Supporting pupil premium attainment in science exams

Jacob Lean

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Submitted for the
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ABSTRACT

The idea for the study originated from my own experience of having to enact interventions in School A to increase the level of exam attainment of Pupil Premium pupils in Science. I wanted to examine the impact that the interventions had over the course of a year to assess how they would translate into gains in exam scores.

Three intervention types were trailed and evaluated by comparing the intervention group to a control group and the previous years results to see if there had been any effect. The intervention for the Summer School and Trips, Easter Revision and Breakfast Revision did not yield any statistical improvement for Pupil Premium students exam scores, but did produce a positive effect in attitude indicated in results from questionnaires. The intervention using a computer programmes called Tassomai yielded a positive result for Pupil Premium exam scores when compared to the control group and previous year's results.

The findings from this report will be used to inform further interventions in School in the following academic year.

ACKNOWLEDGEMENTS

I would like to thank my Head Teacher for allowing me the scope to complete interventions within her school. I would like to extend my sincere gratitude to the Head of Science and Pupil Premium Co-ordinator who have been instrumental in helping me complete this research. I would also like to thank the Science department for their patience and determination.

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1 INTRODUCTION

The following report discusses how School A utilises pupil premium funding to support pupils in Science to raise their attainment and narrow the gap between attainment for students eligible for pupil premium funding and their peers who are not eligible. This assignment explored various new and existing interventions used in School A throughout Key Stage 3 (KS3) and Key Stage 4 (KS4) pupils in the academic year 2014 - 2015 and how this affected pupils' attainment in their end of year exams. School A is a non-selective, mixed comprehensive catering for approximately 1650 pupils. It was recently found to be a "good school with many outstanding features" including "outstanding leadership and management" (OFSTED, 2014). The focus for this research was in line with School A's priorities for the academic year, which enabled collaboration with staff members to be facilitated easily, which in turn allowed access to entire year groups and interaction with senior staff members over an extended period of time. School A has recently been downgraded by the Office for Standards in Education (OFSTED) from "Outstanding" to "Good" because "the gap in achievement was not closed quickly enough between pupils receiving additional funding, and those who do not".

This issue is one that affects many schools and has been recognised not only within the education sector itself but in wider government as well. Consequently, it has become a government priority to raise the attainment of pupils who come from lower income families to be in line with their peers who have a greater net household income (this will be referred to as "narrowing the gap" throughout this report). This has given rise to this particular issue being noted in OFSTED statements in the report to the local authority (LA) where School A is based, and has even been raised an important issue reported by the Guardian national newspaper (2014). School A, along with many other schools with similar goals, implements various interventions using pupil premium funding with the aim of narrowing the gap.

School A has only recently appointed a Pupil Premium Co-ordinator to oversee the provision of pupil premium-related interventions across the entire school. In my role as deputy head of Science, I have recently put together a programme of interventions and assessed their impact on the science department. This approach has then been used as a single cycle action research project. The measure for registering an impact of the interventions has been structured end of year assessments, which allowed comparison with the previous year in which most interventions where not carried out in Science, and if they were carried out, how, if at all, the attainment in Science has changed. The end of year exams created by the school were based on SATs exams for KS3 which were customised for the topics the students had been studying that year or in previous years for KS3. The GCSE exams in Core Science, Additional Science and Triple Science followed the 21st Century OCR exam board syllabus that was used for KS4. The comparison of different interventions strategies, across the school cohort

enabled a review of the current system to take place, which in turn allowed reflection and adaption to the current use of pupil premium funding for the academic year 2015-2016. The scope for this assignment was very large, as School A had an average pupil premium share of 29% compared to a national average of 27%. This equated to an available budget for pupil premium intervention in the order of £400,000. For the purposes of practicality the impact of the most recent OFSTED report for School A was analysed in relation to the response of the Science department specifically. To maximise the utility of this research, the decision was taken to work very closely with the newly appointed Pupil Premium Co-ordinator, Head of Science, other science teachers and pupils themselves to implement different interventions for pupil premium-eligible children. The impact that these intervention strategies had on pupil attainment and narrowing the gap, was then assessed.

The key research questions that guided the following literature review were:

1) How does national government policy affect implementation of policy in schools regarding low Social Economical Situations (SES) pupils?

2) What is the current understanding of the impact that pupil premium funding has for pupils from lower SES, with consideration to government policy?

3) What pupil premium interventions have had successful outcomes at narrowing the gap and what were their impacts?

The key questions for the action research cycle in School A were:

4) How do pupil premium interventions affect narrowing of the gap in SES pupil attainment in Science exams?

5) Which interventions led to the greatest narrowing of the gap (the most impactful) and reasons why this was the case?

6) What decisions led to the use of intervention strategies in the Science department?

2 LITERATURE REVIEW

2.1 Methodology Of The Literature Review

In order to develop a research strategy for this assignment it was necessary to establish the key terms that would prove useful in providing a direction for the project. To this end, to set the context for this research, the database ERIC was searched using the key search terms; "pupil premium," "free school meals," "summer school," "academic achievement," "computer-assisted instruction," "instructional effectiveness," "meta-analysis," "science education" and "quantitative measurement". The use of PsycINFO and the universities database SOLO were also utilised to gather background information. The government-funded initiative specialising in the research of pupil premium spending, the Education Endowment Fund (EEF), was also used as a tool to identify relevant research articles regarding the evaluation of pupil premium interventions. Articles and resources were then down-selected that had quantitative measurement or that contained a reference in the title or abstract, and where possible studies that contained quantitative analysis were used. It was also aimed to track the changes to policies that the different governments have enacted in recent years (since

1997) including the theoretical basis for doing so and the evaluations of their impacts to help frame the current policy of pupil premium.

2.2 Literature Review Research Questions 1 And 2

In order to answer the first literature research question (below), the areas concerning the driving forces capable of enacting change on a large scale, namely OFSTED and Government initiatives were evaluated.

1) How does national government policy affect the implementation of policy in school in schools regarding pupil premium?

The standpoint of OFSTED and relevant government policies were used to highlight the nature of the need for Pupil Premium, which enabled the second literature review question (given below) to be investigated:

2) What is the current understanding of the impact of the need for funding pupils from lower SES with consideration to government policy?

2.3 OFSTED and Inspection

Educational practice has been open to scrutiny for many years, but has in recent times become popularised with holding individuals and organisations to account publically, across the country. The Education Reform act in 1988 lead to a pseudo free market in which parents could choose a school based on a wealth of published data (Kogan, 1988; Fidler, 1989; Wilcox & Gray, 1996). This position on education was later

galvanised by a conservative government's policy on raising standards in schools through regular standardised inspections. This became a reality in the formation of a non-ministerial body in the summer of 1992. Shortly after this came into force the age of what Norris (1998) described as 'the evaluation culture', where evaluation procedures and processes were a routine part of management and administration became fully entrenched in U.K. culture.

From their inception OFSTED or as it is now known, Office for Standards in Education, Children's Services and Skills, was a force for radical change in the education sector. Their increased 'at-arms-length' inspections (Lee and Fitz 1997) provided many things including:

> *Increasing the amount of information, both objective and subjective, available to parents. Providing a professional judgment of how a school is conducting itself. Highlighting areas for the school which are examples of good and poor practice. The School was to provide an action plan for how it would improve its practice.*

By judging all schools by the same rulebook, direct comparisons between schools could be made. These new performance indicators have since been used to develop a measurement of quality of a school, which has led to funding decisions being made, changes to the delivery of services, and in some cases, which agency provided those services (Ousten, 1997). Consequently, in the 1990's the education sector underwent a period of external examination on a scale unparalleled in the modern world (Wilcox & Gray 1996).

How this information on school quality was provided and to whom it was provided, also evolved over time. For example, reports to Head Teachers on the best and worst performing teachers in their school, using a 7-point scale was commonplace. These conversations and feedback were often private with the Head Teacher, who was responsible for acting upon and disseminating this information to the relevant staff affected. Inspections where originally all completed with a school being given many weeks' notice prior to an inspection (Ousten, 1997). This resulted in a side effect of inspections, whereby schools changed typical behaviour by 'window dressing' for the inspection by preparing students (de Wolf & Janssens, 2007). In an attempt to overcome this un-representative behaviour, schools are now given less than 2 days' notice before an inspection team can attend. This was extremely prevalent in the government's commitment to social justice and improvements in exam results of pupils from lower SES background were observed.

Following a new round of governmental education initiatives, and a new name for OFSTED, a new statute was produced, The Education and Inspections Act 2006. This initiative promised more data to help in the campaign against inadequate education provision and to ensure parents played a major part in shaping the school system. The formation of a new government website RAISE, provided unparalleled access to information about a national status of educational results. This gave schools the ability to carry out self-evaluation based on evidence, which constituted a major part of the inspection process.

The notion of 'improving through inspection' has now become synonymous with OFSTED. Indeed, recent OFSTED reports showed that 90% of schools previously judged to be inadequate displayed improvement upon their next inspection (OFSTED 2009/10). A somewhat surprising result reported by Fidler (1998) was that OFSTED inspections have generally been accepted as a necessary accountability mechanism by schools and others. The motivations for these opinions have been varied, with most of these results being collected by post in 1996, with other major conclusions being drawn from a small sub-group that was further questioned via telephone.

Perhaps the most crucial part of an inspection, regardless of what is being inspected, is the feedback. It is from this summative assessment that schools are required to complete an action plan and subsequently improve on their practice. If an OFSTED inspection was not beneficial then there was simply no reason in conducting it. It is the degree of benefit that researchers are currently working to illustrate. The use of OFSTED to decrease the gap in attainment of low SES pupils, termed Pupil Premium pupils and their non-SES counterparts, was the impetus for the following report.

2.4 Is The Pupil Premium A New Invention?

There had been a small number of schemes before the Pupil Premium scheme, including Excellence in Cities (EiC), Every Child Matters (ECM) in the U.K. and the equivalent policy interventions in the U.S. (No Child Left Behind (NCLB)). Pupil

premium originated from research conducted that indicated pupils from lower SES backgrounds do not achieve as well as there more well-off peers (Blanden and Machin, 2007; Schoon, 2006; Feinstein, 2003). A more recent analysis of each policy highlighted a top down approach which leaves the government or local authority responsible providing funding for schools in deprived areas or schools that contain a large number of pupils that are from deprived backgrounds. The aim of this approach was to remove 'lag in education,' in more commonly terms the 'gap' that these pupils suffer from, when compared to pupils from a higher SES background.

This gap is first apparent during early child education (Feinstein, 2003) and is continually present until the pupil leaves formal education. By this time the pupils have been the product of an education system that is not tuned to their circumstance and they are therefore not well served by the system. This lack of tailored support would lead to the pupil achieving a work life provision of less than those pupils that had gone through the same education system and had come from a higher SES background (Feinstein, 2003). This social injustice that permeates schools in deprived areas is something that has been politically important and important for society for many years. It is widely accepted that a more highly educated society has a numerous socio-economic benefits (CED, 2006) and results in young adults of working age having the potential for higher earnings (Chevalier et al., 2005; Blanden et al., 2004).

