CEE Special Report 004

The Determinants of Non-Cognitive and Cognitive Schooling Outcomes

Report to the Department of Children, Schools and Families

Anna Vignoles
Elena Meschi

This research was commissioned before the new UK Government took office on 11 May 2010. As a result the content may not reflect current Government policy and may make reference to the Department for Children, Schools and Families (DCSF) which has now been replaced by the Department for Education (DfE). The views expressed in this report are those of the authors' and do not necessarily reflect those of the Department for Education.

CENTRE FOR THE ECONOMICS OF EDUCATION

August 2010

Published by
Centre for the Economics of Education
London School of Economics
Houghton Street
London WC2A 2AE

© A. Vignoles and E. Meschi, submitted August 2010

The Centre for the Economics of Education is an independent multidisciplinary research centre. This research was commissioned before the new UK Government took office on 11 May 2010. As a result the content may not reflect current Government policy and may make reference to the Department for Children, Schools and Families (DCSF) which has now been replaced by the Department for Education (DfE). The views expressed in this report are those of the authors' and do not necessarily reflect those of the Department for Education.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission in writing of the publisher nor be issued to the public or circulated in any form other than that in which it is published.

Requests for permission to reproduce any article or part of the Working Paper should be sent to the editor at the above address.

Executive Summary

The Centre for the Economics of Education was asked to investigate the factors that influence a range of children's *academic and non-academic* outcomes, including their enjoyment of school, whether they take unauthorised absence from school and whether they feel they are bullied. The study also investigated whether schools can influence these non-academic outcomes.

The study makes use of the Longitudinal Study of Young People in England, which is a survey of young people in secondary school that collects information on bullying, truancy and many other factors in each child's life. The data is linked to information on each child's academic achievement, enabling this study to investigate the inter-relationship between a pupil's academic performance and non academic outcomes.

Pupils who enjoy school more at age 14 have, perhaps unsurprisingly, higher academic achievement by age 16. Equally, children who have higher achievement at age 11 go on to enjoy school more at age 16 though this is a not a strong relationship. In other words enjoyment of school and academic achievement are clearly linked.

Pupils who were bullied or who took unauthorised absence at age 14 had significantly lower educational achievement at GCSE. Pupils who experienced bullying at age 14 were also much more likely to experience bullying at age 16. Therefore early negative outcomes, such as being bullied, suggest the child is at risk of having later negative experiences at age 16. Conversely, pupils who participate in positive extra-curricular activities, such as clubs, were also found to have better academic achievement later in their schooling. High achievers at school, i.e. pupils who do well academically at age 14, were also no more likely to be bullied at age 16 than other children.

The report also investigated the impact of schools on some of these non-academic outcomes between 14-16 and found little evidence that schools currently have different impacts on pupil's enjoyment of school, nor whether they take unauthorised absence,

nor their likelihood of being bullied. In other words, which school a pupil attends is likely to have small or no effect on their wider well-being. This does not mean that schools do not have the potential to impact on these factors but rather that currently there are not large differences across schools in these outcomes once socio-economic factors have been taken into account.

The report concludes that non-academic factors, such as a pupil's enjoyment of school, are inextricably linked to pupils' academic achievement. We need to be aware of these relationships when considering policies to improve pupil achievement. The report also provides some useful risk indicators of future low pupil academic achievement. For example, some factors, such as being bullied or taking unauthorised absence, predict low future academic achievement. Again this can be used by schools and policy-makers to identify pupils at risk of low attainment.

This research report was written before the new UK Government took office on 11 May 2010. As a result the content may not reflect current Government policy. This research will be of use to officials and ministers in helping to shape the future direction of policy and Departmental strategy.

The Determinants of Non-Cognitive and Cognitive Schooling Outcomes

Anna Vignoles
Elena Meschi

Acknowledgments

Elena Meschi is a Research Officer at the National Research and Development Centre for Adult Literacy and Numeracy, Institute of Education. Anna Vignoles is Professor of Education at the Bedford Group for Lifecourse and Statistical Studies, Institute of Education, a Research Associate at the Centre for Economic Performance, London School of Economics and Deputy Director of the Centre for the Economics of Education.

1 Introduction

In the UK, there are currently two major policy issues of pressing concern in the field of education. The first is the continuing educational marginalization of some groups of students, in particular the socio-economic gap in education achievement (HM Government 2008). Secondly, in many countries, including the US and the UK, there has been a gradual recognition of the potential importance of broader *non academic* outcomes, especially child well being[1]. Non-cognitive skills, including attitudes, aspirations and well being, appear to play a crucially important role in individuals' life chances and there is some expectation from policymakers that schools can contribute to the development of these non cognitive skills. However, whilst our understanding of the myriad factors contributing to children's cognitive skills and educational achievement is reasonably good and growing[2], our knowledge about the determinants of these non cognitive outcomes is more limited. In particular, the evidence base on the role of schools in promoting non academic outcomes, such as well being, is extremely limited. This report aims to contribute to this literature and will focus on the role of schools in producing cognitive and non-cognitive outcomes, specifically academic achievement, school enjoyment and avoidance of bullying.

There is an important policy context to the evidence presented in this report. In the UK the *Every Child Matters*[3] *(ECM)* policy (described in more detail below) aims to both strengthen the accountability of schools for the educational achievement of every child, including vulnerable and lower achieving children, and to broaden the outcomes that schools focus on, to include well being and other non cognitive skills. It is still early days for ECM and it has not as yet been fully evaluated. Indeed this report is not a formal evaluation of ECM but rather aims to inform policy-makers about the likely impact from ECM by adding to the limited evidence base on the role of schools in producing non academic outcomes.

The Centre for the Economics of Education has in fact been commissioned to undertake two distinct strands of work around the ECM policy agenda. The first strand has focused on the determinants of a range of non academic outcomes in school age children and is the subject

[1] See Cunha and Heckman (2001).
[2] See Todd and Wolpin, 2003, for an overview of the education production literature. See Teddlie and Reynolds (2000) for a summary of school effectiveness literature.
[3] In some respects similar to the No Child Left Behind policy adopted earlier in the US.

of this report. Specifically, we explore the extent to which schools may influence ECM outcomes, and the role of family background factors in explaining differences in ECM outcomes across children. We also attempt to identify potential complementarities and trade-offs between different ECM outcomes, recognizing that potentially a strong emphasis on one outcome (e.g. academic achievement) might come at the expense of other outcomes (e.g. enjoyment of school). The second strand of work is the subject of a sister report on the inter-generational transmission of non academic outcomes, i.e. the extent to which parental health, wealth and well-being, for example, is transmitted to children and how this inter-generational relationship may be changing over time (Blanden et al. 2009).

We start by describing the ECM policy itself (section 2), before moving on to review and comment on the existing literature in the field (section 3). Methodological issues are addressed in section 4[4]. An important methodological contribution of this report is to discuss the extent to which the results we find are simply correlations or potentially causal relationships. Much of the existing literature on the determinants of non cognitive skills has been correlational evidence rather than necessarily causal and we discuss this point at length. Section 5 describes the data we use and section 6 presents results. We conclude with a discussion of the implications of the results.

2 The ECM Policy

The Every Child Matters initiative aims to encourage schools and other professionals to take a broader approach to child development and specifically children's education. In particular, it aims to focus policy on the potentially wider aims of schooling and to place much more emphasis on the general well-being of children. Although academic achievement continues to be an important marker for student and school success, this shift in policy discourse towards discussion of broader outcomes marks a clear departure from the historic emphasis on academic achievement alone. In some respects ECM can be seen as a means of reversing an over emphasis on academic achievement arising from the pressures induced on schools from parental choice, school competition and the production of education "league tables".

