that that students' ability to learn during different times of the day varies and it is important in today's society that students are learning at their maximum potential. Therefore, it is crucial that schools and teachers are aiding students with their needs and are acknowledging their learning patterns in order to effectively teach students. It is reasonable to say that randomly scheduling important subjects such as mathematics, Science and English in schools may not be advisable since research indicates that different times of the day directly affect the learning capability of students and it is important that efforts are made to meet the needs of the students. It is still not clear whether in today's society students have similar time of day preferences which brings about the need of an up-to-date research assessing the time of day students learn best.

As we can see the vast majority of literature reviewed was USA based with some research into the European and Asian education sector. Currently very little is known about the educational system in the UK regarding time of day and its effects on teaching and learning. It can be argued that there are similarities between American and British education but the differences between the two such as different school scheduling as well as other factors advocates the need for further research in the UK.

Chapter 3- Reflexivity- Research through the eyes of the researcher

3.1 Introduction

In this chapter I will be taking a reflexive analysis to unravel the motivations, methodological approach and the decisions taken in this study. Reflexivity can be an important methodological tool as my experience as a teacher, my social environment, assumptions, behaviour and position may impact the research process in this study therefore to increase validity it is important to reflect on this study.

The first section of this piece of writing will first introduce and define reflexivity in educational research and the different aspects of reflexivity and the second section will deconstruct personal reflexivity in this research.

In order to fully understand my reflexive approach, I will consider the following points.

- What is Reflexivity
- Reflexivity as introspection
- Reflexivity as intersubjective reflection
- Reflexivity as mutual collaboration
- Reflexivity as social critiques
- Reflexivity as ironic deconstruction
- Reflective opportunities
- Motivation behind the study
- Reflexivity in the methodological approach
- Reflexivity in the formation of the research question

3.2. What is Reflexivity?

Over the last decade reflexivity has gained popularity in academic research. Researcher especially in qualitative type studies are keen to recognise the situated environment of their research and to express the reliability of their findings through the seeking of new tools. Through reflexivity, they find that subjectivity in research can be changed from problem to opportunity. The origin or the root of the word 'reflexive' means 'to bend back upon oneself'. In research terms reflexivity can

be described as thoughtful, self-aware analysis of the intersubjective dynamics between researcher and the researched (Finlay & Brendan 2008).

Reflexivity is a self-reflection of how the researcher's background, social environment, assumptions, behaviour and position may impact the research process. It requires the researcher to acknowledge and critically analyse themselves before constructing their research process and findings. Reflexivity both challenges valued research traditions and is demanding to apply in practice.

According to Lynch (2000), we can also witness a 'confusing array of versions of reflexivity' or 'reflexivities'. Reflexivity can be viewed as an essential part of our human capacity or used as a self-critical lens.

Some researchers make the most of reflexivity, as a source of personal insight, while others use it to interrogate the expressions underlying shared social discourses. Reflexivity as a methodological tool can be used to ensure validity or to undermine truth-claims. Due to the multitude of uses the concept of reflexivity and how to apply it in practice can be very difficult (Lynch, 2000).

Reflexivity is an essential feature of human awareness in a postmodern world. We are aware of being aware, of performing a variety of roles and for some this implies that honesty and authenticity have been replaced by insincerity and pessimism (Finlay & Brendan 2008).

Reflexivity facilitates a superior insight into a personal and social experience which is one of the main reasons why some qualitative researchers have embraced reflexivity – it not only helps situate the research project but also enhances the understanding of the topic under investigation. Reflexivity is a challenge to conservative ideals which favour professional distance and independence over engagement and subjectivity. Reflexivity is also quite difficult to do. It involves a major effort for the researcher to identify and cross-examine personal and professional practices. There is also some uncertainty and confusion about how reflexivity should be defined and practised – with examples of reflexivity poorly conceived and/or executed (Finlay & Brendan 2008).

Reflexivity arguably is now a defining aspect of qualitative research. Qualitative researchers are now beginning to accept that the researcher is a crucial and integral part of who constructs the collection and analysis of data. Therefore, it needs to be appreciated that research, the researcher

and the participant's relationships are a joint product. We realise that meanings are only settled within a particular social framework and that another researcher may have different viewpoints thus produce a different story. Reflexivity is about no longer seeking to abolish the researcher's presence but instead embraces subjectivity in research to transform a problem to an opportunity (Banister et al., 1994, as cited in Finlay 2002).

3.3 Reflexivity as Introspection

According to Maslow (1966) '*there is no substitute for experience, none at all'* (1966, p.45), Here Maslow is referring researchers towards the value and importance of their experience and self-dialogues.

Researchers who use their experience as a starting point for their research seek to 'embrace their own humanness as the basis for psychological understanding' (Walsh, 1995, p.335).

Researchers that use their intuition and experience as primary evidence in the formation of the research question can have more of a connection with their research. According to Moustakas (1990) 'The task of the initial engagement is to discover an intense interest, a passionate concern that calls out to the researcher' (1990, p.27).

Beyond questioning personal experience and meanings for their own sake, such introspection can yield insights which then form the basis of a more generalised understanding and interpretation. Self-reflections are assumed to provide data regarding the social/emotional world of participants. As Parker (1997, p.488) reminds us, 'We need to be aware of ourselves as the dreamers . . . unlike instances of other people telling us their dreams, we understand and share, partially at least, at some level, the story.'

3.4. Reflexivity as intersubjective reflection

The genre of reflexivity as intersubjective reflection has grown significantly in the past decade and can be found across a range of research types. Here, researchers explore the mutual meanings involved within the research relationship. They focus on the situated, developing and negotiated

nature of the research encounter and how the unconscious processes structure relations between the researcher and participant. The process here involves more than reflection – instead, a thorough self-reflective consciousness is required where the self-in-relation-to-others becomes both the aim and object of focus (Sartre, 1969). Moreover, in psychodynamic terms, "construing both researcher and researched as anxious, defended subjects", Hollway (2001, p.15) reminds us 'that both will be subject to projections and introjections'. These dynamics can become the focus for analysis.

Reflexivity can be understood in a large number of ways according to the aims and functions of the exercise at stake and the theoretical or methodological traditions embraced. In terms of aims, reflexivity can be referred to as a confessional account of methodology or as probing our own personal reactions. It could mean observing the dynamics of our researcher- researched relationship. Otherwise, it can focus more towards how the research and researcher are situated, through providing a critique or through deconstructing pretences of established meanings. The functions of reflexivity shift from employing it to offer an account of the research to situating the researcher and voicing difference; from using reflexivity to interpret and understand in terms of data analysis to attending to broader political dimensions when presenting material.

3.5 Reflexivity as mutual collaboration

Researchers making use of reflexivity as mutual collaboration are found using a wide range of methodologies (Heron, 1996; Wilkinson, 1988; Banister et al., 1994; Potter & Wetherell, 1995). These wide-ranging research methodologies are linked by the way they seek to enlist participants as co-researchers and vice versa. Recognising research as a joint venture can indicate that the research participants also have the capacity to be reflexive beings: they can be co-opted into the research as co-researchers. At the very least this involves participants in a reflexive dialogue during data analysis or evaluation. Co-operative inquiry approaches however fully apply reflexivity. In this approach researchers are also participants in their own study through the engagement of self-reflection and experience.

While these studies are to be valued for their collaborative, democratic, inclusive spirit, critics reject the pronounced element of compromise and negotiation which could potentially 'water down' the insights of single researchers. In reply, collaborative researchers argue that dialogue within a group allows members to move beyond their preconceived theories and subjective

understandings towards representing multiple voices. Halling (1999) makes this point in his discussion on a dialogic, phenomenological study on forgiveness he carried out in collaboration with a group of master students:

"*Working in dialogue and comparing personal experiences and the interviews with each other allowed us to come to a rich, collective understanding of the process of forgiving another. Freedom infuses the process with a spirit of exploration and discovery and is evident through the group members' ability to be playful and imaginative with their interpretations. Trust provides the capacity to be genuinely receptive to what is new and different in the others' experiences and expressions and accounts for respect toward each person's descriptions, interpretations, and stories"* (Halling 1999, p.11).

3.6 Reflexivity as social critiques

Johnson and Scott (1997) examine the way their two ethnographic studies (on deinstitutionalisation of women and on child protection practices respectively) sought to 'provide a voice for the unheard' and how, as researchers, they 'identified strongly with the people who were subject to the power of others' (1997, p.40). Exemplifying reflexivity as social critique, they go on to highlight some problematic and coercive institutional practices.

One particular concern for researchers using reflexivity as social critique is how to manage the power imbalance between researcher and the participants. The position of power whether it is related to class, social position, gender, age or race can create tensions between the researcher and partaker.

According to Wasserfall (1997) *'the use of reflexivity during fieldwork can mute the distance and alienation built into conventional notions of "objectivity" or objectifying those who are studied. The research process becomes more mutual, as a strategy to deconstruct the author's authority'* (1997, p.152).

Reflexivity as social critique offers the opportunity to utilise experiential accounts while situating these within a strong theoretical framework about the social construction of power. One of the key strengths of this account is the acknowledgment of the numerous changes in the position of power between the researcher and participant. The task of deconstructing the author's authority, however, carries associated costs. As with the previous variant, concern with fairness can divert attention

away from other more significant issues and can result, inconsistently, in a strategy which lays claim to more authority. Such rhetorical strategies are the focus of the final variant of reflexivity.

3.7 Reflexivity as ironic deconstruction

Reflexivity as ironic deconstruction, in common with some versions of reflexivity as social critique, arises out of a postmodern, post-structuralism paradigm. This perspective sees the world as a babble of competing voices, none of which has privileged status. In this view, the researcher's imperative is to challenge and unravel the rhetoric of being a 'voice of authority' enabling, instead, multiple voices to be heard. In reflexivity as ironic deconstruction, a lot of interest is paid to the uncertainty of meanings in language used and to how these impacts on modes of presentation. When researcher enquire how to represent the dynamic, multiple meanings implanted in language. Woolgar (1989) proposes one route forward is to contrast *"textual elements such that no single (comfortable) interpretation is readily available. In this scheme, different elements manifest a self-referring or even contradictory relation with one another"* (Woolgar 1989, p.85).

Another good example of ironic reflexivity is in Ashmore's (1989) study on 'Writing sociology of scientific knowledge'. Here Ashmore plays upon and parodies the circumstances of the production of his doctoral thesis by interspersing compelling, fictional dialogues along with literature reviews and dialectical critique: *'It is not enough to take reflexivity as one's topic. It sets out to be a mode of inquiry. The self-destructive solution of non-inquiry in which paradoxical problems are outlawed, and only the others suffer, is no solution at all. Indeed, by showing and displaying and talking around its own socially constituted nature, its own textuality and its own paradox, instead of always and only talking of these things, it can talk of other things. Celebratory practical reflexive inquiry is writing beyond the tu quoque. And it must be shown, not told'* (Ashmore, 1989, p.110).

This variation of reflexivity follows through its radical project by refusing to exempt the sociology of science from its own enquiry. 'Rather than attempting to evade paradoxes created by applying relativist arguments to themselves', Lynch (2000, p.37) notes, 'they celebrate paradox and argue that it is threatening only to those who hold on to a restricted and outmoded conception of certainty and logical compulsion'. Researchers inclined towards social constructionists focus more explicitly on deconstructing the language used and its rhetorical functions (see Billig et al., 1988).

Edwards (1997) explains that '*factual or fictional stories share many similar written procedures for constructing credible descriptions, building plausible or unusual event sequences, attending to causes and consequences, agency and blame, character and circumstance'* (Edwards 1997, p.232). Researchers from this tradition would notice how both participants and researchers are engaged in an exercise of 'presenting' themselves to each other – and to the wider community which is to receive the research.

3.8 Reflexive opportunities

Reflexivity, then, can be understood in a number of ways according to the aims and objectives of the exercise at stake and the theoretical or methodological approaches embraced. Reflexivity can be understood as examining our own personal, possibly unconscious, reactions. It can mean exploring the dynamics of our researcher- researched relationship. On the other hand, it can centre on how the research is socially situated, through offering a critique or through deconstructing pretences of established meanings. The functions of reflexivity shift from employing it to offer an account of the research to situating the researcher and voicing difference; from using reflexivity to interpret and understand in terms of data analysis to attending to broader political dimensions when presenting material. In terms of academic and methodological commitments, the 'social critique' and 'ironic deconstruction' variations favoured by postmodernists, social constructionists and sociologists stand in opposition to the more personal and individual stance of 'introspective' experiential researchers. At the same time, feminists and other socially minded researchers would embrace several of the variants valuing both the experiential and critical dimensions. The focus paid towards critical, relativist values in some variants offers a harsh contrast to the realist intentions of some essentialist or methodologically focused accounts. The style adopted in 'intersubjective reflection' can be more descriptive or explanatory, when human behavioural interpretations come into play. Decisions about which variant of reflexivity to embrace needs to take into account these different epistemological values and assumptions.

When taking reflexivity as a whole we can see that it has the potential to be a helpful tool, as something that can assist us with:

- Examining the impact of the position, perception and existence of the researcher. Promoting deeper insights through examining interpersonal dynamics.
- Opening up unconscious motivations and implicit biases in the researcher's approach.

- Empowering others by opening up a more radical consciousness.
- Evaluating the research process, techniques and outcomes.

However, as we have also seen, reflexivity is not without its issues or its pitfalls. In offering a methodological account, researchers seeking to promote the reliability of the research need to struggle with the challenging spectre of having a distinct, 'true' account. Does the practice of explicitly situating the researcher customarily produce a better account or might it function as an unwitting strategy to claim more authority? When researchers focus on their own experiences, as we discussed earlier as reflexive 'introspection', could the researcher's voice eventually overshadow that of the participant? In the case of reflexivity as 'intersubjective reflection' and mutual 'collaboration' (assuming it is even possible to unravel such complex dynamics), focusing on the interpersonal process may shift attention away from the phenomena being studied. In a different way, researchers using reflexivity to deconstruct or as 'social critique' have to struggle with shifting subject positions and slippery meanings as they strive to find a balance between profitable deconstruction and nihilism (Finlay and Brendan 2008).

3.9 Reflexivity as Introspection – *Personal Reflexivity*

According to Maslow (1966) 'there is no substitute for experience, none at all' (1966, p.45), Here Maslow is referring researchers towards the value and importance of their experience and self-dialogues.

As a mathematics teacher in a large mixed comprehensive school in north London. I had always enjoyed studying mathematics mainly because of the nature of the subject and that despite how different someone's working out can be there is still only one correct answer. Throughout my years as I student I have always enjoyed mathematics and felt that it was the only subject where I was able to measure my own achievement and understand whether I have made a mistake or not as the results were clear.

I have always found mathematics as a wonderful and stimulating subject, but how it works, and why it is so triumphant, is not something that is easy to understand, even by mathematicians themselves. Perhaps further clarification would require deeper investigation of the language and psychology that are at present unavailable. Even within various cultures mathematics has always

been viewed as an important subject and mathematicians are highly respected within various cultures including my own. If I reflect back before I started secondary school, I could remember that the only subject my parents ever taught me was mathematics. This was mainly because my parents went to school in another country and were taught everything in a different language. Therefore, the only subject that was easily translated was mathematics, due to the similarities in numbers and mathematical process being the same regardless of language. Over the years mathematics became an integral part of my life, therefore I continued to study mathematics through to university. It was purely based on these past experiences that I enjoyed studying mathematics which was one of the main reasons I chose to become a maths teacher.

3.10 Motivation behind the study

It is important to note that timetabling and attention are not new concepts and have troubled teachers for years. In after lunch classes, for example, students are hyperactive and in early morning classes students are often half asleep. All these factors contribute to the learning of students and with subjects such as maths, it is important that students are learning at their maximum potential.

As a mathematics teacher in a large mixed comprehensive secondary school, I have come across various behaviour and learning difficulties in my lessons that seem to vary throughout different times of the day and with the same students. Upon various observations of how students learn in different lessons, it is apparent that their overall focus and attentiveness varies throughout the day and from lesson to lesson. It was during my PGCE course whilst I was on my first placement I was given my very first GCSE class to teach. I spent hours planning a series of lessons and was looking forward to teaching this class. The first lesson I had with them was in the morning, the students were very calm and worked quite well during the lesson. The lesson went just how I thought it would and I was very pleased with the outcome. I was looking forward to the following lesson with this class as it seemed we got off on the right foot and the behaviour was very good, the next lesson was on a Thursday period 5 (last lesson of the day). I went into the class with the same expectations as I had from the previous lesson except to find the class were no longer calm and found it very difficult to follow instructions. After a very difficult hour and the fact that my lesson didn't go as I hoped it would I went to see my mentor for advice in order to understand why students behaved in that manner.

I could clearly remember the question and answer that was given; *Me: "I just had a very difficult lesson and didn't understand why the students behaved in that way, did I do something wrong? "*
Mentor: *"I wouldn't worry about it considering it was period 5"*
Other teachers from the department could hear what I was saying and also seemed to relate to the fact students behaved differently during *period 5* and that it was commonly accepted amongst many teachers.

Teachers in my school as well as in other schools are aware that different times of the day can have both a positive and negative impact on students which is why I became interested in this study as I need to understand why students behave and learn differently and how can teachers use this knowledge to help improve their practice. Therefore, in order to understand the effect time of day has on teacher and learning it is important to consider the factors that affect and contribute to this. During my PGCE course we had a chose a topic to research within our school, at this point I was very interested as to why student engagement had changed from one lesson to another and began to research how the time of day can affect learning.

Due to the size and timescale of the research I was unable to reach any solutions except to gain a series of additional unanswered questions.
Which brings me to the aim of this research; To *what extent does 'time of day' affect teaching and learning with adolescents in secondary school?*

3.11 Reflectivity in the methodological approach

During this research I will be taking a mixed methods approach using a combination of both qualitative and quantitative methods. Although the primary home for this research is quantitative as the majority of the data will be collected using methodological tools associated with quantitative research.

It is important to note that mixed methods research is formally defined here as the class of research where the researcher uses a combination of quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study.
One of the main reasons as to why I have chosen this approach is due to the flexibility of using both quantitative and qualitative research methods.

As a researcher I am very comfortable with quantitative methods due to the association it has with mathematics and the ability to use statistical representation to analyse the data in a clear and efficient manner. Although as a mathematics teacher I am fully aware of the constraints that quantitative methods may have on research and therefore need some qualitative data in order to help to gain a deeper insight into certain aspects of this study.

It is important to acknowledge my position of power in this study. Since the data that was collected in this research was from students in my school who view me as their mathematics teacher, some of the data that was gathered may be skewed. However, with the majority of the data gathered being quantitative, I overcome this constraint by collecting data from a large population of students and was able to generalise the information accumulated. In addition, all of the questionnaires and tests the students completed were anonymous which should have increased the truthfulness of the results.

The qualitative methods used in this study involve group interviews and focus groups in which my position of power may have a greater influence upon. Therefore, the use of reflexivity as social critique can help to manage the power imbalance between researcher and participants.

3.12 Reflexivity in the formation of the research question

The importance of the research question cannot be overestimated. It is not enough to simply pose a question. As Peirce argues: *'Some philosophers have imagined that to start an inquiry it was only necessary to utter a question and have even recommended us to begin our studies with questioning everything! But the mere putting of a proposition into the interrogative form does not stimulate the mind to any struggle after belief. There must be a real and living doubt, and without this all discussion is idle'* (Peirce, 1955, p.11). In order that research really involves the search for something, the question must be 'true', i.e. it must be the expression of a real and living doubt (see Maslow, 1969). First, it is important that the question is something the researchers are eager to find the answer to. Only then will they acquire the passion, the emotional investment, that '*provides the motivating force for the endless hours of intense, often gruelling, labour'* (Keller, 1998, p.198; see also Maslow, 1969). Second, it must be a question in which an answer has not yet been settled (Gadamer, 1988), i.e. that there exists no scientific literature that already answers the question

convincingly. As the expression of real and living doubt, a 'true' question points to both limitation and openness: *'It implies the explicit establishing of presuppositions, in terms of which can be seen what still remains open'* (Gadamer, 1988, p.327). These presuppositions do not indicate preliminary answers, but represent the situation in which the question has been asked, i.e. the motives, beliefs and conceptual framework from which the question has originated (Gadamer, 1986a). It is this situation which represents the sense of the question, the direction *'in which alone the answer can be given if it is to be meaningful'* (Gadamer, 1988, p. 326). In other words, motives, beliefs and the conceptual framework open up the range of possible answers and thus the direction in which to look for them. In order to know what could be relevant, to overcome *'the fluid indeterminacy of the direction in which it is pointing'* (Gadamer, 1988, p.327), every researcher has to know what motivated the research question, which beliefs are behind it and of which conceptual framework it is an expression. To this end, researchers must interrogate themselves and/or their clients.

Initially, due to my experience as a student teacher, I began to form assumptions that time of day had a major impact on student learning. However, I wasn't sure in what way or to what it extent did it affect teaching and learning. It wasn't until after reading past literature that I was even able to begin forming the research questions.

Reflecting back on the formation of the research questions I would say that I was heavily influenced by the literature that I was reading as it provided me with ideas on the structure of my research and the key factors that I needed to consider to help decipher the research problem. The overall aim of this research is to determine to what extent timetabling affects teaching and learning with adolescents in secondary school.

3.13. Conclusion

Reflexivity is a concept central to qualitative research in general, where it is viewed as a means of adding credibility. Reflexivity, in the form of articulating the researcher's personal views and insights about the phenomenon explored by means of, for instance, a personal journal, is a method of enhancing credibility in grounded theory methodology (Chiovitti and Piran 2003). However, Gergen and Gergen (2000) caution that although reflexivity is valuable to the vocabulary of inquiry, the reflexivity 'movement' has not been entirely successful in subverting the concept of

validity. Because the act of reflexivity requires the reader to accept itself as authentic in its efforts to 'tell the truth' in the making of the account, it results in the possible infinite regress of reflections on reflection (Gergen and Gergen 2000).

Achieving reflexivity is not a straightforward endeavour. Reflexivity requires the researcher to be aware of their effect in the process and outcomes of research based on the principle that the researcher cannot be separated from the research itself. Hand (2003) argues that reflexivity should be considered at each stage of the research project, with the researcher examining and making explicit the decisions made. Also, an analysis of the context and political environment surrounding the study is a part of reflexivity (Hand 2003). Such reflexivity does not give the reader pause to consider the biases but adds richness to the research by its presentation of the union of the self and subject matter (Gergen and Gergen 2000).

In research it is very difficult to remain outside our subject matter and that the researcher's presence will in some way have some effects on the research collected. Even within this study, my past experience as a mathematics teacher has already influenced the methodological approach that I have chosen to take. It is important to continuously question myself and reflect on the decisions taken in this study. Taking reflexivity as an important aspect of this research, I must accept that my past experiences role as a mathematics teacher may lead me in certain directions, however, through the development of this paper I believe I am now able to take a reflective stance where needed through the process of questioning and self-assessment.

These processes include: relating with how the field of study is sorted by the interpretive lens of the researcher; acknowledging that the researcher may influence the phenomena being studied; and recognition that the researcher is also affected by being in the field.

Chapter 4- Methodology

4.1 Methodological approach

The methodological approach that I will be taking during this research is mixed methods, using a combination of both qualitative and quantitative methods.

Although there are many significant paradigmatic differences between qualitative and quantitative research (Johnson and Onwuegbuzie, 2004), there are several connections between the various approaches that are sometimes overlooked. Both quantitative and qualitative studies use pragmatic observations to deal with research questions. According to Sechrest and Sidani (1995, p. 78) they state that both qualitative and quantitative research "describe their data, construct explanatory arguments from their data, and speculate about why the outcomes they observed happened as they did." In addition, both quantitative and qualitative research aim to minimize confirmation bias and other sources of invalidity that is likely to exist in every research study (Sandelowski, 1986).

Mixed methods research is formally defined here as the class of research where the researcher uses a combination of quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study.

Mixed methods research rejects dogmatism as it attempts to justify the use of multiple approaches when answering research questions by removing the constraints in the methodological tools used within a study.

Rossman and Wilson (1985) identified three reasons for mixed methods in research. Firstly, combinations are used to enable corroboration of each other through triangulation. Secondly, combinations can be used to enable or to develop analysis in order to provide richer data. Thirdly, combinations are used to initiate new modes of thinking by attending to paradoxes that emerge from the two data sources.

Graphic of the Three Major Research Paradigms, Including Subtypes of Mixed Methods Research

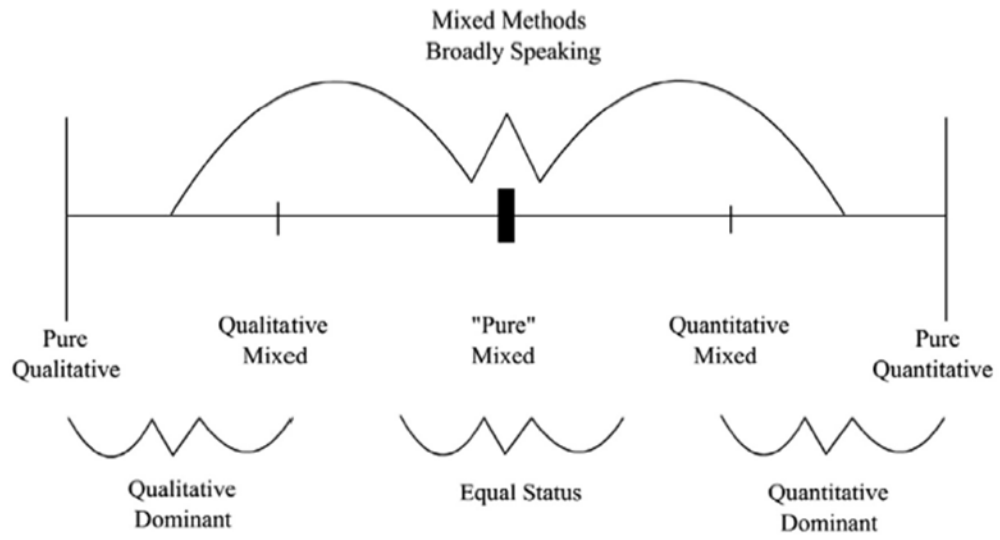

Figure 2-Research paradigms

Looking at the qualitative quantitative continuum in Figure 2, mixed methods research can be observed as integrating a number of overlapping groups of types of mixed methods research. The centre area of the model represents the purest form of mixed methods research using both qualitative and quantitative methods in equal form where as if we move to the left the research can be considered as qualitative mixed a towards the right research can be view and quantitative mixed (Johnson & Onwuegbuzie, 2004). For this research the primary home is quantitative mixed methods as the majority of data that was collected was quantitative.

Based on Figure 2, this research will be mainly quantitative as the majority of the data collected will be through quantitative methods such as questionnaires, surveys and tests although it will also contain observations and interviews to gain an in depth understanding in order to help reduce the weaknesses that quantitative data produces.

The most important thing in research is the research question therefore research methods should follow research questions in a way that offers the most productive way to obtain valuable answers. Mixed research methods enable researchers to answer questions in an effective manner depending on the type of question mixed methods can use the strengths and weaknesses of various methods to obtain data in a way to reduce bias (Cohen et al., 2017). In order to fully understand the mixed

methods, approach it is important to identify the all of the relevant characteristics of quantitative and qualitative research.