2.4.1 Early Government Policy - EiC

The achievement of secondary school pupils from a lower SES background has been noted by OFSTED as key concern leading to the need for intervention (OFSTED, 2013). There have been policies previous to EiC aimed at trying to raise the standards of education in order to close this gap. However, schemes such as Educational Priority Areas, Urban Compacts and Education Action Zones, have faced a variety of challenges and Mortimore and Whitty (1997) characterised historical intervention quiet harshly:

> *Most formal education systems have failed pupils whose families are disadvantaged.*

This criticism did not go unnoticed by governments, and indeed this was recognised by the 'new labour' government of 1997 which enacted the policy as:

> *Successive Governments have failed to resolve the educational problems of the major cities. Standards have been too low for too long. Raising standards in order to lift opportunities for our children is the key priority for the Government. It is clear that schools in our inner cities demand urgent attention. (Gulson, 2005)*

This gap in attainment was most prevalent in cities as these areas contained the highest concentrations of pupils from lower SES backgrounds (Carpenter et al., 2013). The main focus of EiC was to increase standards in schools and promote inclusion for pupils within the school environment. The project ran from 1999-2003 through a series

of phases including more and more cities over time. The project focused on five main strands, which centred on crediting or altering infrastructure in the locality of the schools in city areas. This was completed via Gifted and Talented (G and T) support, learning mentors, learning support units, a network of city learning centres and action zones and finally, expansions of the beacon and specialist schools programme. The programme had some degree of success and demonstrated some improvement in attainment for pupils in national KS3 exams. It was reported that the raise in pupil achievement was higher in schools that had shown high levels of engagement with EiC partnership. This scheme provided on average around £120 per pupil per year. This figure can be easily put in the context of being worthy of the funding when considered alongside the increase in attainment at GCSE using the method Machin (2010) highlighted. This method is considered a relatively simple test of relating the economic translation of higher grades to higher wages. Machin (2010) summarised the current literature as assuming that an average rate of return of schooling to be around 8% for every year of schooling in terms of final salary. This number was arrived at by using the Family Resources Summary Database, using the wage profile for different jobs with people who had different levels of schooling. This means that for a lifetime benefit of £20,000 a 14-year-old pupil would have received an 'extra' year of schooling and left school to work at age 16 years old. Of course, time cannot be just conjured from nowhere, and indeed it is not the case here. The 'extra' year of schooling comes from the fact that 1 level of progress using the national curriculum levels would equate to approximately 2 years of schooling. So by increasing the attainment of a pupil relative to their target, this gain in time can be achieved.

When considering the results of the EiC quantitatively, different results were reported dependent on the Key Stage considered, pupil characteristics and school characteristics. The largest impact from EiC was reported for Mathematics at KS3 in schools considered the most disadvantaged (Machin, 2010). This was derived by comparing schools which were part of the EiC programme and those which were not, taking into account different school and pupil factors, but the programme mainly focussed on end of KS2 results. The average reported effect was an increase in the achievement in mathematics by 0.01 of a national curriculum level, after having been exposed to three years of the programme. Using a policy cost-benefit analysis using the information mentioned previously, one can use a simple calculation of average achievement increase multiplied by 2 years would yield the cost of the policy over its life time. This is from the assumption that two years of schooling equates to one level increase of the national curriculum, which would give you a result of 0.02. When you factor this as a proportion of the total increase in wage earnings over that schooling it would be given by the factor increase multiplied by £20,000. This allows us to arrive at an average benefit of £400 (0.02 x £20,000) of increased wages in the population affected by the EiC policy. When you compare this to the total cost of the policy, which would be £120 multiplied by 3 years (the length of time used to give the average effect size) you arrive at a total policy spend of £360. This is very close to the perceived benefit of the EiC programme (£360 policy cost for a £400 rise in lifetime wages).

It is interesting to note that there was no evidence that the EiC had an impact on levels of attainment in English or Science, which would have had assessment at KS3 (Machin, 2010). The EiC also did not correlate with attainment at the end of KS4 in the areas that the policy was enacted.

The criticism or more likely cooling of the potential gains of the EiC programme are contextual. Schools were also in the spot light from politicians through OFSTED to increase the achievement nationally of low SES pupils, whether or not they were in an EiC area, meaning the EiC could not be considered as an isolated mechanism. The evaluation criteria for whether the programme met its targets was designed early in 2000, even though the programme continued until 2003 and took many different turns, and put a greater emphasis on the inclusion of pupils. Another methodological criticism of the review of EiC comes from the fact that schools in less challenging circumstances where less likely to respond and participate in the evaluation. This meant that the effect size of 0.01 could have been over reported. Another drawback of EiC was that pupils with high levels of absences and/or low levels of literacy in EiC schools were not represented due to not completing the questionnaire.

2.4.2 The next Labour government initiative - 2003 Every Child Matters

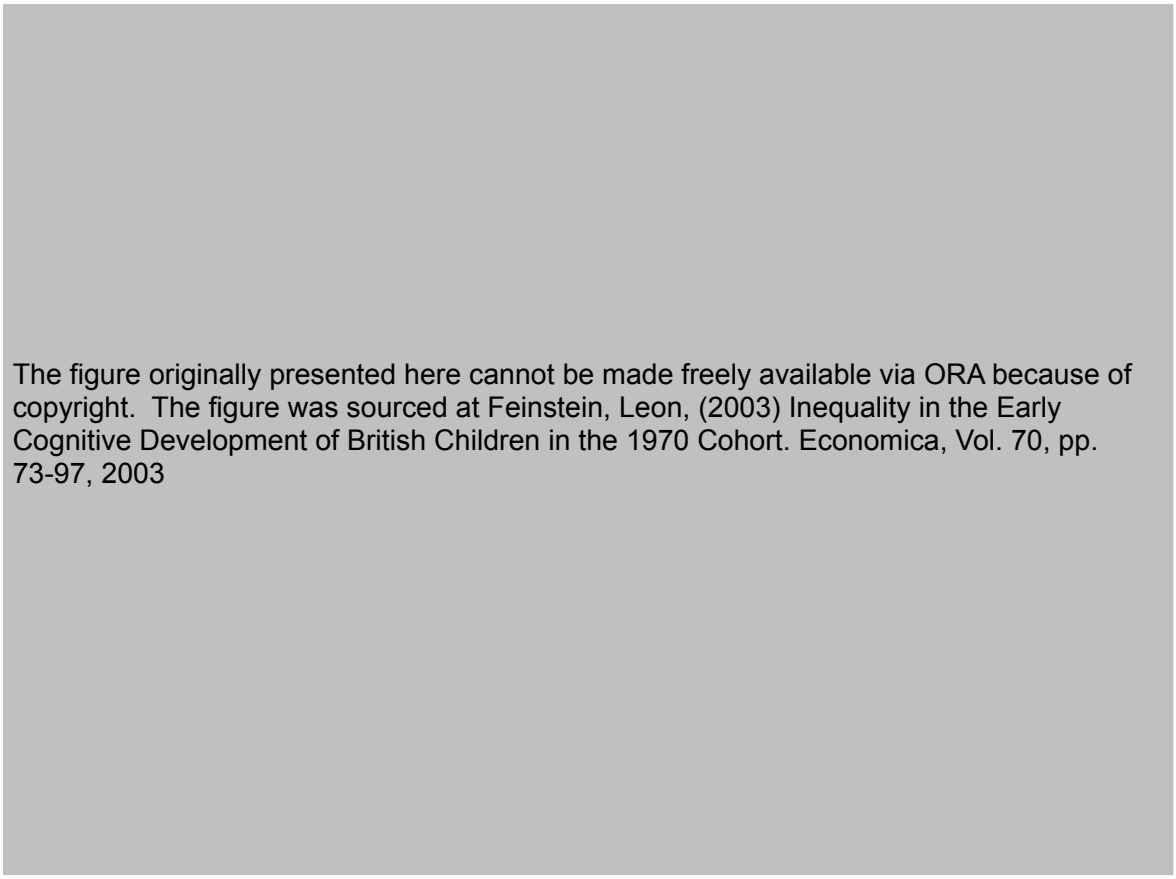
Whilst the EiC programme delivered relatively successful quantitative results for the specific areas targeted such as maths, it still needed to achieve its targets in English and Maths and to also penetrate into groups other than the G&T strand. Every Child Matters (ECM) sought to also further impact pupils that were in English As additional Language (EAL) categories. In the five years since the EiC phased introduction, the proportion of 11 year olds achieving targets in mathematics and English increased from 63% to 75%, with GCSE A*-C increasing by an average of 6% (DCSF, 2007). But how much of this can be accounted for with by the influence of EiC is debateable -

considering the criticism levelled by Hanushek (2003) of exogenous determinants - factors that are outside the remit of the policy intervention that cannot be controlled for effect or separated from the outcome, it had perhaps a relatively small impact.

ECM was created in the climate of horror at the death of school pupil Victoria Climbie, leading to massive public outcry at how the case was handled and the government policies regarding safeguarding and education in general. As such, the Labour government of the day felt under pressure to act with a new policy announcement. It is hard to distinguish the funding received per low SES pupil aimed at increasing attainment at KS3 and GCSE from funding designed to improve the social justice of the pupil - to improve standard of life, lower conviction rates, increase health amongst others; all of which one would expect to have a positive impact on attainment.

The ECM scheme prioritised parental influence to increase attainment at school, as research seemed to indicate that early intervention by parental influences had a potentially significant effect on attainment (Feinstein, 2003). Leon Feinstein's work was very influential at the time and persuaded government policy implementers to use the recommendations as part of the research basis for ECM, this resulted in the work being included in the final policy document. Feinstein (2003) produced a distilled version of his research, which took place from birth up until 26 years old, creating data points at 22 months, 42 months, 5 years, 10 years and 26 years. Early data was primarily collected to study the effects of foetal malnutrition, hence why the separation of data for twins, post-mature babies and small for dates babies (a baby under the predicted birth weight), as these were seen as the most at risk for the original study. Feinstein did highlight two major issues with his data, firstly that 27% of

the 10% random group suffered from an attrition rate of over a quarter (27%). The second issue was that of the original intention of data collected, which was designed to capture an understanding of foetal malnutrition but which actually posed a source of possible bias. The bias in the sub sample comes from the possibility that foetal malnutrition is indeed linked to performance in developmental tests (Feinstein, 2003). But as the data was analysed independently of each subgroup mentioned previously, it was reported that no major divergence between the results was evident in the subgroups. There are of course issues when relating the performance of young children that do not stay on task for long periods of times, and the fact that physical maturity will also lead to differences in how the children can be assessed quantitatively. Feinstein attempted to control for this using the work of Zeanah *et al*. (1997) to allow symbol and verbal representation after 22 months, although different tests were used to assess performance at each stage leading to another possible criticism and caveat of using the data. The use of rank position rather than raw test data was also used to increase stability of the results.



The influence this data has had on government policy should not go unchallenged.

The largest criticism that has been levelled at Feinstein's work was from Jerrim & Vignoles (2011) research into the misuse of statistics in understanding social mobility. They argued that Feinstein work was a clear example of the statistical problem of regression to the mean; that the first measurement might seem extreme, but subsequent measurements lead to a closer set of results to the average on its second and subsequent measurements (Barnett et al., 2004).