[4] There are a number of methodological issues raised by this course, including how we measure school effects. This latter issue is dealt with more comprehensively in the methodological appendix (appendix 2).

Specifically, the ECM agenda recognizes that schools potentially "produce" a range of different outcomes in children, over and above their academic achievement, and in the future the ECM agenda may involve providing clearer incentives for schools to focus on these broader outcomes. The ECM outcomes fall under the following headings:

1. Be healthy
2. Stay safe
3. Enjoy and achieve
4. Make a positive contribution
5. Achieve economic well-being

As the above titles suggest, ECM is a programme that potentially spans a wide range of policy domains, including education, social care and health services. However, ECM is not just about recognizing that the broader outcomes from education are important. It is also an initiative that was developed following some serious failings in the child protection system (e.g. the case of Victoria Climbie http://www.victoria-climbie-inquiry.org.uk/). Thus there is also an increased emphasis on more coordinated care and protection of children, based on the recognition that all professionals who have contact with children (whether medical, educational or from social services) have a duty to encourage children's development in a positive way and prevent them from being harmed.

There are a number of specific dimensions to the ECM initiative, including the establishment of children's trusts, the appointment of a Children's Commissioner for England and myriad school based initiatives. In addition, some new funding has been directed towards ECM related activities. That said, the effect of ECM is as yet largely unevaluated. This is partly because, as has already been said, we first need to establish meaningful ways to measure the ECM outcomes identified above and develop a better understanding of how ECM outcomes, such as child well being, are affected by a range of factors both within the school environment and without. This report is an attempt to do just that.

3 Literature

By necessity, this report examines a subset of ECM outcomes, namely non cognitive outcomes related to school engagement, such as enjoyment of school and bullying, as well as academic achievement. It relates however, to the literature on the wider non cognitive outcomes from schooling, including general well being, health and child safety. We therefore review the literature on the determinants of a broader range of potential ECM outcomes, starting with a general overview of some research which has focused specifically on the socio-economic gap in both cognitive and non-cognitive outcomes in the UK.

Socio-economic inequalities and non cognitive outcomes

The most recent and extensive research programme focusing on both socio-economic inequalities in educational achievement and non cognitive outcomes was carried out by the Institute for Fiscal Studies (IFS) and the Centre for Market Performance and Organisation (CMPO), and was sponsored by The Joseph Rowntree Foundation (Barreau et al. 2008). This work has been motivated by evidence that socio-economic inequalities in educational achievement emerge early (Feinstein, 2003 and 2004). Although Barreau et al. (2008) have not investigated the interactions between the different cognitive and non-cognitive outcomes and the role of schools in shaping these outcomes, we nonetheless review their key findings as they are pertinent to our own study.

Specifically, Barreau et al. have analysed the relationship between child socio-economic circumstances and academic achievement in both primary and secondary school and evaluated how this relationship may be mediated by a number of factors such as:

- home learning environment
- parental attitudes
- self belief i.e. the young person's assessment of their own ability
- the student's locus of control
- the young person's attitudes, aspirations and expectations.

Barreau et al. have also examined some key routes by which socio-economic background might influence educational achievement, namely via an impact on bullying, behaviour in and out of school, and family relationships. Importantly for the purposes of our research, the authors do not restrict themselves to academic outcomes only (e.g. they model behavioural outcomes as measured by individuals' scores on the Strengths and Difficulties Questionnaire). They also make use of the same data as we do, namely the Longitudinal Study of Young People in England (LSYPE). Although the authors take account of an unusually rich array of factors that may influence educational achievement, they acknowledge that they cannot establish robustly causal relationships.

Barreau et al. find unsurprisingly that children from lower socio-economic backgrounds have poorer cognitive and non-cognitive development pre-school and go on to have lower levels of academic achievement and non-cognitive development at school. In fact they conclude that the socio-economic gradient in *academic* achievement actually steepens as pupils progress through the school system.

Some of the socio-economic gradient found by Barreau et al. can be explained by parental characteristics, e.g. parental education, or other child factors, such as birth weight. However, the authors also found that an important part of the socio-economic gradient in academic achievement can be explained by what they term "non-traditional" factors i.e. parental and child attitudes and beliefs. For example, the authors find that whether a parent reads to a child is an important determinant of cognitive development. Focusing on non academic outcomes, they confirmed that some of the socio-economic gradient in *non-cognitive* outcomes (measured by instruments indicating behavioural and emotional problems) is also attributable to these "non-traditional" factors. In particular, maternal mental health seemed to play a significant role in explaining a child's non-cognitive outcomes. The pupil's aspirations, self confidence in one's own ability, locus of control and behavioural problems explained both their academic achievement and non-cognitive outcomes. In particular these factors, along with traditional factors (e.g. parental education) could partly explain teenage non-cognitive outcomes, such as exhibiting behavioural problems and risky behaviours.

The authors conclude that both traditional factors (e.g. parental education and characteristics) and non-traditional factors (e.g. attitudes, beliefs and behaviours) are important in explaining the socio-economic gradient observed in both cognitive and non-cognitive outcomes. Barreau et al. did not however analyse in detail the role of schools, although they did find some evidence that the socio-economic gradient in outcomes was also related to the use of pre-school child care. In this study we focus particularly on the role of schools, and differences across schools, in cognitive and non-cognitive outcomes.

Be healthy

In the scoping study for this research project, we identified a number of data sets that included indicators of mental health and in particular depression. For instance, the National Child Development Study and the British Cohort Study data sets both use the Rutter internalizing scale, while the Longitudinal Study for Young People in England uses the GHQ score. These measures have been used extensively by other researchers particularly the CMPO/ IFS team that have been investigating non-cognitive outcomes for the Joseph Rowntree project (Barreau et al, 2008) as discussed above. Here we review key studies that focus specifically on health outcomes or health as an input to explain other educational outcomes.

Work on the relationship between education and health outcomes has been undertaken using data from the Avon Longitudinal Study of Parents and Children (ALSPAC). Propper, Rigg and Burgess (2004 and 2007) analysed the association between family income and child's health and focused on the mechanisms by which income translates into better child health. Both papers concluded that whilst poorer children have worse health outcomes the actual role of income per se is very small. In other words, in models that allow fully for parental behaviours (e.g. the diet they provide for their children, breast-feeding, maternal employment etc.), parental health and other factors describing the home environment, the role of income is generally small. What is more important is the mother's own health, particularly her mental health. Children of anxious mothers, for example, had worse health outcomes. These studies did not however focus specifically on the role of education or schools.

Greg et al. (2008) looks at the relationship between health and cognitive and non-cognitive outcomes. Specifically they find that poor health behaviours (e.g. smoking, poor child nutrition etc.) are important in explaining poor cognitive outcomes, as are environmental factors such as parenting skill (parental psychological health, cognitive stimulation of children by parents).

Reflecting the fact that obesity is the major public health issue in the US, there is a very large US literature that has examined the determinants of obesity and in particular the role of education and schools (see Story 1999 for a review). This literature has generally found that parental education and a person's own education are good predictors of obesity (for illustration, see studies such as Goodman et al. 2003 or Wardle et al. 2002). Certainly both the socio-economic status of parents and even more so parental education, are risk factors that are strongly correlated with childhood obesity (see for example, Goodman et al. 2003). Obesity aside however, the evidence on the link between education and health outcomes is quite mixed.

In a methodologically robust study, Clark and Royer (2008) found only limited impact from education on long run health outcomes. Their study used UK data and a regression discontinuity design based on the increase in the compulsory school leaving age in 1947. In 1947 the school leaving age was raised from age 14 to 15. This meant that there was an increase in education levels imposed by the state, and therefore exogenous. Clark and Royer (2008) confirmed the results from previous literature that the increase in the compulsory school leaving age did increase the overall level of education and qualification in the UK population. It also increased long run wages of those affected. However, it had only limited impact on long run health outcomes and mortality. Given the robust design of this study, the fact that they found only a weak link between a person's education and their health outcomes is highly informative.