4.2 Characteristics of quantitative data

Strengths

Larger sample sizes were collected which enabled the researcher to make generalised conclusions
Data collected using questionnaire and surveys were less time consuming
Enabled the use of school management systems as a tool to collect over 700 000 pieces of data
Data analysis was relatively less time consuming (using statistical software, ANOVA tests).
The research results were independent of the researcher
Reduced the position of power between participants and researcher (teacher).
Questionnaires were anonymous which should have increased validity

Table 1-Strengths of quantitative data

Weaknesses

The findings in this study may not apply to all school populations
Quantitative data collected cannot explore why or how
The researcher may have missed out on phenomena occurring due to limitations of the questionnaires

Table 2-Weaknesses of quantitative data

4.3 Characteristics of Qualitative data

Strengths

Provides richer data with depth and detail
Semi structured Focus groups created openness- Participants are able to expand on their responses
The data are based on the participants' own categories of meaning.
It is useful for describing complex phenomena.
Provides understanding and description of people's personal experiences of phenomena (i.e., the "emic" or insider's viewpoint).
Provides individual case information.
Qualitative data in the words and categories of participants lend themselves to exploring how and why phenomena occur.

Table 3-Strengths of qualitative data

Weaknesses

Position of power – Results and discussions may have been influenced due to teacher/researcher *Knowledge produced may not generalize to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study).* *It is difficult to make quantitative predictions.* *Data collected is not generalizable due to small sample size* *It generally takes more time to collect the data when compared to quantitative research.* *Data analysis was more time consuming.*

Table 4-Weaknesses of qualitative data

4.4 Characteristics of Mixed Research

Strengths

Can provide quantitative and qualitative research strengths (i.e., see strengths listed in Tables 1 and 2). *Allows research to be split in phases with a larger range of research questions because the researcher is not confined to a single method or approach.* *A researcher can use the strengths of an additional method to overcome the weaknesses in another method by using both in a research study.* *Provides stronger evidence for a conclusion through convergence and corroboration of findings.* *Adds insights and understanding that might be missed when only a single method is used.* *Can be used to increase the generalizability of the results.* *Qualitative and quantitative research used together produce more complete knowledge necessary to inform theory and practice.*

Table 5- Strengths of mixed research

Weaknesses

Mixed methods is more time consuming (Qualitative methods used) *Unable to overcome all weaknesses of quantitative and qualitative methods (Position of power may still exist)* *Some of the details of mixed research remain to be worked out fully by research methodologists (e.g., problems of paradigm mixing, how to qualitatively analyse quantitative data, how to interpret conflicting results).*

Table 6-Weaknesses of mixed research

(Johnson and Onwuegbuzi 2004)

4.5 Triangulation

Triangulation can be defined as the use of two or more methods of data collection in the study of some aspect of human behaviour. Triangulation in research can help map out, and explain more

fully, the richness and complexity of human behaviour as it enables the researcher to study from more than one standpoint by making use of both quantitative and qualitative data (Cohen et al., 2017).

Webb et al. (1966) are recognized as being the first to label the term *triangulation*. This type of triangulation is referred to as between or across-method triangulation, although, Denzin (1978) first outlined how to combine methods. Denzin defines triangulation as "the combination of methodologies in the study of the same phenomenon" (Denzin 1978 p. 291).

According to Denzin there are four types of triangulation:

- Data triangulation (i.e., use of a variety of sources in a study),
- Investigator triangulation (i.e., use of several different researchers),
- Theory triangulation (i.e., use of multiple perspectives and theories to interpret the results of a study).
- Methodological triangulation (i.e., use of multiple methods to study a research problem).

This study will be split into 4 sections and I will be using methodological triangulation i.e. the use of multiple methods to help collect efficient data to help understand this study further. The first 3 sections taking a quantitative approach using methods such as questionnaires and tests and the final section I will be taking a qualitative approach through the use of focus groups and interviews.

4.6 Phase 1. Are students sleep deprived?

Overview

The purpose of this study is to assess whether students are currently sleep deprived and whether school start times and timetabling is having a negative or positive effect on student learning. It is clear in the literature review (Chapter 2) that school timings and its effects on learning is a large topic with many factors that contribute to it. In particular, the majority of the studies in the literature review identified 'sleep' as having some impact on school scheduling and student learning.

4.6.1. Participants

This research was carried out in a large comprehensive secondary school in north London with approx. 1700 students enrolled. This research was undertaken in the Mathematics department where the students are grouped by age and ability from year 7 through to year 11 (ages 11 – 16). In each year group there are 6 sets on each site, set 1 consists of approximately 30 students which are all high ability through to set 6, which consist of around 20 low ability students. These sets enable teachers to teach at suitable levels to suit the needs of the students and to help maximise student learning.

Four main classes have been selected based on age and ability in order to identify whether ability, sleep and time of day have any correlations.
Class A – Year 8 (Average ability students) 28 students
Class B – Year 9 (High ability students) approximately 30 students.
Class C- Year 11 (Average ability students) 28 students
Class D – Year 12 (High ability students) 15 students
All classes and have similar timetabling of morning lessons and afternoon, these classes where used throughout the study however, questionnaires were also distributed to a larger population for quantitative analysis.

Questionnaires were distributed to the following groups:
Year 8- 3 class groups (87 students)
Year 9 – 3 class groups (84 students)
Year 11- 3 class groups (85 students)
Year 12- 2 class groups (28 students)

4.6.2 Data collection

Questionnaires were used to determine the sleep duration of students as well as questions to help identify students' average bed times and wake up times which were compared against the recommended sleep requirement of 9.25 hours (Maas & Robbins 2011). This data enabled me to assess whether the students were sleep deprived and the possible issues that they may be currently facing.

The questions that were used in the questionnaire were mainly closed multiple choice questions which were distributed to all classes, however, some questions were open ended and scaled so that further information can be obtained. The findings were then analysed and represented through statistical diagrams.

4.6.3 Design of questionnaire

For comparison purposes, a straightforward survey design was used to compare the responses of the sample groups. The groups were identified in advance and were chosen selected particular based on accessibility as all the classes are taught by the researcher allowing me to effectively compare and contrast the data and reflect them against past literature.

There are many kinds of question and response modes in questionnaires, including, for example, multiple choice questions, rating scales, constant sum questions, ratio data and open-ended questions (Cohen et al., 2017).

During the questionnaire design, the most fundamental choice was whether each question should be open or closed. For the purpose of this research I used mainly closed format questions due to the fact that they are easier to analyse, although they tend have the disadvantage that one must anticipate what the respondents want to say, and therefore the questions had a wider response choice in order to reduce the chances of being bias (Cohen et al., 2017).

The closed format questions will ask respondents to select one of several categories as corresponding most closely to their opinion, or to express their opinion as a position on an ordered scale. The design of scales is the most complex of these, particularly in the choice of whether or not the scale should have a midpoint. The standard British social attitude scale is a 5-point scale; the standard American scale has 4 points (Schuman & Presser 1981). If you use a scale without a midpoint, this may negatively limit responses therefore I will be using the standard British social attitude scale on a 5-point scale. Since the response to different questions was compared, it is very important to minimise unnecessary differences between them.

There are many advantages and disadvantages with using closed questions in a questionnaire, it is important to consider these issues in the designing of the questionnaire to help assess the credibility of the data. The main motive for using closed questions is because they are quick to answer and

easy to analyse which was essential due to the time being a key constraint in this research. Although the main disadvantage of closed-ended questions is that misleading conclusions can be formed due to the limitations that the questions enclose, therefore the researcher is unable to deal with qualifications such as 'buts' or 'it depends' forcing the participants to choose an answer which may not fully represent what he/she are trying to communicate (Cohen et al., 2017).

Although by identifying these constraints I have attempted to an extent to reduce the impact of these constraints. Firstly, by using 5-point scale questions the respondents are able to have neutral responses which can reduce the impact of the first constraint, and secondly the questions will be analysed using means and percentages which are useful when assessing the credibility of a question.

It is important to note that these methods merely reduce the impact of the constraints and do not completely overcome them and that depending on the sample size closed-ended questions produce less information nor are they as effective as open-ended questions.

4.6.4 Limitations with primary data

The research on sleep disruptions during childhood has been significantly hindered by a key methodological impediment (Sadeh 1994). This impediment is related to the lack of a cost-effective and nonintrusive method to study sleep in natural settings, which has led to an over reliance on subjective reports. It is also important to note that that in spite of many years of research on sleep problems throughout the life cycle, it is difficult to state a clear definition of what is meant by sleep disorder.

With regard to the first impediment, a review of the literature reveals that, to date, most sleep-related studies in this field were based on subjective data e.g. parental reports or self-reports (Wolfson and Carskadon 1998). Sleep assessment based on subjective reports (either by the child or the parents) is by far the most commonly used method. Despite the informative value of subjective reports, it has been repeatedly demonstrated that these reports are limited by the restricted and biased knowledge that children and their parents have about their sleep (Carskadon 1993; Dunn & Griggs, 1990).

4.7 Phase 2- Time of day and its effects student's class performance

Overview

The purpose of this study is to assess whether the time of day can have an impact on student learning, and whether students' attention and cognitive performance varies during a school day.

According to a study by Jaquith (1996) which compared short term memory and academic performance in 546 students in a private school, he found that there was a positive correlation between short term memory and standardised achievement scores in students. Jaquith found that by using the digit span test, which was a test of immediate memory, where students had to recall a string of numbers, the higher the digit span, the higher the test scores were. The stronger a student's auditory or visual processing is, the higher their standardized tests scores should be. Therefore, based on the results from the short-term memory tests and the problem solving activities some assumptions can be made in relation to academic performance in students.

Folkard (1980) and Oakhill (1988) found that information is remembered better at different times of the day depending on the significance of the information. Upon re-examining the questionnaire used to test the student's recall in a previous study (Folkard et al., 1977), Folkard (1980) found that students were mainly able to recall the information that was deemed as less important in the morning presentation whereas students who attended the afternoon presentation were able to recall both the important and unimportant information. Similarly, Oakhill (1988) found that students who were tested in the morning remembered more superficial aspects of the text whereas students who were tested in the afternoon remembered more intricate aspects of the text. Despite studies that argue that short term memory is better in the morning, it may favour remembering less significant information.

Taking this into consideration I decided to develop my own memory test. Although the concept and idea is similar to the digit span test, which measures the amount of information immediately recalled in a short period of time. As mentioned by Folkard (1980) and Oakhill (1988) the ability to remember elements may also be affected by the function of the material, like the length of the words, the emotional relevance of the stimuli, and other individual differences. In a secondary school there are four main areas taught in mathematics, numbers, shapes, algebra and statistics, therefore I attempted to recreate a short-term memory test which incorporates a widespread of

topics instead of only using numbers. It is important to note that this is not a validated or recognised memory test. Nevertheless, this test should be able to provide the necessary information needed to determine whether there was a significant difference in the performance of short-term memory recall when testing students in the morning and afternoon.

4.7.1. Participants

In this phase two classes were selected and given a series of short-term memory tests and problem solving tasks over a 3-week period.
Class A – Year 8 (Average ability students) 28 students
Class E – Year 10 (Average ability students) 28 students.
Both classes were taught by the researcher at the time of the data collection and followed the same procedures to enable the accuracy of the data collected.

4.7.2 Data collection

This phase was split into two tasks. Task 1 is a short memory test and task 2 is a problem-solving activity.

Task 1- short memory test

Over a space of three weeks each of the participating classes undertook short memory tests at the start of each lesson twice a week, one in the morning lesson and one in the afternoon. In total each class have undertaken 6 memory tests at different times of the day. Tests A, B, C, D, E and F was displayed through a projector containing 30 Mathematical symbols, shapes and words (10 of each) in a 6x5 grid. All six tests contained the same number of symbols, shapes and words in order to assess and compare the findings. Students each had 60 seconds (2 second per image) to try and memorise the images and then were given enough time to recall and draw the image on a blank 6x5 grid.

Task 2- problem solving test

Over the space of two weeks each of the four participating completed a short problem-solving activity. Each activity was designed and based on the level of the participating class on topics

previously covered. Once a student completed the activity he/she placed their completed activity into a box in the front of the room. The time taken to complete each task was recorded for each section and for every student until all students have completed the activity. This activity was repeated twice a week (morning and afternoon) over a two-week period.

4.7.3 Design of memory test

The memory tests contained a total of 30 images 10 mathematical symbols, 10 shapes and 10 words which were displayed in a 6x5 grid all shown on a PowerPoint slide. Students were given exactly 60 seconds to look at the slide before the image were removed. Each student needed to recreate the image on a blank 6x5 grid.

Each participant was scored in two ways. Firstly, students were awarded a score out of 10 for each of the symbols, shapes and words each participant recall. Secondly they were awarded a score out of 30 on the correct location of each image in the grid giving a total possible score of 60.

4.7.4 Design of Problem-solving activity

The problem-solving activity was a series of worded problems based on the National Curriculum on topics previously covered by each of the participating classes. The main purpose of this activity was to calculate the time it takes to correctly solve the problem and students were given a different activity at the start of each lesson. All activities were on similar topics and within the level of each class.

Since all mathematics classes are set, based on student's mathematical ability, all students within any given set have very similar academic abilities and therefore are all able to access the activity. The chosen topic was mainly logical thinking and involved mathematical skills that have been already taught although the problems were worded which required students to carefully read and interpret the questions.

Each student was required to write a code on every activity they complete, this enabled the researcher to compare times of every individual participant whilst keeping the data collected anonymous.

This activity was distributed to the entire class therefore each participant had to write the time taken to complete each activity themselves. There was a timer displayed via projector with minutes and seconds.

4.7.5 Limitations with primary data

It is important to note that with the memory tests some symbols may have different meanings to students and may have been taught in different ways enabling students to recall certain images depending on their personal learning methods. In order to overcome this issue, the test contains a combination of words, letters and images which will be spread over a two-week period with 6 tests, in addition the researcher will take the average score of the two tests taken at the same time of the week to increase validity and reduce outliers.

4.8 Phase 3- To what extent does behaviour and perceived learning preference vary throughout the day?

4.8.1 Introduction

Smith's (1987) study examined the effects of learning-style time preferences on average and high achieving students on matched and mismatched mathematics course schedules. When students learning- style preference match their lessons, even high achieving students demonstrated an increase in results (Milgram, Dunn, & Price, 1993). Although time preference affected underachieving students considerably more that achieving students, this is mainly due to underachievers finding it more difficult to focus during mismatched timing as opposed to the higher achieving students.

Therefore, when taking into account different learning styles, it is important to keep in mind that students learn in different ways. Research indicates that all students retain and learn more from a variety of instructional strategies. For example, faculty who mainly teach using a lecture format need to be aware that the average student will retain only 10–20% of what they hear (Arthurs 2007).

This study aims to address the issue of whether students feel they learn differently at different times of the day. In order to gain a better understanding of students as learners, I will be evaluating the way students prefer to learn or process information.

One of the most widely used and well researched models is the Dunn and Dunn model (Dunn et al., 1975, 1992, 1993, 2003). This model is one of the most popular and widely accepted models of learning styles and been the subject of extensive research (Given and Reid 1999, Reid 2003).

Due to the age group of students in this study, an adaptation of both the Dunn's Model and the Middlesex University inventory was used as a basis and was simplified to ensure all students in this study can understand and access all questions (See Appendix 11.2). These learning style inventories have been used as part of the students' learning portfolio assignment at the university and was adapted to suit the age group that I am researching in this study.

There are various learning style inventories that are available (Murray 1990, Dunn et al., 1975, 1992, 1993, 2003) that can provide more in-depth analysis into learning styles the Dunn Model is the most widely accepted inventory. However, the key focus of this phase is on time of day, therefore, we are only comparing the data collected from the inventories to measure whether there was a significant difference in the way students answered each section at different times of the day, and will not be using the inventories as accurate measure of learning styles.

4.8.2 Learning style inventories

This learning style inventory is made up of 25 key questions regarding how students learn and their approach to tasks. Each response is either related to kinaesthetic, auditory or visual learner types and students had to circle which category the feel suits them best on a separate answer sheet. Students then needed to add up the number of circles in each column to identify which group is their dominant learning style. This inventory was repeated at different periods of the week to measure whether their dominant learning style changes at different times of the day.

4.8.3 Limitations with data

It is important to note that the inventories used in this study are quick, informal indicators of preference and not scientific measures. Therefore, although they may indicate students learning

styles, they may not be absolutely reliable. In addition, these inventories indicate students learning preference and are not meant to classify them as an absolute "type". This means that although the Learning Style inventory may classify someone as an auditorial learner, the reality is that a student can also be a visual learner, however, the results in this particular inventory can indicate that one may have a tendency towards a certain dominant learning style.

Furthermore, it is also possible to have a learning preference that may be an area of weakness e.g. students who are visual learners may be in a lesson where the teaching style doesn't match that students' learning, which as a result could affect the data collected, as it would be difficult to distinguish whether time of day was a contributing factor or not.

Regardless of these limitations these learning style inventories still produced valuable data as it was important to this study to measure whether the results from the learning style inventories for each student varied at different times of the day, considering that factors such as behaviour, teaching style, classroom environment etc. can change, therefore as a result learning preferences may also be affected.

4.9 Phase 4- Comparative study- How can school timetabling be adapted to improve students' academic achievement?

4.9.1 Introduction

For this phase I took both a quantitative and qualitative approach, through the use of school data and structured focus groups, interviews and class discussions. The structure and questions that were used in the focus groups were based on the results from the previous studies, hence the methodology was a working document that was influenced from the quantitative data that was collected. The aim for this phase is to understand the views and perceptions of both teachers and students, along with the evidence collected which helped identify the learning styles and sleep patterns, as well as the results from the memory and problem solving tests in order to understand the views of both the teachers and students which helped identify strategies that could be used to improve teaching and learning.

In order to structure the focus groups and interviews I consistently compared and analysed the results from phases 1, 2 and 3 which enabled me to construct phase 4 and could help determine how the school day can be adapted to help improve students' academic achievement.

Focus groups and class discussions were used in this section as the primary method to help develop an understanding and take a collaborative approach with both students and teachers to identify whether there were any issues with the school day and whether it can affect behaviour and learning.

The use of Focus Groups in this research allowed the researcher to gain an insight into the views of both teachers and students as well as being used to help validate the results found in the previous studies or provide a foundation for further research.

4.9.2 Participants

4 teachers and 4 students were selected to participate in focus groups. The 4 teachers were from the mathematics department and were fully aware of the research which was undertaken in the school and during mathematics lessons.

The 4 Students were selected from my A level mathematics class. There were a number of influences behind the rationale for selecting this particular year group. Firstly, the age of students at A levels was similar to a number of studies (Noland et al., 2009; Steptoe et al., 2006; Wahlstrom 2002a; Dunn 1983; Wolfson and Carskadon 1996), which enabled the researcher to make comparisons between the finding in this and similar studies. Secondly A level students had more experience in the school as well as the mathematical ability to read and interpret some of the findings in this study which would contribute to the discussions in the focus groups.

4.9.3 School Data

The school management information system currently used in this large mixed comprehensive school is SIMS.net. SIMS (School Information Management System) is a school management information system currently developed by Capita. It is the most widely used MIS in UK schools, claiming over 80% market share across the primary and secondary sectors. SIMS helps you to focus on problem areas and intervene quickly. With the help of data analysis tool **SIMS Discover**,

you can analyses behaviour and attendance patterns and link these to performance, ensuring that low-level poor behaviour does not go unnoticed and good behaviour is acknowledged.

As part of the school policy it is mandatory for teachers to record registers at the start and end of every lesson using a point system to record the behaviour and 'perceived learning' (the term perceived learning is the learning taken placed during lesson as perceived by the teacher) during that period. At the end of every lesson all teachers will enter the following code when calling out the register:

3- Outstanding behaviour, excellent work and effort during lesson
2- Good Behaviour, good work and effort during lesson
Satisfactory behaviour, satisfactory work and effort during lesson
8- Poor behaviour, little work completed during lesson
9- Serious incident- poor behaviour, no work completed during lesson

These codes are entered for every individual student five times a day five time a week generating over 700 000 pieces of data over the year. Using SIMS.net the researcher will generate reports based on the perceived learning over the year and will analyse the findings along with the data gathered from phases 1, 2 & 3. This data will only be used to identify behaviour and perceived learning trends to help determine whether there is any correlation between the time of day and student's performance in lesson. Once data has been gathered all phases and data will be analysed alongside the data gathered from focus groups and interviews.

4.9.4 Focus groups

Focus groups are a form of group interview that capitalises on communication between research participants in order to generate data. Although group interviews are often used simply as a quick and convenient way to collect data from several people simultaneously, focus groups explicitly use group interaction as part of the method. This means that instead of the researcher asking each person to respond to a question in turn, people are encouraged to talk to one another: asking questions and commenting on each other's' experiences and points of view.' The method is particularly useful for exploring people's knowledge and experiences.

The suitability of focus groups consists of asking how active and easily the participants would discuss the topic of interest in the research (Morgan 1988). Focus groups are particularly suited to

be used when the objective is to understand better how people consider an experience, idea, or event, because the discussion in the focus group meetings is effective in supplying information about what people think, or how they feel, or on the way they act or behave (Morgan 1988).

For this study I used focus groups as an exploratory tool to complement the quantitative research methods used in this study, although it is important to consider the advantages and disadvantages of focus groups and the impact it may have of the research.

Advantages	Disadvantages
• It is comparatively easier to drive or conduct • It allows to explore topics and to generate hypotheses • It generates opportunity to collect data from the group interaction, which concentrates on the topic of the researcher's interest • It has high "face validity" (data) • It has low cost in relation to other methods • It gives speed in the supply of the results (in terms of evidence of the meeting of the group) • It allows the researcher to increase the size of the sample of the qualitative studies	• It is not based on a natural atmosphere • The researcher has less control over the data that are generated • It is not possible to know if the interaction in group he/she contemplates or not the individual behavior • The data analysis are more difficult to be done. The interaction of the group forms a social atmosphere and the comments should be interpreted inside of this context • It demands interviewers carefully trained • It takes effort to assemble the groups • The discussion should be conducted in an atmosphere that facilitates the dialogue

Table 7-Advantages and disadvantages of the focus group.

Source: based on Krueger (1994) and Morgan (1988).

In spite of the disadvantages as seen in Table 7 (especially the subject of spontaneity and the effort required to assemble the groups), the application of this method facilitates the collection of interesting data. This data contributes to a stronger persuasion on the part of the researcher, as it is a good source of information for the formulation of hypotheses or for the construction of frameworks. These in turn allow further investigation (Freitas et al., 1998).

The goal of a Focus Group is to have the participants understand the topic of interest to the researcher, irrespective of its use, alone or together with other research methods. Though increasingly researchers are recognizing the advantages of combining qualitative and quantitative research methods, resulting "methodological mix" that strengthen the drawing of the research (Freitas et al., 1998).

The use of Focus Group in this research will allow the researcher to gain an insight into the views of both teachers and student as well as be used to help validate the results found in the previous studies or provide a foundation for further research.

4.9.5 Planning of Focus Groups

Focus Groups will be executed in three stages:
Planning
Conduct of the interviews
Analysis of the data

The planning is critical for *Focus Group* success because, in this phase, the researcher considers the intent of the study and the users of the information, besides developing a plan that guided the remainder of the research process, including the elaboration of the subjects and the participants' selections. The interview phase consists of the moderation of the meetings. After the sessions, in the analysis phase, they take the transcripts of the meetings, evaluate them and articulate them in a report (Freitas et al 1998).

For this study, the planning stage to develop the structure and questions that was used in the focus groups were based on the results from the previous phases however the focus groups were semi structured as questions may arise depending on the nature of the conversation (for questions and structure of focus groups see appendix). The aim for this study is to understand the views and perceptions of both teachers and students along with the evidence collected which will identify the learning styles, sleep patterns as well as the results from the memory and problem solving tests to understand the views of both the teachers and students to help identify strategies that could be used to improve teaching and learning.

In Table 8 we can see the chronological plan of the delivery of the focus groups for both students and teachers. In week 1 (first week after completion of phase 3) we began to develop the structure of the focus groups and the questions that was used to help lead the discussions for both the students and teachers. This was followed by two focus group discussions where the aim of the first session is to be used for feedback for planning. Finally, results were transcribed and analysed and written up in the final report, and could be used as a guide for further research and planning.

The chronological plan- Focus groups

Planning		Interviews	Analysis	
Week 1	Week 2- 4	Week 5-6	Weeks 7-15	Weeks 15-20
To develop the structure and plan of focus groups				
	To elaborate questions based on results from studies 1-3 To develop the structure of Focus Groups for students To develop structure of focus groups for teachers			
		Student: 1st session Feedback for planning Student: 2nd session Teacher: 1st session Teacher: 2nd session	To transcribe To process data To analyse the data	
				To write findings in report

Table 8-Chronological Plan. Source adapted from Krueger 1994

4.9.6 Analysis of focus groups

Production of the transcriptions and the analysis there of are a slow, time-consuming process. Depending on the number of groups, the participants' readiness, and the type of analysis intended for the transcripts, it can take a long period of time. This task is laborious, because the group discussions are conducted over two sessions, with specific types of participants to identify tendencies and patterns in the participants' perceptions (Freitas et al 1998).

The analysis will be systematic, verifiable, and focus on the topic of interest and with an appropriate degree of interpretation. During the focus groups the discussions was recorded as well as transcribed as each session may produce a great number of pages of transcripts and field notes. In the analysis, the words and their meaning, the context in which the comments were made, the internal consistency, frequency, the extent of the comments, the specificity of the answers, and the importance of identifying the main ideas, need to be considered (Krueger, 1994).

4.10- The limitations of data

This section comprises of the limitations and structure of the comprehensive secondary school in this study. Although policies, timetables, students and teachers may not be the same in all schools, there is still a lot of similarities between schools such as school timings, exam timings and curriculum across all British secondary schools.

Table 9 below shows the typical school day of the comprehensive school where the research was undertaken in this study. Although the number of periods may vary from 5 to 6 lessons per day from school to school, generally the timings of a school day are similar across secondary schools in the UK.

	Period 1 8.35-9.35	Period 2 9.35-10.35	Tutor time 10.35-10.55	Period 3 11.15-12.15	Period 4 12.15-1.15	Period 5 2pm-3pm
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						

Table 9-The school day

The head teacher of a maintained school usually recommends the length of a school day, including session times and breaks. The governing body must agree the recommendation, as with term dates, and holidays whereas academies have the flexibility to alter their own school day (Long 2016).

The DFEE research report 'Do academies make use of their autonomy?', published in July 2014, found that:

• 8% of academies had increased the length of the school day, while a further 6% planned to;
• 4% of academies had changed the length of the school term, while a further 5% planned to.

This indicates that the vast majority of schools still operate with similar timings to the school in this study.

4.10.1 Perceived Learning

Learning is an extremely complex matter, and therefore has various definitions (see literature review). However, there are a great number of commonly accepted or overlapping theories of learning that are still continuously being developed, some of which are referring back to a more traditional understanding, whereas others are trying to explore new possibilities and ways of thinking. It is important to note that whereas learning conventionally has been understood as the gaining of knowledge, today the notion of learning covers a much larger field that includes social, emotional and societal dimensions (Knowles et al., 2005).

Since learning is difficult to define let alone measure, in this research we will be using the terminology 'Perceived Learning'. Due to the constraints and demands of a secondary school environment, the average teacher will teach 22 lessons per week with an average class size of around 30 students, an outstanding teacher will plan and deliver lessons to suit the needs of students to help prepare them for examinations. This cycle is repeated throughout secondary school and teachers are required to ensure students are learning and progress is measured against performance in tests. Key factors that contribute to learning are behaviour, attention and participation in lessons. It is difficult to compare, measure or define learning in a secondary school environment as factors such as teaching styles, subjects and testing methods vary throughout the year.

Across all secondary schools' teachers are required to prepare students to pass their end of year examinations. Throughout the year teachers will report to school leaders, management and parents on students' performance and will make predictions on what they believe students will achieve in assessments. Accurate predictions in a school provide an indication of a teacher's capability to measure the learning and progress of their classes. Therefore, in this study have referred to the term 'Perceived Learning' which includes the acquisition of knowledge, behaviour and performance in a lesson as perceived by the classroom teacher, which is measured and supported by standardised assessments throughout the year.