Another possible flaw in the methodology used by Feinstein is the use of a single data point at 22 months to distinguish children into different categories of high ability - low SES and low ability - low SES, based on the distribution of test scores. An example would be a child that scores 20 in the initial test at 22 months leading to them be

labelled low ability - low SES indicated the average child in this group would occupy the 20th percentile as a function of the age of the child. A score of higher than 20 in subsequent tests would indicate that the position in the test ranking has increased.

A further methodological weakness of Feinstein's (2003) work is the possible distribution of test scores that a pupil might score at a given time. This effect is not controlled for, and could lead to the pupil being entered into a higher ability group or vice versa when in fact their test results were not something that could be replicated (Jerrim & Vignoles, 2011). See Appendix A for a graphical representation of this reproduced from (Jerrim & Vignoles, 2011).

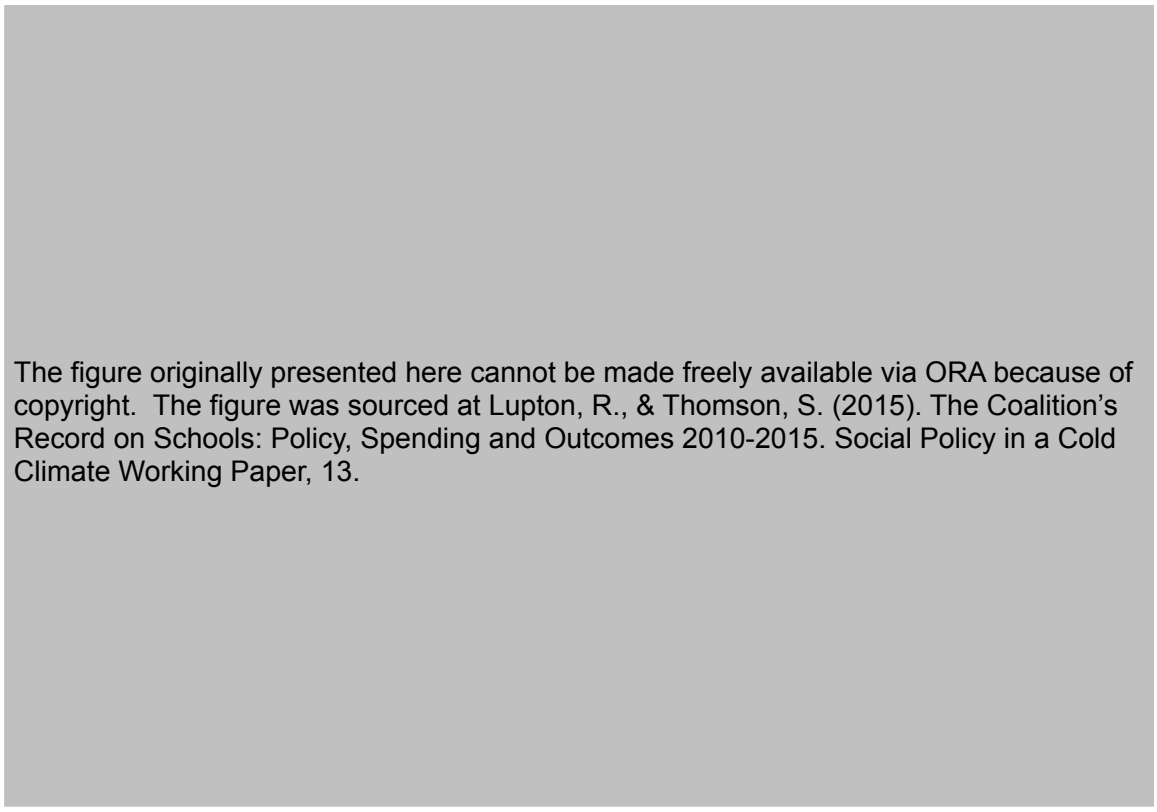
Despite these issues and limitations these results of Feinstein have been used to both evaluate and drive policy decisions based on low SES performance nationally. This work has played crucial roles in supporting major national reviews including; Poverty and Life Chances by Frank Field MP (Field 2010), the Marmot Review of Inequalities in Health (Marmot et al., 2010) and the Social Mobility Strategy by the previous coalition government.

The legacy of the Blair-Brown Labour government was one that led to some gains in national achievement for GCSEs. By the end of the government 76% of pupils in England made the benchmark of 5 A*-C grades compared to 45% in 1997. Data points including English and Maths were included from 2005 when the government started to collect this information. This shows a raise in 5 A*-C including English and Maths from 44% in the school year of 2005-2006 to 54.8% in the school year 2009-2010.

The gap in achievement for low SES pupils - defined as those that are eligible for Free School Meals (FSM) and those who are considered high SES (not eligible for FSM) dropped from 30.7% in 2003 to 20.2% in 2010. When this data is extended to include English and Mathematics a much smaller drop of 0.5% is noted, falling from 28.1 % in 2006 to 27.6 % in 2010 (Lupton, & Thomson, 2015). This improvement in England was not shared by international standards when compared to the attainment gap that they sought to close (Jerrim, 2012). This led to the common criticism that GCSE exams were of a lower quality than exams in the past. This criticism gained traction in national news agencies, with the most prevalent criticism being levelled at schools that were offering lower SES pupils 'easier' courses, which were usually vocational courses such as BTEC Science. This was done with the aim to raise low scores some schools had in national league tables (Wrigley & Kalambouka, 2012).

2.5 New Government - New Policy - The Pupil Premium

Despite the apparent success of previous government policies, the new coalition government decided not to continue under the ECM umbrella for funding SES pupils. Whilst results of this programme showed progress in national exams, this was not reflected in the Programme for International Student Assessment (PISA) tests.



Before the general election of 2010, the Conservative party drew a lot of attention to the apparent 'evidence' of the U.K. educational performance decline relative to other countries, mainly based on the PISA test. The Department for Education (DfE) linked this to the lack of national social mobility and the effect it would have when our children had to compete in global labour market. It was quite surprising then, that they had said that despite the increase in funding for those pupils of low SES standing, no performance increase in international standings can be reported (DfE, 2011c). But of course, this might have been just the party in opposition trying to undermine the previous governments policies and record. In fact, more rigours analysis of the international data suggested there was no correlation within the data, suggesting no decline or improvement relative to other courtiers. Moreover, there was some improvement for low SES pupils (Jerrim 2012a; Smithers 2013). In 2012, the Chair of the U.K. Statistics Authority, Mr Dilnot, wrote to the Secretary of State expressing

concern about the conclusions that were being drawn from the statistics and urged a more careful interpretation.

The coalition government then decided to remove the ECM policy of the previous government and replace it with a policy of their own (Lupton & Thomson (2015)). The pupil premium is a term used to describe an educational policy first enacted in April of 2011 (DfE, 2011). The aim of this policy was to give schools direct control of funding, found outside the education budget, to target disadvantaged pupils (Lupton & Thomson (2015)). These are pupils who have been registered as eligible for free school meals and/or had been looked after for 6 months or longer. The amount that was initially offered to schools was £400 per year per child giving a total national spend of £625 million. The provision for pupil premium was changed the following year when it was announced that the eligibility criteria had been opened to any child that had been eligible for free schools meals at any point in the past 6 years, which was termed the Ever6 criteria. Funding allowance per child was also increased and split into 3 bands; £1320 per primary school aged pupil, £935 per secondary school aged pupil and £1900 per pupil who had been looked after for one day or more, adopted from care or had been placed in care under a special guardianship order or child arrangements order (Lupton & Thomson (2015)). This led to a massive increase in the total national pupil premium budget to £2.545 billion. This increase in funding created an accountability measure for schools to adhere to with a change to the inspection practice of OFSTED to particularly target the exam progress of pupils deemed eligible for pupil premium funding and those that are not. This accountability of schools was also highlighted in the decision to include the attainment of pupil premium funded students in performance tables highlighting the progress each child makes from primary school

and the gap in attainment between those pupil premium funded students and their non-pupil premium peers.

It should be noted that this is similar but distinct from the government policy to supply schools with additional funding for the children eligible for the service premium, who have a parent actively serving in the armed forces or within the last 3 years or if a parent had died whilst serving and is the recipient of a pension under the Armed Forces Compensation Scheme and the War pensions Scheme. The amount a school has to spend is currently £300 per pupil paid directly to schools.

In addition to the funding schools can secure from the DfE for pupil premium, the government has launched a relatively new initiative to further boost interest and to share best practice in using the funding by creating the Pupil Premium Awards. This award scheme provides schools with the ability to enter into a competition to win additional funding based on how they prove the beneficial impact of current spending of Pupil Premium funding.

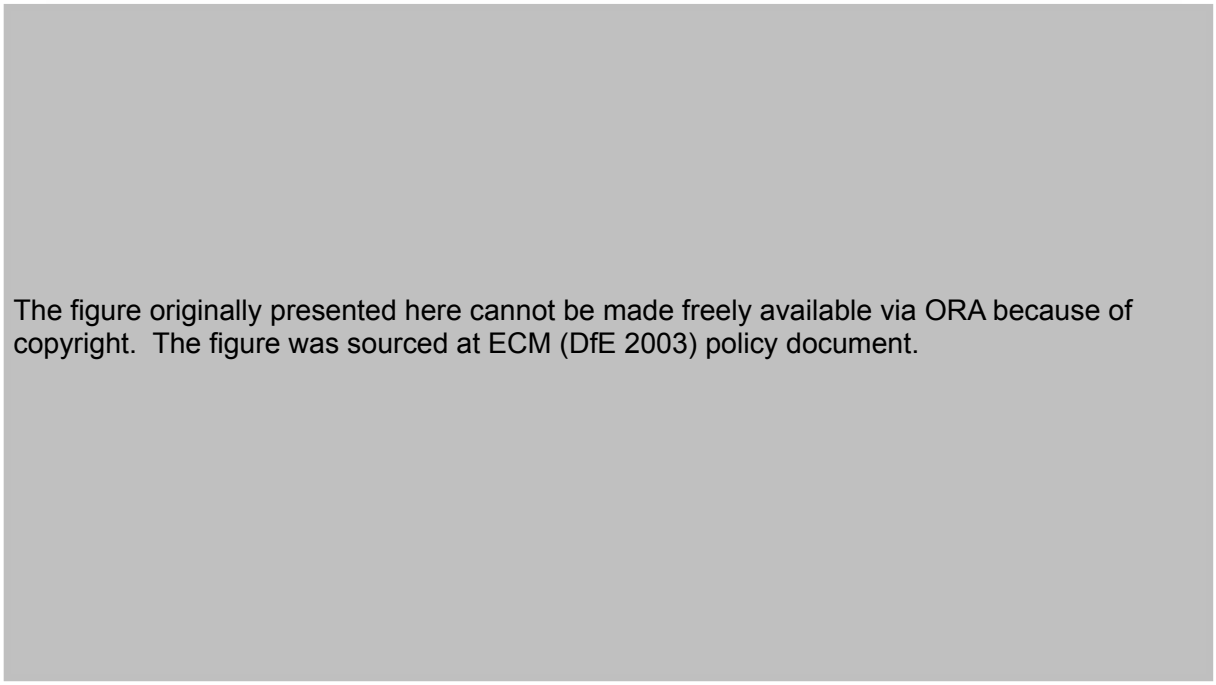
2.6 Literature Research Question 2 – A Detailed Review

The preceding policies of previous governments to outline the foundation on which the Pupil Premium has been created have been outlined in this report thus far. The second literature research question (shown below) discussed herein explores reasons why the U.K. has a requirement for a pupil premium in the current socio-economic climate.