As well as policy interest in the health outcomes from education, there is also a growing recognition that there may be reverse causality, i.e. an impact from health factors on education outcomes. There is a large literature on the link between childhood obesity and educational achievement. The vast majority of studies have found a positive correlation

between obesity and schooling outcomes. That said, much of this correlation is attributable to the fact that lower socio-economic groups have a higher incidence of childhood obesity (Goodman et al., 2003).

A study using ALSPAC data found what they interpreted to be a predictive link between childhood obesity (in pre-adolescence) and a child's likelihood of being a bully (Griffiths et al. 2006). Janssen et al. (2004) have also found that overweight and obese children are more likely both to be victims of bullying and to perpetrate bullying.

Stay safe

One issue that has been explored is the determinants of bullying. Studies have looked both at the chances of being the victim of bullying, and the impact of bullying or being a victim of bullying on other non cognitive outcomes (for instance, Gutman and Feinstein (2008) using ALSPAC; Barreau et al (2008) using LSYPE data, Brown and Taylor (2008) using NCDS, Bond et al. 2001 and Juvonen and Schuster (2003)).

Gutman and Feinstein (2008) using data from the Avon Longitudinal Study of Parents and Children (ALSPAC) found that children's individual experiences of bullying, victimisation and friendships are key factors affecting their well-being. Brown and Gutman (2008) - also using ALSPAC - explored the role of children's peer relationships. Their evidence suggested that belonging to a cluster characterised by a negative friendship pattern (i.e. being a *victim* or *bully/victim*) was significantly related to worse levels of well-being, behaviour and academic achievement. Compared to the positive friendship groups, these children overall suffered higher levels of depression, lower levels of self-esteem, were less likely to feel they had control over events, and less likely to enjoy or do well at school. They also engaged in more antisocial activities and interacted with more antisocial friends than the other clusters. This difference was especially large for *bully victims*, indicating that they are most at risk of such problems. Again the relationships are not necessarily causal although the authors of these studies do control for a range of confounding factors.

Using a different dataset (NCDS), Brown and Taylor (2008) studied the effect of bullying at school on educational attainment. They found that school bullying (in primary and secondary schools) has an adverse effect on human capital accumulation both at and beyond school and that these adverse effects are consistently larger if bullying occurred when the individual was aged 11 (as opposed to a younger age). Furthermore, their results suggested that being a victim of bullying has long lasting effects and also influences wages received during adulthood.

Foreman-Peck and Foreman-Peck (2007) used the LSYPE dataset to examine the relationship between student and parent reports of behaviour in and out of school and student learning between the ages of 11 and 14. They show that bullying when reported by the parent in all cases is associated with a negative relationship with student learning. This is not always the case when the bullying is student reported.

Much of the above literature however, has not attempted to establish causality per se, i.e. it has not taken account of the fact that individuals may have unobserved characteristics that are correlated both with bullying behaviour and achievement. Thus what appears to be a negative impact from being a victim of bullying and a pupil's academic achievement may actually be attributable to some unobserved characteristics of the student which is correlated with both being a victim and low achievement, e.g. self-esteem. Furthermore, the analyses have generally not considered the role of schools in preventing bullying nor the simultaneous relationship between bullying and other outcomes, as we do in this report.

Enjoy and achieve

Well being and school engagement

As part of the CEE work programme, Gibbons and Silva (2008) have examined the relationship between school quality, pupils' happiness or general well being and parental satisfaction. In particular they have focused on examining how parental satisfaction with their child's school and the pupil's enjoyment of school is determined by broader notions of school quality than can be measured simply by academic outcomes. They ask whether other

school factors that might impact on pupil well being are also important to parents. To do this work they too rely on the LSYPE data set, using cross section rather than the panel element. Pupil enjoyment is measured by three variables that describe a) whether the child enjoys school, b) whether the child is bored at school and c) whether the child dislikes his or her teachers. These measures of well being obviously focus on enjoyment of school rather than the more general notion of happiness that has been extensively explored in the literature (Layard, 2006; Blanchflower and Oswald, 2004)[5]. Gibbons and Silva conclude that a pupil's test score is the most important factor in determining parental satisfaction levels. They also find a significant relationship between the pupil's progress between KS2 and KS3 and their enjoyment of school. However, school average level of academic achievement, as measured by value added by the school between KS2 and KS3, only weakly predicts pupil enjoyment of school (and the relationship is often insignificant). Thus the academic achievement of the school is only weakly predictive of pupil enjoyment of school. This may be unsurprising given that they find that variation across schools in pupil enjoyment of school is limited (5.7-6.8%). Their analysis therefore suggests that most of the difference in pupil enjoyment is between pupils within the same school rather than varying at school level. Initially this might suggest that schools are playing a limited role in influencing pupil enjoyment, an issue we return to in our own analysis.

Another study by Opdenakker and Van Damme (2000) looked specifically at schools, teachers and classes on pupils' well being using a multi-level model approach and data from Flanders. The study used 8 measures of well being, namely well being in a school context, how well the pupil integrated to their class, their relationship with teachers, motivation, attitude to homework, attentiveness and their academic self-concept. Many of these measures relate more to the specifics of engagement and enjoyment of school, which we discuss next, rather than the general concept of well being. The multi-level model had three levels, i.e. pupil, class and school. This study, although not causal, found that schools accounted for a much lower proportion of the variation in well being than the variation in academic achievement. In other words on the face of it schools appear more important in determining academic achievement than well being. For example, around 40% of the raw variation in academic achievement of pupils is related to which class or school they are in. By contrast only 5 to 6% of the variation in well being was related to their class or school

[5] See Gibbons and Silva (2008) for a full discussion of the reliability and subjectivity of these types of measures of enjoyment and well being.

(not dissimilar to the Gibbons and Silva (2008) result above). Another key finding of the study was that good teacher engagement with pupils was associated with strong positive effects on pupil achievement and pupil well being. The authors also concluded that policies to enhance orderly learning environments and teaching quality may be effective for the achievement and for the well-being of the pupils.

School engagement specifically has attracted increasing policy attention as a possible antidote to perceptions of declining academic motivation and achievement (see Fredricks, Blumenfeld & Paris, 2004). As summarised in Fredricks et al. (2004), educational researchers have defined school engagement as a "multidimensional construct" which includes "behavioural engagement" (academic participation such as attendance and effort), "emotional engagement" (interest, boredom, sadness) and "cognitive engagement" (attitude towards work, flexibility in problem solving). Although it has been recognised that school engagement has potentially important implications for academic success (Fredricks et al., 2004), there are few economic studies that have investigated the determinants of engagement and the role of schools in affecting it, and this is therefore what we focus on in this report.

The only study we know that has analysed the role of schools on non cognitive outcomes is Dee and West (2008) who looked at the impact of class size on behaviours and attitudes that can be categorized as dimensions of student engagement. In particular, they group the items drawn from teacher and student surveys into three additive scales measuring student effort, initiative, and non-participatory behaviour. Using data from the Project STAR class-size experiment they find evidence that assignment to smaller class size is associated with an increase in student initiative, but does not have a significant impact on student effort and non-participatory behaviour

There is however, a theoretical literature on school engagement and satisfaction. For example, Verkuyten and Thijs (2002) model the determinants of school satisfaction, where school satisfaction is considered one of the components of general life satisfaction and wellbeing. They use a social cognitive perspective. This perspective emphasizes that people have intrinsic needs and people's attitudes and behavior are affected by the extent to which these needs are perceived to be met. Verkuyten and Thijs conclude that important

determinants of school satisfaction include the perception of one's own academic competences, peer status and acceptance, ethnic marginalization, gender and teacher likeability.