Chapter 5- Phase 1 Findings– The importance of sleep

5.1 - Sleep data and analysis

In order to assess whether students are sleep deprived it is important to acknowledge the sleep environment in which the student sleeps in on a regular basis. A good sleep environment helps with the transition to resting effectively and to the quality of one's sleep or can be the factor that can keep a student tossing and turning all night.

For the purpose of this research, students were questioned regarding their sleep environment to ensure that any further data regarding sleep duration isn't affected by external factors such as being uncomfortable and if so it needs to be addressed to ensure validity in the findings.

Table 10 shows the class percentage of the secondary school student responses to their views on their sleep environment. All classes stated that their beds are comfortable which should support healthy sleeping, however, the majority of the students questioned shared their bedroom, which as a result student may have had more sleep disruption from siblings, which in turn could result in less quality sleep for some students in this survey.

	Year 8 N=87		Year 9 N=84		Year 11 N=85		Year 12 N=28	
	YES	NO	YES	NO	YES	NO	YES	NO
Do you usually sleep in the same bed every night?	100%	0%	100%	0%	100%	0%	100%	0%
Is your bed comfortable?	95%	5%	100%	0%	94%	6%	100%	0%
Do you have your own bedroom?	57%	43%	40%	60%	76%	24%	67%	33%
Do you or a sibling (*in same room*) watch TV, read in bed or use a computer before sleep?	43%	57%	73%	27%	65%	35%	67%	33%
Does your sibling often disrupt your sleep?	43%	57%	40%	60%	18%	82%	42%	58%

Table 10-Responses to sleep environment

In general, it is easiest to sleep in a quiet place as we tend to respond to external stimuli while asleep for example, if we hear a noise we will wake up, or if the light is kept on, it can, in turn, disrupt a child's circadian rhythm (See literature review 2.6). Although not everyone will become

fully conscious if there is noise, but they certainly will come out of the deeper stages of sleep. Therefore, it is important that there is a good sleep environment.

Table 10 shows that more than two-thirds of students watch television or use a computer in their room before going to sleep. In adolescence, there is an increased reliance on technology for social interactions as well as increased availability of technology (National Sleep Foundation, 2006). There are various negative effects that come with the use of computers or watching TV, such as difficulty in falling asleep (Polos et al., 2010; Shochat et al., 2010), as well as problems with mood, behaviour, and cognitive performance during the day have been reported (Polos et al., 2010). Many students with technology in their bedrooms report recurrent awakening at night due to receiving a text, phone call etc. (Wahlstrom et al., 2014)

In addition to disruption of sleep the use of technology in rooms can have a direct influence on the time students fall asleep due to continuous exposure of light. The circadian rhythm (see literature review 2.6) is influenced in part by the amount of light exposure whether this light is natural and comes from the sun, or artificial, as in from electronics such as a computer or TV. As you can see in table 10 more than two thirds of the participating students report having and using electronics in their room before going to sleep, Thus, adolescents who report using an electronic device which emits light, in particular blue light, shortly before bed may be artificially affecting their bodies' natural sleep rhythm (Calamaro et al., 2009; Carskadon, 2013). While light exposure in the morning helps adults to awaken more easily, there is some evidence that this facilitating factor is diminished in adolescence (Hansen et al., 2005) while the effect of evening light exposure inhibiting sleep may be enhanced (Carskadon et al., 2004).

Overall we can see that the majority of students in this survey believe that their sleep environment is comfortable although the vast majority of participants may not get good quality sleep due to distractions from their siblings as well as the use of electronic devices which has a negative impact on their sleep patterns.

To analyse teen sleep patterns for students who attended a secondary school in North London, students were asked a variety of questions on the survey related to their bedtimes and wake up times (see Appendix 11.1). Table 11 below presents the mean average times students said they usually go to bed and when they said they usually wake up on school nights/days and on weekend

nights/days. On average, as you can see in Table 11 all the students surveyed sleep later and wake up later during the weekend as opposed to the sleep and wake up times during the school week.

Mean Average Student Bedtimes and Wake Up Times on School Days and Weekends

	Weekday			Weekend		ANOVA (Weekday vs weekend)		
Year	N	Mean sleep duration	SD	Mean sleep duration	SD	DF	F	P
8	87	9hr 1min	0.909	10 hr 57 min	1.861	1	18197	0.000
9	84	8hr 15min	1.126	9 hr 31min	1.59	1	12.948	0.001
11	85	7hr 47 min	0.989	9hrs 54min	2.312	1	12.757	0.001
12	28	7hr 50 min	0.702	9hrs 40min	1.307	1	18.398	0.000

	ANOVA TEST (Age groups)			ANOVA TEST (Age groups)		
	DF	F-value	P-value	DF	F-value	P-value
	3	6.240	0.001	3	2.749	0.048

(1) **Source** means "the source of the variation in the data.". The factor is the characteristic that defines the populations being compared
(2) **DF** means "the degrees of freedom in the source."
(3) **SD** means "the Standard deviation."
(4) **F** means "the *F*-statistic."
(5) **P** means "the *P*-value."

Table 11-Mean average bed time

Table 11 shows the sleep duration of students during the school week and weekend. Based on these findings we can see that the majority of groups are sleeping below the recommended sleep duration of at least 9 hours (Wahlstrom & Freeman 1997). During weekdays (school days) the average amount of sleep students got varied slightly based on the age group. On average the year 8 students aged 12-13 years old had approximately 9 hours sleep which is close to the recommended sleep duration however even within this group there was a 30% of the students had 8.5 hours sleep or less. Year 9, 10 and 11 students all were at least 1 hour short of the recommended amount sleep, this, as a result, indicates that the majority of the students questioned have sleep deficiency.

ANOVA tests was used to determine whether the sleep duration between age groups and between weekend and weekdays were significantly different. Based on the findings there is a significant difference between the amount of sleep students get during the week when compared to the weekend. This is most likely due to the fact that during the week students need to wake up earlier for school, as opposed to the weekends when they are able to sleep in. In addition to this there is a significant difference between the sleep duration of students in different year groups during the school week. Since school start time is similar for all students it may be due to different bed times

that weekday sleep duration differs. When comparing sleep duration of students during the weekend there is less variation, although the P value is less than 0.05 the difference is less significant as compared to the school week.

Deprivation of sleep not only weakens physical and mental functions, lower work productivity, but could also cause mental problems such as depression. Thus deprivation of sleep has enormous effects on society as well as individuals. For example, it was reported that annual social costs of daytime sleepiness due to various sleep problems were estimated to be $15 billion in the united states (Seoul 2000).

It is also likely that the amount of sleep students get is also related to how long it takes students to get to school. In general, taking the school bus may be expected to take more time than driving directly to school. Therefore, taking this into consideration figure 3 shows that a minority of students are getting less than 7 hours of sleep could be due a combination of late bedtimes and/or very early start times due to school travel arrangements.

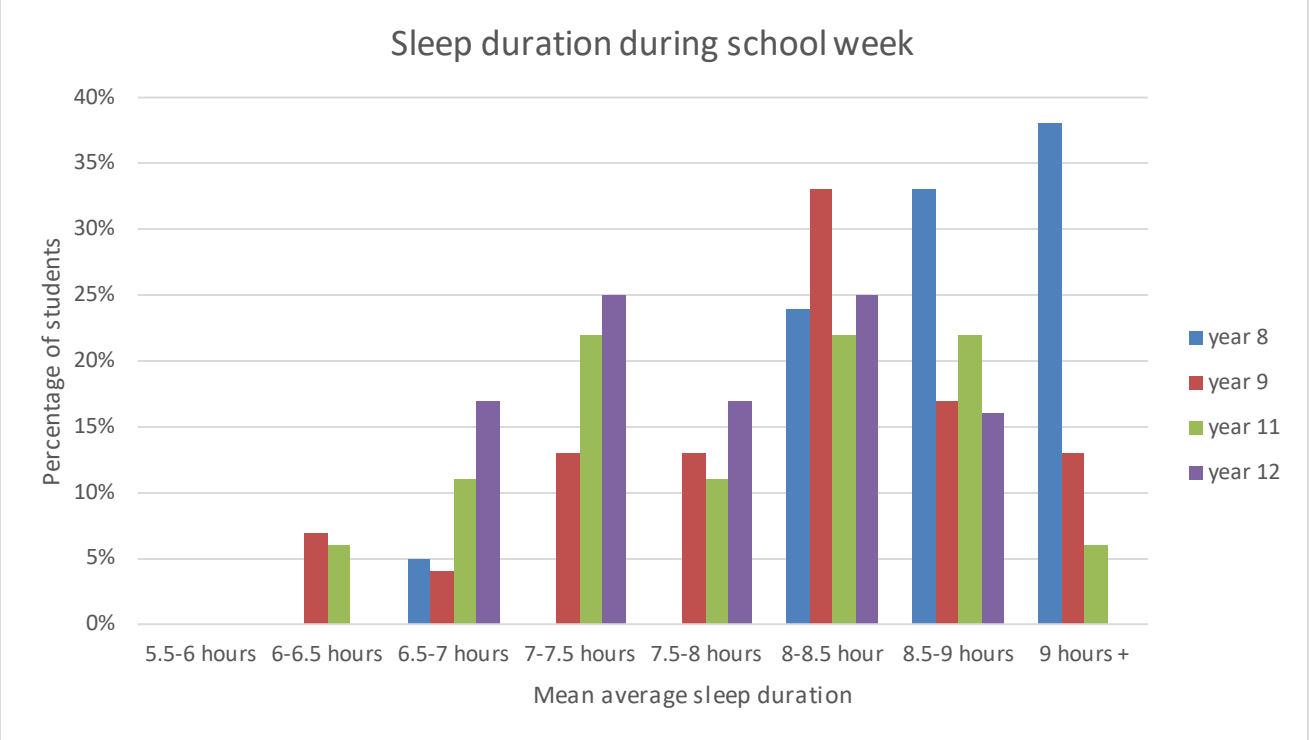

Figure 3-Sleep duration during school week

Figure 3 shows the approximate number of hours of sleep students got during the week. As you can see there is a larger proportion of students in year 8 compared to the older year groups who slept longer than 8.5 hours. A possible reason for this is that at around the age of puberty, teenagers tend to become more ‘‘evening typed’’, preferring later bedtimes, and wake times. Preference for ‘phase delay’ has a biological basis, with circadian phase also referred to as the ‘human clock’ becoming increasingly delayed in young people relative to pre-teens (Carskadon & Acebo, 1997; Altun & Ugur-Altun 2007). Almost all of the older students questioned on average had less sleep than the younger students because despite later bedtimes students were still required to wake up early for schools, therefore, are unable to stay in bed for the duration of sleep required.

Based on research conducted in sleep labs, where researchers seek to determine the natural sleep/wake cycles of humans, the recommended amount of sleep for teens ranges from 9 to 9.5 hours of sleep at night (Carskadon, 1999). In Figure 3 we can see that the vast majority of students in secondary school get approximately 8 to 8.5 hours sleep which is approximately 1 hour below the recommended sleep teenagers require which builds up over time and can cause a number of health issues (Wolfson and Carskadon 1996).

A large number of studies have identified that lack of sleep in adolescents during school term has been connected with mood swings, tiredness in class, decreased functioning during the day, accidents, increased substance use and lower academic grades in cross-sectional studies. Furthermore, irregular sleep patterns only add to these outcomes (Giannotti, Cortesi, Sebastiani, & Ottaviano, 2002; Wolfson & Carskadon, 1998).

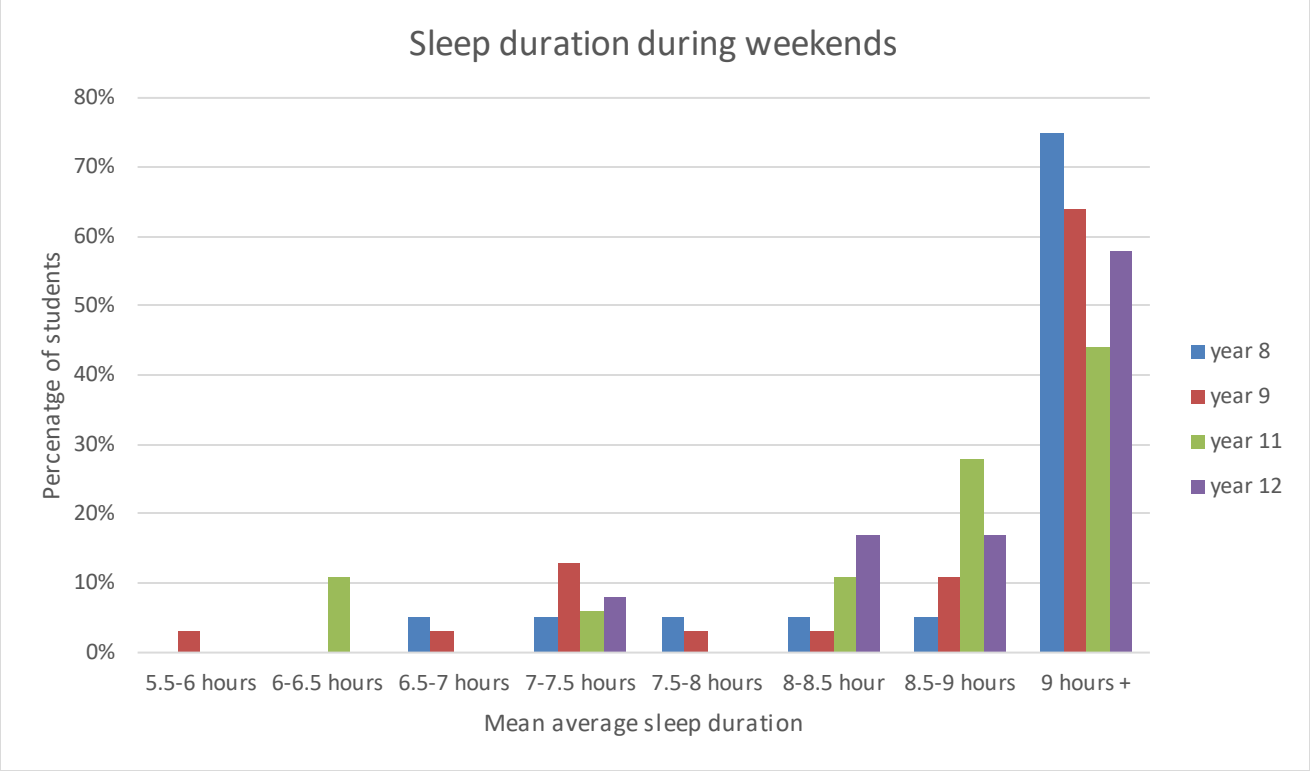

Figure 4- Sleep duration during the weekend

Figure 4 represents the sleep duration of students during the weekend. As we can see, a large proportion of students in secondary school are able to get more than 9 hours sleep during the weekend. This is mainly because more than 65-70% of students wake up naturally during the weekends as they do not need to wake up early as opposed to the weekdays where the majority of students are woken up for school (see Table 11).

Considering students can sleep 9 hours or more during the weekend, indicates that students on average get 1-2 hours less sleep each day during the school week, which is a considerably large amount. If we compare these findings to section 2.3 (see literature review), there are many similarities found in past studies, indicating that students have always been sleep deprived. Although, if we compare this study with Carskadon's (1995) research, we can see that students nowadays are clearly getting a lot less sleep then they did 22 years ago, indicating that students are currently worse off than they were previously with regards to the potential issues that they could be facing.

School start time is a major externally imposed constraint on adolescents' sleep/wake schedule. For the majority of teenagers, waking up and going to school eis neither spontaneous nor is it

negotiable. Table 12 shows that during the school week more than 72% of students are either woken up by an alarm clock or by someone in order to get themselves to school on time. However, during the weekend, we can see a more natural sleep pattern as there is less externally imposed constraints and students are able to wake up naturally, which as a result enables them to receive more than 9 hours sleep.

	How students are woken during the school week			**How students are woken during the weekend**		
	Naturally	Alarm Clock	Person	Naturally	Alarm Clock	Person
Year 8	24%	38%	38%	76%	10%	14%
Year 9	27%	44%	27%	67%	27%	6%
Year 11	7%	48%	45%	81%	11%	8%
Year 12	17%	58%	25%	67%	25%	8%

Table 12-Responses on how students wake up

Table 12 shows the method in which students wake up during the week and weekend. For simplification purposes there are three ways in which an individual can wake up, this is naturally (no alarms etc.) by an alarm clock or to be woken up by someone else. It is important to note that there are other factors such as temperature, lighting etc that can also disturb sleep. However, since this questionnaire was targeted at students, it was simplified (see methodology 3.3). During the school week it is clear that the majority of students (over 75%) need to be woken through means of an alarm or by someone, in order to get up in time for school. This indicates that the only a small minority of students wake up naturally for school and all other students' sleep is disrupted, this in turn could be one of the main reasons as to why students feel so tired in the morning which as a result is carried over to at least the first school period.

When Secondary School Students' Bodies Start to Tell Them It Is Time for Bed

	Year 8	Year 9	Year 11	Year 12
Average time	8.51pm	9.08pm	9.17pm	9.10pm

Table 13-Mean average time students feel it is time for bed

To assess whether or not students' actual bedtimes match when they think their bodies tell them

it is time for bed, the survey asked students what time they thought their body starts to tell them it is time for bed. In Table 13 results show that there is not a consensus among teens about when their body starts to tell them it is time for bed. However, the majority seem to think their body starts to feel tired at around 9pm, which is consistent with the medical research about sleep timing preferences in teens. Despite this, students do not seem to be going to bed when they feel tired, instead they stay awake for longer periods of time which only adds to their fatigue.

Adolescents demand more sleep, even with 9 hours of sleep or more teenagers still struggle with drowsiness early in the morning. With the problem only getting worse over the years as students seem to be sleeping later due to internet, television and many other distractions that are available 24 hours a day. According to a study by Steptoe et al. (2006) on sleep duration in young adults, approximately 17500 university students were questioned on the amount of sleep that they get during the week, results found that 63% of the respondents slept around 7 to 8 hours; 21% were short sleepers (6%, <6 hours; 15%, 6-7 hours); and only 16% were long sleepers. Based on this research it is clear only a small minority (16%) of the students are getting adequate sleep and the majority of the students are unable to get the required 9 hours of sleep needed in order to be fully alert and focused in school. As you can see in the data collected even with a smaller sample group, we see very similar results with regards to sleep duration in adolescence in secondary schools.

Students were questioned on average how long it takes them to fall asleep at night. Table 14 shows that less than one fifth of students in years 8, 9 and 10 can fall asleep in less than 15 minutes with the majority of students needing between 30-60 minutes before falling asleep.

Response Option	Year 8	Year 9	Year 11	Year 12
Less than 15 minutes	19%	13%	19%	50%
15-30 minutes	5%	7%	37%	25%
30 -45 min	38%	30%	22%	25%
45-60min	38%	47%	22%	0%
60min +	0%	3%	0%	0%

Table 14-Mean average time it takes to fall asleep

Carskadon points out that social pressures as well as biological factors play a major role in determining adolescent sleep. The key factors that directly affect adolescent sleep patterns are

puberty, parental control and influence in setting bedtimes (this tends to decrease as teens get older), curfews, substance use, employment, school schedules and finally the development of circadian rhythms (Carskadon, 1990).

It is common for parents of teenagers to stop enforcing bedtimes, while still enforcing a wake-up time which as a result is reducing crucial hours of sleep that puberty is demanding (Carskadon, 1993).

Most teenagers have different weekday sleep patterns than they do during the school week. Usually teenagers sleep much longer over the weekend which to some extent can be due to the insufficient hours of sleep they get during the weekdays.

Students were asked what time they think they should go to bed and what time they should wake up in order for them to feel their best. The Table below represents the average time students responded.

	Year 8	Year 9	Year 11	Year 12
Bed time	9.26pm	9.34pm	9.16pm	10pm
Wake up	8.10pm	8.10pm	8.20am	8.39am
Total hours	10 hours 44 min	10 hours 36 min	10 hours 54 min	10 hours 39 min

Table 15-Average time students think they should go to bed and wake up

Table 15 represents the duration of sleep students think they need during the week. Students in all year groups reported that they feel they need more that 10 and a half hours of sleep, which is considerably longer than what they are actually getting. All students responding to a wake up time of just after 8am, which is generally the time students need to already be in school, and in some cases classes would have already started. These findings highlight the struggles students are facing in the morning, and the possible issues teachers and students are facing with early morning classes.

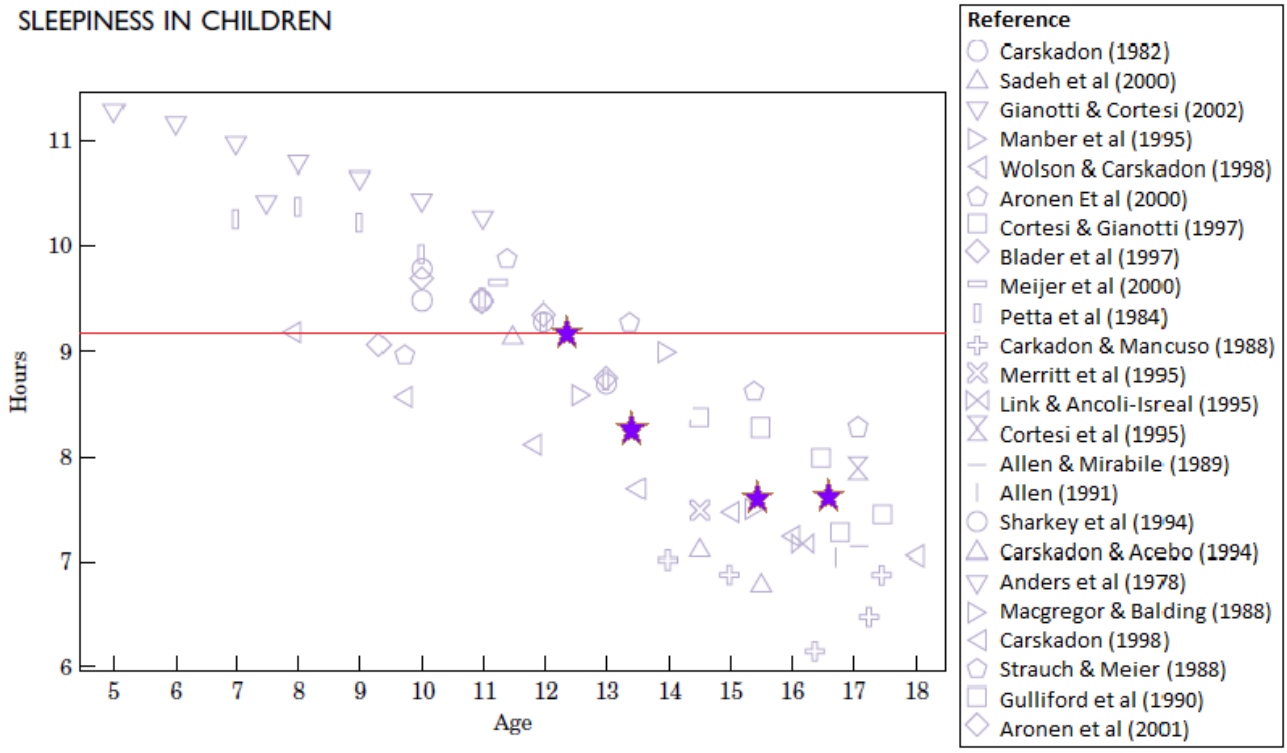

Figure 5-Mean school night sleep duration extracted from surveys & assessments. Adapted from Fallone, Owens & Deane (2002)

Figure 5 represents the age groups and the average amount of sleep from 24 studies, all of which show similar correlations in results. The stars represents the average sleep duration of participants in this study which follows a general patteren along with numerous previous studies. The red line just above the 9 hour mark represents the recommended amount of sleep students require. Based on the finding is this study along with many other studies, there is a a steady decrease in sleep as students get older, with students from as young as 11 getting below the recommended amount of sleep required.

5.2 Conclusion- Are students getting enough sleep during the school week?

This phase aimed to address the importance of sleep, and whether students in this study faced similar issues to previous literature with regards to sleep deprivation and the possible impacts sleep can have on students during the school day. The findings in this study suggest that students from the ages of 13 onwards are significantly getting below the recommended amount of sleep needed during the school week. Results in Figure 5 indicate a similar pattern with regards to sleep duration

in comparison to numerous previous studies, which suggests the possibility of similar issues being faced in this school as compared to schools in previous studies.

As many parents will agree, adolescents often burn the candle at both ends by staying up late whether it is to complete homework, watch TV, browse the internet or just socialising with friends adolescents are not sleeping early enough and then struggle out of bed early in the morning to reach school before the first bell rings. Based on the findings in this chapter the majority of students are sleep deprived with older students in secondary school having less sleep than those in the earlier years.

Over the years student sleep duration has been steadily decreasing, this could be due to the increase in technological developments as students now have access to 24-hour entertainment as oppose to students 10 years ago. Nowadays, in adolescence specifically, there is an increased dependence on technology for the use of social interactions as well as an increase in the availability of technology (National Sleep Foundation, 2006). Late night use of computers and television is having a negative effect, such as struggle of falling asleep (Polos et al., 2010; Shochat et al., 2010), as well as issues with mood, behaviour, and cognitive functioning during the day have been reported (Polos et al., 2010).

Many students with technology in their bedrooms report disrupted sleep and frequent awakening at night due to technological social interactions receiving a text, phone call, or email (Harvey et al., 2013). The circadian rhythm which is the body's natural clock is influenced by exposure to light, whether the light is from the sun or blue light from electronics such as mobiles, computers and TV before going to sleep may be artificially affecting their bodies' natural sleep rhythm (Carskadon, 2013). While light in the morning helps adults to awaken more easily, there is evidence that this facilitating factor is diminished in adolescence (Hansen et al., 2005) while the effect of night light exposure preventing sleep may be enhanced (Carskadon et al., 2004).

If we compare the results from this study with the study by Wolfson and Carskadon (1998) on the relationship between adolescent sleep/wake habits and the characteristics of students daytime functioning, they revealed that more than 3000 adolescents had an average of 1 hour and 50 minutes more sleep over the weekend than they have during a school week. We can see very similar results with the average student having approximately 7-8 hours' sleep during the week and over 10 hours during the weekend. Since the weekend usually represents adolescents natural sleep

duration, we can see that during the school week students are getting on average more than 2 hours less sleep.

Studies suggest there are many risks that adolescents may face if they do not get enough sleep, apart from daytime sleepiness there are a lot of behavioural issues that could arise (Dinges & Kribbs, 1991, Nilsson et al., 1989, Carskadon 1990). According to Maas (2001) there are a number of issues that could occur when you done get enough sleep such as;

- Daytime drowsiness- Difficulty to get through the day without a temporary loss in energy and alertness.
- Micro sleeps- Episodes of sleep which last a few seconds which produces inattention, can be very dangerous resulting in accidents or even deaths.
- Sleep seizures- a severely sleep deprived person can face longer episodes of sleep that occur as rapidly as a seizure.
- Mood shifts, including depression, increased irritability and loss of sense of humour
- Stress and Anxiety
- Lack of interest in socialising
- Reduced immunity
- Lack of motivation
- Reduction in productivity (Reduction in concentration, short-term memory, communication skill, creativity etc.).

All of these issues can impact student learning and some of which students may face on a daily basis. Wolfson et al. (1995) found that adolescent behaviour issues were highly associated with reduced sleep times and later bedtimes. As a result, daytime sleepiness could negatively impact early morning lessons which may result in students not focusing or willing to learn.

Chapter 6- Phase 2 Findings- Time of day and its effects on student performance

6.1 Introduction

One of the earliest studies on time of day and its effects on performance was undertaken by Laird in 1925, which was then later by numerous researcher such as Blake (1967), Baddeley et al., (1970); Hockey et al., (1972). In these studies, they acknowledged that the performance in a variety of tasks varied with time-of-day. In standard tests of short-term memory using immediate recall, Baddeley et al., (1970) found that short-term memory improved from early to mid-morning and then decreased steadily over the day. However, Folkard et al.'s (1977) study, they found that short-term memory recall was better in the morning than in the afternoon. It is important to note that that the majority of studies on time of day and memory were administered over a decade ago and with the changes in social environment and technology it is important to assess students on a regular basis.