2) What is the current understanding of the impact of the need for funding pupils from lower Social Economical Situations with consideration to government policy?

2.6.1 Why do we need Pupil Premium?

Previously outlined in this report was the basis for a need for some sort of intervention to help low SES pupils achieve as well as their more well off peers (Goodman and Gregg, 2010) accompanied by DfE statistics (DfE, 2011). The graph below shows the progression of the attainment gap between ages 7 and 14:



The fact schools need interventions to achieve this goal of closing the gap is not up for debate, however, the means by which the successive governments have attempted to solve this problem is not so clear cut. Many commentators have noted that the scale of the governments' ambitions for education have been monumental and ambitious. This is a common view shared by both those in favour of the changes to academies outside

of Local Authority (LA) control and those who are not in favour of this, with West and Bailey describing it as:

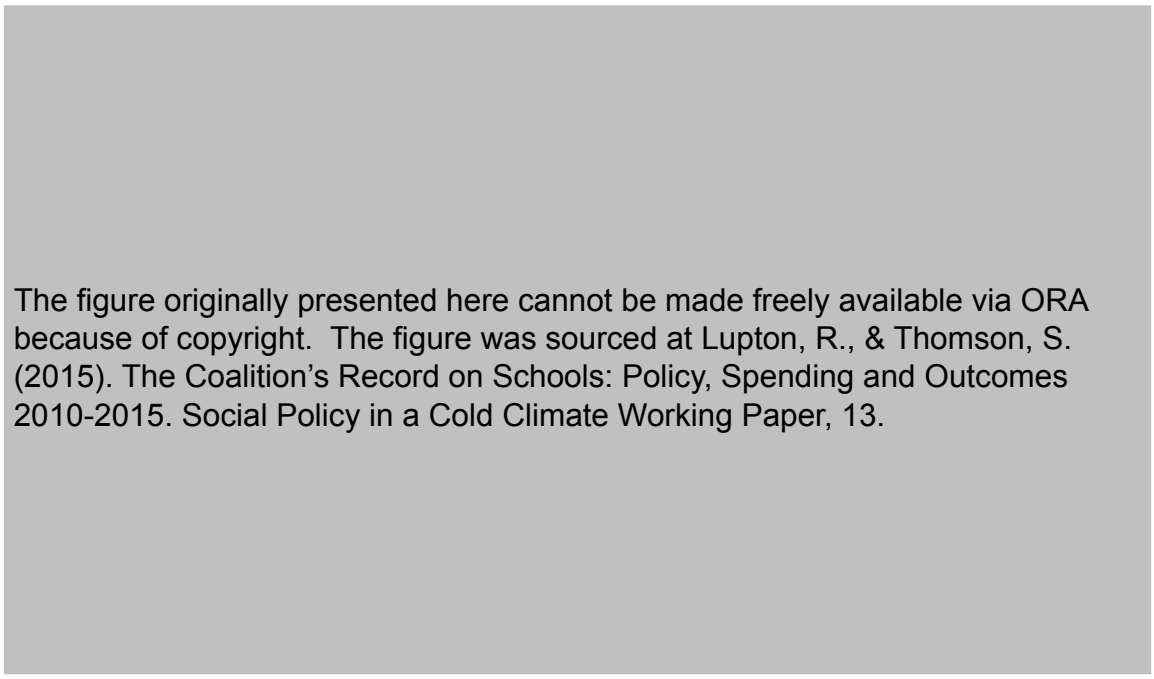
> *"the school-based education system in England changing radically from a national system locally administered via democratically elected local education authorities to a centrally controlled system with Secretary of State having legally binding contractual arrangements with an increasing number of private education providers. The speed and extent of what is in essence a form of privatisation –the transfer of responsibility from the public sector to actors outside it - has been remarkable".*

The rate of change is not something the collation government had anticipated. With initial financial calculations indicating a conversion rate of approximately 220 schools per year into academies outside of LA control, actually resulted in that number being closer to 650 schools per year (or approximately 1300 in the initial 2 years). Whilst there have been numerous studies highlighted on the Educational Endowment Fund (EEF) website that have shown the positive effect that money spent on interventions can have, most quantitative results reported are from standardised tests. The problem with this methodology is that it doesn't accurately take account of gender, culture or English as an additional language (Gardner, Holmes & Leitch, 2009).

The next problem considered is whether or not schools need a Pupil Premium. By separating the effects of different government policies such as, Child Benefit, Sure Start and other literacy and Numeracy strategies (Hanushek, 2003) one can explore this question. This is clear problem and a possible topic for future research.

The myriad of policy changes can also have an effect on their implementation in schools, which is a challenge that School A has had to deal with. When this challenge is coupled with the changes in Senior Management Teams (SMT) over the decades, the understanding and awareness of which government policies to take advantage of, and which methods are the best for doing so can become lost.

Despite the aforementioned poor use of statistics by the DfE, and not for the first time as also mentioned previously, the overall government policy of the new funding strategy has not been met with the same increase in low SES pupil attainment, as shown in Figure 4. This apparent reversal in achievement does have many contextual factors mentioned previously, but it does highlight a worrying trend in 2014 for low SES student achievement at KS4 2010 levels of achievement.



2.7 Summary Of Literature Research Questions 1 And 2

Policy 'evolution' and 'metamorphosis' of the successive Labour governments provided an interesting story of how funding for low SES pupils in the U.K. has changed over the past 18 years. This has had a massive impact on the amount of funding available for schools to utilise. Some government polices like the EiC have delivered substantial benefits when related to the investment cost of the policy. Subsequent government policies have continued to highlight low SES pupils are a group that needs funding to improve attainment in order to close the gap, however, these government policies have been based on flawed statements or statistics.

The true legacy of the coalition government's Pupil Premium policy when compared to previous government polices cannot yet be properly reviewed due to the amount of data available (due to the rapid change in pupil premium funding). But as will be reported in the upcoming section, the interventions that are being funded on the recommendation of the coalition government, the use of this funding has changed dramatically from central government control to LA control, to individual Head Teacher and other SMT control within a school. Whether this will demonstrate a better low SES pupil performance, only time and further rigorous quantitative analysis will provide the answer.

2.8 Successful Pupil Premium Interventions?

In order to answer my third literature review research question a number of research articles and quantitative meta-analysis to outline Pupil Premium spending that have resulted in positive pupil outcomes were reviewed. The third and final literature research question is given below:

2) What interventions have had successful outcomes at narrowing the gap and what is their impact?

2.8.1 Extended Time in the School Environment

Research in the U.S. and U.K. has highlighted that extending school learning time need not only happen in the summer holidays, but also within the normal school terms (Zief et al. 2006, Cooper et al., 2003, Baker et.al. 2004 Kidron & Lindsay, 2014 Crawford, 2011). Again, the factors that influence the effectiveness of this intervention are whether the student is low or high SES. Kidron & lindsay (2014), completed a meta analysis of over 7,000 studies and selected 30 which could yield quantitative data sets from which to estimate an effect size. These analyses were divided into four main areas, literacy and maths achievement, academic motivation and social-emotional development. Kidron & lindsay found a positive effect for mathematic achievement, but a negative overall effect for literacy achievement, both of which were within the error of being statistically insignificant. The main issue highlighted in this study was the need for robust evidence analysing the quantitative effect of extra time spent in schools during the day or summer holiday.

The learning decline over the summer months is a phenomenon that has been known about and researched relentlessly (Cooper et al., 1996). The effect will depend on the student, with an average SES student losing 1 months worth of skill in maths and reading over the summer holiday, where as a low SES pupil would double the rate of loss (Cooper et al,. 1996). The most extreme decline was reportedly three months in reading skill loss in low SES students, equating to approximately a third of the time they would spend in school (Cooper et al,. 1996).

The apparent solution to this problem is to not let school end in the summer, but instead continue to provide some school based learning opportunity. Cooper *et al.*, (2000) found that over 93 studies that contained quantitative analysis, an average effect size of 0.19 was prevalent. This affect was more evident in pupils who were high SES pupils than low SES pupils (Cooper et al., 2000). Other studies have found similar effect sizes for low SES students being, d=0.22 (Maxwell et al., (2014)), d=0.17 (Togerson et al., (2014)) both projects funded by the EEF and focused on literacy, with no reported gains for the mathematics intervention by Maxwell *et al*., (2014).

So whilst the strength of evidence suggests that a gap in achievement is created by the absence of school in the summer holidays, interventions have been shown to reduce the effect of this mainly for English in terms of reading and writing (Kidron & Lindsay, 2014 Lauer *et al*., 2006, Maxwell *et al*., 2014, Togerson *et al*., 2014, Gorad *et al*., 2014a). The effect size indicated that three months gave rise to additional progress, compared to pupils who did not attend the summer school. However, this is severely limited in terms of the number of pupils who took part in recent studies, leading to statistically insignificant effect sizes. Togerson *et al*., (2014) recognised this fact citing

'chance' as relevant causation as the intervention itself. A similar criticism can be brought to Gorad *et al*., 2014a which suffered form an over 50% lack of uptake and subsequent dropouts, leading to possibly biased findings in terms of pupils who would actively engage with a summer school programme.

Day *et al*., (2013) produced a report for the DfE on the use of summer schools for Pupil Premium pupils, which highlighted the positive impact reported in terms of confidence and behaviour and relationship between the staff and the pupils. But this conclusion is not soundly based on a large data set, as only two schools questionnaires responses were used. This type of intervention is a costly one, with the total cost per pupil being around £1500 (Gorad *et al*., 2014a, Togerson *et al*., (2014)). This intervention could use an entire pupil premium fund for a child in primary school. These findings that were based on mixed literature reviews using low samples of pupils who were mainly primary school students, might not be a good use of pupil premium funding.

2.8.2 Interventions using ICT

The use of digital technology to help raise the attainment of pupils has been well documented (Kulik, J. (2003); Liao, Y.C. (2007); Crook (2010); Camnalbur & Erdogan (2010); Li & Ma (2010); Cheung & Slavin (2011)). Government policy in England and Wales on Information and Communication Technology (ICT) in schools has been heavily influenced by a series of non-randomised controlled studies. Torgerson, C.J. & Elbourne, D. (2002) completed a systematic review and meta-analysis of the effectiveness of these trials. It was reported that a statistically insignificant effect size

(Effect size =0.37, 95% confidence interval=70.02 to 0.77, p=0.06), when 6 of the 7 studies had their results pooled. However, the focus for this analysis was the improvement of learning spellings, which showed no statically significant improvement over more traditional methods. The limited amount of studies and the time in which this review was made would have influenced the study, perhaps indicating that modern computers have vastly improved and the need for new research in this area, ideally large randomised controlled trials.