Dweck and Legget (1986) and Kaplan and Maehr (1999) take a somewhat different theoretical approach. They study the role that achievement goals may play in facilitating the well-being of students. Goal theory in educational psychology purports to explain students' motivation to learn. Goals of learning are thought to be the key component of student intrinsic motivation. Goals are divided into two types: task goals and ego goals. A student is described as task-involved when he engages in an activity with purpose of developing skills, gaining competence, and promoting understanding. This is associated with higher intrinsic motivation. Students who are ego-involved will be seeking to perform the task to self-enhance social comparison. Their own ego is tied up in the success of the task. These studies argue that schools can influence well being because goals that affect learning and achievement are also likely to contribute adolescents' wellbeing. Specifically, they argue that students who adopt ego goals tend to manifest a helpless pattern when they encounter failure, especially when students consider themselves to have low ability. In contrast students who pursue task goals manifest an optimistic orientation, and positive affect. Since the students' focus is not on the self, their positive attitude does not depend on their level of perceived ability. Whilst such theoretical work cannot tell us exactly how schools currently affect pupil well being it certainly assists us in thinking how schools might influence pupil satisfaction and we have incorporated this thinking into our analysis described below.

In terms of empirical evidence, there are a number of studies (apart from this one) that look specifically at school engagement and satisfaction. Dee and West, 2008 have analysed the impact of class size on non-cognitive outcomes categorized as dimension of student engagement. Using data from the Project STAR class-size experiment they find evidence that reductions in class size improve some non-cognitive skills related to student engagement.

Some empirical studies have focused specifically on the correlation between school satisfaction and academic achievement and generally found that students who dislike school are also those most likely to be failing academically, perhaps unsurprisingly. Conversely

students who have a positive perception of school and classroom climate are better motivated and achieve more. (Rutter et al. 1979, Epstein, 1981, Mortimore et al.,1988, Fisher and Fraser, 1991, Resnick et al., 1993).

Gilman and Huebner (2006) focus on the relationship between global high life satisfaction and academic outcomes. In order to investigate this relationship they use the "student life satisfaction scale" (SLSS) created by Huebner (1991): a 7-item self-report measure designed to assess global life satisfaction. Students rate their agreement to the items on a 6-point Likert scale scoring of this scale. The scale is then constructed by reverse keying negatively worded items, adding all items responses and dividing by the total number of items. Higher scores denote higher global satisfaction. They find that students with high life satisfaction reported more positive school experiences, a greater frequency of extracurricular activities participation and higher academic achievement than student with low satisfaction. These findings also reveal conceptual connections between life satisfaction and school context factors.

There is less research on the determinants of student satisfaction with school. Some studies suggest that characteristics associated with a positive view of school are student participation in and responsibility for the school life, and a good relationship with teachers. (Epstein, 1981, Good and Brophy, 1986, Kottkamp and Mulhern, 1987, Fraser et al., 1988, Millstein, 1993, Cabello and Terrel, 1994).

Suldo et al (2008) provide a review of the empirical literature on school-related correlates of life satisfaction. In particular they identify some correlates which have a strong positive correlation with global life happiness: namely, a positive relationship with teachers, perceived academic achievement and competence and academic self-efficacy. They conclude that the schools are indeed important to children's life satisfaction. In general students who feel they can handle schoolwork and perceive their teachers to be caring and supportive tend to evaluate their school experiences positively.

Unauthorized absence

Truancy has received a great deal of attention from policy makers and in the UK different initiatives to reduce unauthorised absences in schools have been recently introduced. For example, recent policies by the Labour government, such as the Anti-Social Behaviour Act of 2003, have introduced penalty notices for truants and parenting orders to combat such occurrences (see Buscha, 2008). Although such policies have not been evaluated in terms of their impact on academic achievement, there is a growing literature on both the determinants of truancy and the impact of truancy on academic achievement.

One of the first papers to investigate truanting behaviour in the UK is Bosworth (1994), using Youth Cohort Study (YCS) data. YCS data includes information on pupils' attitudes to school, as well as information about their truanting behaviour and cognitive achievement (the latter is measured by examination scores at age 16). The study not only found a clear socio-economic gap in attitudes towards school but also that pupils' attitudes towards school were found to be highly correlated with truancy and examination performance. Indeed this study suggests that pupils' attitudes to school and their truancy both determine pupils' cognitive outcomes.

Dustman, Rajah & Smith (1997) study the link between working part time whilst in school and truancy in the UK using NCDS data. They find that the probability of playing truant increases with the numbers of hours worked. The paper takes into account that the decision to work is likely to be endogenous in the truancy equation, and thus the authors model labour supply decision as a reduced form, estimating it simultaneously with the truancy equation. They use the unemployment rate and the percentage of married women participating in the labour force at the local authority level as external factors influence the numbers of hours worked (in technical parlance, these are instrumental variables). The idea is that these local labour market indicators should affect the supply of labour, but are likely to be uncorrelated with truancy directly. Once they take this endogeneity into account, they find a significant effect of part-time working on truancy for females only. Those who do more part-time working have higher rates of truancy.

Burgess, Gardiner & Propper (2002) use a structural model to determine whether truanting behaviour responds to economic incentives. Their idea is that truancy is the result of a rational decision process based on the comparison between the economic value of o schooling and the value of other activities the pupil can undertake whilst being of mandatory school age. In particular, they put forward a model of time allocation to various competing activities: school attendance, being in paid work and engaging in crime. In this framework truancy is the outcome of a rational choice by individuals who maximise their expected payoff from the three activities. Their estimates (based on a US panel dataset, the NLSY79) reveal that the economic rate of return to school, work and crime do in fact affect truancy. In particular, it seems that pupils with higher expected returns from studying are more likely to be in school, whilst those who have higher returns in the labour market, or who live in areas where the gains from crime are greater, have higher rates of truancy. Other factors, such a family background, are found to explain truanting behaviour. This paper constitutes an interesting attempt to provide a theoretical framework to truanting behaviour and highlights that truancy is not only related to personal and family characteristics but is also a function of other area and labour market characteristics that affect the benefits of school, the value of working and the payoff from crime.

As far as other determinants of truancy are concerned, Dustmann et al (1997) find that pupils' measured ability and parents' education have a negative impact on truancy, while truancy is increased by paternal unemployment. No effect of household income on truancy behaviour is found.

Denny (2006) has used PISA data to model the determinants of truanting behaviour, investigating the role of family background and birth order. Denny in fact found that socio-economic background and sibling birth order had little impact on the likelihood of children being late for school or missing school altogether. However, pupils' attitudes towards school and teachers did seem to be related to the likelihood of playing truant. PISA data are cross-section and although Denny used a rich set of covariates, this evidence may not necessarily be viewed as causal.

Buscha (2008) focuses on both the determinants of and effects of truancy and analyses the interrelationship between working during school, truanting and educational attainment,

using data from the Youth Cohort Study of England and Wales (YCS). They model this relationship using a trivariate probit model, to account for the endogeneity of the decisions to both truant and/or engage in part time working. The results show that working part time has a negative impact on academic attainment for boys, but not for girls. Truancy also has a strong detrimental effect on achievement for both genders. Moreover, both boys and girls experience an indirect negative effect on educational achievement from part-time working because working significantly affects truancy behaviour (consistent with Dustman et al. 1997, although the latter find an affect only for girls). Although Buscha (2008) uses a methodology that allows account to be taken of the endogeneity of truancy and working, he stresses that his results should not be interpreted as causal as the cross-sectional nature of the data does not allow one to identify the direction of causation.