In this chapter we will be looking at the effects time of day has on short term memory and problem solving activities and whether the period (time of day based on school timetable) can influence the performance in these two areas. According to a study by Jaquith (1996) which compared short term memory and academic performance in 546 students in a private school, there was a positive correlation between short-term memory and standardised achievement scores in students. Therefore, based on the results from the short-term memory tests and the problem-solving activities, some assumptions can be made in relation to academic performance in students.

Two classes from different age groups, year 10 and year 8, were selected in this phase. The main reason behind this choice was due to the fact that I taught these classes, and were the only two classes that had their maths lessons at different time of the day.

I taught the year 10 class 3 times a week, once during period 4, once during period 2 and once during period 3 and the year 8 class are taught during period 1, period 4 and period 5. I decided to test the year 10 students during period 2 and period 4 over two weeks to increase the reliability of the results and the year 8 students during period 1 and period 5.

Over a space of two weeks, each of the participating classes took short memory tests at the start of each lesson twice a week one in the morning lesson and one in the afternoon. In total each class had undertaken 6 memory tests at different times of the day. Tests A, B, C, D, E and F were displayed through a projector containing 30 Mathematical symbols, shapes and words (10 of each) in a 6x5 grid. All six tests contained exactly the same number of symbols, shapes and words in order to assess and compare the findings. Students each had 60 seconds (2 second per image) to try and memorise the images and then were given enough time to recall and draw the image on a blank 6x5 grid.

Before the analysis of the quantitative data, the tests were scored and data assessed for missing or unusable data. The raw data was graphed using box plots for each time-of-day tested. This helps to give a sense of the distribution of the data. First, measures of averages (Mean) and the standard deviation were calculated for each time-of-day tested (morning and afternoon) and compared the means to get a general sense of the data. Next, the variance was calculated for each time-of-day of testing. The variance ratio is computed and used to determine if the variance in the scores is too widespread. If the variance ratio is under a certain value, then the analysis of variance (ANOVA) test can confidently be used to determine if there is a statistically significant difference between mean test scores at different times of day. Next, an ANOVA is performed on the data, which produces a number, F. This is a quantitative representation of the degree of difference between the means. For accepting or rejecting the null hypothesis, a significance value of $p = .05$ is used (Cresswell, p.188). If the critical value of F is less than the computed value of F, then the results are statistically significant and the null hypothesis is rejected. If the critical value of F is more than the computed value of F, then the results are not statistically significant and the null hypothesis is accepted

6.2 Memory test findings

The first test was during the period 4 lesson where students had to complete a short memory test followed by the 2nd test during the period 2 lesson. These tests were then repeated the following week and below is the data collected in the 2nd week. The reason behind selecting the second weeks' data was to overcome a key constraint. Since the first time the students took the test they had never seen the format of the test before. The second time, they would have gained some experience of the test format, which could have resulted in an unfair inflation of results. Therefore,

by only using the second weeks data, students are all familiar with both the tests which minimises this constraint.

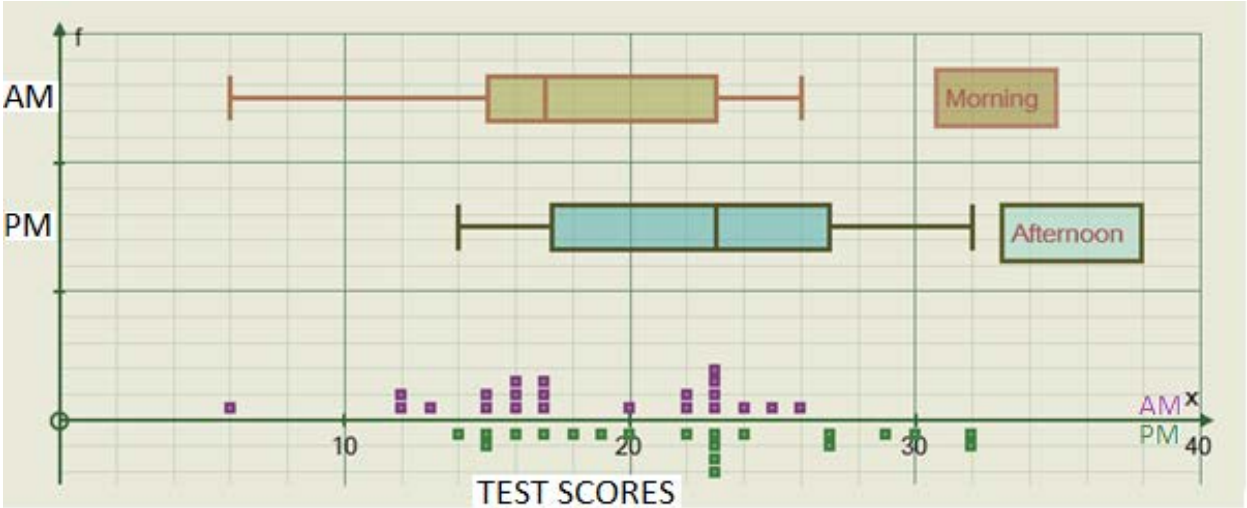

Figure 6-AM vs PM- Year 10 memory test results

Figure 6 shows a comparison of the two tests. According to the box plot, there was a positive shift in the afternoon indicating that students were able to remember a lot more information as a class compared to the morning, this indicates that students could have been more alert which could have resulted in students being able to retain more information.

During the afternoon, out of a total of 60 marks the class mean average was 22.45 marks with a standard deviation score of 5.56. In the morning session, the class mean dropped to 18.32 marks with a slightly smaller standard deviation of 5.06. In both the morning and afternoon there were no outliers and all data collected was used. Outliers were calculated by multiplying the interquartile range by 1.5 and adding it onto the upper quartile and subtracting it from the lower quartile. ANOVA tests were then used to compare the means of the year 10 data. Based on the results collected, it is clear to say that there is a significant difference in scores between the morning and afternoon tests. Students were able to retain more information in the afternoon as compared to the morning session. Similar results were also found in other year groups.

Yr. 10	Morning Test	Afternoon Test
Mean	18.3182	22.45
SD	5.03069	5.56305
Range	20	18
Semi-I.Q Range	4	4.875
N	22	20

ANOVA		
DF	F-Value	P-Value
1	6.390	0.016

(1) **Source** means "the source of the variation in the data.". The factor is the characteristic that defines the populations being compared
(2) **DF** means "the degrees of freedom in the source."
(3) **SD** means "the Standard deviation."
(4) **F** means "the *F*-statistic."
(5) **P** means "the *P*-value."

Table 16-ANOVA Test- Year 10 memory results

Figure 7 looks at the results of the memory tests on the slightly younger age group. Based on the findings there is a similar trend to the results of the year 8 students when compared to the year 10 students. Although the mean average for both tests were lower than the year 10 students, the year 8 students still outperformed themselves in the afternoon tests in comparison to the morning tests.

Figure 7- AM vs PM- Year 8 memory test results

Yr. 8	Morning Test	Afternoon Test
Mean	14.7083	19.9231
SD	4.58693	6.9111
Range	16	27
Semi-I.Q Range	4	4.625
N	24	26

ANOVA		
DF	F-Value	P-Value
1	9.708	0.003

(1) **Source** means "the source of the variation in the data.". The factor is the characteristic that defines the populations being compared
(2) **DF** means "the degrees of freedom in the source."
(3) **SD** means "the Standard deviation."
(4) **F** means "the *F*-statistic."
(5) **P** means "the *P*-value."

Table 17- ANOVA Test- Year 8 memory results

Table 17 shows the results of the year 8 class who completed the same memory tests as the year 10 students. Out of a total of 60 marks, the class mean average of the afternoon tests was 19.92 marks with a standard deviation score of 6.91. when we compare this to the morning tests which had a much lower mean average of 14.71 and a standard deviation score of 4.59. Therefore, on average students scored approximately 5 marks higher in the afternoon as compared to the morning. When comparing the standard deviations and interquartile ranges we can see similar results to the year 10 tests which had a smaller variance in the morning in comparison to the afternoon, indicating that overall the results were more consistent in the morning.

Results from the ANOVA test similarly indicates that the results between the morning and afternoon are of a significant difference in both year groups ($p \leq 0.05$). Findings suggest that the students in this sample worked more consistently in morning, However, on average performed significantly better in the afternoon.

6.3 Problem solving activity findings

Students were each given a series of problem solving questions based on topics they have previously covered. Each student was given a stopwatch and they each had to record the time it took to answer each question. Each student was given 5 questions to complete in each lesson over

a 2-week period. The first activity was undertaken during period 4 which was from 12.15pm to 1.15pm and second activity was during period 1 which was from 8.35am to 9.35. These activities were completed over a 2-week period and the line graph above shows the average score of the 5 questions completed. In order to increase validity only the data collected from the second week was used as it would have been unfair to use the data collected from the first session as students may not have got used to timing their questions. For simplification purposes, students were told to round the times to the nearest second.

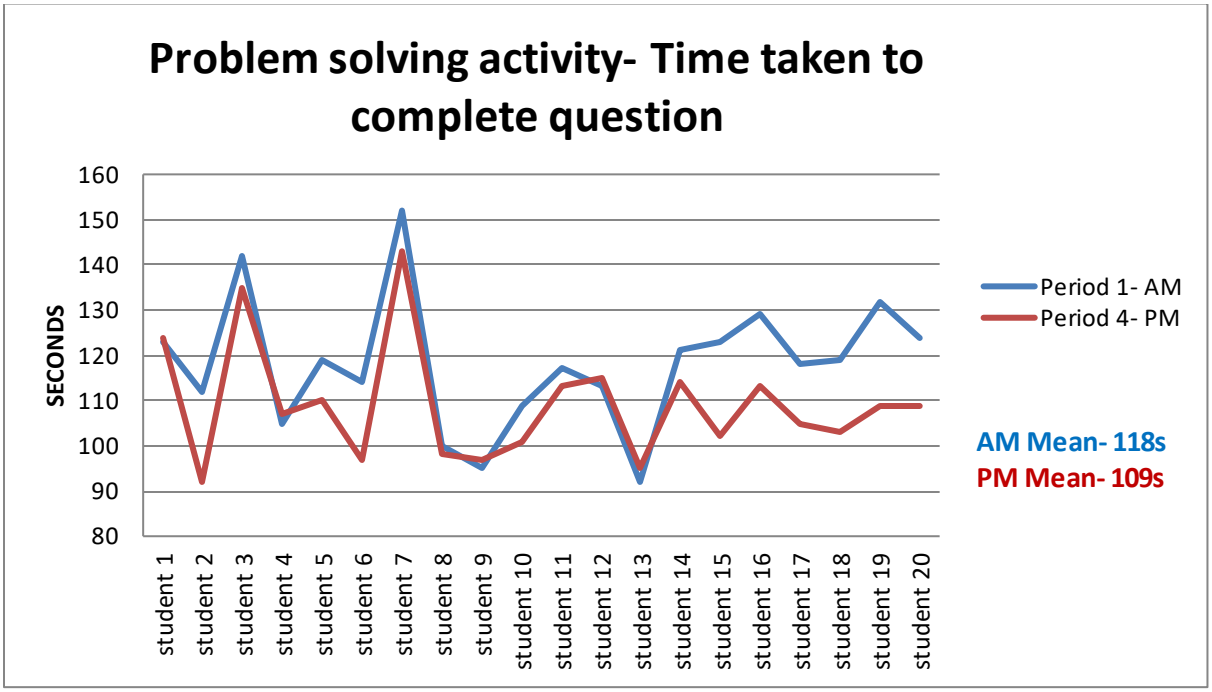

Figure 8-Problem solving activity

ANOVA		
DF	F-Value	P-Value
1	4.1241	0.0493

Table 18 -ANOVA test- Problem solving activity

Figure 8 suggests students were a lot quicker at completing the tasks during the afternoon period 4 session in comparison to the morning period 1 session. Despite a couple of students performing better in the morning session, the majority of students completed the activities quicker during the afternoon session. The average time taken to complete a question during the morning was 118 seconds and 109 seconds during period 4, which is an approximate difference of 9 seconds per

question. Based on the ANOVA test in Table 18, there is a significant difference $P<0.05$ in the time taken to complete the activity in the morning compared to the afternoon session. Findings suggest that the students in this sample perform better in the afternoon in both the memory problem solving activities.

6.4 Conclusion- Does the performance of students vary at different times of the school day?

The overall findings in this study suggest that student performance in both the problem solving and memory activities significantly varied at different time of the day. Student performance for all age groups was better in the afternoon in comparison to morning testing. A possible contributing factor could be due to student's alertness or fatigue in the morning. The findings in phase 1 revealed that the majority of students were getting below the recommended sleep duration needed which as a result could mean students are still sleepy in the mornings.

Many studies document that sleep deprivation negatively affects academic performance and that eveningness types are at risk of sleep deficits and higher daytime sleepiness (e.g., Kirby & Kirby, 2006; Meijer, 2008; Randler & Frech, 2006). Students with eveningness orientation go to bed later but have to wake up early. This causes them to be more tired during the day and may be reflected in lower academic performance.

As we can see from the findings in this study, students in this school perform better in the afternoon than in the morning in both the memory and problem solving activity. Based on my experience as a teacher and from the literature and research it can be reasonable to say that the students in this study may not have perform to the best of their ability due to the level of tiredness or alertness in the morning which can be associated with the quality and/or duration of sleep.

Cardinali concluded from their study that *"Since children's time of day preference shifts towards eveningness as they get older, their cognitive functioning is likely to be at its peak more towards the afternoon than in the morning. Thus, if important basic classes such as reading and mathematics are taught in the morning, older school children will be learning this critical material at their less-preferred or non-optimal time of day, resulting in poorer school performance than might be found were the courses in greater synchrony with circadian arousal rhythms."* (Cardinali, cited in Battro, Fischer, & Léna, 2008 p. 122). It is clear that the time of day is an important factor

in student performance and that more time is needed in identifying students' time of day preference to ensure that they are learning at times when their performance is at its peak. In the next section we will be taking a look at learning styles and how teachers perceive learning and behaviour at different times of the day.

Chapter 7- Phase 3 Findings- Time of day Vs Perceived learning

7.1 Learning Style inventory

In this chapter we will be investigating the time of day and its effects on behaviour and perceived learning.

Over the years there has been a significant interest in understanding the way students learn and using this information as a tool for educators to better equip themselves in a classroom. Understanding how a student learns is said to unlock new potential and increase academic performance. According to Ellis (2005), an individual's learning style is more or less fixed. It is not easy to change someone's learning style as it is not easy to change personalities, habits, or cognitive style. However, the classroom environment, school and peers can influence ones' personality which in turn could affect a student's learning style.

In this sense, it is important for teachers to understand different types of learners and to get to know the students' learning styles, and to understand to what extent a classroom environment can affect the way in which students learn.

Some educators question whether students are able to identify their own learning style, although Rita Dunn, one of the leading advocates for learning styles-based education points out that *"in testing more than 175,000 youngsters in grades 3-12, we find that most children not only can tell you how they learn, they want and are delighted that you asked"* (Dunn, 1983 p. 60). However, Dunn does point out that 15% to 20% of students who do not have a significant change in levels of attentiveness during the day are unable to identify their peak times. This portion of the population includes those students who are fortunate enough to learn equally well at all times of the day; therefore, their inability to identify this learning style does not hurt them (Dunn, 1983).

Many studies support the idea that students can in fact identify their preferred learning style. In a 1971 study, seventy-two college students showed that when questioned they could predict the learning style in which they would display their best performance (Dunn, 1983).

In this chapter we investigated whether the time of day can impact the way students feel they learn. To investigate this, students had to complete a learning style inventory which was an adaptation of the Dunn and Dunn LSI and the Middlesex community colleges LSI. Regardless of the findings of

the LSI, the motivation behind the use of LSI was simply to provide students with a useful set of questions to measure whether the time of day impacted the way students answered ach question, and whether the findings from the LSI differed in the afternoon compared to the morning.
This learning style inventory was given to different class groups of secondary students which had to be filled out in the morning and afternoon classes at different points during the week to see if students assessed themselves differently based on how they felt at certain times of the day. The classroom setting was exactly the same and all LSI's were given out to students by me during their mathematics lessons.

Table 19 below shows the results of the learning style inventory of a group of year 12 A level students.

	VISUAL (MEAN)	**SD**	**AUDITORIAL (MEAN)**	**SD**	**KINAETHETIC (MEAN)**	**SD**
MORNING	11	2.12	7	2.31	7	1.68
AFTERNOON	9.25	1.92	6.42	1.89	9.42	1.98
ANOVA TEST BETWEEN AM AND PM	DF= 1 F= 5.87 P=0.024		DF=1 F=0.45 P=0.51		DF=1 F=10.42 P=0.0039	

(1) **Source** means "the source of the variation in the data.". The factor is the characteristic that defines the populations being compared
(2) **DF** means "the degrees of freedom in the source."
(3) **SD** means "the Standard deviation."
(4) **F** means "the *F*-statistic."
(5) **P** means "the *P*-value."

Table 17-AM vs PM -Learning style inventory responses

Table 19 shows a slight shift in the average mean score for the Learning Style Inventory during the morning compared to during the afternoon lesson. Students were given exactly the same instructions during both sessions, and were given the exact same LSI. The responses to the LSI completed in the morning compared to the afternoon was different, indicating that the time of day may have influenced student.

The ANOVA test shows that there was a significant change in the average scores of the Visual and Kinaesthetic learning style between the AM and PM session $P<0.05$, although there wasn't a significant change in how students scored on the auditorial style. These results indicate that there was a significant difference in the way students answered the LSI and how they perceived their learning between the morning and afternoon sessions.

The same LSI was given to a group of year 8 and year 9 students (see Appendix) which also revealed changes in which the LSI was answered for the vast majority of students, however I decided to use the year 12 data mainly due to students age their age and ability in effectively understanding the LSI questions to ensure validity in the data collected.

Another key factor that plays a fundamental role in the changes in which students learn during a school day is behaviour. For most teachers, behaviour and learning go hand in hand, if a student is well behaved he is able to learn better and stay focused in lesson, however, poor behaviour in schools generally leads to poor grades. It is the responsibility of teachers to ensure that all students are well behaved and fully engaged in lessons. However, the findings in Table 19 suggests that even learning preferences can change at different times of the day; therefore, it is safe to assume that behaviour management could become more difficult at different times of the day. In order to effectively test this hypothesis, a large amount of data is required to effectively identify whether there are any changes in behaviour patterns and perceived learning at different times of the day.

The following tables show the changes in behaviour and perceived learning of students in secondary school over the course of a year. This data has been recorded by teachers during the year as part of the classroom registration and monitoring process. At the end of each lesson teachers are required to record and monitor the student's behaviour and the perceived learning during each lesson and score them based on that lesson using the codes below.

Code	**Point Score**	**Perceived Learning**
3	2	Outstanding in lesson, very well behaved and completed work to a high standard
2	1	Good in lesson, well behaved and completed work to a good standard
1	0	Satisfactory, student may have gotten distracted and/or completed work to a satisfactory standard
8	-1	Poor, misbehaved in the majority of lesson and/or student completed work to a poor standard (or didn't complete enough work)
9	-2	Very poor, serious incident occurred in lesson and /or no work completed and/or student was removed from lesson

Table 20- Score codes for school management system (SIMS)

This coding was used to measure 'perceived learning' which is a combination of behaviour, work completed, and the progress made in lesson as perceived by the teacher. For example, a score of 3

would only be awarded if all criteria (see Table 20) is met to the standard of that teacher. It is the responsibility of the teacher to monitor the work of students throughout the lesson and therefore all codes recorded are at the discretion of the classroom teacher. Data was collected on a weekly basis and reviewed to help identify areas of improvement and interventions needed in the school. It is important to note that although teachers make every effort to assess progress made in lessons, there may be times where teachers are unable to check every student's book during a lesson, which could impact the validity of a score entered. In some cases a certain score may have been awarded based on behaviour alone. Therefore, a significant amount of data was needed to increase the validity of the data collected.

Over 700 000 pieces of data was recorded by teachers over the course of an academic year. In the following section I began by reviewing an overall summary of all year groups using ANOVA testing to compare the significance on a period by period basis as well as a comparison by different age groups. Table 21 shows the overall mean average for each year group at different time (periods) of a school day. The higher the mean average score is the better perceived learning and behaviour was at that particular period. As you can see the average score varied for every year group throughout the day, in order to assess whether these varied scores were of a significance ANOVA tests were completed comparing scores on a period by period and year by year basis. Based on the findings in Table 21 we can see that the perceived learning score for every period and every year group was significantly different indicating that student's performance varied throughout the day. In year 7, students' perceived learning and behaviour score was at its highest in first thing in the morning and steadily decreased as the day went on. In year 8 and 9, we can see similar findings with regards to the period 1 lesson, however, in period 4 we can see an increased score as compared for both year groups as compared to period 3 and period 5. A possible reason for this, could be because both lessons are after break and lunch, therefore, students may have taken some time to settle down which could have impacted their scores. In year 10 and 11 we can see the scores to begin to fluctuate throughout the day, although the perceived learning scores are at its highest first thing in the morning, we see a large dip in period 2 followed by an increase in period 3 which is different to the trends in the younger year groups. Finally, if we look at year 12 and 13 we can see that the perceived learning score was lower in Period 1 and 2 and increased later on in the day. Period 4 was the optimal learning time for year 12 and period 3 was the optimal learning time for year 13. When we look at the ANOVA test results on a year group by year group basis, $P<0.05$ for all periods indicating that the perceived learning score varied significantly indicating that age is also a contributing factor to performance at different times of the day.

7.2 Summary data – Academic year 2013-2014

SUMMARY ALL WEEK	PERIOD 1			PERIOD 2			PERIOD 3			PERIOD 4			PERIOD 5			ANOVA period to period
	Mean	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	
YEAR 7	1.312	0.585	25187	1.266	0.632	23173	1.244	0.642	22210	1.198	0.638	23645	1.152	0.669	24987	F=235.3756 P=0.0000
YEAR 8	1.24	0.636	26421	1.19	0.701	24514	1.112	0.76	23848	1.167	0.756	23543	1.129	0.712	26393	F=129.8330 P=0.0000
YEAR 9	1.279	0.624	27146	1.184	0.663	23869	1.17	0.68	23786	1.158	0.705	22848	1.11	0.662	26938	F=232.1960 P=0.0000
YEAR 10	1.286	0.617	25712	1.22	0.664	23097	1.252	0.665	23051	1.181	0.708	21929	1.199	0.699	25359	F=95.0912 P=0.0000
YEAR 11	1.293	0.577	26142	1.168	0.584	23939	1.232	0.616	22658	1.2	0.594	22265	1.194	0.638	25969	F=164.6056 P=0.0000
YEAR 12	1.481	0.566	15417	1.456	0.57	15865	1.445	0.562	15702	1.484	0.559	15012	1.472	0.558	14705	F=13.5911 P=0.0000
YEAR 13	1.482	0.537	4046	1.511	0.534	4041	1.613	0.514	4142	1.554	0.544	4155	1.589	0.519	4208	F=42.5619 P=0.0000
ANOVA Year by year	F=335.3934 P=0.0000			F=540.2171 P=0.0000			F=671.2167 P=0.0000			F=222.0960 P=0.0000			F=8125380 P=0.0000			

Table 21-Summary of Perceived Learning scores for all year groups

Table 21 only provides an overall score on perceived learning however, the following tables provides more detail on the perceived learning that took place on a period by period basis using the coding score as defined in Table 20. In the appendices we will find the full data on a day by day basis however, due to the size of data collected and for the purpose of this research we will only review data collected on a period by period basis in different year groups. I will begin by analysing the data on a year by year basis to understand why the perceived learning scores were lower at specific times of the day.

7.3 Year 7 data

Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	P3		Period Number	P4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	924		1	1141		1	1207		1	1595		1	2022
2	14851		2	13555		2	13146		2	14488		2	15309
3	9211		3	8094		3	7460		3	7139		3	7059
8	174		8	357		8	354		8	401		8	542
9	27		9	26		9	43		9	22		9	55
Grand Total	**25187**		**Grand Total**	**23173**		**Grand Total**	**22210**		**Grand Total**	**23645**		**Grand Total**	**24987**

Table 22- Year 7 Perceived Learning summary scores

Table 22 shows the count of marks in year 7 for every period since September 2013 until 2014. Based on the data recorded, period 4 and 5 had the highest number of recorded 8 and 9 scores, this indicates there was a higher number of poor/very poor behaviour and learning during those lessons in comparison to the rest of the day. Period 1 had the lowest recorded incidents (out of the total recorded for that period) and the highest number of good to outstanding recorded for behaviour and/or work. A possible reason for this could be due to an increase in alertness, which as a result may have impacted behaviour. Another reason could be due to learning preferences as discussed in the previous chapter. Regardless of the reasons we can see a huge increase in serious incidents during period 5 indicating that this may not be a good time for some students.

7.4 Year 8 data

Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	1384		1	1675		1	2311		1	2244		1	2493
2	15895		2	14242		2	13455		2	12518		2	15457
3	8688		3	7871		3	7093		3	7952		3	7626
8	389		8	632		8	847		8	711		8	729
9	65		9	94		9	142		9	118		9	88
Grand Total	**26421**		**Grand Total**	**24514**		**Grand Total**	**23848**		**Grand Total**	**23543**		**Grand Total**	**26393**

Table 183- Year 8 Perceived Learning summary scores

Table 23 shows the recorded scores in year 8 for every period since September 2013 until 2014. Period 3 and 4 had the highest number of recorded 8 and 9 scores, indicating there was a higher number of poor/very poor behaviour and learning during those lessons, in comparison to the rest of the day. Period 1 had the lowest recorded incidents (out of the total recorded for that period) and the highest number of good to outstanding recorded for behaviour and/or work which show similar findings to year 7 (see Table 22). If we refer to Table 21, we can see that period 4 had the second highest perceived learning score, this is due to a higher number of 3's (outstanding learning) taking place indicating that period 4 is a highly productive period. A possible reason could be that the subject matter that took place for this year group was very engaging and as a result increased student performance, however, this is merely a speculation and further research is needed to identify the root cause.

7.5 Year 9 data

Year Group	Year 9		Year Group	Year 9		Year Group	Year 9		Year Group	Year 9		Year Group	Year 9
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	1179		1	1859		1	1788		1	2171		1	2215
2	15915		2	14263		2	14264		2	13020		2	17316
3	9630		3	7267		3	7117		3	7047		3	6692
8	388		8	427		8	554		8	555		8	643
9	34		9	53		9	63		9	55		9	72
Grand Total	**27146**		**Grand Total**	**23869**		**Grand Total**	**23786**		**Grand Total**	**22848**		**Grand Total**	**26938**

Table 24- Year 9 Perceived Learning summary scores

Table 24 shows the count of marks in year 9 for every period since September 2013 until 2014. As you can see period 5 has the highest number of recorded 8 and 9 scores which means there was a higher number of poor/very poor behaviour and learning during those lessons in comparison to the rest of the day. In addition, period 3 had the least number of 3's indicating that this period was not a good time for a large number of students in year 9. A possible reason could be that the lesson that took place doesn't seem to engage students or the fact that period 5 is after lunch and students are not focused in lesson.