Bayraktar S. (2000) used a meta-analysis and investigated how effective computer-assisted instruction (CAI) is on student achievement in secondary and college science education. The comparison was drawn between this new type of instruction and what was deemed to be more traditional teaching methods (not using CAI). The effect size reported overall was 0.273 and was calculated from 42 studies. Using 108 different effect sizes, and average student moved 12 percentiles (from 50th percentile to the 62nd) in Science with the use of CAI. The duration of the CAI intervention, the student to computer ratio and the mode of the CAI were deemed important factors in determining the CAI effectiveness.

2.8.3 Interventions Designed to Raise Aspirations

There have also been a number of researchers which have recently asked the question of raising aspirations of low SES pupils and linking this to a possible effect of raising standards, but not enough to create a clear casual relationship between interventions and pupil educational outcome (Lupton & Kintrea (2011); Doyle & Griffin, (2012)).

Cummings *et al*., (2012) conducted a systematic review and reported a range of effects on attainment from a number of different factors that have been known to effect the aspirations of pupils, namely parental influences, mentoring and extra curricula activities such as school trips. The effect size for parental involvement of the 60 studies reviewed went from 0.17 to 0.45 for attainment. The results reported for mentoring scored effect values of 0.09 to 0.22 and from 0.03 to 0.09 for extra-curricular activities. Again, the similar criticism of each intervention influencing each other such as parental involvement in reading or academic mentoring interfered with the separate reporting of each area.

2.9 Summary Of Literature Review Question 3

The interventions recommended by the EEF come with 'health warnings' regarding the analysis on which they are based. Some areas such as the use of ICT in the classroom have not been explicitly and statistically evaluated with respect to Pupil Premium funding indication a gap in the literature for future investigation.

There are a number of promising factors that will form the basis for interventions in School A to increase the attainment in school exams.

The literature has provided background and direction to investigate my action research questions in the yearlong cycle. The limitations to the investigations will be discussed in a later section, but by answering the questions detailed below, it is the envisaged

that this report will provide, for the first time, a detailed quantitative analysis of the use of Pupil Premium funding in School A to reduce the attainment=ent gap between Pupil Premium students and their peers in Science exams.

The following sections detail how the investigation was approached using the following key research questions to guide the research:

4) How do the interventions affect the narrowing of the gap in pupil premium attainment in Science exams?

5) Which interventions led to the greatest narrowing of the gap and why this is possibly the case?

6) What decisions led to the use of intervention strategies in the Science department?

3 METHODOLOGY

3.1 Action Research as tool for evaluation

The aim of this study was to use the literature I had reviewed in conjunction with various members of my school to enact and evaluate different pupil premium-interventions that have been used in the Science department. Interventions were chosen with the aim to have the largest impact on pupil premium students, as this was a course for concern with the recent OFSTED report, as discussed above. Whilst it was not highlighted with the report itself, the Science department does have a large pupil premium gap in achievement at various key stages.

The investigation was undertaken as one large action research cycle, with the evaluation of the interventions being completed in the following academic year, to provide the starting point for the next cycle, which would either reinforce interventions, which had shown positive results, or to guide investment in new interventions. The action research was conducted in line with Altricher, Posch and Somekh (1993) work, with clear starting problems, frames of reference and evaluative criteria.

This was also used as a framework in my reflections to try and determine the situational influences on the results and attributing factors, which may have also played a part in the findings. Action research is a widely used tool and has been defined by (Reason & Bradbury 2001, p1), is:

> *a participatory, democratic process concerned with developing practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview which we believe is emerging at this historical moment. It seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities.*

This is an important definition which has had a large influence on the methodological choices made, which are outlined in the next section. The genesis of this project was to help the community of School A and every member that is part of it. It was anticipated that the pupils would benefit by having tailed interventions, which would be proactively evaluated. It as also envisaged that the teachers would be able to prioritise their time using interventions so that they could have confidence in their school setting. Another aim of the study was to provide the senior members of School A with a robust evaluation of the money being spent for pupil premium and provide proof for OFSTED of the framework they use to monitor the impact in Science. Brydon-Miller *et al*., (2003), made a critical point when discussing the use of action research; all action researchers were dissatisfied with the current state of affairs and sought evidential solutions to those problems.

In the following section the different year groups and the interventions that have been used will be outlined. The motivation, practicalities and contextual reasons for using certain interventions with different year groups will also be explained. And finally, it will be detailed how I collected the information and explanations of why this was deemed to be appropriate will be provided. The report will conclude with a timeline of the different data points and the subsequent analysis.

3.2 Research Goals

As stated in the introduction to this section, a key research goal was to evaluate the use of funding in the Science department to increase the attainment of pupil premium-eligible pupils. From data analysis and evaluation of the previous OFSTED inspection the scope for this intervention strategy was found to be too vast. The interventions were chosen to enact and evaluate were spread across the year group and were used over this action research cycle for the first time. This allowed a comparison to be made with the previous year's results to establish if there had been any significant effect. This also helped to remove the effect of other interventions that had been going on at the same time (if it was used in the previous year then the effect of this 'background' was normalised by comparison). This approach cannot be fully accurate, however, due to the scale and scope of this report. The target group therefore were pupil premium students in Science across KS3 and KS4 (KS5 have not been included even though interventions had been carried out due to the amount of students involved (3) compared to other year groups). In the literature review, the rationale behind

intervention strategies was outlined, namely Summer school and aspirational trips, physical resources (revision guides, work book), which increased time at school through breakfast revision sessions and the use of an independent computer programme. Each was shown to provide some benefit to the pupils in most studies cited, even if they contained methodological flaws. The situational context for these interventions were also important as a new role of Pupil Premium Co-ordinator was endorsed during this action research cycle. This meant that some interventions that had been planned, such as revision sessions after school early in the cycle, had to be cancelled due to priority being given to an early date for the year 11 mathematics exams. This provided an example of the ethos for the relentless work ethic that both staff and students possessed at School A, and possibly highlighted the pressure that both parties are consistently put under.

3.3 Action Research Interventions Used

The interventions chosen have been applied to different year groups. This was done in line with common practice at School A and based on approaches driven by the literature reviewed. For example, the summer school was only attended by new year 7 pupils as a form of easing the transition from primary school, and to remove the drop in achievement over the summer break (Cooper et al., 1996). The following will detail the intervention and the year group that the intervention was used with and the rationale for doing so.

3.3.1 Year 7 - Summer School and Aspirational Trips

The principal element that was investigated here is the gap in progress made by pupil premium students from their KS2 baseline data, to their reports and subsequent end of year 7 test. There were two data points for teachers to input data for reports, which were based on in classroom-based assessment and a final SATs exam at the end of the academic year. The in-class assessments were a mixture of SATs based questions relevant to the topic that they had been studying, and long style GCSE-based questions, which were also relevant to the topic being studied. The parental influence mentioned in the literature review was something that is hoped to come in to play in the future. By parents having to go through the process of completing a consent form for the trip, which at school A is quite a laborious task, a conversation should begin with the pupil. This in turn may lead to a greater parental involvement in the pupils' science studies. Details of the interventions are given below:

The nature of the aspirational trip was a daylong discovery course on what it would be like to study science at the University of Southampton. It consisted of a series of lectures of current research and tours and demonstrations of the department of engineering and physics. It also included group work to complete a presentation of how they would attract students in their secondary school to go on to study science at university, which concluded the day. As mentioned previously the trip was aimed at Pupil premium pupils, but a handful of participants who were not pupil premium, but recommended by the department also attended.

The Summer school was a weeklong event for pupil premium pupils only, based at school A in line with findings reported previously (Cooper *et al*., 2000). Members of the science department along with the English and Mathematics departments took sessions that lasted throughout the day. The science based sessions over two of the five days involved 'building a rocket' and scientific investigations, which were similar to those conducted during an after school STEM club. The pupils were encouraged to make discoveries with the experiments rather than following a set method. The rocket session was delivered by experienced members of science staff in line with the literature by Kidron & Lindsay (2014).

3.3.2 Year 10 - Breakfast revision sessions and Easter revision sessions

The current climate of schools having to battle with a changing specification and the pressure to still improve results was found to be hard-felt by the Science department in this research project. The revision sessions were started as a means of supporting pupils that were felt to be at risk of not making the expected three levels of progress, with an emphasis on pupil premium students. It was felt that sharing the delivery of these sessions was practical as many members of staff still had a large workload to contend with, or had other commitments. Member of the Science department that did not have a tutor group were primarily used for this purpose. This intervention was received well by the department, and pupils alike, as attendance before the start time of 08:00 meant that they received a free bacon sandwich or equivalent breakfast. The Easter revisions sessions were shared out over the course of four days as a first come first served basis with members of the science staff delivering the sessions. Support for

such interventions was prevalent with the senior management team as it was provided as a paid time for staff to come in and work with key students that had taken part in the breakfast sessions, and any other pupil premium students that had not chosen to take up the opportunity. Both interventions sessions followed a similar format, with a large focus on exam technique and practice exam questions immediately followed by an intensive revision power point. The power points contained key pieces of information on a topic, for example B1.1 for the OCR 21st century syllabus. Exam questions, or mock exams were marked in class with students recording the correct answer in green if corrections were necessary. This modelled the marking practice that pupils would have been familiar with in school A.

3.3.3 Year 11 - Adaptive online quiz -*Tassomai*

There were a number of year 11 students who had been a cause for concern regarding not being able to make the progress needed to keep on track with their target grades in Science, especially to make Science count as one or two of their 5A*-C measure. Due to a personal communication of the pupil premium co-ordinator met a university colleague who had developed an adaptive online computer programme designed to "guarantee and A or A* or your money back" called Tassomai, named using the Greek word which loosely translates into "being organised or prepared". Whilst the requirements for this guarantee meant that the pupils would have to complete the course of the series in a year with a certain number of questions attempted. The amount of time recommend would be five minutes a day. The computer programme has had great success in those schools that have trialled it, however, the sample of

results are biased, as a high percentage were private school students and the programme had not been deployed in state schools due to the costs involved. As part of an arrangement, school A received student licences for free to evaluate the use of Tassomai with pupil premium students or pupils who were at risk of not making the three levels of progress. The normal price for such an intervention would be around £50 per pupil per module; meaning that over a two year KS4 science education, a triple science (separate sciences OCR syllabus) pupil could expect to require almost £2500 to fund access to this resource. As mentioned previously, even with the connection with the pupil premium co-ordinator, the results that Tassomai had reported were impressive. Out of 1000 pupils that completed the course in the required format only two did not achieve an A, and instead achieved a B. This intervention was put into action for four weeks before the final exams for the selected year 11 students. Whilst this was not in keeping with the recommended use of the programme, benefits of using it over a short space of time had reported positive effects.

The computer programme could be accessed anywhere and had a specially formatted mobile phone version. The screen the pupils were faced with had a recommended test, and a monitoring ring, which changed colour depending on if the pupil had kept on track with usage. Each question was a multiple choice question and gave guidance if needed, and an explanation if required. The brilliance of Tassomai came from how it selected the questions that the pupils were presented with. If a pupil struggled with a particular topic, P1 for example, submitting a series of incorrect answers in this topic, the programme responded to this and then selected easier questions designed to reinforce basic principles in that area when making a new quiz. Conversely, when a pupil was excelling in a topic, harder and more open questions were selected. This

adaptation enabled the pupil to remain challenged whilst not being discouraged by the difficulty of the questions. The OCR 21st century modules consisted of a library of 3000 questions, which meant some students found a repetition in the questions with intensive use.