Arulampalam et al. (2008) study the impact of absences from class on student performance using a rich administrative panel for economics students at a UK university. Although their study does not relate to schooling, we include it due to its robust methodological design. Their estimates control for endogeneity between absence and academic performance using an instrumental variable strategy. In other words, like a number of studies reviewed they find external factors (instruments) that predict absence but do not directly impact on academic performance. They use as instruments the days of the week and the time slots of the tutorial classes. Given the random assignment of students to class, the timetable of the classes is found to affect absences, but is not related to student characteristics. The results suggest that indeed missing class leads to poorer performance. This paper seems to find a genuinely causal effect, but since it focuses on university student it is indicative.

Other papers have investigated truanting behaviour without trying to uncover a causal relationship. For example Malcolm et al. (1996) study the determinants of truancy as well as its effect on achievement in 14 primary and secondary schools in Scotland. The nature of the study is mainly qualitative with in-depth interview to parents, pupils and teachers, but the report also provides some quantitative results. A simple regression analysis suggests a negative relationship between the number of absences and school performance for both boys and girls. Interestingly they find that explained and unexplained absences have similar effects on attainment.

Make a positive contribution

There are numerous outcomes that one potentially could consider under this ECM heading, including education achievement. Here we consider a number of studies that focus particularly on non cognitive behavioural outcomes. We do not review the existing literature on the determinants of academic achievement and school effectiveness, as this literature is already well reviewed (see Todd and Wolpin, 2003 and 2007; Reynolds and Teddlie, 2000 for example).

Gregg, Propper & Washbrook (2008) estimated the relationship between parental income and a number of different child outcomes using ALSPAC data. The outcomes they considered included IQ, academic achievement, locus of control, self esteem and behavioural problems, as measured by the Strength and Difficulty Scale[6]. They generally found a strong relationship between childhood disadvantage in primary school (age 7-9) and these outcomes. In particular they found a strong link between pupil disadvantage and *cognitive* outcomes. The relationship between family background and *non-cognitive outcomes* was somewhat weaker. The authors found a particularly strong role for parental education which was found to be the most important factor across the full range of child outcomes. This finding is important as their models controlled separately for income and other aspects of the home environment, suggesting a distinct role for parental education. It was not possible; however, with their data to determine exactly how parental education impacted on pupil outcomes. For instance, we would need to know whether parental education impacts on pupil outcomes because it is correlated with positive genetic traits or better parenting ability, or does it have a genuinely causal impact because parental education enables better transmission of knowledge and skill to the child. They concluded that:

> *"The unexplained differences in child outcomes associated with parents' education alone can account for between a quarter and two-fifths of the deficits of low income children."*

[6] They also considered physical health which was discussed earlier.

Gregg et al. (2008) also considered the role of home environment and some factors were found to be particularly strongly related to the full range of child outcomes. These included maternal smoking, breastfeeding, child nutrition and parental psychological function. Of course the relationships and associations they observe are not necessarily causal. For example, it may be that mothers who smoke in pregnancy and early childhood have other characteristics that negatively impact on their children and that are not accounted for in the admittedly rich data set that the authors use.

Greg et al. (2008) are also able to control for family income. They find that three quarters of the relationship between income and cognitive outcomes, for example, is in fact spurious and attributable to other socio-economic characteristics (e.g. psychological functioning of parents and parental education). That said, income remains a significant determinant of IQ and Key Stage 1 test scores in their analysis and income appears to be a better predictor than, for example, family structure and neighbourhood. Family income is also the most important predictor of some socio-emotional outcomes, namely self esteem and behaviour. In fact the relationship between income and non cognitive outcomes is stronger than is the relationship between family income and cognitive outcomes.

Greg et al. (2008) found little role neither for schools nor for the pupil composition of schools in determining these pupil outcomes, at least as measured by school fixed effect models. The authors do acknowledge though that they may be unable to separately identify the impact of neighbourhoods and schools in their data so this result should be viewed with caution.

Achieve economic well being

The focus of this report is the role of schools in producing various ECM outcomes. The value of those outcomes in the wider economy and in particular the labour market return to those outcomes is beyond the scope of this study. We just note that there is a vast literature on the relationship between cognitive outcomes, particularly education levels and qualifications, and economic success in the labour market. There is also a sizable and growing literature on happiness and its relationship to a variety of outcomes, including

economic outcomes (Oswald et al. 2008 and literature cited therein). The link between well being and economic prosperity is less robust, although Oswald et al. found in an experimental context that individuals who had greater happiness (or more specifically who were put in a better mood due to various stimulate) were more productive in piece rate work. A sizeable literature has also found that some health outcomes, including physical and mental health, are correlated with earnings. In particular, the wage penalty from obesity has been well researched. Thus we know that many ECM outcomes have some economic value, motivating our study on how such outcomes might be produced.

4 Empirical Strategy and Methodological Issues

Our empirical strategy is based on the theoretical concept of an educational production function. According to this approach, a number of inputs (such as family background, educational resources, and initial ability) are transformed by schools into different outcomes. The standard production function framework assumes that knowledge acquisition is a cumulative process by which current and past inputs are combined with a child's initial (or genetic) ability to produce cognitive outcomes[7] (see Todd and Wolpin, 2003 and 2007). This framework has been then extended to study the production of non cognitive outcomes as well (see for example Cunha and Heckman, 2007 and 2008 that jointly model the formation of cognitive and non-cognitive skills).

Following Todd and Wolpin (2003), the process of skill formation can be modeled as follows:

$$O_1 = g_0(F_0, \mu) \qquad (1)$$

Where O_1 is the child outcome in period 1 (the first year of school), F_0 are family inputs in t=0 (pre-school period) and μ is a measure of the child's endowed ability. In t=2, the child

[7] The main outcome variable of interest in the previous literature has been academic achievement proxied by standardised test scores or, exam results or staying on rates (see Vignoles *et al*, 2000, and Hanushek, 1997 and 2003 for detailed reviews of the literature on education production functions).

outcome depends on the entire story of family inputs, on initial endowment and on school inputs (S_1)[8] and therefore the equation will be:

$$O_2 = g_1 (F_0, F_1, S_1, \mu) \qquad (2)$$

In this way, child educational outcomes at any point in time are modeled as a cumulative function of endowment, family inputs and school experiences, which implies that the education production function should include the cumulative history of inputs that have affected the child's development. However, such detailed information is rarely available in the data and therefore analyses that study the contemporaneous relationship between school (or family) inputs and pupils achievement are likely to be affected by an omitted variable bias.

A common solution to this problem is to adopt a "*value added*" approach; that is to focus on the *change* in pupil outcomes over specific time periods. In its basic form, the value added specification relates educational achievement to contemporaneous measures of school inputs and family inputs and to a lagged achievement measure (Todd and Wolpin, 2007). Therefore, equation (2) is augmented by pupils' educational achievement (test scores, for example) in the previous period:

$$O_2 = g_1 (F_1, S_1, \mu, O_1) \qquad (3)$$

This approach allows us to control for the prior and often unobserved history of parental and school inputs. As stated in Vignoles et al (2000), the inclusion of the lagged outcome measure "effectively 'levels the playing field' at the time of school entry" (p. 5). We apply this value added model to both the cognitive and non cognitive outcomes that we analyse.