7.6 Year 10 data

Year Group	Year 10		Year Group	Year 10		Year Group	Year 10		Year Group	Year 10		Year Group	Year 10
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	1185		1	1625		1	1442		1	1690		1	1965
2	14969		2	13370		2	12967		2	12593		2	14337
3	9232		3	7671		3	8191		3	7020		3	8401
8	291		8	371		8	405		8	527		8	578
9	35		9	60		9	46		9	99		9	78
Grand Total	**25712**		**Grand Total**	**23097**		**Grand Total**	**23051**		**Grand Total**	**21929**		**Grand Total**	**25359**

Table 195- Year 10 Perceived Learning summary scores

Table 25 shows the count of marks in year 10 for every period since September 2013 until 2014. As you can see period 5 highest number of recorded 8 and 9 scores which means there was a higher number of poor/very poor behaviour and learning during those lessons in comparison to the rest of the day. There was a similar trend compared to the younger year groups with period 1 scoring the highest. However, the worst period was period 4 with the least amount of 3's and the highest amount 8's and 9's. Based on this data it seems period 1 may be the optimal time for learning for this year group.

7.7 Year 11 data

Year Group	Year 11	Year Group	Year 11	Year Group	Year 11	Year Group	Year 11	Year Group	Year 11
Day of the week	(All)	Day of the week	(All)	Day of the week	(All)	Day of the week	(All)	Day of the week	(All)
Period	p1	Period	p2	Period	p3	Period	p4	Period	p5
Sims score	**Count**	**Sims score**	**Count**	**Sims score**	**Count**	**Sims score**	**Count**	**Sims score**	**Count**
1	925	1	1339	1	1219	1	1243	1	1572
2	15949	2	16248	2	14001	2	14488	2	16223
3	9045	3	6034	3	7135	3	6265	3	7671
8	206	8	281	8	253	8	239	8	444
9	17	9	37	9	50	9	30	9	59
Grand Total	**26142**	**Grand Total**	**23939**	**Grand Total**	**22658**	**Grand Total**	**22265**	**Grand Total**	**25969**

Table 206-Year 11 Perceived Learning summary scores

7.8 Year 12 data

Year Group	Year 12	Year Group	Year 12	Year Group	Year 12	Year Group	Year 12	Year Group	Year 12
Day of the week	(All)	Day of the week	(All)	Day of the week	(All)	Day of the week	(All)	Day of the week	(All)
Period	p1	Period	p2	Period	p3	Period	p4	Period	p5
Sims score	**Count**	**Sims score**	**Count**	**Sims score**	**Count**	**Sims score**	**Count**	**Sims score**	**Count**
1	299	1	385	1	270	1	260	1	294
2	7162	2	7644	2	7909	2	7026	2	7021
3	7874	3	7763	3	7438	3	7659	3	7340
8	82	8	71	8	79	8	64	8	45
Grand Total	**15417**	9	2	9	6	9	3	9	5
		Grand Total	**15865**	**Grand Total**	**15702**	**Grand Total**	**15012**	**Grand Total**	**14705**

Table 27- Year 12 Perceived Learning summary scores

7.9 Year 13 data

Year Group	Year 13		Year Group	Year 13		Year Group	Year 13		Year Group	Year 13		Year Group	Year 13
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	55		1	44		1	56		1	66		1	45
2	1966		2	1863		2	1492		2	1689		2	1627
3	2019		3	2126		3	2594		3	2398		3	2532
8	4		8	7		**Grand Total**	**4142**		8	10		8	4
9	2		9	1					9	1		**Grand Total**	**4208**
Grand Total	**4046**		**Grand Total**	**4041**					**Grand Total**	**4164**			

Table 28- Year 13 Perceived Learning summary scores

The findings in Table 28 indicate that period 3 is the best time of the school day for year 13 students. During this period there were no 8's or 9's recorded at all during the entire academic year as well as the highest proportion of 3's recorded. During period 4 however we can see a dip in performance with a higher number of issues arising. This could be due to a specific lesson that was being taught or due to the fact that students are anxious to go to lunch. During period 5 there is an increase in performance in the year group similar to period 3, both period 3 and period 5 lessons are directly after break/lunch which could be an influencing factor, however it seems these two periods are mainly productive for year 13 students only and are the least productive periods for the younger year groups.

Whether it is to do with how alert or tired students are at different times of the day, it is clear that student's performance significantly varies at different times of the day If we can utilise this information, it can be highly beneficial for teachers and students when scheduling certain

classes to match times of the day when performance is at its best and to provide support during the times when perceived learning scores are low.

It is important to note that as students got older the number of 8's and 9's recorded reduced significantly, this indicates that there may be a correlation between the behaviour of students and the perceived learning score, this notion is based on the assumption that student behaviour improves as they get older. Another possible reason could be due to the importance if examinations, as students in year 11 have to complete their GCSE's and in year 12 and 13 students are studying for their A level exams to prepare for university, students are more focused during lessons and as a result put in more effort. Regardless of the reasons the finding students in different age groups tend to have a preference towards specific times of the day. Therefore, if we can harness this information to inform teaching and learning we can help provide students additional support at times of the day where it is needed.

If we refer to the full list of tables in Appendix 11.4 perceived learning scores were not only affected by the time of day but also during different days of the week. For example, for year 7 students, Tuesday period 3 had a large decrease in outstanding perceived learning scores compared to any other day during the week. And Period 5 in general was the worst period for year 7's regardless of the day of the week which as a result may have a negative impact on a subject that is scheduled for this time. In year 13 Wednesday seemed to be the worst day of the week, with scores of 8 and 9's appearing in all periods except for period 3. Period 3 seems to be the optimal time for learning for this particular year group with not a single 8 or 9 score recorded in over 4100 lessons during the course of the year which is remarkable.

7.10- Conclusion

To what extent does behaviour and perceived learning preferences vary throughout the day?

The findings of this study suggest that students' performance in lessons, behaviour and perceived learning significantly varies throughout the school day. There were also significant differences in age groups indicating that performance in lessons varied also on a period by period basis by different year groups (see Table 21). In year 7, 8 and 9 according to the teachers, students perceived learning was at its highest first thing in the morning and steadily decreased as the day went on. This indicates that for the younger students Perceived Learning was at its best first thing in the morning. Similar findings were found in a study by Muyskens and Ysseldyke (1998) where 122 second to fourth students (plus one fifth-grader) were observed during a school day. The findings revealed that students were more engaged during the morning than they were in the afternoon.

In year 10 and 11 perceived learning fluctuated with high scores in period 1 followed by a dip in period 2 and then high scores again during period 3 followed by a steady decrease for the rest of the day whereas in year 12 and 13 Performance was at its highest late in the morning/early afternoon with the highest recorded score during period 3 and period 4.

In a study by Klein (2001) which examined mathematics aptitude and levels of attention. Using a questionnaire to study self-assessed levels of attention in fifth and tenth grade students, Klein (2001) found that levels of attention were highest in the afternoon and lowest in the morning for fifth grade students no matter what their mathematical aptitude level (determined by their yearly mathematical aptitude tests). Similarly, in a study by Allen & Mirabile (1989), students were consistent when reporting their level of alertness throughout the day. On average student's alertness was at its lowest at around 10am whilst approximately 50% of students were most alert until after 3pm. Therefore, there is a large number of students that leave school at their utmost level of alertness and are learning when they are least focused.

Based on the findings from this study, we can see there are some similarities to past research on student performance at different times of the day. It is difficult to make direct comparisons due to the nature of this research and the different geographical regions in which each study was administered. However, based on the very large sample size of data, one thing that we can conclude with is, there is significant change in the performance of students at different times of the day across all year groups. It is important in today's society that students are learning at their maximum potential. Therefore, it is crucial that schools and teachers are aiding

students with their needs and are acknowledging their learning patterns to effectively teach students. It is reasonable to say that randomly scheduling important subjects in schools may not be advisable, since findings in this study show that at different times of the day student learning significantly changes, therefore every effort is needed to help meet the needs of the students.

In the next chapter we will be taking a collaborative approach where we will be comparing the results from the previous phases and along with data collected in the student and teacher interviews, and we will attempt to identify any connections and draw conclusions from the findings in these studies. The questions used in the focus group interviews were formed based on the finding from the previous phases to help understand and analyse the data gathered. This phase attempts to use the students and teachers as co-researchers to help gain an in depth understanding as to the importance school scheduling can have through the experiences of the students and teachers.

Chapter 8- Phase 4 Findings– Comparative study

8.1 Introduction

For this study focus groups were used as an exploratory tool to complement the quantitative research methods used in the previous phases, although it is important to consider the advantages and limitations of focus groups and the impact it may have of the research.

Focus groups are a form of group interview that capitalises on communication between research participants in order to generate data. Although group interviews are often used simply as a quick and convenient way to collect data from several people simultaneously, focus groups explicitly use group interaction as part of the method. This means that instead of the researcher asking each person to respond to a question in turn, people are encouraged to talk to one another: asking questions and commenting on each other's' experiences and points of view.' The method is particularly useful for exploring people's knowledge and experiences (Cohen, Manion & Morrison 2017).

There are some limitations to the use of focus groups, firstly since the focus groups were held in a classroom by a teacher, there is a position of power that needs to be considered which may influence the responses of students. To help reduce this constraint, the researcher selected A level students and teachers only as opposed to younger students. A brief introduction was given to help participants understand the nature of the research and that their responses would be completely anonymous. Finally, it was not possible to know the interaction of students in a group, and therefore there is less control over the data that was generated.

The questions used in the focus group were formed based on the finding from the previous phases to help understand and analyses the data gathered. The focus groups were semi-structured, and although the majority of questions were formed prior to the focus group, some questions were asked during the interview based on the responses given from some of the students and teachers. During the focus group the researcher endeavored to ensure all participants had equal say.

8.1.1 Structure of focus groups

Demographics of focus group

	N	Male	Female	Duration	Age	Additional information
Student	4	2	2	60-90 min	17-18	All focus groups discussions were recorded. Names altered Start time 3pm- Mathematics Classroom
Teacher	4	2	2	60-90 min	30+	

Table 29- Demographics of focus group

Table 29 shows the demographics of the both the student and teacher focus groups. There were four mathematics teachers in the first focus group, 2 male and 2 female teachers. Similarly, the student focus group had 2 male and 2 female A-level mathematics students. A brief introduction was given prior to the focus group outlining the aims and purpose of the study this can be found in the appendix 11, although all teachers and students were familiar with the research as they participated in the questionnaires previously during the early data collection stage. The duration of the focus groups lasted approximately 60-90 minutes and was held in the mathematics classroom at 3pm afterschool.

During the focus groups Figure 9 which has been reprinted from chapter 6, is a box plot of the results from the memory tests discussed previously. Box plots were used to represent the findings due to the fact that all the teachers and students are familiar with them as they are part of the GCSE curriculum and therefore are able to provide useful responses.

Results of year 10 Memory Task- Morning Vs Afternoon

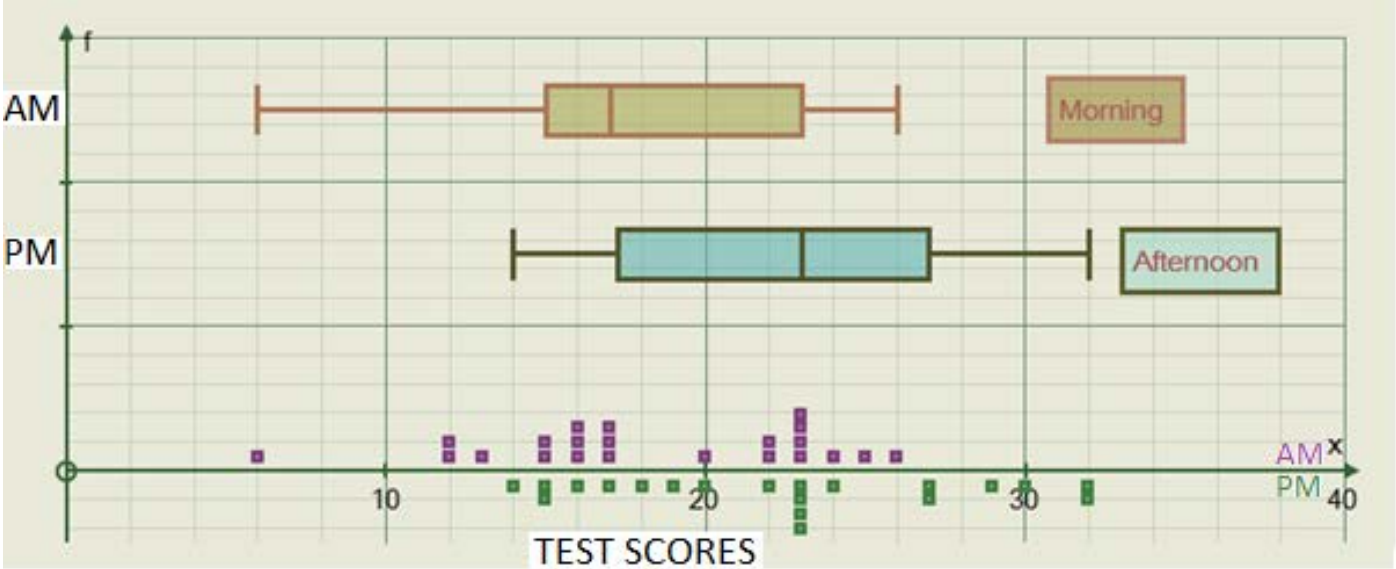

Figure 9- Boxplot- Findings of memory task for year 10 class (Reprint of Figure 5)

The box plot shows that on average students scored significantly higher in the afternoon tests compared to the morning. The median score was approximately 17 in the morning, which was 5 points lower than in the afternoon. This is further supported with higher scores in all quartiles throughout the afternoon box plot. The median score for the afternoon was in line with the upper quartile in the morning test indicating average of 25% increase in the overall scores of students in the afternoon test. All participants in the focus group were capable of reading and understanding the box plot and were able to discuss this during the interview.

If we refer to Table 11 which showed the mean sleep duration of students during the school week and weekend. Based on these findings the majority of groups are sleeping below the recommended sleep duration of at least 9 hours (Wahlstrom & Freeman 1997). During weekdays (school days) the average amount of sleep students get varies slightly based on the age group. On average the year 8 students aged 12-13 years old had approximately 9 hours sleep which is close to the recommended sleep duration however even within this group 30% of the students had 8.5 hours sleep or less. Year 9, 10, 11 and 12 students all were at least 1 hour short of the recommended amount sleep, this as a result indicates that the majority of the students questioned have sleep deficiency. ANOVA tests were used to determine whether the sleep duration between age groups and between weekend and weekdays where significantly different. Based on the findings there is a significant difference

between the amount of sleep students get during the week when compared to the weekend as well as between age groups.

8.2 Discussion from focus group

In this section the results from the previous phases will be compared along with the data collected in the student and teacher focus groups. The connections made and conclusions and finding drawn by the focus groups were discussed.

Students and teachers were asked questions around sleep duration, time of day and teaching and learning, in the following section is the responses of both students and teachers on a number of questions discussed during the focus group. The questions referred to in the discussion are displayed for the convenience of the reader. The full transcript and questions used in the focus groups can be found in Appendix 11. All names have been changed to protect participants and anonymity.

The focus group discussion was split into two part. In the first part, questions revolved around sleep duration and student perceived learning during the school day, in the second part of the focus group the questions were linked to some of the findings from the previous chapters, with the attempt to collaborate with teachers and students to provide their own perspectives for this study.

8.2.1 - Do you think that students get enough sleep during a school week?

> *Yatin- "no because we have to do work when we get home so then we don't have time to sleep in the afternoon and then we wanna relax as well therefore we go to bed late" (Yatin)*

> *Steve- "yeah I agree especially because some kids wanna, they get loads of work and don't finish until roughly 9 o'clock, you want hours to get into the sleep mood so that you have a good night's sleep and you're not constantly thinking about your day, you need time to relax"*

This response was supported by all of the students in the focus group who felt that they needed time to relax after doing work in the evening instead of going to sleep when they felt tiered. On average students in year 11 and 12 reported under 8 hours sleep (see table 30), whether this is due to the increase in work load during these

years with the added stress of GCSE and A level exams or simply biological reasons it is apparent that students are staying up at later than their younger peers.

These statements are also supported by teachers in the school who also feel students don't get enough sleep. Below are some of the responses given by the teacher of the students in the school.

> Head of Department- *"no I don't think so because I've spoken to students who seem very tired in the morning and they have told me what time they have gone to bed and I've questioned them about where their parents are, they say that they say goodnight to their parents and they go into their room and close the door and their parents don't ever check on them, they go to bed at 1, 2 3 o'clock in the morning and some of them actually stay up until 5 or 6"*

> Melda- *"it's the same with my class nearly more than half of the students are feeling tired in the 1st period and they don't have their breakfast at all so it makes a bad impact on their learning"*

8.2.2- How many hours' sleep does you think your body needs?

> Katie- *"I'd say 8 as most people say that the minimum is 8 then I find that I'm still tired in the morning and I want that extra hour but I guess that if you over sleep you would be tired the whole day so it's about finding the happy median I guess"*

Other students agreed with this amount with some students saying at least 7 hours. As you see students are not aware of the recommended sleep amount of at least 9 hours and are on average losing a minimum of around 1 hours sleep per night, which according to research can have a significant impact on a student's mind and body (see literature review), in addition to this it can also affect student's behaviour which may contribute to the way students approach a lesson during the school day (Chapter 7- Phase 3). In addition, students seem to have to force themselves up and although awake don't feel ready to do work.

8.2.3- Do you think there is a 'good' time to learn?

> *According to Yatin:"on the weekend after I wake up if I need to do work I would wait around 2 to 3 hours before doing work and even then I don't focus that much"*

Steve- "yeah on the weekend I always start past 12 o clock, that way I can do whatever I want in the morning and then figure out what I am going to do for the rest of the day"

The majority of students interviewed in year 12 feel that they need to be awake for a few hours before they feel ready to learn and work, however due to school timings the majority of students are in lesson from as little as 1 hour after waking up, this may contribute to the behaviour issues during period 1 on Mondays and why the older students in year 12 and 13 performed best during period 3 which is after students have been awake for a few hours at least, this notion is also supported by many teachers who also feel students although quite are not enthusiastic about the work and are more productive in the late morning to afternoon sessions.
During the interview when teachers were asked about which period, they felt their students performed best, the following responses were given.

Head of Department- "um I think I'm going to be biased because I've heard from someone done a bit of research so in that way I do know it should be around period 3 and period 4. Period 1 and 2 it takes students a lot of time to get up, from students who have actually said to me "Miss I'm actually still asleep " and I look at them and they are still asleep so students have actually said to me miss period 1 I'm still asleep because I've had year 11 option group period 1 on a Tuesday they are absolutely silent you can't get a word out of them and then period 5 on Monday they are buzzing, they do millions of worksheets and they get lots of work done but period one they just sit like this (froze) and cannot answer a question so yeah I think after period 3".

Melda- "the best period is period 3"

Deeps- "yeah period 3"

Ali- "period 3 and period 2 but not period 5 and not period 1"

Deeps- "I think period 4 because they have had 3 lessons to kind of get school started and know what's expected in lesson and I think before lunch there's an incentive as students think I've got lunch next I've got to work hard in this lesson as sir or miss can potentially keep me behind but I think period 4 is a good time as you can give them the extra pressure that you have to get this work done or they can't go to lunch so period 4 is ideal"

There seems to be a consensus from the teachers' responses that the best lessons to teach is in the late morning to early afternoon with the majority of teachers disliking period 1 and period 5. If we compare these findings to an early study by Millar et al. (1990) they claim that time-of-day when academic subjects are taught can affect student achievement. Millar et al believe that morning learning is associated with superior immediate recall when compared to learning in afternoon or evening. However, material initially learned in afternoon is more beneficial to long-term memory recall.

Furthermore, student achievement in reading is shown in several studies to be influenced by time-of-day of instruction. These studies show an increase in reading achievement for students is more likely if students receive instruction in the afternoon rather than instruction in early morning lesson. This is because reading comprehension entails connecting information presented in text to relevant prior knowledge by a reader (Davis, 1987a). This is similar to what we are seeing in mathematics as mathematics also relies on prior knowledge which is more difficult for students to recall during early morning lessons.

As we can see in the statements below it is clear that the students interviewed supported the teacher's responses with regards to the best time of day for learning.

> *Yatin- "I would say period 3 because you have had the proper time to wake up from the morning and you not yet tired as in later in the afternoon"*
>
> *Steve- "I think period 3 as well because it's just after break so you already had your mini relaxation after the past two lessons and it's still before lunch so you won't be full on food waiting for it to settle down"*
>
> *Abeer- "well it depends because if it is 1 lesson then period 3, but if it's a double lesson then either 2 and 3 or 3 and 4 so you can have a break in between".*

As we can see in the responses, the students interviewed felt that the best time of day varies from period 3 to period 4 which is from 11.15am- 1pm. It seems most teachers and students dislike the first period of the day as the students are very tired and are not in the correct frame of mind in lesson, in addition it seems that period 5 which is the last lesson of the school day from 2-3pm to also causes issues whether it is due to the fact that

students have just had their lunch and have a burst of energy, or whether the activities at lunch exhaust students, it is clear that this period has various issues and puts a lot of strain and pressure on the teacher.

8.2.4 Discussion of box plot

During the second part of the interviews both teachers and students were used to help analyse some of the data collected in the previous phases of this research. Students and teachers were shown Figure 9 (Boxplot findings from the year 10 memory task) and were given a few minutes to look at the diagram before resuming the discussions.

Teacher responses

HOD- "yeah I think that some of them wake up too late in the morning so by the time they have their period 1 and 2 their brain not alert yet their brains are still waking up because some of them tell us that I woke up and took 5 minutes to get dressed and 5 minutes to walk to school so by the time they are starting period 1 they have only been up for 30 minutes so their brains haven't started to function properly but period 4 they are alert and ready to learn"

Ali- "if I look at this at first what you are showing me is a something that I am learning from because I would say that if you hadn't shown this to me I wouldn't have agreed with it to be honest with you but I've got so many years of teaching I would have thought that in the morning that they will do better on average but if we look at this actually it tells us what HOD was saying that in the morning their brains was asleep because if you look at the minimum values you can see they are not comparable the minimum values of the afternoon is much much more than the minimum in the morning which shows that those people were asleep yes but when you look at the afternoon the median of the second one the afternoon is the upper quartile of the morning (teachers agree) which is very very interesting and I would say that this isn't something I can say or bring reason for it because I need to think about it to be honest with you because I didn't know"

Deeps- "I think that one of the reasons that could be to explain why the median is close to the upper quartile is I think in afternoon they've not only woken up but they have gone through a few lessons so they are more motivated to think but I think in period 1 like as miss said they

haven't really woken up yet and won't take the activity seriously so I think that's definitely a factor to consider"

According to these responses, teachers are aware of how tired students are and their lack of sleep from discussions with students during the lessons. The findings from the previous chapter demonstrates that students were able to perform better in the afternoon on the memory and problem solving tasks, however, from Ali was that he thought that students perform better in the morning and didn't consider students sleep duration as a factor that could affect performance. On the other hand, if we look back at the findings from the SIMS data (See table 21) the average 'perceived learning' SIMS score was higher in the morning for younger students, these results support Ali in his view regarding students performing better in the morning however as students the students get older the more they begin to lean towards afternoon lessons and therefore both teacher's responses are somewhat correct.

Student responses

Katie- "I think they had enough time for their brains to warm up because for the afternoon ones in particular they would have had lessons before that they would have been in the mode to learn but in the morning you wake up and your still tired because you didn't get enough sleep and you are put straight into a test the likelihood is you're not going to do very well"

John- "I think they definitely out performed themselves in the afternoon test probably because they have used their brains already in the morning sessions of school um so their brains are already ready to learn so I definitely think that that affected their results um in the afternoon"

As we can see from the responses from both students and teachers, the majority of the replies based on the test scores in Figure 9 were to do with how tired students were, this demonstrates the importance of sleep as identified in phase 1 of this study as both students and teachers believe that the amount of sleep students get can directly affect students' academic performance in a school, and as a result both students and teachers are favoring certain times of the school day differently which contributes to the results shown in chapter 7. These findings are also supported by a number of researchers who argue that those with inadequate sleep may also encounter more academic difficulties. Several surveys of similar sample sizes ranging from 50 to 200 high school students reported that more total sleep, earlier bedtimes and later weekday wake times are associated with better grades in school (Allen, 1992; Link & Ancoli-Israel, 1995; Manber et al., 1995).

In order to explore other factors, both teachers and students were asked about learning styles and whether from the students' perspective if they believe their learning varies during the school day, and from the teachers' point of view whether the 'perceived learning' of students change.

8.2.5- Would you say the way students learn changes throughout the day?

HOD- "I have only found that it changes throughout the week, at the beginning of the week it's more like they can take more lecture style and I can talk and talk but by the end of the week they need more activities to get them through that Friday or that Thursday lesson but I'm not sure"

Melda- "in a way this was what you were saying they are open to discussion when they are more active obviously even the quiet ones become more active through their discussions and through the talk they can learn more so yeah I think it depends and also depends on the err the topic the environment so not just one thing I can say just about the time"

Deeps- 'erm for me I think it wouldn't really make a difference, I don't think their learning style would be different during the day, their concentration span yes, but I wouldn't say their learning style would change throughout the day. I think they learn how they learn and some students by nature are kinesthetic learners some are more they want to listen to something and some students need something more hands on so I don't think those traits will change as that in the students' nature anyway on how they are that's it"

Based on these responses it seems the teachers believe that the way in which students learn doesn't change. As a result, some teachers may plan their lessons based on how alert or active students are in lesson. According to the Head of Department, at the start of the week lessons are similar to a lecture (which supports the auditorial type learning) and plan more hands-on activities (which supports kinesthetic type learning) later on in the week. Therefore, as a result teacher planning may vary which in turn could affect student learning at different times of the week.

Similarly, the students agreed with the teachers and also referred to how tired students felt which varied at different times of the day;

Abeer- "yes, I think that year 7's perform better in the mornings because after lunch they get tired and just argue with the teacher and don't do any work whereas in the morning they are more fresh and do what they are told more, I dunno I just feel they do better in the morning"

Katie-" in terms of us I think especially last period on a Friday I don't think anyone works particularly well you are just looking forward to the weekend and first period on a Monday everyone is just tired from the weekend and you don't particularly learn very well, but I find during the middle of the week your more focused because you're not think about the weekend anymore and you're not thinking about the coming weekend because it's still a couple of days away so you are more focused on school and especially periods during the middle like period 3 is when you are most focused, I think for me"

8.2.6- Does your teaching style change throughout the day?

When teachers were asked whether their teaching style changed throughout the day, it was clear that the majority of the teachers had to adapt their style with the needs of the students, however according to one of the teachers the 'Time of day' also played a role in the way teachers teach;

HOD- "yeah I definitely think throughout the day my teaching changes because I start with my first class and I'm more just trying to establish that you need to be sitting you need to be settled you need to be quite so I'm more talk and talk but as the day goes on if I do activities I must admit I'll do activities in the middle session and in the last session and maybe that comes back to your question before maybe I'm noticing something subconsciously that some children will do better at activities then but I've never started the first lesson with activities, my first 2 lessons are never activities its odd but I've never started my first two lessons with activities but I will always do activities in the middle two lessons"

An important skill in teaching is to try to teach and adapt lessons to meet the needs of students to help create a positive learning environment. Based on the response from the Head of Department it seems that time of day can influence the type of lesson being taught, as she said that her teaching changes throughout the day and tends to talk more during the morning to help keep students settled and quiet, and will only plan activities later during

the day. Whether this is due to the students or the teacher being tired in the morning, or if it because of some other reason, it doesn't change the fact that the time in which lessons are taught can be a factor to in delivery of the lesson, which may have positive or negative impact to learning. However, it is important to note that 'time of day' may not the cause for the changes in a students' behaviour, learning or teaching styles etc. but it can be used to predict how students will behave, the mood they are in and as a result the way a teacher will teach their lesson.

8.3 Conclusion

The findings from both the student and teacher discussions supported the findings from the previous chapters in this study on sleep and perceived learning. The majority of students and teachers felt that the learning taking place was closely linked to how tired students felt at certain times of the day.