3.4 How to collaborate with colleagues?

It was found that the staff at school A were a very motivated group of individuals who worked very hard to help pupils to achieve the best they can. As Deputy Head of Science, my role includes being Head of KS3, which entails leading the provision of pupil premium analysis. Every member of the Science department is aware of the gap present in pupil premium attainment when compared to their non-pupil premium peers, and so trialling possible solutions to this problem was met with wide appreciation. Some members of the department (2 out of 17) had also completed research masters in education and were fully aware of the need to design interventions that could be evaluated and the process behind this. This was found to be a great benefit as it allowed discussion of ideas with colleagues who understood the idiosyncrasies of School A, and could help the research to be adapted. Due to some staff movement within the department, during this research project I was also responsible for sharing leadership of Head of KS4 with the Head of Science. The work with the Pupil Premium Co-ordinator was extensive, in terms of time spent securing pupil funding for interventions and the practicalities for school management. This link to the Senior Management Team (SMT) made recommendations for interventions to the SMT much easier. Without this support I would not have been able to conduct

such a large-scale system of interventions. Support and collaboration with other members of SMT were also crucial in allowing students to attend out of school sessions and obtain the permission and funding needed for the breakfast revision sessions. It was hoped that the review of the interventions in Science would be of a measureable effect, which could then be reported to the governors on behalf of the Science Department. It was aimed that the results from the evaluations of the interventions would also be communicated back to the Science department, as a whole, so that adaptations to the department's current intervention provision could be implemented. It was hard not to understate the need to collaborate in such circumstances, not only as good management practice, but to empower the department.

3.5 Ethical Considerations

As a matter of procedure the research that was conducted was done so with the highest regard for the pupils involved. The guidelines set out by BERA published in 2011 were strictly followed. Permission from the Head Teacher was sought as soon as possible, and as a result the fact that I was conducting research into school interventions was publicised to all members of staff in a school briefing. It was also included in the Head Teachers termly letter home to inform parents, and if they had any questions or concerns regarding such research to get in contact. No opposition from parents was forwarded to the school. All of the interventions carried out fell within the schools normal operating policy. However, the summer school interventions

required parental permission. Attendance for all interventions was completed with schools normal practice in line with safe guarding procedures.

Some interventions used questionnaires to contextualise possible results recorded. All questionnaires were issued along with a statement by the teacher that it was a completely voluntary exercise and pupils were under no obligation to fill out the questionnaire. Participants were also told of the confidential nature of their responses which would not be seen by anyone apart from the researcher and the supervising tutor at Oxford University. As a result, any names or identifying information has been removed and any names used have not been assigned to the pupil.

It is important to highlight the possible conflict of interest when completing this evaluation. As a teacher in School A and as a person of responsibility within the Science department, it was part of my normal working duty to help all pupils achieve the best possible grades. This meant that whilst the thrust of this report is the use of pupil premium funding to support low SES pupils achievement, some pupils who did not fall into this category were also included in the same intervention. It would in my opinion, not be practical to create separate groups to create a quasi-random controlled trial with two different groups. It was also due to this fact that it was not possible to exclude certain interventions that pupils would be subjected to for the study. For example, all year 11 students had the opportunity to attend an after school master classes for Science. No registers were taken for these sessions and it would also be impractical to try and record the individual interventions of teachers with certain pupils, for example the contact they had with parents, individual or small group revision sessions. Whilst every effort was made to try and collect this data, it was not

always practical with teacher workload and the circumstances of the departments teacher turn over. This methodological flaw will be discussed later in the report.

3.6 Data Collection

The lack of many studies using clear comparable quantitative data was apparent from the research reviewed in available literature. This was compounded by my desire to include as much data as possible to build the strongest case for use of Pupil Premium funding in School A for Science interventions. Through numerical data I hoped to demonstrate an effect size that the intervention has had, by using the previous year's data, when the interventions were not used, as a baseline. The limitations of this approach will be discussed in the following sections. The rationale behind the information which was captured to answer the corresponding research questions is detailed in the following sections:

3.6.1 Data used to answer action research question four

The action research question four related the narrowing of the gap between Pupil Premium students and those who were not eligible for Pupil Premium funding.

Action research question four:

How does Science interventions affect the narrowing of the gap in pupil premium attainment?

To answer research question four, numerical data from the Information and Guidance (IAG) reports, which is the name given to the termly report in school A, were reported up to three times a year. This was used in conjunction with end of year exams for KS3 (Year 7) and GCSE exams for KS4 (Year 10 and 11). This data was compared with the previous year's data to see if the intervention had an effect that could be attributed to it. The results of pupils that did not complete the intervention programme were also used to form a baseline where appropriate.

The total pupil intervention group sizes number for year 7 was 38 pupils for the inspirational trip and 24 pupils attended the summer school. Of those pupils 10 attended both interventions. All of these pupils sat the end of year 7 Science Exam. The total pupil intervention group sizes number for year 10 using the interventions of Easter classes and breakfast revision was 69 pupils. The group suffered from the largest attrition and only pupils who attended all the interventions were used in this report. Therefore the total number of pupils in this intervention was 55 pupils.

The total pupil intervention group sizes number for year 11 using the interventions of Tassomai numbered 41. The data collected by the programme included the number of questions answered and the number of questions answered correctly, which was then converted into an accuracy percentage. These pupils sat different exams relative to each other. 17 pupils sat only the 21st Century OCR Additional Science Exam, 14 Sat only the 21st Century OCR Core Science Exams due to being removed from the BTEC Science course completed the previous year. Eight pupils sat both 21st Century OCR Additional and Core Science Exams and five sat the 21st Century OCR Triple Science Exams.

3.6.2 Limitations to the data used to answer action research question four

By trying to conform to my original intention of using numerical data to answer the research questions, compromises had to be made for the group sizes that could be analysed. Each intervention group had to go through selection with the Head of department, Pupil Premium Co-ordinator and Progress Leader (Head of Year) for contextual reasons. Some students who could have been eligible to be part of these intervention groups were discounted based on the need that they presented with IAG data, i.e. if they were making the progress required in KS4 they were not necessarily included in the intervention. This meant there was inherent bias in the group selection, with pupil premium not on target, being the main descriptor. This however, did open up the ability to compare two populations of pupil premium pupils, those who had been part of the intervention and those that had not.

Due to the relatively small data set for year 7, only very tentative statistical analyses have been reported regarding the effect size of the intervention.

Both KS4 intervention groups are larger, statistical analysis yielded results that could be discussed using the rule of thumb suggested in Cohen *et al*., (2007) of 30 participants for sample size.

3.6.3 Data used to answer action research question five

The action research question five related the narrowing of the gap between Pupil Premium students and those who were not eligible for the Pupil Premium funding as a function of the intervention used.

Action research question five: Which interventions led to the greatest narrowing of the gap and why this is possibly the case?

The data which answered this question was from the same data set as used to answer question four. The only difference was the use of contextual questionnaires that were used to 'soften' the numerical data and possibly give indications that the raw data did not report, i.e. factors that would not be collected by the computer programme, such as the location of where pupils used Tassomai. It was also aimed to obtain a representative sample of all the students who undertook the interventions. This could have been done through interviews, but it was felt this was too time consuming, even with group interviews. There were also no names stored on the questionnaires to ensure anonymity of the pupils was preserved. It was found the rate of return of questionnaires was poor considering the sample sizes that were in the initial intervention group. These were 10 for the year 7 intervention, 24 for the year 10 intervention and 5 for the year 11 interventions.

The questionnaire consisted of a group of open questions, as the intention was to perform a thematic analysis of the responses. This was also chosen to not bias responses and allowed the participants to fill in as much or as little for each question

as they liked. It was also felt that including a Likert scale to obtain a numerical results was not needed due to the numerical analysis conducted with the test results and the aim of the questionnaires to provide context.

The questions chosen for the year 7 intervention group consisted of how they rated their enjoyment of the interventions and what they thought of Science after the interventions. It was also aspired to explore whether pupilks saw a link between these interventions and their subsequent performance on the end of year 7 test and IAG results. All the questionnaires included a question on what they understood Pupil Premium to be, or if they recognised the term at all.

3.6.4 Limitations to the data used to answer action research question five

A methodological weakness in questionnaire timing was most likely the cause of this limitation. The year 7 intervention group did suffer from a low literacy rate, which, when some participants did not return their questionnaire, an enquiry was made for the reason and they choose not to provide one. The main reason reported by year 7 was the inability to understand what the questions wanted and organisational problems; most had completed it but had lost it and not thought about it again, even after being given a new questionnaire. The main reason reported for the low year 11 response was the fact that not many turned up to have their Science teacher 'Sign them off' for handing back equipment; most did not have text books to return so never thought to return the questionnaire either. Whilst the year 10 response was more positive, it was still a low response for the group size. Similar responses to the year 7

intervention group were reported by the year 10 intervention group. A possible improvement to the design of the questionnaire to include some identifying feature such as a name that could then be anonymised at a later date would have been useful in retrospect. It would have allowed better tracking of respondents and enabled follow up those who had lost their questionnaires.

3.6.5 Data used to answer Action Research question six

The action research question six related to the organisation processes of how these interventions were approved by relevant parties. This research question was inspired by a DfE document asking for research relating to the reasoning behind school intervention choices (OFSTED, 2010).

Action research question six: What decisions have led to the use of intervention strategies in the Science department?

The data used to answer this question was a semi-structured interview with the Head of Science and the Pupil Premium Co-ordinator. This took place after all of the interventions had occurred and the results for the GCSE students had been received from the examiners.

3.6.6 Limitations to the data used to answer action research question six

Due to the timing of the interviews in the first week back in the new academic year 2015-2016, after the action research cycle, the Head of Science had already begun analysis of pupil's performance in Science and was well informed. The interview with the Pupil Premium Co-ordinator was similar in this respect and was also influenced by the collaboration of the creator of the Tassomai programme. This meant that when discussing interventions, Tassomai took up a large proportion of the interview. The interviews lasted around 30 minutes discussing the results obtained by the intervention groups. During this time, due to the nature of the interviewees, the study was interrupted a number of times by other members of staff requiring answers to queries. This was a greater problem in the interview with the Head of Science as the interview took place in the classroom, which was very accessible. The interview with the pupil premium co-ordinator took place in an office in a less public part of the sixth form building, which was not as accessible to the physical presences of staff, but his office telephone was a cause for distraction.

As these were semi-structured interviews with a very small sample, numerical data analysis was not considered. The contextual information gained from these interviews did lead to a better understanding of the decisions made when choosing interventions. It provided contextual information that would not have been otherwise known, such as accountability measures for some interventions and not others, which were a product of the idiosyncrasies of School A.

4 RESULTS AND DISCUSSION

4.1 Results for Year 7 - Answering Action Research Question four and five

In order to answer the action research questions four and five that have already outlined, two data sets were taken to use for Year 7, which was the IAG reports and the final Year 7 exam. Standard statistical analysis was used to separate the intervention group from the comparison group, to see if there was any measureable difference in the effect of the interventions, both independently or when considered together. To calculate the effect of the intervention, the effect size relative to the end of year 7 exam scores was calculated. The explanation of this is given in the next section.