The value added specification also helps to reduce the problem of the possible endogeneity of school quality. If pupils are not randomly allocated into schools, then measures of school

[8] Along with the technology of education achievement production, Todd and Wolpin (2003) also model family and school decision on inputs. Family inputs depend on families' permanent resources and family decisions are assumed to be made subsequent to the actual realisations of the school inputs applied to their children. Schools are assumed to choose input levels for a particular child purposefully, taking into account the child's achievement level and the endowment and this decision does not depend directly on the level of family resources (Todd and Wolpin, 2003, p. F8).

quality may be correlated with pupil's characteristics resulting in biased estimates. In other words, if higher ability or more motivated pupils tend to enroll in different schools from lower ability and less motivated pupils then in a simple model of school effectiveness it will look like some schools are more effective than others, even though in fact this is attributable to their different pupil intake characteristics. This situation is likely to occur when wealthier or more educated parents make quite different school choices from less wealthy and less educated parents. What this means is that school effect estimates will be biased if the determinants of school assignment are not adequately controlled for. By including measures of outcomes before the pupils started at the school and controlling for a number of family and pupils characteristics, we are able to control for many of the determinants of school selection and for school intake[9]. In this way we reduce (but not eliminate) the bias of the estimates we produce.

We apply this value added approach to three separate outcomes: education achievement, school enjoyment and bullying. Following Todd and Wolpin (2003) we model a pupil's outcome as a linear, additive function of the full history of inputs received to date (captured by a lagged outcome measure). Formally, our econometric specification will be the following for each outcome:

$$O_{ijt} = \alpha_i + \beta O_{ijt-1} + \gamma_k \sum_k X_{ijkt} + \varphi_k \sum_k F_{ijkt} + u_{ij} \qquad (4)$$

where *i*, *j*, and *t* denote respectively pupil, school and period. O_t is the measure of outcome (respectively academic achievement, attitude toward schools and bullying) at age 16, while O_{t-1} refers to prior measures of the same outcome at the end of primary school in the case of measures of achievement (age 11) and at age 14 in the case of attitude toward school and bullying. X_k and F_k are a set of *k* pupil characteristics and *k* family inputs. As we will see in the next section, we are able to include a much richer set of controls as compared to many previous studies. Finally u_{it} is the usual error term.

[9] Rothstein (2008 and 2009) observes that students are sorted across classrooms in ways that correlate with both their score levels and their gains, implying that value added estimates will be biased as well. However, this problem should be less pronounced in the case of analyses that focus on schools (as is the case here).

A key focus of this report is the inter-relationship between different cognitive and non cognitive outcomes. Specifically we model the impact of each outcome (lagged) on all the others. In this way we can ask questions such as: what is the impact of prior education achievement on school enjoyment or the impact of being bullied on school enjoyment? This will help us develop a fuller understanding about which outcomes are likely to influence other ECM outcomes. However, we do need to be aware of the difficulties of establishing causality. We use lagged measures of each outcome in the models, thereby making full use of the longitudinal nature of the data. However, it may still be the case that individuals who have certain unobserved characteristics that make them enjoy school more, for example, also have higher levels of education achievement. In this case we may be wrongly attributing causality to the relationship between school enjoyment and academic achievement, for example. In some models for some variables we adopt an instrumental variable (IV) approach to overcome this problem and obtain causal estimates.

For an effective IV model we need a variable that predicts the endogenous explanatory variable but that does not directly impact on the outcome of interest. For example, we may fear that pupil academic achievement at age 14 is endogenous in a model of enjoyment of school at age 16. In other words, if we find a positive relationship between lagged academic achievement and school enjoyment it may be because there are unobserved characteristics that determine both whether a person has good academic achievement and whether they enjoy school. We thus seek another (exogenous) variable that predicts academic achievement but that does not directly impact on enjoyment of school. In this example we have a candidate, namely month of birth which has been found in other research to predict academic achievement (see Crawford et al., 2007) but that appears unlikely to directly impact on enjoyment of school. We were also able to find a suitable instrument for the number of absences experienced by the child, using the change in the total number of absences at the Local Authority level to predict the individual pupils' number of absences. We use this instrument on the grounds that it will measure exogenous changes in the likelihood of absence brought about by changes at the LEA level, e.g. from changes in policy. In other instances, for example lagged measures of school enjoyment and bullying in a model of academic achievement we were unable to find appropriate instrumental variables. In the discussion of results we make it clear where our estimates are more likely to be causal.

Another objective of this report is to examine the role of schools. The education production function literature has mainly studied the causal impact of specific school characteristics on student achievement, such as class size, teacher quality and expenditure (see Vignoles et al, 2000 for an overview). In this paper we also try to identify systematic school effects in the production of different outcomes and evaluate whether the scope for school intervention is the same when targeting cognitive and non-cognitive outcomes. Therefore we include *'school effects'* in our equation that allow us to examine the proportion of the overall variance in outcomes that are explained by differences between schools. This analysis of covariance should capture all between school differences in outcomes once the model includes the full range of other explanatory variables (see Rivkin *et al*., 2005). This approach is however, potentially problematic in survey data such as LYSPE where there are a limited number of children sampled from each school. Thus whilst we report the total variance in the outcomes that appears to be explained by differences between pupils within the same school and by the differences between schools, we are mindful that this will not provide statistics comparable to national data. Weighting is also not a solution in this instance since weighting would have to take account of the multilevel nature of the model and such weights are not currently available. This issue does not however, bias the coefficients on the other variables in the model, which are our prime interest.

In the hierarchical school effects model we estimate, the error term (u_{it}) is then decomposed into two components: a component ϑ_i which is specific to each school and constant across pupils in the same school, and a component ε_{ij} which is specific to each pupil.

$$u_{it} = \vartheta_i + \varepsilon_{ij} \qquad (5)$$

There are two approaches to estimating school effects ϑ_i. The first approach treats school effects as random (***random effect*** or multilevel models), while the second approach treats school effects as fixed (***fixed effect*** models). Most of the literature on school effectiveness has used a multilevel model approach which treats the school effect as random. In this paper, we estimate both random and fixed effects models and test the sensitivity of our

results across the two models. We are mindful however that where sample sizes per school are small, this points to a random rather than a fixed effect model being optimal.

Both random and fixed effect models suffer from a common problem, namely that pupils may sort into different schools on the basis of their ability or socio-economic background. If we want to interpret the school effects as causal, we need to be sure that we are controlling for everything that determines which school a child attends. For instance, if more educationally oriented parents enrol their children in particular schools, a simple fixed effect model may misleadingly suggest that these schools are more effective when in fact it is simply that they enrol the children of more educationally oriented parents who achieve more anyway. Only if we can control for parents' attitudes to education in our model (as we can in our data), can we be confident that the apparent effect of the school is genuinely causal. Of course in reality there may be many other factors that we do not have in our data which influence both which schools pupils attend and their outcomes. Therefore, in the absence of experimental data, we cannot be totally sure we are estimating causal impacts.

Having obtained estimates of school effects, we then explore whether these effects differ systematically across different types of school and whether there are potential trade offs between different ECM outcomes. We do this by estimating random effect models and including various specific school characteristics, such as school size or proportion of children in receipt of Free School Meals, on the magnitude of the school effect. This can help us answer the question: what characteristics of schools are associated with better school effectiveness on that particular outcome?

We can also correlate the school effects extracted from a fixed effect model of each outcome (i.e. the models of academic achievement, school enjoyment and bullying). This evidence is indicative only but will help us understand whether schools that have greater than average progress in their pupils' academic outcomes also have greater than average changes in their pupils' school enjoyment?

5 The Data

Our analysis relies on an extremely rich data source. We use data from the Longitudinal Study of Young People in England (LSYPE) matched to administrative data collected by the Department for Children, Schools and Families (DCSF) on all pupils in all state schools in England. The National Pupil Database (NPD) provides information on pupils' records in standard national test (Key stage tests) for all children aged between 7 and 16, and the Pupil Level Annual School Census (PLASC) contains a number of pupil-level background characteristics.