Based on the responses from both the students and teachers, the best time for learning was late in the morning/early afternoon during period 3 and 4. However, not all students performed best at this particular time-of-day. According to Table 20 (SIMS data in chapter 7), students in year 7 and 8 had a higher average perceived learning score in the morning in comparison to the afternoon. Whereas, the older year groups had a highest recorded perceived learning score later during periods 3 and 4. Nonetheless, if we compare these findings with the results from chapter 6 where students performed significantly better in the memory and problem-solving tasks in the afternoon, we can see there is a positive correlation. This is also supported by discussions in the focus groups from both students and teachers.

Previous studies have found sleep duration and school timings can play a significant part in student achievement (Blatter & Cajochen 2007; Dahl 1999; Dinges & Kribbs 1991; Petros et al., 1990). When we compare this with the findings from chapter 5 on sleep duration we can see that the younger year groups had significantly more sleep than their older peers, suggesting that sleep duration contributed to the perceived learning scores.

According to Dunn (1985), only one-fifth of elementary school students are highly alert in the early morning, one-third only after 10:00 to 10:30 a.m., and another one-third not until the afternoon. As students get older and reach middle school, their ideal times are usually late morning or afternoon. Although this is an early study we can see similarities in our findings. Currently, schools are not set up to match every student's optimal time-of-

day preferences, however time of day is one of the few areas in which educators can exert a greater deal of planning. It would be useful for teachers and administrators to consider this evidence when planning lessons, examinations and school timetabling to help improve the learning environment for students who do not learn well at certain times of the day.

Educators are responsible for providing the best possible education for all students, and the best possible education is one that includes time of day as a factor in the process of learning.

In the next chapter I will be reviewing the findings from all four phases from chapters 5 to 8 and will refer back to the overall aim which was to determine whether time of day can influence the teaching and learning of adolescents in secondary schools.

These phases that were discussed previously are:
Chapter 5 – Phase 1- The importance of sleep in school timetabling- Are students getting enough sleep during the school week?
Chapter 6- Time of day and its effects on Perceived learning: Memory and attainment – Does the performance of students vary and different times of the school day?
Chapter 7- Learning preferences and behaviour vs school timings- To what extent does behaviour and perceived learning preferences vary throughout the day?
Chapter 8 - Collaborative study: How can a school day be adapted to improve students' academic achievement?
Chapter 9 - Will discuss the main findings and conclusions from each chapter and will identify any correlations between each of the four phases with respect to the research question and will conclude with the overall recommendations, limitations and contribution to practise along with possible problems the needs for any future research.

Chapter 9- Conclusion

9.1 Summary of findings

The aim of this research is to determine the influences of time of day on teaching and learning of adolescents in secondary school?

With the intention of attaining this aim the following study was split into four phases which were developed based on key factors identified in the literature review.

Phase 1- The importance of sleep in school timetabling- Are students getting enough sleep during the school week?

The purpose of this phase was to assess whether students were getting enough sleep during the school week and the potential issues this could have on student learning. Based on the findings in this chapter we found that the majority of the students that took part in this study, sleep approximately 7-8 hours' sleep during the school week which is significantly below the recommended amount of sleep needed.

Mean Average Student Bedtimes and Wake up Times on School Days and Weekends

	Weekday				Weekend			ANOVA (Weekday vs weekend)		
Year	N	Mean sleep duration		SD	Mean sleep duration	SD		DF	F	P
8	87	9hr 1min		0.909	10 hr 57 min	1.861		1	18197	0.000
9	84	8hr 15min		1.126	9 hr 31min	1.59		1	12.948	0.001
11	85	7hr 47 min		0.989	9hrs 54min	2.312		1	12.757	0.001
12	28	7hr 50 min		0.702	9hrs 40min	1.307		1	18.398	0.000
		ANOVA TEST (Age groups)			ANOVA TEST (Age groups)					
		DF	F-value	P-value	DF	F-value	P-value			
		3	6.240	0.001	3	2.749	0.048			

Table 30- Mean average bed time (Reprint of Table 11)

Table 30 which is a reprint of Table 11, for the convenience of the reader, shows the sleep duration of students during the school week and weekend. Based on these findings we can see that the majority of groups are sleeping less than the recommended sleep duration of at least 9 hours (Wahlstrom & Freeman 1997). During weekdays (school days) the average amount of sleep students get varies slightly based on the age group. The students in years 9, 10 and 11 were all at least 1 hour short of the recommended amount sleep. Whereas, on

average the year 8 students are 12-13 years old, had approximately 9 hours sleep which is close to the recommended sleep duration. However, even within this year group 30% of the students had 8.5 hours sleep or less. Therefore, the findings in this phase suggest that the majority of the students questioned could have sleep deficiency.

ANOVA tests were used to determine whether the sleep duration between age groups and between weekend and weekdays were significantly different. Based on the findings there is a significant difference between the amount of sleep students get during the week when compared to the weekend. This is most likely due to the fact that students need to wake up earlier for school as opposed to the weekends when they are able to sleep in. It can be argued that the weekend usually represents adolescents natural sleep duration as they do not need alarms to wake up early for school.

In addition to this, there is a significant difference between the sleep duration of students in different year groups during the school week. Since school start time is similar for all students it may be due to different bed times that weekday sleep duration differs. When comparing sleep duration of students during the weekend there is less variation, although the P value is less than 0.05 the difference is less significant as compared to the school week.

If we compare these findings to section 2.3 (see literature review), there are a number of similarities found in previous studies indicating that students have always been sleep deprived. Although, if we look at a study by Carskadon (1995) we can see that students nowadays are seeing a decrease in sleep duration compared to students from 20 years ago. Some of the reasons behind this may be due to the technological advancement we have seen over the past decade, which as many parents would agree, adolescents would often stay up later. Whether it is to complete homework on their computers, watching TV, browsing the internet or just socialising with friends, students have everything they need at their fingertips, which is why they may struggle to get out of bed early in the morning to reach school before the first bell rings.

Overall the students in this study are getting below the recommended amount of sleep needed for adolescents, especially the older students, indicating that students are currently worse off than in previous studies indicating that they too could be facing a number of issues which in turn could affect student performance in school (See Literature review). Since school start time is a major externally imposed constraint on adolescence sleep/wake schedule. For the vast majority of teenagers waking up and going to school is neither spontaneous nor is it

negotiable and as a result, students may be arriving to school not fully prepared to learn which in turn could affect certain lessons during the school day.

Time of day and its effects on Perceived learning: Memory and attainment – Does the performance of students vary and different times of the school day?

Phase 2 looked at the affects time of day could have on short term memory and problem-solving activities and whether the period (time of day based on school timetable) can influence the performance in these two areas. The findings in this phase indicate that student performance significantly varied at different times of the day in both the memory and problem-solving activities.

The results from the short-term memory task as displayed in Tables 16 and 17, is reprinted below as Table 31, indicates that students were able to recall more items in the afternoon as compared to the morning for both year groups. Based on the finding in the ANOVA test there was a significant change in scores in both tests indicating that students were able to perform better in the afternoon session as compared to the morning.

Yr. 10	**Morning Test**	**Afternoon Test**
Mean	18.3182	22.45
SD	5.03069	5.56305
ANOVA		
DF	F-Value	P-Value
1	6.390	0.016

Yr. 8	**Morning Test**	**Afternoon Test**
Mean	14.7083	19.9231
SD	4.58693	6.9111
ANOVA		
DF	F-Value	P-Value
1	9.708	0.003

Table 31- Memory test results (Reprint from Tables 16-17)

In a study by Cardinali, he states that "*Since children's time of day preference shifts towards eveningness as they get older, their cognitive functioning is likely to be at its peak more towards the afternoon than in the morning. Thus, if important basic classes such as reading and mathematics are taught in the morning, older school children will be learning this critical material at their less-preferred or non-optimal time of day,*

resulting in poorer school performance than might be found were the courses in greater synchrony with circadian arousal rhythms." (Cardinali, cited by Battro, Fischer, & Léna, 2008 p. 122).

Based on my experience as a teacher and from the literature and research it can be reasonable to say that a possible reason the students in this study, may not have performed as well as they did in the afternoon test, could be due to the level of tiredness or alertness in the morning, which can be associated with the quality and/or duration of sleep.

The second task students participated in was a timed problem-solving activity. Students were each given a series of problem-solving questions based on topics they have previously covered. Each student was given a stopwatch and they each had to record the time it took to answer each question. The first activity was undertaken during period 4 which was from 12.15pm to 1.15pm and second activity was during period 1 which was from 8.35am to 9.35. These activities were completed over a 2-week period and the line graph below shows the average score of the 5 questions completed.

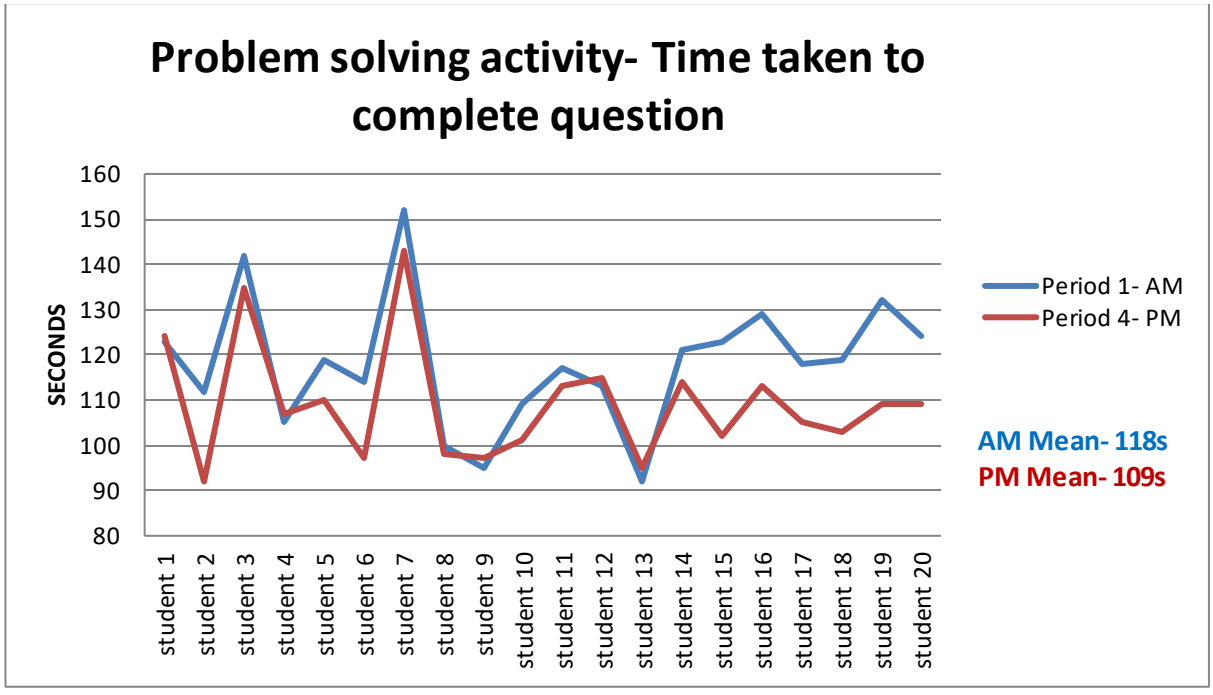

Figure 10- Problem solving activity (Reprint of figure 8)

Based on the findings in figure 10, we can see that students were able to complete the activities more efficiently in the afternoon compared to the morning. The difference in time was considered significant ($P<0.05$ ANOVA) indicating that students were more alert an active in the afternoon compared to the morning. The findings in

this phase suggest there could be a correlation between sleep duration in phase 1 and the results in phase 2. Therefore, it is difficult to rule out the possibility that students may have just felt tired during the morning and as a result may not have put in as much effort as they could have. Regardless of the reason is can still be argued that time of day may be a possible influence or significant contributing factor.

Learning preferences and behaviour vs school timings- To what extent does behaviour and perceived learning preferences vary throughout the day?

Phase 3 looked at behaviour and the perceived learning of students at different times of the day. In this phase we investigated the time of day and its effects on behaviour and perceived learning. Students completed a learning style inventory (LSI) at different points in the day/week in order to identify which type of learner students were and whether the time of day had an impact in the way they answered the learning style inventories. Based on the findings (see table 19) there was a slight shift in the average mean score for the LSI during the morning compared to during the afternoon lesson. Students were given the same instructions during both sessions and were given the exact same LSI. The findings suggest that the way they felt during the morning compared to the afternoon was clearly different which as a result changed the way in which they answered the LSI.

Generally, in the morning there was a higher mean score in visual and auditorial learner types as compared to the afternoon findings where the kinaesthetic mean score increased. A possible reason for this could be due to the fact that students felt more tired in the mornings and selected answers based on how they felt whereas in the afternoon they may have been more alert and therefore decided to change their choices (see appendix for LSI). It is important to remember that the motivation behind the use of these LSI was not to categorise students as a specific type of learner, rather is was used to help assess whether students would complete the inventories the same way at different times of the day or whether students completed the inventories differently based on how they feel at that particular time.

Behaviour is a fundamental factor that can impact the productivity of a lesson. For most teachers, behaviour and learning go hand in hand, if a student is well behaved, he/she can learn better and stay more focused in lesson, however, poor behaviour in schools generally lead to poor grades. It is the responsibility of all teachers to ensure students are engaged in all lessons and are well behaved and are learning effectively, although at times this may not always be the case. At the school, SIMS, which is the schools' management system, is used to

register and assess students' behaviour and perceived learning throughout the school day. Teachers are instructed to do the register at the end of every lesson and need to enter a simple code (3, 2, 1, 8, 9) to represent students' performance in every lesson (See table 20).

Based on the findings in this study, behaviour and perceived learning significantly varied throughout the day and week. Generally, for the earlier years 7 to 9, students' perceived learning was higher in the morning compared to the afternoon, however as students got older there was a shift in scores with performance at its lowest early in the morning and at its highest towards the early afternoon. If we relate these findings to the findings in phase 1, we can see that there could be a significant correlation between sleep duration and morning lessons. Students in year 7-9 had more sleep than the older year groups which may contribute to the perceived learning scores in table 21, whereas older students who were significantly below the recommended amount of sleep scored lower in the early morning lessons.

How can a school day be adapted to improve students' academic achievement?

Phase 4 was a collaborative study where both teacher and student focus groups discussed sleep duration, behaviour and learning and different times of the day. Based on the findings in this chapter there seems to be a relationship between the discussions from both students and teachers along with the findings from previous chapters on sleep and perceived learning. This is also supported by discussions in the focus groups from both students and teachers. A number of studies have found sleep duration and school timings play a significant part in student achievement (Blatter & Cajochen 2007; Dahl 1999; Dinges & Kribbs 1991; Petros et al 1990).

The results of this study suggest that time of day is an important factor and should be considered when planning and scheduling lessons. Schooling is a significant part in a child's life and therefore every effort is needed to ensure students are learning in an environment and at a time when they are most alert and ready to learn.

The interaction between sleep and wake schedules, circadian rhythms, behaviour, social demands, technology along with various factors can result in increasing pressure on students' routine, producing insufficient sleep in many teenagers and, ultimately, changes daytime functioning (Carskadon, 1995). The findings in this study correlates with numerous other studies with regards to performance at different times of the day. As students go through adolescence there are various factors that will directly influence their academic performance,

whether it is how alert students are during the school day, the type of lessons, or other factors. These will always vary throughout the school week.

One thing that is for certain is that students' overall performance will fluctuate during the school day and week. Presently school scheduling is still considered an admin task and factors such as time of day, sleepiness, lesson type or learning preferences are rarely considered when scheduling lessons.

Time of day has long been known to affect all people. However, educators seem to still ignore this important factor when scheduling the school day. Every effort should be made to schedule students to learn at the times when they are most biologically ready to learn. It is apparent that students are even able to predict the times when they are most alert. We suggest that teachers who wish to implement learning style theory into their classroom give the LSI to all their students at the beginning of the year. This test could be then used along with time of day tests and teacher feedback to schedule students in their demanding classes at times when they are most alert. Whilst it is impossible to fit all subjects into a student's preferred time of day, there are some subjects and courses that do not require as much concentration and could be taught at times when students are not at their peak level of alertness. Furthermore, some subjects may benefit and help increase alertness for students which could then help support the following lesson etc. In the event timetabling students at their peak times proves impossible or causes too many issues, then the next best solution is to have teachers rotate the subjects being taught so that all students have a chance to learn at times when they are most alert. This can be the ideal solution in primary schools where students are in one fixed classroom, however in secondary schools there is the option of rotating timetables. For example, 2 or even 3-week rotating timetables can help ensure that certain classes are not fixed on a time where student concentration is at its lowest for a whole academic year, this will also help relieve pressure on teachers who have to teach difficult or exam classes during these times also. It is unfair for a student to have to sit an exam or learn a certain subject that they are struggling with at a time when they are tired first thing in the morning, while another students get to learn or sit an exam at a time when they are most alert and enthusiastic. The same goes for teaching and learning at different days of the week; based on the findings from the previous chapters we could clearly see the differences in student perceived learning scores between periods on different days of the week. At present it could be argued that the current educational system is not providing the very best opportunities possible for all students by not identifying time of day as a factor that can influence the academic performance of students.

9.2 Future work

This study does not provide the solutions for all schools or subjects, and further study is needed to cover all age groups and subjects. However, it is clear that more time and effort is needed when timetabling classes with a focus on student alertness, sleepiness and learning time preference especially when timetabling certain subjects for exam classes, to ensure they have the best possibility of working to their potential.

Time of day and academic performance is a large field and there is a number of recent studies that are emerging. Some suggestions on how this research can be expanded further are:

- Further research is needed to determine the best time of day for a wider range of subjects. Currently, the economic context of schools in England results in large class sizes of around 30 or more students in a classroom, making it difficult to meet every student's individual needs. If most students perform better in mathematics during afternoon hours and English during morning hours, class schedules should be matched to meet learning requirements.
- Research into how changing classes and timings for specific classes to measure impact against external assessments.
- Research around student's academic performance out of school hours (e.g. evening), compared to traditional school timings
- Research on student performance at different times of the year e.g. does student performance in the morning vary between summer and winter?
- Research on how time of day can impact formal examinations- are some students advantaged or disadvantaged for AM or PM examinations.
- According to Sharples and Kelley (2015) there is limited interaction between neuroscience and education. Therefore, further research is needed on testing short and long term memory at different times of the day using methods supported by neuroscientists.

The motivation of this study was to raise awareness of time of day as an important factor in students learning, and how data can be used to influence teaching and learning to ensure students are given every possible advantage to work to their full potential. Although specific solutions are outside the scope of this research, however, this study can be used as a basis to further extend this field of research and to begin to offer advice and guidance for school scheduling.

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Appendices

The purpose of this Questionnaire to assess whether students are getting enough sleep during school term times. This questionnaire is completely anonymous (NO ONE WILL KNOW WHO ANSWERED THIS) if you do not wish to fill this questionnaire in then please tick the correct box below		
Do you wish to take part in this survey	YES	NO

11.1 Sleep questionnaire

DO NOT WRITE YOUR NAME

YEAR GROUP ..... SET.....

SLEEP ENVIRONMENT

	YES	NO
Do you usually sleep in the same bed every night?		
Is your bed comfortable?		
Do you have your own bedroom?		
Do you or other sibling (*in same room*) watch TV, read in bed or use a computer before sleep?		
Does your sibling often disrupt your sleep?		

USUAL SLEEP HABITS

1. On weekdays (school days), I usually go to bed..... (please tick)

Before 9pm (..) 9-9.30pm (..) 9.30-10pm (..)10-10.30pm.() 10.30-11pm.(…..) 11.30 -12am (…) 12am or later (…)

2. On weekdays (School days), the earliest time in the last two weeks I have gone to bed is: _____

3. On weekdays (school days), the latest time in the last two weeks I have gone to bed is: _____

4. My usual weekend (off days) bedtime is: _____

5. On weekdays (school days), I usually wake up....
Before 6am ..... 6am-6.30am ..... 6.30am-7am ..... 7am-7.30am ..... 7.30am-8am .....
8am or later .....

6. On weekends, I wake up at: _____ (to nearest half hour)

7. To feel my best, I should go to bed at: _____

8. To feel my best, I should get up at: _____

9. In the evening, I usually start feeling tired at: _____

10. The amount of time that I usually take to fall asleep is: _____

11. I usually wake up (please tick)
Naturally (by myself) ..... with alarm ..... by someone .....

Many commonly used substances can affect sleep. Please tick the one that describes you

I always drink **caffeinated** beverages (including coffee, tea, sodas, etc.) in the mornings .....

I sometimes drink **caffeinated** beverages (including coffee, tea, sodas, etc.) in the mornings.....

I hardly ever drink **caffeinated** beverages (including coffee, tea, sodas, etc.). in the mornings.....

I never drink **caffeinated** beverages (including coffee, tea, sodas, etc.). in the mornings.....

I always drink **caffeinated** beverages (including coffee, tea, sodas, etc.) in the evenings .....

I sometimes drink **caffeinated** beverages (including coffee, tea, sodas, etc.) in the evenings.....

I hardly ever drink **caffeinated** beverages (including coffee, tea, sodas, etc.). in the evenings.....

I never drink **caffeinated** beverages (including coffee, tea, sodas, etc.). in the evenings.....

SCHOOLTIME SLEEPINESS SCALE

(Please take with you and fill in at end of each lesson)

Directions:
Rate your degree of sleepiness during the day by choosing the statement below that best describes your feeling at the time. Write the number of that statement in the appropriate box.

1. Alert and wide awake, peak alertness high concentration.

2. Awake, able to concentrate, but not quite at peak.

3. Awake, but not fully alert; responsive, can concentrate a little.

4. A little sleepy, losing interest, but still able to do some work.

5. Sleepy, prefer to be lying down, can't concentrate.

	Period 1 8.35-9.35	Period 2 9.35-10.35	Tutor time 10.35-10.55	Period 3 11.15-12.15	Period 4 12.15-1.15	Period 5 2pm-3pm
Monday						
Tuesday						
Wednesday						
Thursday						
Friday						

11.2 Learning Styles Inventory (LSI)

Code name (must remember) _____ period _____

During the afternoon……..	**YES**	**NO**
1. I like to listen and discuss work with a partner.	_____	_____
2. I learn by hearing my own voice on tape.	_____	_____
3. I prefer to learn something new by reading about it.	_____	_____
4. I often write down the directions someone has given me so that I don't forget them.	_____	_____
5. I enjoy physical sports or exercise.	_____	_____
6. I learn best when I can see new information in picture form.	_____	_____
7. I am able to visualize easily.	_____	_____
8. I learn best when someone talks or explains something to me. 9. I usually write things down so that I can look back at the later.	_____	_____
10. If someone says a long word, I can count the syllables that I hear. 11. I have a good memory for old songs or music.	_____	_____
12. I like to discuss in small groups.	_____	_____
13. I often remember the size, shape, and colour of objects.	_____	_____
14. I often repeat out loud the directions someone has given me. 15. I enjoy working with my hands.	_____	_____
16. I can remember the faces of actors, settings, and other visual details of a movie I saw in the past.	_____	_____
17. I often use my hands and body movement when I'm explaining something.	_____	_____
18. I prefer to practice redrawing diagrams on a chalkboard rather than on paper.	_____	_____
19. I seem to learn better if I get up and move around while I study.	_____	_____
20. If I wanted to assemble a bike, I would need pictures or diagrams to help with each step.	_____	_____
21. I remember objects better when I have touched them or worked with them.	_____	_____
22. I learn best by watching someone else first.	_____	_____
23. I tap my fingers or my hands a lot while I am seated. 24. I speak a foreign language.	_____	_____
25. I enjoy building things.	_____	_____
26. I can follow the plot of a story on the radio. 27. I enjoy repairing things at home.	_____	_____
28. I can understand a lecture when I hear it on tape.	_____	_____
29. I am good a using machines or tools.	_____	_____
31. I enjoy acting or doing pantomimes. 32. I can easily see pattern in designs.	_____	_____
33. I need frequent breaks to move around. 34. I like to recite or write poetry.	_____	_____

35. I can usually understand people with different accents. 36. I can hear many different pitches or melodies in music. 37. I like to dance and create new movements or steps. 38. I enjoy activities that require physical coordination. 39. I follow written directions better than oral ones. 40. I can easily recognize differences between similar sounds. 41. I like to create or use jingles/rhymes to learn things. 42. I wish more classes had hands-on experiences. 43. I can quickly tell if two geometric shapes are identical. 44. The things I remember best are the things I have seen in print or pictures. 45. I follow oral directions better than written ones. 46. I could learn the names of fifteen medical instruments much easier if I could touch and examine them. 47. I need to say things aloud to myself to remember them. 48. I can look at a shape and copy it correctly on paper. 49. I can usually read a map without difficulty. 50. I can "hear" a person's exact words and tone of voice days after he or she has spoken to me. 51. I remember directions best when someone gives me landmarks, such as specific buildings and trees. 52. I have a good eye for colours and colour combinations. 53. I like to paint, draw, or make sculptures. 54. When I think back to something I once did; I can clearly picture the experience.		

Scoring Your Profile

1. Ignore the NO answers. Work only with the questions that have a YES answer.

2. For every YES answer, look at the number of the question. Find the number in the following chart and circle that number.

3. When you finish, not all the numbers in the following boxes will be circles. Your answers will very likely not match anyone else's in class.

4. Count the number of circles for the Visual box and write the total on the line. Do the same for the Auditory box and the Kinaesthetic box.

Visual	Auditory	Kinaesthetic
3, 4, 6, 7, 9, 13, 16, 20, 22, 32 39, 43, 44, 48, 49, 51, 52, 54	1, 2, 8, 10, 11, 12, 14, 24, 26, 28, 34, 35, 36, 40, 41, 45, 47,	5, 15, 17, 18, 19, 21,23, 25, 27, 29, 30,31, 33, 37, 38, 42,
Total: _____	**Total: _____**	**Total: _____**

Analysing Your Scores

1. The highest score indicates your *preference*. The lowest score indicates your weakest modality.

2. If your two highest scores are the same or very close, both of these modalities may be your preference.

3. If all three of your scores are identical, you have truly integrated all three modalities and can work equally well in any of the modalities.

4. Scores that are 10 or higher indicated you use the modality frequently.

6. Scores lower than 10 indicate the modality is not highly used. Most often, it is because you have had limited experience learning how to use the modality effectively as you learn. In this case, learning new strategies can strengthen your use of the modality.

common Characteristics of Visual, Auditory, and Kinaesthetic Learners

The following chart shows common characteristics of each of the three types of learners or learning styles. A person does not necessarily possess abilities or strengths in all the characteristics but may instead "specialize" in some of the characteristics. Some of this may be due to a person's educational background or background of experiences. For example, an auditory learner may be strong in language skills but may not have had the experience to develop skills with a foreign language or music.

Common Characteristics

• Learn best by seeing information • Can easily recall printed information in the form of numbers, words, phrases, or sentences • Can easily understand and recall information presented in pictures, charts, or diagrams • Have strong visualization skills and can look up (often up to the left) and "see" information • Can make "movies in their minds" of information they are reading • Have strong visual-spatial skills that involve sizes, shapes, textures, angles and dimensions • Pay close attention and learn to interpret body language (facial expressions, eyes, stance) • Have keen awareness of aesthetics, the beauty of the physical environment, and visual media
• Learn best by hearing information • Can accurately remember details of information heard in conversations or lectures • Have strong language skills that include well-developed vocabularies and appreciation of words • Have strong oral communication skills that enable them to carry on conversations and be articulate • Have "finely tuned ears" and may find learning a foreign language relatively easy • Hear tones, rhythms, and notes of music and often have exceptional musical talents
• Learn best by using their hands ("Hands-on" learning) or by full body movement • Learn best by doing • Learn well in activities that involve performing (athletes, actors, dancers) • Work well with their hands in areas such as repair work, sculpting, art, or working with tools • Are well-coordinated with a strong sense of timing and body movements • Often wiggle, tap their feet, or move their legs when they sit • Often were labelled as "hyperactive"

11.3 Learning Strategies

Now that you are aware of your own learning style, you can begin to select learning strategies that work with your strengths: In the following charts you will find a wide array of learning strategies for you to try; the majority of your strategies will likely come from your area of strength. However, a valuable goal to set for yourself is to strive to integrate all the modalities into your learning process; therefore, try using several of the strategies for your weaker modalities as well. As you will also notice, some learning strategies will incorporate more than one modality. Multisensory learning strategies have the capability of strengthening your memory even more.