4.1.1 The Effect Size

The effect size is a common statistical tool used by researchers to determine the difference between two groups of data (Cohen *et al*., 2007). The equation used to determine this effect size is given below:

Equation 1 - In this case, group 1 is the intervention group and group 2 is the control group

$$d = \frac{M_{group1} - M_{group2}}{SD_{pooled}}$$

To analyse the results the difference between the arithmetic mean of the Pupil Premium intervention students (Group 1) and those students who are Pupil Premium, but did not take part in the intervention (Group 2) were calculated and this was then divided by the pooled standard deviation. Once this had been calculated, this equated to the effect size, which is a measure of the difference between the two mean values. This can then be interpreted as a 'Z-Score' of a standard normal distribution. An example would be if the effect size was 0.6, then the score of an average person in the intervention group would be 0.6 standard deviations above the person in the non-intervention group, and would therefore exceed 59% of the non-intervention group. It was decided not to calculate the value for the correlation coefficient due to the limited population of the results (Cohen *et al*., 2007).

By using the effect size rather than just the standard deviation or the arithmetic mean it was aimed to quantify the difference between the intervention and non-intervention groups.

The confidence intervals were also calculated which allowed exposure of the nature of using a small sample size, as of course a large sample size would provide a better basis to calculate the effect size. Therefore, the confidence interval can be thought of as the margin for error. A confidence interval of 95% was used as it represented a good statistical model of the standard error (Cohen *et al*., 2007).

To this end the difference (addition and subtraction) was found between the mean of the sample by 1.96 multiplied by the standard deviation of the sample. The value of 1.96 was based on the fact that 95% of the area under a normal distribution was within 1.96 standard deviations of the mean value for the sample.

4.1.2 Results for Year 7 - Analysis of end of year test

Table 1 shown below, shows the total results for the year 7 Pupil Premium intervention.

Table 1 - Results of analysis of Year 7 end of year test

Group	Standard Deviation	Arithmetic Mean	Effect Size	Lower Confidence Interval	Upper Confidence Interval
Total Yr 7 Population (294 pupils)	6.188	32.937			
Trip Intervention (38 Pupils)	6.322	32.888	0.009	20.496	45.279
Summer School Intervention (24 pupils)	6.288	32.867	0.006	20.543	45.191
Both Interventions (11 pupils)	6.220	33.000	0.027	20.808	45.192
PP pupils with no intervention (39 pupils)	6.207	32.832			

These results showed that there was no effect size of statistical significance relating to the interventions carried out with the year 7 cohort. This was complimented with the literature findings which showed no disenable pattern between aspirational interventions and results on standardised tests (Doyle & Griffin, 2012; Lupton & Kintrea, 2011).

It was interesting to note the effect size almost quadrupled for those that had undertook both of the interventions compared to just the summer school intervention. It was also interesting to note that the trip intervention scored a higher effect size than the summer school. Of course, all of these comments did not correlate to statistical significance due to the small effect size and the small sample size.

4.1.3 Comparison to Previous Year 7 exam results

When you compare the results of the Year 7 who had undergone the intervention against those of the previous year 7, the results were not quite as predicted.

Table 2 - A table to show the results of the year 7 test taken over 2 years.

Group	Standard Deviation	Arithmetic Mean	Effect Size	Lower Confidence Interval	Upper Confidence Interval
Year 7 2014-2015 PP	6.220	33.000		20.808	45.192
Year 7 2013-2014 PP	5.358	34.292	-0.223	23.790	44.794

Of course, it is not correct to compare a group of 39 pupils from the 2014-2015 cohort to the 101 Pupil Premium pupils from the previous year without inciting some statistical bias. But it does provide an interesting discussion point regarding the use of Pupil Premium money to subsidise a relatively expensive intervention for no proven gain in exam attainment at the end of year 7 in Science.

4.1.4 Results for Year 7 - Analysis of IAG reports

Table 2 shown below, collates all the IAG reporting for year 7 throughout the academic year. I have included it here to demonstrate how I have calculated the Pupil Premium Gap. It has been broken down into niche groups to highlight the different amount of progress made.

Table 3- Results complied from IAG reporting throughout the year

Cohort	Total Pupils	L4+ on entry		L5+ on entry		IAG KS2 L4+ on target		IAG KS2 L5+ on target	
		No.	%*	No.	%*	No.	%**	No.	%**
All	294	257	87	149	51	96	37	36	24
B	140	121	86	68	49	43	36	17	25
G	154	136	88	81	53	53	39	19	23
SEN	70	45	64	15	21	21	47	4	27
PP	66	52	79	23	35	21	40	6	26
NPP	228	205	90	126	55	75	37	30	24

294 pupils considered of the 304 (9 pupils without target data, 1 with no IAG data)
* Calculated as percentage of total pupils, rounded up.
** Calculated as percentage of that group (e.g. L4+ PP) who have met (or exceeded) their end of year target

By taking the difference between the Pupil Premium students at each point I am able to see the gap between PP and Non-PP attainment. Shown in Table 3 are the Pupil premium.

Table 4 - The gap calculated between Pupil Premium and Non-Pupil Premium pupils for the year 2014-2015

Descriptor	Gap %
L4+ KS2 Avg	-11
L5+ KS2 Avg	-20
IAG L4+	3
IAG L5+	2

Where the table records a negative number the gap and a positive number as Pupil Premium pupils exceeding the score of non-Pupil Premium students. It is clear to see that as a cohort, the year 7's came in with very negative results, indicating a large gap in attainment at KS2. This has been completely wiped out by the first year at School A. When this is compared to the previous year's results we can see that in table 4, it was a very different story.

Table 5 - The gap calculated between Pupil Premium and Non-Pupil Premium pupils for the year 2013-2014

Descriptor	Gap %
L4+ KS2 Avg	-15%
L5+ KS2 Avg	-25%
IAG L4+	-2%
IAG L5+	-24%

The table clearly shows that after the year's end, there was still a gap for the low level on entry Pupil Premium pupils, and a very large gap remaining for the higher level on entry Pupil Premium pupils.

4.1.5 Results for Year 7 - Analysis of questionnaires

Whilst the response rate to the questionnaire was very low as previously reported, it did provide some interesting information. Conclusion being drawn from such a limited sample and low quality response should be treated with extreme caution when interpreting any meaningful results. Nevertheless the answers were on the whole were as short as possible and did not go into a deeper explanation of their answer as I had

hoped. The general consensus was that the Summer School was 'fun' and provided a good introduction to the school. The most positive aspect reported was that they got to meet their teacher and do 'fun practical's, which had been an experience they had not had at primary school. The students that responded did not have a clear understanding of what Pupil Premium meant, other than it was the reason they were chosen to go to summer School. In terms of the possible reported improvements to Summer school, making it longer was the most common response, but with most pupils leaving that question blank.

With regards to the Trip, the consensus was that it wasn't as 'fun' as the Summer School, it did provide them with information they did not know before - what it was like to go to University. Under improvements, it was suggested that the activities in the day should be more practical and team based.

When adding the final comments, one response struck a chord with me. It was simple question why Summer School didn't happen in the Summer holidays between year 7 and year 8. It was obviously something that the pupils enjoyed and perceived a great benefit from.

4.2 Discussion of results for Year 7

From the results I have obtained, it is hard to make any clear conscious statement regarding the effectiveness of the Summer School and Trip intervention with regards to increasing the attainment of Pupil Premium pupils. This is mainly due to the low sample number and the issues this faced. Taking into account the effect size and confidence interval, there was no statistical correlation between those interventions and increased exam score, which is in line with the literature I reviewed previously

(Doyle & Griffin, 2012; Lupton & Kintrea, 2011). It does however highlight the fact that a relatively high cost intervention, should only be targeted at those pupils who would benefit from some sort of social engagement with the school, and not to have the goal of increasing attainment in Science.

4.3 Results for Year 10 - Answering Action Research Question 4 and 5.

4.3.1 Results for Year 10 - Analysis of Core GCSE results

The total amount of Pupil Premium pupils that underwent the intervention of Easter school and Breakfast revision was 69, of those 63 were entered for the Core exam in the summer of 2015. Of those pupils 19 made the 3 levels of progress or above which gave a percentage of 30.01%. The equivalent results for non-Pupil Premium was 61 out of 126 which gave a percentage of 48.40% that made the 3 levels of progress or above. This meant that in the 2014-2015 year 10 cohort there was a pupil premium gap in attainment for the 21st century OCR Core Science exam of -18.4%.

If this number is compared to the previous year's cohort core results, 46.4% Pupil Premium pupils made the expected level of progress or more, compared to 65.3% of non-Pupil Premium pupils. This meant that in the 2013-2014 year 10 cohort there was a pupil premium gap in attainment for the 21st century OCR Core Science exam of -18.9%. So overall, this showed a reduction in the gap of 0.5%, which was a statistically insignificant figure.

4.3.2 Results for Year 10 - Analysis of questionnaires

Relative to the other intervention groups, year 10 had the highest return of questionnaires, as stated previously. Thematic analysis indicated that of the sample returned many were not sure what Pupil Premium meant with regards to their own education. The most common response (n=11) was that it meant you received free school meals. With regards to the usefulness of Easter School vs breakfast revision, breakfast revision time had a more positive pupil response (n=20 positive remarks for breakfast revision, compared to n=13 for Easter School). The most important factor in attendance to breakfast club was in receiving a card to collect a free breakfast if you intended to complete a whole revision session. Having time to work with their teachers, or a more knowledgeable adult was also seen as important (n=7). When considering improvements to the system, a later start for Easter School (n=3) was reported, with no further correlation being made. There were no other relevant patterns in the answers to questions with all questionnaires returning at least one question with a nil response.

4.4 Discussion of results for Year 10

This decrease in the gap for pupil students of 0.5% compared to the investment of time and funding for Easter and Breakfast revision sessions indicated that this doesn't not produce the kind of effect size reported in the literature terms (Crawford, 2011, Kidron & Lindsay, 2014, Baker *et.al*., 2004, Cooper *et al*., 2003). However, there were a lot of contextual factors surrounding KS4 this year at School A. As mentioned

previously, a high staff turnover rate (3 members of staff) meant new members of cover staff were needed to replace more senior members. Although, this still provided an interesting point of discussion, feeding into the possible reallocation of funding for the following year's intervention strategy in Science.

4.5 Results for Year 11

For the Tassomai intervention programme, 32 Pupil Premium-eligible pupils had access to the full programme for four weeks in the lead up their exams. The exams they sat are listed in the table below.

Table 6 - Complete results for Pupil Premium pupils that used the Tassomai programme.