The LSYPE is a survey of about 15,000 young people in England who were aged 13 and 14 in 2003/2004. The survey provides detailed information on pupils' personal characteristics, attitudes, experiences and behaviours, as well as on family background, household composition and parents' characteristics and aspirations. The first wave includes about 15,000 pupils in Year 9 attending maintained schools, independent schools and pupil referral units[10]. These pupils have been followed and interviewed on an annual basis. Our analysis is based on the first three waves which cover schooling years 9, 10 and 11. Our final matched sample includes about 5700 individuals for which we have full information on all the variables.

Cognitive outcomes are proxied by academic achievement measured using the results in Key Stage tests contained in the NPD. The Key Stage tests are national achievement tests performed by all children in state schools and that are anonymously marked by external graders. Key stage 1 is taken at age 7, Key Stage 2 at age 11, Key Stage 3 at age 14 and Key Stage 4 at age 16. Throughout Key Stage 1 to Key Stage 3, pupils are assessed in the core disciplines English, Mathematics, and Science, while at Key stage 4 pupils can take a variety of subjects (on the top of English and Mathematics that are mandatory for all pupils). Our cognitive outcome measure is the pupil's results at Key Stage 4 (GCSEs[11] and equivalent) that marks the end of compulsory schooling. In particular, we use a capped average point

[10] The LSYPE used a two-stage sampling design that oversampled more deprived schools and then over-sampled pupils from the major minority ethnic groups (Indian; Pakistani; Bangladeshi; Black African; Black Caribbean; and Mixed) within schools. Therefore the sample is not fully representative of the population.
[11] General Certificates of Secondary Education

score[12] - already available in the raw data - that takes into account the pupil's eight highest grades.

Since we estimate a value added model we also include in the equation prior attainment as measured by results in Key Stage 2 before the pupils enter secondary school. In this case, we use a continuous measure computed by summing up the total marks in the core subjects English, math and science. In order to make the results in the two sets of tests taken at different ages comparable, we standardise both the age 11 score and the age 16 score so that they have mean 0 and standard deviation 1.

To measure non-cognitive outcomes we first use a variable describing pupils' attitude toward school in year 11. This variable is obtained from LSYPE interviews in 2006 and it sums the answers that the young person has given to 12 attitudinal questions relating to how they feel about school[13]. The variable ranges from 0 – 48 by assigning values to the variables (using a Likert scale) according to whether they were positive or negative statements[14]. The higher the score, the more positive is the young person's attitude to school. As for the cognitive outcome variable, for the attitude equations we include a measure of prior attitudes, calculated in the same way using questions from school year 9, when the pupils were aged 14.

The second variable capturing non-cognitive outcomes is a scale that measures the extent to which pupils have been victims of bullying at school. The LSYPE questionnaire contains a set of questions regarding bullying at each wave. Questions are asked to both parents and children and we chose to use parent-reported measures.

[12] According to the new scoring system introduced between 2002–03 and 2003–04, 58 points were awarded for an A*, 52 for an A, 46 for a B, 40 for a C, 34 for a D, 28 for a E, 22 for F, and 16 for a G. Marks are allocated for standard GCSEs, but also for all qualifications approved for use pre-16, such as entry-level qualifications, vocational qualifications, and AS levels taken early.

[13] The specific items: are 1) I am happy when I am at school ; 2) School is a waste of time for me; 3)School work is worth doing; 4) Most of the time I don't want to go to school; 5) People think my school is a good school; 6) On the whole I like being at school; 7) I work as hard as I can in school; 8) In a lesson, I often count the minutes till it ends; 9) I am bored in lessons; 10) The work I do in lessons is a waste of time; 11) The work I do in lessons is interesting to me; 12) I get good marks for my work. For each of these items pupils have to say whether they a) strongly agree; b) agree; c) disagree; or d) strongly disagree.

[14] For further details see the LSYPE user guide, available at http://www.data-archive.ac.uk/doc/5545/mrdoc/pdf/5545wave_three_documentation.pdf

Parents are asked to state whether the pupil has had been the victim of any of the following bullying behaviours in the past 12 months:

1. Called names by other pupils at his/her school;
2. Sent offensive or hurtful text messages or emails;
3. Shut out from groups of other pupils or from joining in things;
4. Made to give other pupils his or her money or belongings;
5. Threatened by other pupils with being hit or kicked or with other violence;
6. Actually being hit or kicked or attacked in any other way by other pupils;
7. Experienced any type of racist behaviour by other pupils;
8. Any other sort of bullying;
9. No, none of these things have happened in the last 12 months.

Based on these questions, we created an index of bullying for wave 3 at age 16 (as the outcome measure) and wave 1 at age 14 (the lagged prior measure). The bullying index is constructed summing up the items above. The resulting variable ranges from 0 (if none of those things have happened in the previous 12 months) to 8 (if all of those things have happened in the previous 12 months).

This bullying index based on parental questions (rather than on questions asked to young people) is our preferred measure as as parent-reported measures are less subjective and less related to pupils' attitude toward schools (see Gibbons and Silva, 2008). However we also test the sensitivity of our results to the use of a different measure of bullying based on questions addressed directly to the young person. This new index is created using the same procedure as above but it based on slightly different items[15], therefore the two indices are not perfectly comparable. A rough comparison of the two indices reveals that parents tend to report a lower incidence of bullying, possibly reporting only the most serious and problematic situations. The two measures are however highly correlated and the correlation coefficient (0.35) is statistically significant. As we will illustrate in section 6.3, our results are robust to the use of these two different definitions.

[15] In particular the index is constructed summing the following items: 1) whether have been upset by name-calling inc text or email in last 12 months; whether have been excluded from a group of friends in last 12 months; 2) whether have been made to hand over money or possessions in last 12 months; 3) whether have been threatened with violence by students in last 12 months; 4) whether have experienced violence from students in last 12 months.

The three outcomes we consider are significantly correlated. In particular a child's attitude to school and their academic achievement is highly positive correlated (0.41). Those with higher levels of academic achievement and with greater levels of enjoyment of school are less likely to have experienced bullying.

While the focus of the paper is on how schools impact on *changes* in outcomes over time, it is still interesting to observe how the *levels* of the outcomes vary across and within schools at the beginning of the studied period. The next table (Table 2) reports some descriptive statistics on prior measures of our three outcome variables, measured before pupils enter secondary school, in the case of KS2 results, and at the beginning of secondary school (wave 1 at age 14) for school enjoyment and bullying. In particular, we regressed the prior measures of the three outcome variables on a constant, which gives the mean value of the variable, including school random effects. This allows us to observe to what extent variations between schools explain the overall variance in the given prior measure of the outcome in question, noting the caveats discussed in the methodology section about the problems of estimating these statistics in sample data with small numbers of pupils per school. Around one fifth of the variation in Key Stage 2 test scores is across schools (rho=0.25). This is a smaller estimate of the across school variation in achievement than we obtain when modelling a similar model, in the full population[16] (estimating our model on NPD/PLASC administrative data). For school enjoyment and bullying the systematic differences across schools seem to be much less: only around 6% of the variance in school enjoyment and bullying is explained by variation between schools: this is likely to be an over estimate but we cannot verify this result in the administrative data as such data do not include measures of enjoyment and bullying.