Learning Strategies That Utilize Modalities

VISUAL

- Create stronger visual memories of printed materials by highlighting important ideas with different colours of highlighters or by highlighting specific letters in spelling words or formulas or equations in math.
- Take time to visualize pictures, charts, graphs, or printed information and take time to practice recalling visual memories when you study.
- Create "movies in your mind" of information that you read; use your visual memory as a television screen with the information moving across the screen.
- Use visual study tools such as visual mappings, hierarchies, comparison charts, and time lines to represent information you are studying. Expand chapter mappings or create your own chapter mappings to review main ideas and important details in chapters. Add colours and/or shapes or pictures.
- Enhance your notes, flash cards, or any other study tools by adding colours and pictures (sketches, cartoons, stick figures).
- Colour-code study tools. (Different colours imprint into memory more easily for some students.) Colours can be used to accentuate specific parts of textbooks, notes, or any written materials you work with or you have created.
- Copy information in your own handwriting if seeing information on paper in your own hand-writing helps you learn and remember more easily. Practice visualizing what you write.
- Use your keen observational skills to observe people and pick up on clues they may give about important information, emotions, or their general state of being.

Learning Strategies That Utilize Modalities (cont.)

AUDITORY

- Talk out loud to explain new information, express your ideas, and practice information you are studying, or paraphrase another speaker.
- Recite frequently while you study. Reciting involves speaking out loud in complete sentences and in your own words.
- Read out loud. (Reading out loud often increases a person's comprehension or clarifies confusing information that is read silently.)
- Work with tutors, with a "study buddy," or in a study group to have ample opportunity to ask questions, articulate answers, and express your understanding of information orally.
- For lectures, take your own notes, but back your notes up with a tape-recorded version of the lecture. (Request approval first from the instructor.) Review only the parts of the lecture that are unclear or confusing.
- When you practice reciting your notes, flash cards, study tools or information from a textbook, turn on a tape recorder. Tapes made in your own voice often become valuable review tools.
- Verbally explain information or processes to someone or to an imaginary person. Explaining verbally provides immediate feedback of your level of understanding.
- Make review tapes to review the most important information (rules, definitions, formulas, lists of information, dates, or other information) prior to a test.
- Create rhymes, jingles, or songs to help you remember specific facts.
- Read confusing information using exaggerated expression. The natural rhythm and patters of your voice often group information in such a way that it becomes easier to understand.
- Use computerized technology (electronic spell checkers, calculators with a "voice," speech synthesizers on computers) to help with the learning process. Access CD-ROM programs and

KINESTHETIC

- Handle objects, tools, or machinery that you are trying to learn. For example, handle the rocks you study in geology, repeat applications several times on a computer, or hold and use tools or parts of machinery that are discussed in class or in your textbook.
- Create manipulatives (study tools that you can move around with your hands). These may include flash cards or cards that can be shuffled, spread out, sorted, or stacked as a way to categorize information.
- Cut charts or diagrams apart; reassemble them in their correct order.
- Use exaggerated movements and hand expressions, drama, dance, pantomime, or role playing to assist the development of long-term memory. Muscles also hold memory, so involving movement in the learning process creates muscle memory.
- Type or use a word processor. Using a keyboard involves fine motor skills and muscle memory; it may be easier to remember information that you typed or entered into a computer.
- Talk and walk as you recite or practice information. Pacing or walking with study materials in hands helps some people process information more naturally.
- Work at a chalkboard, with a flip chart, or on large poster paper to create study tools. List, draw, practice, or write information while you stand up and work on a larger surface.
- Learn by doing. Use every opportunity possible to move as you study. For example, if you are studying perimeters in math, tape off an area of a room and walk the perimeter.

11.4 SIMS Perceived Learning full data

Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	199		1	193		1	313		1	462		1	495
2	2951		2	2872		2	2699		2	2967		2	2590
3	1902		3	1500		3	1473		3	1476		3	1886
8	44		8	82		8	93		8	144		8	161
9	1		9	7		9	9		9	4		9	9
Grand Total	**5097**		**Grand Total**	**4654**		**Grand Total**	**4587**		**Grand Total**	**5053**		**Grand Total**	**5141**

Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	181		1	244		1	344		1	273		1	293
2	3252		2	2720		2	2697		2	3108		2	3379
3	1698		3	1719		3	1433		3	1455		3	1366
8	34		8	57		8	118		8	78		8	66

9	8		9	3		9	8		**Grand Total**	**4914**		9	2
Grand Total	**5173**		**Grand Total**	**4743**		**Grand Total**	**4600**					**Grand Total**	**5106**

Year Group	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	232		1	280		1	136		1	308		1	433
2	3218		2	2662		2	2862		2	2863		2	3332
3	1522		3	2074		3	1619		3	1449		3	1469
8	42		8	62		8	39		8	58		8	103
9	5		9	8		9	11		9	7		9	10
Grand Total	**5019**		**Grand Total**	**5086**		**Grand Total**	**4667**		**Grand Total**	**4685**		**Grand Total**	**5347**

Year Group	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5

Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	106		1	163		1	194		1	299		1	335
2	2866		2	2538		2	2192		2	2977		2	3016
3	2118		3	1421		3	1659		3	1121		3	1186
8	24		8	53		8	67		8	55		8	89
Grand Total	**5114**		9	3		9	11		9	5		9	18
			Grand Total	**4178**		**Grand Total**	**4123**		**Grand Total**	**4457**		**Grand Total**	**4644**

Year Group	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**		**Year Group**	**Year 7**
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	206		1	261		1	220		1	253		1	466
2	2564		2	2763		2	2696		2	2573		2	2992
3	1971		3	1380		3	1276		3	1638		3	1152
8	30		8	103		8	37		8	66		8	123
9	13		9	5		9	4		9	6		9	16
Grand Total	**4784**		**Grand Total**	**4512**		**Grand Total**	**4233**		**Grand Total**	**4536**		**Grand Total**	**4749**

Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7		Year Group	Year 7
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	P3		Period Number	P4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	924		1	1141		1	1207		1	1595		1	2022
2	14851		2	13555		2	13146		2	14488		2	15309
3	9211		3	8094		3	7460		3	7139		3	7059
8	174		8	357		8	354		8	401		8	542
9	27		9	26		9	43		9	22		9	55
Grand Total	**25187**		**Grand Total**	**23173**		**Grand Total**	**22210**		**Grand Total**	**23645**		**Grand Total**	**24987**

Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	272		1	373		1	622		1	585		1	606
2	3865		2	2667		2	3048		2	2431		2	3455
3	1056		3	1423		3	1275		3	1357		3	1174

8	97		8	166		8	160		8	130		8	134
9	13		9	24		9	44		9	16		9	13
Grand Total	**5303**		**Grand Total**	**4653**		**Grand Total**	**5149**		**Grand Total**	**4519**		**Grand Total**	**5382**

Year Group	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	290		1	347		1	353		1	548		1	596
2	3089		2	2805		2	2787		2	2291		2	2721
3	1910		3	1699		3	1233		3	1892		3	1693
8	75		8	85		8	125		8	152		8	195
9	10		9	9		9	21		9	26		9	43
Grand Total	**5374**		**Grand Total**	**4945**		**Grand Total**	**4519**		**Grand Total**	**4909**		**Grand Total**	**5248**

Year Group	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5

Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	296		1	283		1	411		1	553		1	537
2	2837		2	3166		2	2770		2	2898		2	2891
3	2197		3	1648		3	1372		3	1484		3	1955
8	67		8	136		8	213		8	262		8	144
9	11		9	18		9	31		9	27		9	9
Grand Total	**5408**		**Grand Total**	**5251**		**Grand Total**	**4797**		**Grand Total**	**5224**		**Grand Total**	**5536**

Year Group	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**		**Year Group**	**Year 8**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	265		1	408		1	507		1	373		1	489
2	2906		2	2819		2	2247		2	2109		2	3254
3	2074		3	1849		3	1789		3	1894		3	1320
8	53		8	111		8	192		8	95		8	106
9	6		9	18		9	33		9	26		9	10
Grand Total	**5304**		**Grand Total**	**5205**		**Grand Total**	**4768**		**Grand Total**	**4497**		**Grand Total**	**5179**

Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	261		1	264		1	418		1	185		1	265
2	3198		2	2785		2	2603		2	2789		2	3136
3	1451		3	1252		3	1424		3	1325		3	1484
8	97		8	134		8	157		8	72		8	150
9	25		9	25		9	13		9	23		9	13
Grand Total	**5032**		**Grand Total**	**4460**		**Grand Total**	**4615**		**Grand Total**	**4394**		**Grand Total**	**5048**

Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8		Year Group	Year 8
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	1384		1	1675		1	2311		1	2244		1	2493
2	15895		2	14242		2	13455		2	12518		2	15457
3	8688		3	7871		3	7093		3	7952		3	7626
8	389		8	632		8	847		8	711		8	729
9	65		9	94		9	142		9	118		9	88

Grand Total	**26421**		**Grand Total**	**24514**		**Grand Total**	**23848**		**Grand Total**	**23543**		**Grand Total**	**26393**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	295		1	532		1	538		1	361		1	423
2	3255		2	2831		2	3385		2	2893		2	3798
3	1718		3	1728		3	740		3	1123		3	1147
8	129		8	95		8	180		8	86		8	103
9	12		9	19		9	16		9	8		9	6
Grand Total	**5409**		**Grand Total**	**5205**		**Grand Total**	**4859**		**Grand Total**	**4471**		**Grand Total**	**5477**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	225		1	279		1	403		1	730		1	448
2	3667		2	3129		2	3146		2	2676		2	3264

3	1721		3	1252		3	1556		3	1137		3	1470
8	37		8	64		8	132		8	204		8	160
9	1		9	11		9	16		9	12		9	18
Grand Total	**5651**		**Grand Total**	**4735**		**Grand Total**	**5253**		**Grand Total**	**4759**		**Grand Total**	**5360**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	256		1	523		1	271		1	431		1	412
2	3017		2	2395		2	2868		2	2911		2	3408
3	2087		3	1347		3	1944		3	1571		3	1749
8	102		8	138		8	73		8	97		8	73
9	3		9	13		9	17		9	12		9	21
Grand Total	**5465**		**Grand Total**	**4416**		**Grand Total**	**5173**		**Grand Total**	**5022**		**Grand Total**	**5663**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**

1	249		1	276		1	334		1	256		1	310
2	2654		2	3004		2	2900		2	2058		2	3771
3	2474		3	1680		3	1494		3	1647		3	1025
8	67		8	46		8	101		8	57		8	103
9	11		9	6		9	9		9	4		9	13
Grand Total	**5455**		**Grand Total**	**5012**		**Grand Total**	**4838**		**Grand Total**	**4022**		**Grand Total**	**5222**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	154		1	249		1	242		1	393		1	622
2	3322		2	2904		2	1965		2	2482		2	3075
3	1630		3	1260		3	1383		3	1569		3	1301
8	53		8	84		8	68		8	111		8	204
9	7		9	4		9	5		9	19		9	14
Grand Total	**5166**		**Grand Total**	**4501**		**Grand Total**	**3663**		**Grand Total**	**4574**		**Grand Total**	**5216**

Year Group	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**		**Year Group**	**Year 9**
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5

Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark
1	1179		1	1859		1	1788		1	2171		1	2215
2	15915		2	14263		2	14264		2	13020		2	17316
3	9630		3	7267		3	7117		3	7047		3	6692
8	388		8	427		8	554		8	555		8	643
9	34		9	53		9	63		9	55		9	72
Grand Total	**27146**		**Grand Total**	**23869**		**Grand Total**	**23786**		**Grand Total**	**22848**		**Grand Total**	**26938**

Year Group	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	217		1	454		1	356		1	510		1	407
2	3198		2	3153		2	2871		2	2704		2	3243
3	1759		3	1080		3	1139		3	1125		3	1400
8	36		8	102		8	93		8	149		8	131
9	3		9	6		9	9		9	30		9	24
Grand Total	**5213**		**Grand Total**	**4795**		**Grand Total**	**4468**		**Grand Total**	**4518**		**Grand Total**	**5205**

Year Group	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday

Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	269		1	462		1	295		1	344		1	369
2	3389		2	2782		2	2474		2	2576		2	2675
3	1517		3	1195		3	2364		3	1624		3	1638
8	52		8	107		8	74		8	95		8	167
9	3		9	17		9	11		9	25		9	16
Grand Total	**5230**		**Grand Total**	**4563**		**Grand Total**	**5218**		**Grand Total**	**4664**		**Grand Total**	**4865**

Year Group	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	283		1	346		1	267		1	267		1	513
2	2742		2	2375		2	3022		2	2503		2	3113
3	2093		3	1511		3	1732		3	1714		3	1681
8	94		8	88		8	63		8	102		8	112
9	14		9	24		9	11		9	11		9	11
Grand Total	**5226**		**Grand Total**	**4344**		**Grand Total**	**5095**		**Grand Total**	**4597**		**Grand Total**	**5430**

Year Group	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**

Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	228		1	160		1	259		1	279		1	354
2	2791		2	2329		2	2430		2	2847		2	2578
3	2040		3	2253		3	1355		3	1293		3	1859
8	62		8	28		8	90		8	121		8	65
9	12		9	6		9	6		9	22		9	16
Grand Total	**5133**		**Grand Total**	**4776**		**Grand Total**	**4140**		**Grand Total**	**4562**		**Grand Total**	**4872**

Year Group	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**		**Year Group**	**Year 10**
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	188		1	203		1	265		1	290		1	322
2	2849		2	2731		2	2170		2	1963		2	2728
3	1823		3	1632		3	1601		3	1264		3	1823
8	47		8	46		8	85		8	60		8	103
9	3		9	7		9	9		9	11		9	11
Grand Total	**4910**		**Grand Total**	**4619**		**Grand Total**	**4130**		**Grand Total**	**3588**		**Grand Total**	**4987**

Year Group	Year 10		Year Group	Year 10		Year Group	Year 10		Year Group	Year 10		Year Group	Year 10
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	1185		1	1625		1	1442		1	1690		1	1965
2	14969		2	13370		2	12967		2	12593		2	14337
3	9232		3	7671		3	8191		3	7020		3	8401
8	291		8	371		8	405		8	527		8	578
9	35		9	60		9	46		9	99		9	78
Grand Total	**25712**		**Grand Total**	**23097**		**Grand Total**	**23051**		**Grand Total**	**21929**		**Grand Total**	**25359**

Year Group	Year 11		Year Group	Year 11		Year Group	Year 11		Year Group	Year 11		Year Group	Year 11
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	309		1	208		1	286		1	222		1	369
2	3417		2	3421		2	2741		2	3516		2	3442
3	1492		3	1396		3	1324		3	870		3	1462
8	78		8	38		8	59		8	37		8	88
9	5		9	5		9	11		9	3		9	5

Grand Total	**5301**		**Grand Total**	**5068**		**Grand Total**	**4421**		**Grand Total**	**4648**		**Grand Total**	**5366**

Year Group	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	170		1	234		1	252		1	284		1	421
2	3618		2	3647		2	2751		2	2962		2	2935
3	1621		3	1077		3	1741		3	1474		3	1523
8	36		8	55		8	75		8	79		8	114
9	2		9	6		9	13		9	8		9	16
Grand Total	**5447**		**Grand Total**	**5019**		**Grand Total**	**4832**		**Grand Total**	**4807**		**Grand Total**	**5009**

Year Group	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	182		1	338		1	228		1	237		1	388
2	2647		2	3041		2	2980		2	2917		2	3133
3	2294		3	864		3	1547		3	1391		3	1781

8	30		8	44		8	26		8	35		8	129
9	9		9	10		9	14		9	3		9	10
Grand Total	**5162**		**Grand Total**	**4297**		**Grand Total**	**4795**		**Grand Total**	**4583**		**Grand Total**	**5441**

Year Group	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	96		1	261		1	232		1	200		1	215
2	3213		2	3046		2	2515		2	2458		2	2799
3	1955		3	1407		3	1439		3	1072		3	1969
8	26		8	88		8	62		8	41		8	69
9	1		9	5		9	5		9	1		9	13
Grand Total	**5291**		**Grand Total**	**4807**		**Grand Total**	**4253**		**Grand Total**	**3772**		**Grand Total**	**5065**

Year Group	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**

1	168		1	298		1	221		1	300		1	179
2	3054		2	3093		2	3014		2	2635		2	3914
3	1683		3	1290		3	1084		3	1458		3	936
8	36		8	56		8	31		8	47		8	44
Grand Total	**4941**		9	11		9	7		9	15		9	15
			Grand Total	**4748**		**Grand Total**	**4357**		**Grand Total**	**4455**		**Grand Total**	**5088**

Year Group	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**		**Year Group**	**Year 11**
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	925		1	1339		1	1219		1	1243		1	1572
2	15949		2	16248		2	14001		2	14488		2	16223
3	9045		3	6034		3	7135		3	6265		3	7671
8	206		8	281		8	253		8	239		8	444
9	17		9	37		9	50		9	30		9	59
Grand Total	**26142**		**Grand Total**	**23939**		**Grand Total**	**22658**		**Grand Total**	**22265**		**Grand Total**	**25969**

Year Group	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5

Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark		Sims score	Count of Mark
1	76		1	112		1	65		1	20		1	13
2	1252		2	1198		2	1426		2	1249		2	1432
3	1809		3	1864		3	1702		3	1783		3	1640
8	4		8	4		8	13		8	10		8	14
Grand Total	**3141**		**Grand Total**	**3178**		**Grand Total**	**3206**		9	2		9	3
									Grand Total	**3064**		**Grand Total**	**3102**

Year Group	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	82		1	118		1	61		1	72		1	82
2	1630		2	1766		2	1572		2	1170		2	945
3	1456		3	1341		3	1851		3	1883		3	1992
8	18		8	42		8	5		8	33		8	11
Grand Total	**3186**		**Grand Total**	**3267**		**Grand Total**	**3489**		9	1		9	1
									Grand Total	**3159**		**Grand Total**	**3031**

Year Group	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**

Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	18		1	27		1	68		1	63		1	88
2	1618		2	1866		2	1965		2	1546		2	1234
3	1498		3	1393		3	1264		3	1450		3	1689
8	7		8	5		8	26		8	8		8	10
Grand Total	**3141**		**Grand Total**	**3291**		**Grand Total**	**3323**		**Grand Total**	**3067**		**Grand Total**	**3021**

Year Group	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**		**Year Group**	**Year 12**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	85		1	70		1	14		1	64		1	65
2	1398		2	1412		2	1348		2	1490		2	1533
3	1458		3	1604		3	1505		3	1432		3	1281
8	23		8	11		8	5		8	6		8	5
Grand Total	**2964**		9	2		**Grand Total**	**2872**		**Grand Total**	**2992**		**Grand Total**	**2884**
			Grand Total	**3099**									

Year Group	Year 12		Year Group	Year 12		Year Group	Year 12		Year Group	Year 12		Year Group	Year 12
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	38		1	58		1	62		1	41		1	46
2	1264		2	1402		2	1598		2	1571		2	1877
3	1653		3	1561		3	1116		3	1111		3	738
8	30		8	9		8	30		8	7		8	5
Grand Total	**2985**		**Grand Total**	**3030**		9	6		**Grand Total**	**2730**		9	1
						Grand Total	**2812**					**Grand Total**	**2667**

Year Group	Year 12		Year Group	Year 12		Year Group	Year 12		Year Group	Year 12		Year Group	Year 12
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	299		1	385		1	270		1	260		1	294
2	7162		2	7644		2	7909		2	7026		2	7021
3	7874		3	7763		3	7438		3	7659		3	7340
8	82		8	71		8	79		8	64		8	45
Grand Total	**15417**		9	2		9	6		9	3		9	5

			Grand Total	**15865**		**Grand Total**	**15702**		**Grand Total**	**15012**		**Grand Total**	**14705**

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday		Day of the week	Monday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	7		1	3		1	29		1	4		1	1
2	473		2	493		2	373		2	168		2	261
3	459		3	435		3	600		3	489		3	506
Grand Total	**939**		**Grand Total**	**931**		**Grand Total**	**1002**		8	5		**Grand Total**	**768**
									9	1			
									Grand Total	**667**			

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday		Day of the week	Tuesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	6		1	6		1	9		1	4		1	1
2	386		2	400		2	376		2	369		2	311

3	385		3	385		3	503		3	544		3	613
Grand Total	**777**		**Grand Total**	**791**		**Grand Total**	**888**		**Grand Total**	**917**		**Grand Total**	**925**

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday		Day of the week	Wednesday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	7		1	6		1	10		1	38		1	26
2	251		2	189		2	175		2	513		2	386
3	454		3	451		3	502		3	490		3	583
8	1		8	2		**Grand Total**	**687**		8	3		8	4
9	2		9	1					**Grand Total**	**1044**		**Grand Total**	**999**
Grand Total	**715**		**Grand Total**	**649**									

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday		Day of the week	Thursday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	3		1	4		1	4		1	16		1	14

2	402		2	342		2	210		2	410		2	440
3	258		3	331		3	478		3	347		3	388
Grand Total	**663**		8	1		**Grand Total**	**692**		8	2		**Grand Total**	**842**
			Grand Total	**678**					**Grand Total**	**775**			

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday		Day of the week	Friday
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5
Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	32		1	25		1	4		1	4		1	3
2	454		2	439		2	358		2	229		2	229
3	463		3	524		3	511		3	528		3	442
8	3		8	4		**Grand Total**	**873**		**Grand Total**	**761**		**Grand Total**	**674**
Grand Total	**952**		**Grand Total**	**992**									

Year Group	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**		**Year Group**	**Year 13**
Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)		Day of the week	(All)
Period Number	p1		Period Number	p2		Period Number	p3		Period Number	p4		Period Number	p5

Sims score	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**		**Sims score**	**Count of Mark**
1	55		1	44		1	56		1	66		1	45
2	1966		2	1863		2	1492		2	1689		2	1627
3	2019		3	2126		3	2594		3	2398		3	2532
8	4		8	7		**Grand Total**	**4142**		8	10		8	4
9	2		9	1					9	1		**Grand Total**	**4208**
Grand Total	**4046**		**Grand Total**	**4041**					**Grand Total**	**4164**			

11.5 Transcript- Teacher interviews

Me- ok I'm going to start with question number 1 – do you think students get enough sleep during a school week?

HOD – no I don't think so because I've spoken to students who seem very tired in the morning and they have told me what time they have gone to bed and I've questioned them about where are their parents they say that they say goodnight to their parents and they go into their room and close the door and their parents don't ever check on them, they go to bed at 1, 2 3 o'clock in the morning and some of them actually stay up until 5 or 6

Melda- it's the same with my class nearly more than half of the students are feeling tired in the 1st period and they don't have their breakfast at all so it makes a bad impact on their learning

Deeps- I concur with them because basically a lot of students have a bad routine they just kind of go to sleep until 2 or 3 o'clock in the morning their parents don't really know what they're doing and they don't have a set routine and because of that um I think that that leads to other problems, because they haven't got a structured life they don't do homework's on time and they watch TV and play computer games until 2,3,4 in the morning and that makes them not focus that well in class because they've got bad discipline that when it comes to their class work you can see that that leads through in their class work as well so I think if they had more structured life at home … ok like you have dinner at 6, you do your homework from this time to this time and you go to bed no matter what at 9 o clock an parents were to keep checking on them I think their school life will automatically improve that my personal opinion

Ali – I agree with the rest of the people whatever they have said, students are different when you go into a classroom students are different but I can say that the majority of students at this school that we have , I think that its good, its ok for them but I'm talking about the majority but some of them as you say even the parents think that they are working hard but they don't go a check regularly and they are just playing games but those students you can see them, not only they are asleep but the way they wear clothes uniform from all of them you can see there isn't structure in their lives

Me- ok question 2, how many hours sleep do you think students need every night?

Melda- 8 hours' sleep minimum

Me- ok minimum 8 hours

Deeps- I think it varies at different stages of your life because if you're an infant you would need around 9 to 12 hours, if you're a teenager I'd say the minimum you would need is at least 10 hours and if you're an adult anything from 6 to 8 hours would suffice so because in our school they are teenagers they should be getting at least a minimum 10 hours sleep to make sure that they are fully awake and their body has enough rest time so when it comes to performance in the class and to concentrate throughout the school day their at optimum best, I think even if they had 8 hours of 7 hours that would still hinder their performance because their brains and bodies are still tried to wont they won't be rejuvenated to revise and work hard and to really push themselves as I teach a lot of bottom set students and because I see a lot of students that actually don't get enough sleep that naturally makes them demotivated for the lesson in the classroom .."Sir I'm tired... I haven't had breakfast" and I think all of these things are not only excuses but the reasons why they can't do things in say contents of say an exam , if a child hasn't gotten enough sleep there is no way they are going to write an exam to a successful and coherent standard so I think even in current classroom practise erm I think it's very difficult I think even as parents how would you know that your child has had 10 hours sleep unless you confiscate their computers, phones and laptops every child should be enforced and as teachers we should enforce it as well that students should be getting 10 to 11 hours sleep because they are still children at the end of the day and everyone under the age of 20 is still a child and should get that amount of sleep.

HOD- I agree and I say 10 hours sleep because I think they should go to bed at 9 and wake up at 7, yeah to me 10 o'clock is a bit late but considering the amount of homework I think 10 o'clock is the latest they should go to sleep and wake up at 7 because they must be up by at least 7 o'clock so they can be up when they are at school

Ali- erm I will answer this question according to me being a teacher but there are people that are more expert than us at answering this question that at what age how many hours sleep do you need. Just the only thing we can say as teachers is that the school life for students is very very difficult it not that students just come here enjoy themselves and go it ca be very very stressful very very difficult

Melda- so just one thing to add knowing from my experience as I have a daughter that is a teenager is that 10 hours is too much from my experience because the more they sleep the more sleepy they might feel the following day I think… I believe that it should be 8 hours or around.

Deeps- I actually disagree in sense that I think in my opinion I think that's true for an adult as an adult is fully matured and the body is actually developed and all their muscles and bones have reached their optimum peak so I think psychologically they can afford to have 6 to 8 hours sleep whereas I think a teenager is still developing and as a human being they are not fully developed even if you look at it from points of gymnastics take any 13 or 14 year old and they can do the splits in like 6 months that's because their bones and muscles haven't fully developed whereas an adult can take 3 to 4 years or even 2 years and even in the contents of sleep rest is really important because if you don't rest well you can never.. your body needs to recover to be …I think being consistent is really important and if they are having 8 hours sleep in my opinion I think they are still sleep deprived because they're not adults and at the end of the day they don't think like adults either so I think in my opinion they should be getting 10 to 11 hours sleep and if they get in their 20's and think I'm an adult now and I think I should cut down my sleep and I think 7 hours is fine as an adult they have made a conscious decision but as a teenager even if they are 19 I still think they are not wise enough to make their own decisions about sleep.

Me- ok question 3, what do you think is the best time to teach in your experience?

HOD- um I think I'm going to be biased because I've heard from someone done a bit of research so in that way I do know it should be around period 3 and period 4. Period 1 and 2 it takes students a lot of time to get up from students who have actually said to me "miss I'm actually still asleep " and I look at them and they are still asleep so students have actually said to me miss period 1 I'm still asleep because I've had year 11 option group period 1 on a Tuesday they are absolutely silent you can't get a word out of them and then period 5 on Monday they are buzzing they do millions of worksheets and they get lots of work done but period one they just sit like this (froze) and cannot answer a question so yeah I think after period 3.