Pupil	Questions Correct	Questions Answered	Accuracy (%)	Science Exam Sat	Grade achieved	Target (3/4LP)
1	2287	3180	72	Triple	BBB	B
2	2129	3051	70	Add	A	B
3	1785	2288	78	Triple	BBC	C/B
4	1321	1762	75	Add	C	C/B
5	645	1168	55	Add	C	C
6	926	1133	82	Triple	AAB	B/A
7	736	1054	70	Core/Add	B C	C/B
8	621	934	66	Core/Add	BB	C/B
9	508	894	57	Add	C	D/C
10	522	799	65	Add	C	C/B
11	462	798	58	Add	C	C
12	594	778	76	Triple	BBB	B/A
13	431	744	58	Add	C	C
14	329	644	51	Core	D	D
15	415	639	65	Add	C	C
16	211	401	53	Add	C	C
17	209	333	63	Triple	BCC	C/B
18	207	322	64	Add	B	C
19	196	319	61	Core	D	D

20	236	300	79	Core/Add	B A	B/A
21	138	232	59	Core/Add	C C	B
22	159	227	70	Core/Add	B B	C/B
23	152	214	71	Core/Add	A A	B
24	75	131	57	Core	D	C
25	55	118	47	Core	D	D
26	43	104	41	Core	D	D
27	46	102	45	Core	D	D
28	57	98	58	Add Add	D	C
29	31	67	46	Core	D	D
30	30	55	55	Core	D	C
31	28	52	54	Core	D	C
32	13	45	29	Core	E	D/E
33	16	45	36	Core	D	C
34	25	45	56	Core/Add	C C	D/C
35	14	36	39	Core	D	D
36	12	32	38	Add	C	
37	13	30	43	Add	C	C/B
38	19	24	79	Core/Add	B C	C
39	3	12	25	Core	D	C
40	5	9	56	Core	D	D
41	4	4	100	Add	D	C

4.5.1 Results for Year 11 - Analysis of questionnaires

There was a very small return rate for the year 11 questionnaires, as discussed previously. Of those that were returned, the common theme was that of independence, and the ability to access to programme at a time of pupils convenience. It was also highlighted that the programme could be completed on mobile device, which was the most evident convenience benefit. The answers to the remaining

questions, however, did not yield any more useful information and did not contain any detailed sentences for answers.

4.6 Discussion of results for Year 11

From the table those scores highlighted in red are pupils who did not make the expected level of progress. This gave a result of 75% of Pupil Premium pupils making the expected level of progress whilst being part of the Tassomai intervention. This is compared to a Pupil Premium result of 58.5%, who did not use Tassomai, making the expected level of progress. When you take account of the non-Pupil Premium pupils, who achieved a 74.6% expected level of progress, it is clear to see the progress that has been made when using the Tassomai programme.

By using the Tassomai programme, it became evident that the Pupil Premium pupils had a clear advantage over those Pupil premium pupils who did not have access to the programme. Within the subset of the Tassomai pupils, there was a clear correlation to the amount of questions answered and the likelihood of making the expected level of progress. This intervention has been the most positive results by a large margin, even with a relatively modest sample size (n=41).

4.7 Results for Interviews - Answering Action Research Question six

The single most important factor highlighted by both interviewees was for the intervention that was proposed to be in sync with the School's policy, or previous methods of working. It was a distinct challenge to engage the SMT and convince them that spending money on a new innovative product, like the Tassomai programme is a financially and developmentally beneficial venture. As reported by the DfE via the EEF, schools tend to spend Pupil Premium money on interventions that have been successful for them in the past, rather than risk committing the funding to a novel approach, like Tassomai.

Other hurdles that were encountered for use of interventions such as Easter School and breakfast club were the availability and motivation of staff. It would have been much more effective for the Head of Science to allow the teachers of the specific pupils to run the sessions, rather than a rota for teachers. However, this decision was taken to compensate for the fact that some teachers would not participate, or not complete the interventions to the same high quality standards expected.

As the Pupil Premium co-ordinator is a new role, the focus has been more about building a detailed picture of School A and the current attainment of Pupil Premium students, rather than researching innovative methods of intervention. In fact, being part of teaching schools alliance allowed the pupil premium coordinator to observe interventions in other schools to make a more informed judgment at School A.

5 CONCLUSION

In conclusion these results have shown me that the most effective intervention at raising the achievement of Pupil Premium students within the intervention groups discussed herein has been the use of a computer programme called Tassomai.

This trial run of the programme, in conditions in which it was not normally used has led to the best Pupil Premium gap reduction in recent memory at School A. This highlights the difference in approach from quite direct funding and labour intensive interventions, such as the others listed, to the more subtle, and more profound in effect background interventions.

5.1 What happens now?

This report will be summarised and feedback to the Science department at the initial INSET days for the academic year 2015-2016 will be provided. A similar version of the report will also go to the Pupil Premium Co-ordinator and Head Teacher.

The results obtained for the Tassomai programme will be used to compose a bid for the extension of the usage to all year 11 and year 10 Pupil Premium pupils, which will be funded by the Pupil Premium budget. The total cost of the programme is currently being negotiated.

As stated previously, this report should be seen as a single action research cycle, with a new cycle beginning at the start of the next academic year. The apparent lack of impact with year 10 Pupil Premium and the high attainment gap has been raised as a concern. It will my primary focus to investigate further and to create a new evaluative framework for interventions in year 10.

In terms of my own teaching practice I have been recently made the Pupil Premium subject lead, being part of a team that shares intervention practice across the school and the teaching alliance. Through this conduit I am hoping to experience Pupil Premium interventions that are robustly evaluated within their school context and take that information and adapt it for use in my school.

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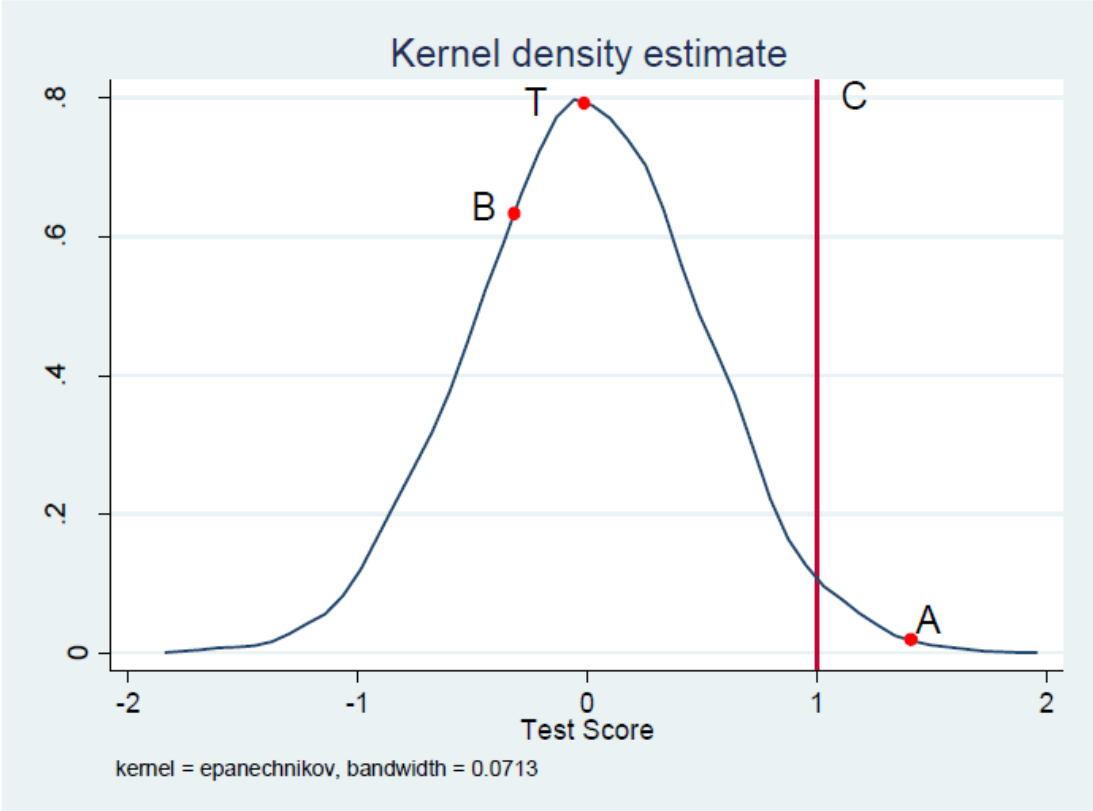
APPENDIX A

Below is a the Kernel density used by Jerrim & Vignoles (2011) to demonstrate how the use of only one data point could results in the overall score of a pupil to be over estimated. This could also be applied to the opposite argument and that some pupils might have been under estimated.

Figure 5. Hypothetical test scores for a child who has experienced "good luck" a test



Notes: Figure refers to hypothetical test scores a particular child could receive on a test. T signifies the child's "true" ability (this is unobserved by the researcher) – which in this example is at the population average (T=0). There is a cut point C, above which children are defined as "high ability". This child is not really part of this "high ability" group, but happens to have a lot of good "luck" on the day a screening assessment is taken place and scores a mark at point A. As this is higher than the cut-point C, they are mistaken as being of "high ability". If they were to take a re-test, however, they would be unlikely to score such a high mark (point B). Hence their scores "regress towards the mean".

APPENDIX B

Below are the questionnaires used for the year 11,10 and 7 intervention groups.

Tassomai Student Questionnaire

How easy did you find Tassomai to use, please explain why?

_____
_____
_____

How much time did you spend on Tassomai each session?

_____
_____
_____

How many times did you use Tassomai?

_____
_____
_____

When did you use Tassomai (the day before the exam...)?

_____
_____
_____

What do you think Pupil Premium is? (it's ok if you don't know)

_____
_____
_____

Where did you use Tassomai (Home, school, on a bus)?

_____
_____
_____

What was one of Tassomai best features?

_____
_____
_____

What did you think Tassomai could do better?

_____
_____
_____

Do your people at home know you use Tassomai, and what did they think about it?

_____
_____
_____

If you had to describe how much difference this has made to your GCSE revision what would you say?

_____
_____
_____

Do you have anything else you would like to add about Tassomai?

Breakfast and Easter Student Questionnaire

How useful did you find the Easter revision sessions, please explain why?

_____
_____
_____
_____

How useful did you find the breakfast revision sessions, please explain why?

_____
_____
_____
_____

How many times did you use attend the breakfast revision sessions?

_____
_____
_____
_____

When did you use attend what was your work ethic like?

_____
_____
_____
_____

What do you think Pupil Premium is? (it's ok if you don't know)

_____
_____
_____
_____

What was one of the Easter revision sessions best features?

_____
_____
_____
_____

What was one of the breakfast revision sessions best features?

What did you think the Easter revision sessions could do better?

_____
_____
_____
_____

What did you think the breakfast revision sessions could do better?

_____
_____
_____
_____

If you had to describe how much difference this has made to your GCSE revision what would you say?

_____
_____
_____
_____

Do you have anything else you would like to add about the revision sessions?

_____
_____
_____
_____

Year 7 Student Questionnaire

How useful did you find the Summer School, please explain why?

_____
_____
_____
_____

How useful did you find the Trip to your Science exams, please explain why?

_____
_____
_____
_____

What do you think Pupil Premium is? (it's ok if you don't know)

_____
_____
_____
_____

What was one of the Summer School's best features?

_____
_____
_____
_____

What was one of the Trip's best features?

_____
_____
_____
_____

What did you think the Summer School could do better?

_____
_____
_____
_____

What did you think the Trip could do better?

_____
_____
_____
_____

If you had to describe how much difference this has made to your year 7 exam revision what would you say?

_____
_____
_____
_____

Do you have anything else you would like to add?

_____
_____
_____
_____