Melda- the best period is period 3

Deeps- yeah period 3

Ali- and period 2 but not period 5 and not period 1

Deeps- I think period 4 because they have had 3 lessons to kind of get school started and know what's expected in lesson and I think before lunch there's an incentive as students think I've got lunch next I've got to work hard in this lesson as sir or miss can potentially keep me behind but I think period 4 is a good time as you can give them the extra pressure that you have to get this work done or they can't go to lunch so period 4 is ideal

Me- Ok would you say students work or perform better at different time of the day and why

Ali- its kid of the same questions

Melda- yeah, in the exams or in the lessons

Me- erm generally do you think that they work or perform better at different times (Melda- yes) not with regards to the behaviour aspects just performance

Ali- are you talking about the time of the day or the environment

Me – time of the day

Ali- in that case I've answered this

Melda- yeah I think we have answered this before

Me- yeah so shall I go with the same period you lot said and ill merge it with this question

All- agreed

At this point box plots were given with year 10 data, teachers had a few minutes to read and interpret the charts

Me- as you can see in the box plots which shows the year 10's data what are your views and reasons behind it and why they performed the way they did

Melda- probably they ate their lunch and their mind was more... you know they can work harder in the afternoon, err they feel awake

Aril- yeah I think that some of them wake up too late in the morning so by the time they have their period 1 and 2 their brain not alert yet their brains are still waking up because some of them tell us that I woke up and took 5 minutes to get dressed and 5 minutes to walk to school so by the time they are starting period 1 they have only been up for 30 minutes so their brains haven't started to function properly but period 4 they are alert and ready to learn

Ali- if I look at this at first what you are showing me is a something that I am learning from because I would say that if you hadn't shown this to me I wouldn't have agreed with it to be honest with you but I've got so many years of teaching I would have thought that in the morning that they will do better on average but if we look at this actually it tells us what HOD was saying that in the morning their brains was asleep because if you look at the minimum values you can see they are not comparable the minimum values of the afternoon is much much more than the minimum in the morning which shows that those people were asleep yes but when you look at the afternoon the

median of the second one the afternoon is the upper quartile of the morning (teachers agree) which is very very interesting and I would say that this isn't something I can say or bring reason for it because I need to think about it to be honest with you because I didn't know

Deeps- I think that one of the reasons that could be to explain why the median is close to the upper quartile is I think in afternoon they've not only woken up but they have gone through a few lessons so they are more motivated to think but I think in period 1 like as miss said they haven't really woken up yet and wont that the activity seriously so I think that's definitely a factor to consider.

Me- the next question I'm going to look at is the way students learn, do you think the way they learn changes throughout the day and their learning style do you think that changed throughout the day,

Long pause- you know how some people say there are different type of learnings like kinaesthetic type and auditorial learners do you think the type of learner is changes throughout the day

HOD- I have only found that it changes throughout the week, at the beginning of the week it's more like they can take more lecture style and I can talk and talk but by the end of the week they need more activities to get them through that Friday or that Thursday lesson but I'm not sure

Melda- in a way this was what you were saying they are open to discussion when they are more active obviously even the quite ones become more active through their discussions and through the talk they can learn more so yeah I think it depends and also depends on the err the topic the environment so not just one thing I can say just about the time

Deeps- erm for me I think it would really make a difference , I don't think their learning style would be different during the day their concentration span yes but I wouldn't say their learning style would change throughout the day I think they learn how they learn some students by nature are kinaesthetic learners some are more they want to listen to something and some students need something more hands on so I don't think those traits will change as that in the students nature anyway on how they are that's it

Ali- yeah but again there are things important things the type of learner to me doesn't work as well to me it's exactly the same as us the way that we want to learn if I want to think about something I would like to have writing in front of me, I did an example of Ms Harley because I know her way when she like to look at the monitor and read from there and do better which doesn't change but as you go through the week exactly like us for example yesterday I dint want to have a lot of hard work to do because the week is almost over for us so if it was something more practical that we

can do like drawing maybe it will be better for them but the type of way that they prefer the teachers to teach I don't think it changes but because of the way they feel they want to have more drawing as they don't want to think hard that's it

Me – ok and I'll just go through the last question as well from your experience as teachers do you think the way you teach change throughout the day or throughout the week as in your teaching style

HOD- yeah I think I definitely think throughout the day my teaching changes because I start with my first class and I'm more just trying to establish that you need to be sitting you need to be settled you need to be quite so I'm more talk and talk but as the day goes on if I do activities I must admit I'll do activities in the middle session and in the last session and maybe that comes back to your question before maybe I'm noticing something subconsciously that some children will do better at activities then but I've never started the first lesson with activities, my first 2 lessons are never activities its odd but I've never started my first two lessons with activities but I will always do activities in the middle two lessons.

Deeps- I think I agree with HOD if I look at all of my lessons what I tend to do is I tend to do worksheets and examples of worksheets maybe one lesson and then exam questions and the second lesson I might give them harder more abstract questions and the last lesson I might give them matching activities or a range of exam question bundled up and they have to work together to solve them, I think the reason for me that works is that later in the week they have had a full week to go over that topic they have gone through a range of questions and I think the last lesson is ideal to do an activity because they have gained enough ground in basic material

HOD- yes but in the day with different classes do you think your style changes?

Deeps- yeah I think it does definitely because obviously with each year group I'm doing something different so maybe the week before I might have started a topic and kind of concluded it on a Monday therefore I would do a matching activity hence if I was teaching year 9 class I would started let's say simultaneous equations I think it does, it depends on where I am with that topic and the year group in question

Melda- yeah I can't say the only perimeter is the time because it depends on the dynamics of the classroom the identity of your class so I think it depends on the majority of the students and how they learn and the type of their learning if it err if it's a class of erm listening and watching their

learning styles is listening and watching and they are thinking then you need to adapt your teaching to their style and so I can't say it's just the time as my perimeter.

Ali- it is in the literature that learning only happens when the teaching matches the learning otherwise it would work and when I go to my classroom I know what I am going to do but as everybody know what they are going to do but I …. Try to understand this classroom and how can they learn and according what they learn I plan my lesson alright and if I know that they will work if I talk on the board 10 minutes give them something and then give them the mark scheme to do themselves it works well and they are learning that the way that I do it in that classroom but if another part of it if me as a teacher changes yes sometimes I can deliver very good lessons and sometimes I know my faults and I can see I am making a mistake I can change the way I teach

END____

11.6 Transcript year 12 focus group

Teacher – ok so the 1st question is do you think students get enough sleep during the school week.

Yatin- no because we have to do work when we get home so then we don't have time to sleep in the afternoon and then we wanna relax as well therefore we go to bed late.

Katie- um yeah I agree especially because some kids wanna, they get loads of work and don't finish until roughly 9 o'clock, you want hours to get into the sleep mood so that you have a good night's sleep and your no constantly thinking about your day, you need time to relax.

Abeer- we don't have free hours as we do a lot of work at home

Teacher- ok so you guys all do a lot of work at home, so roughly what time do you go to bed?

John- well it depends on how much work I had to do, so sometimes it can be as late as 1 in the morning and other times I would be finished by 8 o'clock

Teacher- ok but you still need to wake up in the morning as well for school

John- yeah most times at 6am

Teacher – so do you find that at night you need to force yourself to sleep or do you just fall asleep naturally.

Yatin- I tend to need to force myself to sleep

Katie – same

Abeer- I just sleep, coz I'm tired

Katie- I find that if you get into a routine, sometimes you just fall asleep just normally.

Teacher- ok question 2 roughly how many hours sleep do you think your body needs

Abeer- 8

Teacher- so you think about 8

Yatin- 7 minimum

John- probably 8-10

Katie- I'd say 8 as most people say that the minimum is 8 then I find that I'm still tired in the morning and I want that extra hour but I guess that if you over sleep you would be tired the whole day so it's about finding the happy median I guess.

Teacher- ok so if you were to sleep around 10 hours for example

Katie- I'd be tiered for the rest of the morning and would lose hours just sitting on the sofa

Teacher – ok so let's go with you need 8 hours sleep, when you wake up in the morning how long does it take until you feel like your fully alert

Yatin- probably an hour

John- yes around an hour until feel like I have woken up

Katie- depends as soon as I have a shower I feel more awake and I usually have to force myself up to get into the shower because otherwise I'm just too tired.

Abeer- I need to be awake for long in the morning, I usually go on my phone in bed

Teacher- ok so you roughly think you need and hour to feel awake, how about your brain how long do you need until you are ready to start learning and doing work

Katie- probably a lot longer

(All students agree)

Yatin- on the weekend after I wake up if I need to do work I would wait around 2 to 3 hours before doing work and even then I don't focus that much.

John- ye on the weekend I always start past 12 o'clock, that way I can do whatever I want in the morning and then figure out what I am going to do for the rest of the day.

Teacher- ok so what about during holidays when you have the whole day off, when do you usually start doing revision or work?

Katie- depends when you have exams, when I have an exam I get up early to do as much work as I can although during the holidays when I can spread it out, I probably won't work until mid-afternoon because I prefer evening over mornings to do work.

(All students agree)

Teacher- ok next question is, do you think there is a good time to learn Maths for example?

What would be the best period to learn maths? So let's start from there

Yatin- I would say period 3 because you have had the proper time to wake up from the morning and you not yet tired as in later in the afternoon

Teacher- ok so you think around period three, what about yourself (moved onto the next student)

John- I think period 3 as well because it's just after break so you already had your mini relaxation after the past two lessons and it's still before lunch so you won't be full on food waiting for it to settle down.

Abeer- well it depends because if it is 1 lesson the period 3 but if it's a double lesson then either 2 and 3 or 3 and 4 so you can have a break in between.

Teacher- ok so you don't think a double period should be together and there should always be a break in between

Abeer- yes because your brain doesn't function properly for 2 hours in a row and you might get bored as well

Teacher- so you think 2 hours in one go is quite a long time

Katie- yeah I agree especially with maths because it's a lot of answering questions like your using your brain a lot so having a break in the middle is quite important.

Teacher- so what are your views about having maths in the morning during period 1

John- it's a bit harsh (all students agree) because you have just woken up and I think it can depends as in if you really do like maths then I guess there's no real problem as you like it so much but for me first thing in the morning, it's a bit much as maths requires a lot more working out and thinking to solve questions and in the morning its quite difficult.

Katie- it requires a lot of concentration so I think in order to do the best that you can your brain needs to be fully alert and I think in the morning you're not

Abeer- But some people are more alert in the morning than the afternoon

Teacher- yes you do get that, some people may be more alert in the mornings but what about you personally

Abeer- afternoons

John- I think if you do have maths in the morning they should set it out so it's easier to start and then it progresses so it's then gets a bit more difficult than you can break your way into it rather than throwing in a huge question on trig or something

Abeer- especially if its new stuff, I find it hard to do it.

Teacher- so if it's a new topic you would find it hard to do in the morning

Abeer- no I just wouldn't understand it at all

Teacher- next question- do you think student learn and perform better at different time of the day and why?

Abeer- yes, I think that year 7's perform better in the mornings because after lunch they get tired and just argue with the teacher and don't do any work whereas in the morning they are more fresh and do what they are told more, I dunno I just feel they do better in the morning

Teacher- yeah so you feel the years 7's do better in the morning than afternoons, anything else, any other year groups…

Katie- in terms of us I think especially last period on a Friday I don't think anyone works particularly well you are just looking forward to the weekend and first period on a Monday everyone is just tired from the weekend and you don't particularly learn very well, but I find during the middle of the week your more focused because you're not think about the weekend anymore and you're not thinking about the coming weekend because it's still a couple of days away so you are more focused on school and especially periods during the middle like period 3 is when you are most focused, I think for me.

Teacher- so period 3 is the time you are most focused for year 12's

(All students agree)

Teacher- what about year 11's, think back to how you were last year was it the same

Katie- it was different in year 11 as we had a lot of different lessons as sometimes it didn't make sense having double PE and then French or something like that because they are not roughly the same as with us now we have like double maths and then physics and it's like you leading in from that whereas our timetable in GCSE we had random lessons and random times so I don't know but it depends what lesson you're in and what lesson you just had, because sometimes if you had a really intense day you tend to do less well as you could have had an intense morning.

Teacher- ok so depending on what you had before can determine how you would feel after

Therefore if you were to have another lesson now (at 2pm) how would you feel

Abeer- dead, I can't handle period 5, I prefer period 3 and 2 but I don't like period 1 as well as I am still really tired because I go to bed late and I wake up early and I feel sleepy and period 4 and 5 I feel sleepy as well because if I was at home I would go back to sleep like on the weekends.

In this section students were shown the BOX PLOTS (see figure 9) which demonstrates the year 10s memory performance at different times of the day.

Teacher- you each have the box plots with the year 10 data which shows how well they did in the morning compared to the afternoon, have a couple of minutes to look at it…..

So what's your views on it?

Abeer- I think they perform better in the afternoon because like me personally when I have exams in the morning I stay up all night revising and stress over it but if my exam was in the afternoon I will just sleep and wake up early in the morning and revise more, so I think I get more sleep and revise better if my test was in the afternoon because it's better that staying up and revising a lot and then your brains shuts down

Teacher- ok but with these tests students didn't really know they were going do have them and didn't need to revise for anything so that it can be more accurate I randomly tested them in the

mornings and afternoons just to see what they could do at that time naturally, so what do you think with regards to that

Katie- I think they had enough time for their brains to warm up because for the afternoon ones in particular they would have had lessons before that they would have been in the mode to learn but in the morning you wake up and your still tired because you didn't get enough sleep and you are put straight into a test the likelihood is you're not going to do very well.

John- I think they definitely out performed themselves in the afternoon test probably because they have used their brains already in the morning sessions of school um so their brains are already ready to learn so I definitely think that that affected their results um in the afternoon

Teacher – ok imagine that you guys did the test do you think that you would do better in the morning or better in the afternoon?

Katie- um I think it depends on what lesson you had before though

John- yeah

Katie- because sometimes if you have a full day and then periods 4 and 5 are just kind of draining because your thinking about going home whereas you are more alert because you've had a whole days' worth of learning but it does depend on what you have had in the morning

Teacher – ok … (pause) now leading on to the next question do you think like, think about this personally for yourselves … do you feel the way you learn is also different at different times of the day? So the way you actually take in information, the way you approach problems, the way you think you learn, do you think that changes at different times of the day?

Yatin- yeah I think so, because earlier on in the day I'm probably more alert and pay attention to what I am hearing but in the evening or like during period 4 and 5 when the teachers speaking it doesn't go in as well, I prefer writing down stuff and reading that works better during period 4 and 5 for me

Teacher- ah so in the morning you prefer sitting down and listening and taking in information and not doing as much and in the afternoon you become more active and like writing

Yatin- yeah otherwise id just get tired and bored and I lose concentration.

Teacher- ok anything different

Katie- I think maybe after lunch I'd prefer to do something active like where, either like a card sort or something like that because you've just come back from lunch so your quite energetic anyway and just coming back and just writing like copying off of a board I think it's quite mundane whereas if you were to come back and .. it's different with maths because obviously you're doing questions because it's a different curriculum but if it was to do something like geography or something like that then I reckon you would have to use just to keep someone more alert because if I'm not doing lots of things because it's the afternoon and your tired you just kind of switch off

Teacher- ok so from your own experience, when do you feel that your most alert and when you are the most sleepy

Abeer- most sleepy period 1

Teacher – so your most sleepy period 1

Student- I think that's only for her

Teacher- does that apply for everyone

John- no I'm more sleep during period 4 and 5

Yatin- yeah

Teacher- so you more sleepy during the late afternoon

John- well I think for me it depends on what lesson it is specifically, like me personally I don't like stats, so when I was doing stats last 2 periods of Thursday I was really drained I don't know why but it just didn't work but when I'm doing other lessons like chemistry I'm more alert as I just find it a bit more interesting

Teacher- ok what about yourself (towards Yatin)

Yatin- I agree with him like it depends because …

Katie- I think personally I'm more tired in the morning because I don't know but I find it a real struggle to get out of bed and your kind of forcing yourself into a learning situation where your brain really hasn't woken up yet so it's not really ready for it

Abeer- yeah and it depends of the teaching as well because some teachers make the lessons so boring and they are so moody in the morning and don't smile at you I don't know…

Teacher – ok imagine playing off that, let's say you've been given the power or ability to control the timetable and control how teachers were to teach you as well, how would you tell teachers to teach you period 1, period 2 , period 3, period 4, period 5 what lessons would you ask for

Katie – I would ask for probably copying of the board and more laid back lessons during period 1 to ease yourself into it and then during period 4 and 5 ids want a more active lesson where you're doing activities to try and keep yourself going until the end of the day

Teacher- ok and is this same throughout the week

Katie- I think maybe all of Friday activities because even when I wake up on a Friday I just wanna like, I wanna have fun in school to not think about how much I wanna be at home if that makes sense

Teacher- ok anything else…

END-

11.7- OFSTED LESSON CRITERIA

		Inadequate	Satisfactory	Good	Outstanding
Environmental Habits	Positive, purposeful atmosphere	The children need regular reminders to keep on –task; some do not keep on-task, despite reminders	With regular reminders, the children work purposefully and productively	Children only need occasional reminders regarding staying on-task	A very positive, purposeful atmosphere pervades all aspects of learning and behaviour within the class
	Planning in place and available	Planning for the lesson is not available	Teachers planning folder is present and a suitable lesson plan is in place	Planning for the lesson is precise and is clearly adapted to the needs of the children; adjustments, based on previous learning are clear; previous plans are annotated, including references to assessment	All planning is thorough and detailed; subject and cross-curricular links are clear; assessment opportunities are identified and annotated accordingly; links to S&L, ICT, Homework ensure integrated approach through lesson
	Key vocabulary displayed and used	Key vocabulary is not displayed	There is evidence of lists or groups of key vocabulary in the classroom that children can, if they choose, make use of	The key vocabulary on display in the rooms is referred to and used by the teacher, LSAs and children in the course of their work	The use of key vocabulary forms a key component in the teaching and learning of the children; routines are evident and the vocabulary is impacting on the learning
	Well-prepared resources in place	Elements of resources are not prepared sufficiently in advance	All resources are prepared ready for the beginning of the lesson	All resources are well-prepared and routines are in place for them to be effectively distributed through the course of the lesson	Full range of classroom resources and specific lesson resources are effectively prepared, available and distributed; routines lead to minimal disruption
	Effective use of display	Displays, where present, to not reflect or impact on the work being carried out in the class	A mixture of displays are used in the class, some with examples of children's work;	A wide range of different displays include children's work, work in progress and items to stimulate interest	A wide range of well-thought out, high quality, stimulating displays are used to support the work in class; there are examples of 3D work, interactive displays, examples of best work
	LSAs effectively deployed	LSAs have little or no impact on learning	LSAs work alongside groups of children or individuals to ensure they are on task	LSAs are deployed strategically by the class teacher and work effectively to support groups of children and individuals	LSAs are deployed strategically, engage actively with the groups or individuals they are working with and ensure above average progress for those they work with
	ICT used effectively, where appropriate	ICT is not used where it could have been used to enhance the learning	ICT is used, principally by the class teacher	ICT is used by both the teacher and the children to enhance the learning	ICT is used in interesting ways to add significantly to the learning
Learning Habits	Learning Objectives	Learning Objectives are not shared or to not accurately reflect the teacher's intention	Appropriate Learning Objectives are shared at the beginning of the lesson and reviewed at the end;	A clear routine for sharing Learning Objectives is present; Learning Objectives are referred to through the lesson and they form the basis of the Plenary; Learning Objectives are distinguished from context	The Learning Objectives permeate all aspects of the lesson; effective routine for sharing, reflecting and assessing the Learning Objectives are in place
	Quality examples of work	Examples of successful work are not used	At least one example of a completed piece of work is referred to in the introduction to the task	Two pieces of work are compared and used to help develop the Success Criteria	Carefully chosen pieces of work, one of which that demonstrates high achievement, are used to stimulate and exemplify Success
	Success Criteria	Success Criteria are not shared, and children are not given clear indications of what constitutes success	Success Criteria have been prepared beforehand and are shared; Success Criteria are mentioned during lesson as a general guide.	Clear Success Criteria are both planned and then developed before task commences; examples of success are shared through lesson and are used in Plenary	Children are actively involved in developing effective Success Criteria before task commences; Success Criteria are referred to throughout whole lesson and used for group/peer/self-evaluation
	Recall of previous learning	References to previous learning are not made	Previous learning is referred to in the introduction, but only incidentally built upon	Clear links are draw between previous learning and how the lesson builds on this	There is a shared and understood link between previous learning and the lesson; preparation is made to link learning to next lesson
	Differentiation	Tasks are not clearly differentiated	Task is differentiated principally by outcome or expected quantity of work	Tasks are carefully designed to meet the learning needs of all three main groups of learners (Core, Support, Extension), including some provision for SEN and G&T	Tasks are carefully designed, chosen and adapted to meet the full range of learners needs; a range of effective strategies is employed
	Effective plenary	The Plenary, if present, refers only to what has been done and does not provide an opportunity to reflect on the learning	The lesson ends with a summary; reference is made to the Learning Objectives and Success Criteria	The Plenary effectively summarises the learning; examples of work that exemplify the Learning Objectives and Success Criteria are shared; children are actively involved, including group/peer/self-evaluation	Building on 'mini-plenaries' through the lesson, the Learning Objectives are extended; children articulate and communicate their learning; wider implications and links are clarified; links made to future learning
	Success celebrated	Success is only celebrated in general term, without specific links to learning	Success is recognised and praised; some links to Learning Objectives and Success Criteria	Learning Objectives and Success Criteria form the basis for praise; reasons for success are articulated and explained	Evident culture of success being celebrated based on specific aspects of Learning Objectives and Success Criteria; children know that their success will be recognised and celebrated
	Cross-curricular links identified and promoted	Reference is not made to cross-curricular links	Examples of links to other subject areas are referred to	Reference is made to how the lesson links to other lessons and subjects	Specific links are made to how skills, knowledge and understanding can and will be used in other areas
	Pupils make good progress	Some children do not make progress	All children make some progress in their learning, but not all make as much progress as planned	All children make progress against their previous learning and most fully meet or exceed the expectations of the lesson	All children engage fully with the learning and demonstrate that good progress has been made in their learning

		Inadequate	Satisfactory	Good	Outstanding
Teacher's Habits	Good teacher subject knowledge	There are noticeable gaps, misconceptions or inaccuracies in the teacher's subject knowledge	The teacher demonstrates adequate subject knowledge	The teacher is able to use subject knowledge beyond that being taught to support learning	The teacher uses their in-depth subject knowledge to support learning, support Able pupils and extend learning for all
	Targeted closed questions used	The teacher does not ask the children questions	The teacher asks children questions in the course of the lesson	The teacher uses targeted closed questions for simple assessment and clarification of learning	Carefully chosen closed questions are used strategically to explore, for example, levels of understanding, misconceptions and for assessment
	Open questions used	The teacher does not ask open questions	The teacher uses open questions in the course of the lesson	The teacher asks carefully chosen open questions to encourage thinking skills, problem solving and discussion	The teacher uses carefully chosen open questions to extend children's learning and understanding
	Teacher modelling	The teacher does not model	The teacher completes examples of what the children might be expected to do	The teacher clearly models what they expect the children to do, referring to how the Learning Objective and Success Criteria are being met	The teacher clearly models their expectations through modelling, and indicates how to both meet and exceed expectations in Learning Objective and Success Criteria
	Teacher works with a focus group	The teacher does not support a specific focus group	The teacher supports a specific group through the lesson, principally in the independent task	The teacher supports the work of a specific group throughout the whole lesson	The teacher significantly enhances the learning of the group they are working with throughout the lesson
	Use of Speaking and Listening	The teacher does not use Speaking and Listening strategies	The teacher makes use of at least one Speaking and Listening strategy	The teacher makes effective use of Speaking and Listening strategies to support learning	The teacher effectively uses a range of carefully chosen, effective Speaking and Listening strategies to enhance children's learning
	Range of learning styles catered for (VAK)	A range of learning styles is not catered for	There are opportunities in the lesson for the children to be presented with and respond using a range of preferred learning styles	Specific opportunities are present through the lesson for children to use a range of learning styles	A range of opportunities are planned through the lesson to enable children to use a range of learning styles, including differentiated choices that support specific preferences
	Lesson is well-paced	Aspects of the structure of the lesson are missing and/or the lesson over/under runs	The lesson has a clear structure and keeps on time	The lesson has a clear, appropriate structure that ensures that each section is built on the last and supports the next at a pace that continues to engage the children throughout	The lesson has an effective structure that injects a sense of determination and perseverance into the lesson
Children's Habits	Maximum involvement of children at all times	The children are not actively involved in their learning	The children area actively involved in aspects of the lesson	There are regular opportunities for the children to become actively involved throughout in the lesson	The lesson is planned and presented in such a way that the children are actively involved through out the lesson
	Dialogue between children & children and children & teacher promoted	There are few, if any, opportunities for the children to engage in dialogue	There are opportunities in the lesson for the children to engage in dialogue with each other and the teacher	Opportunities for dialogue are planned in the lesson and used to promote learning	Effective use of dialogue, including modelling, within the classroom ensures that all children have opportunities to express and discuss aspects of their learning, including with the teacher
	Independence encouraged	Classroom practices discourage independence	The children have opportunities to use skills of independence in the course of a lesson	There are regular opportunities for the children to work independently in the course of a lesson	Work in the class is organised in a way that the children must use skills of independence to succeed, while support mechanisms are also effectively used
	Response partners used	The children are not used to working with a Response Partner	Response partners are used occasionally through course of the lesson	The children engage actively with their Response Partner and the teacher uses Response Partners strategically to support the children's learning	The children make effective use of their Response Partner both when directed and to support their own learning
	Children demonstrate	Children do not have the opportunity to demonstrate	There are opportunities in the lesson for children to demonstrate what they have done and achieved	Opportunities for children to demonstrate are planned and used to support learning	Children's demonstrations are used effectively by the teacher to encourage, praise, support learning, model and support self-review, and to provide opportunities to extend learning
	Children carry out self-assessment	The children do not carry out self-assessment	The children have some opportunities to assess their own work	The children use the Learning Objective and Success Criteria to evaluate their own work and learning	The children use the Learning Objective and Success Criteria to effectively assess their own work, identify strengths and weaknesses and set targets

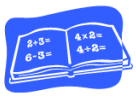
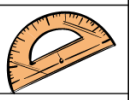
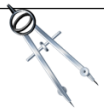
11.8- Short term memory test

DO NOT WRITE YOUR NAME

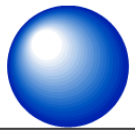
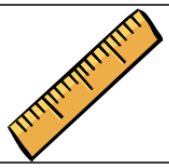
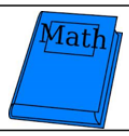
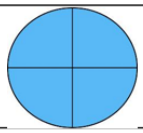
SHORT TERM MEMORY

TRY TO REMEMBER AS MANY SYMBOLS, WORDS AND NUMBERS AS YOU CAN

Extra marks for correct position

MEAN		84	NUMERATOR	
	ADDITION	52	FREQUENCY	
DIVISION	99		63	SOLVE
	25	RATIO	49	
ESTIMATE		56	FACTOR	36
	81	12		BIDMAS

- TIMES UP
- HOW MANY CAN YOU REMEMBER
- DO NOT CALL OR SAY ANY
- DO NOT SHOW YOUR WORK TO ANYONE
- THIS IS NOT A COMPETITION

MODE	π	64	DENOMINATOR	
	SUBTRACT	48	MULTIPLY	
SOLVE	76		33	SOLVE
	21	BIDMAS	42	
GRAPH		19	FRACTION	81
	100	16	%	ALGEBRA