We include in the regressions a rich set of covariates (as set out in brief in Table 2: full details, including descriptive statistics can be found in Appendix A). The first set of covariates is taken from NPD/PLASC and includes pupils' characteristics commonly available in administrative data. These are: gender, ethnicity, whether English is the first language,

[16] When we calculate the variation in Key Stage 2 test scores across schools using the full NPD/PLASC data, we obtain a rho equal to 0.34; however when we use NPD/PLASC data, restricting the sample only to the schools included in LSYPE survey, rho is 0.17, which is smaller than that obtained using only the observations for pupils in LSYPE.

whether eligible for Free School Meals (FSM) as an indicator for poverty and whether any Special Education Need (SEN) is identified. In our main analysis we do not distinguish between SEN with statement and Action Plus and non-statemented SEN. However, we have run additional regressions where we disaggregated the two types of SEN and the results indicate that being classified as SEN with statement has a stronger impact especially on the experience of bullying (see Table A3.4 in appendix 3). Since 2005, PLASC also provides information on the number of (authorised and unauthorised) absences at the pupils' level. Therefore, an interesting novelty of our analysis is that we are able to include in our model the number of unauthorised absences, which includes lateness, unauthorised term time holidays, absence which is not yet explained and other absence which the school has not yet authorised. As we underlined in section 3.4, unauthorised absence has received great attention from policy makers and is an important variable in the ECM programme but its actual impact is still under-investigated in the literature. The variable we use to measure unauthorised absence is a count of the number of days that the pupil is absent without permission from school. There is particular policy focus on persistent absence, i.e. absence in excess of 20%, and the DCSF has identified that children with this higher level of persistent absence are known to be at particular risk of negative outcomes[17]. However, we also find a significant linear relationship between levels of unauthorised absence and the outcomes of interest and therefore include the total count of unauthorised absence.

The second set of much richer covariates is taken from the LSYPE questionnaire and includes other variables that are able to capture family socio-economic background in more detail. The LSYPE covariates also include several variables on pupils' attitude and behaviours and expectations (see table 2). We have tried to include all attitudinal and behavioural responses that are likely to influence both parental choice of schooling and pupils' engagement with school, taking account of other findings in the literature. Unlike many other data sets, the LSYPE was designed specifically to address issues around secondary schooling. As a result it contains an incredible array of detailed questions relating to the attitudes, values and behaviour of both parents and children. As such we are confident that we are controlling for most factors that are likely to influence schooling choices and outcomes. The other advantage of the LSYPE data set is that it includes many other

[17] http://nationalstrategies.standards.dcsf.gov.uk/node/98020 The DSF identifies persistent absentees as having more than 63 sessions of absence (authorised and unauthorised) during the year, typically over 20 percent overall absence rate.

measures that are central to the ECM programme, particularly measures of pupils' health and their extracurricular activities.

The measure of health is self reported by the pupils who are asked to rate their overall health over the past 12 month. The variable assumes values from 1 (not good at all) to 4 (very good). To capture extra-curriculum activities we inserted two dummy variables, one for extra- curriculum private classes in subjects that pupils also do at school and the other for extra- curriculum activities or private classes in other supplementary subjects. While the former may be correlated with pupils' attainment in a negative way (those who need extra private classes are those with lower achievement), the latter should capture more precisely the effect of the involvement in activities outside schools on pupils' achievement. We include these variables in our modelling and comment on any significant relationships that emerge.

The third set of variables that we include is a set of school-level characteristics which may influence pupil outcomes, such as school type, pupil-teacher ratio, proportion of pupils eligible for free school meals and school average KS2 results. These variables are taken from the *Local Education Authority Statistical Information Service* (LEASIS) database.

Table 3 lists all the variables we used in the analysis: descriptive statistics are provided in Appendix 1.

6 Results

This section presents our estimation results. We model the determinants of the three different ECM outcomes separately: namely, education achievement (table 4), enjoyment of school (table 6) and bullying (table 8). For each outcome we start by focusing on the inter-relationships between the various ECM outcomes, where possible using results from applying the method of Instrumental Variables to robustly establish causality (as described in section 5). We then move on to consider the role of schools in producing such outcomes.

Education achievement

Table 4 models the determinants of education achievement, as measured by KS4 (GCSE) test scores. Table 4 can be read as follows. As we move from left to right across the table, we add first covariates from the administrative data (PLASC) and then the richer set of covariates from LSYPE data. For each specification we estimate both a fixed and random effects model, which we discuss in Appendix 2. We note however, that results, in terms of the coefficients on the explanatory variables, are virtually identical regardless of whether a FE or a RE model is applied.

Of primary interest are the coefficients on our two (lagged) outcome variables, namely pupils' attitudes to school and whether or not the student has been bullied. Recall these non cognitive ECM outcomes are prior measures i.e. measured at age 14. The results suggest that even allowing for as many other factors as the data will allow (columns 7 and 8), pupils with more positive attitudes towards school at the beginning of the period have higher academic achievement by age 16 and pupils who were being bullied at age 14 had significantly lower education achievement at GCSE. Specifically, pupils with a 1 SD increase in school attitude and enjoyment of school[18] have around 0.1 SD higher levels of academic achievement at KS4: the effect is not large. The strength of the relationship between being bullied and academic achievement is somewhat weaker still. A 1 SD increase in the incidence of being bullied[19] is associated with a 0.02 reduction in academic achievement.

We include a number of other variables in the model relevant to the ECM initiative. In particular, we include a variable indicating the pupil's self rated health, which is found to be positively and significantly associated with academic achievement. Likewise participation in extracurricular activities is also positively and significantly correlated with achievement. We also have a lagged measure of another potential ECM outcome, namely the number of unauthorised absences from school. We find a strong negative and significant relationship between previous unauthorised absence levels and academic achievement. Children who have more unauthorised absence also have lower levels of academic achievement.

[18] The attitude variable has mean 32 units, SD approximately 8 units.
[19] The bullying variable has mean 0.27 units, SD 0.7.

Approximately, a 1SD higher level of unauthorised absence is associated with a 0.25SD lower level of academic achievement, so the relationship is relatively strong[20].

In order to understand if the observed relationship between unauthorised absence and achievement is causal, we have re-estimated the model in col. 7 using instrumental variable methods. We instrumented the number of unauthorised absences in 2005 with the change in the total number of absences at the Local Authority level between 2004 and 2005. The idea is that a pupil's number of absences may be affected in a random way by changes in policies to deal with unauthorised absence at the LA level. Such shocks in policy are unlikely to be related to pupils' achievement. Our instrument seems to work satisfactorily, as the first stage F statistic is equal to 6.30 and strongly significant. Once we instrument individual absence, the coefficient on absence increases substantially to -0.22[21] and remains strongly significant, suggesting the existence of a causal relationship between unauthorised absence and achievement.

The other controls in the model are not the focus of this report so we do not discuss them in detail. The results are however consistent with previous research (see table A6.1 in Appendix 6) where we report the coefficients of all variables). The Free School Meal variable (FSM), measuring pupils' socio-economic disadvantage, is always negatively signed and significant. Poorer children who are in receipt of Free School Meals make less progress between Key stage 3 and 4. Females by contrast make more progress, as do all ethnic minority groups when compared with white students. The coefficients on the ethnic groups are only statistically significant however, in the case of Bangladeshi, Indian, Chinese and African groups. Parents' qualification levels are positively related to their children's academic achievement. In fact the influence of parental qualifications appears to be stronger than parental social class. Parental aspirations about their child's educational prospects were also found to be positively and significantly related to students' academic achievement.

We are also interested in the specific effects of schools. In the first column, we estimate an empty model i.e. with no covariates. This model therefore provides us with the basic information about the extent of variation in education achievement that is within schools

[20] The mean value of the lagged unauthorised absence variable is 2.9 and the SD 9.9.

[21] The observed increase in the coefficient once we use IV may be due to the fact that IV estimates correct for the measurement errors that tend to downward bias the estimated coefficient.

and between schools. The intra class correlation statistic at the bottom of column 2 from the random effects model is most useful in this regard. This statistic indicates that around one fifth of the variation in Key Stage 4 test scores is across schools (rho=0.23). As additional covariates are included in the model we find that the value of rho does not reduce, indicating that the variation in education achievement across schools does not vary significantly when we take account of other factors that influence education achievement[22]. We might have expected that as additional controls are included in the model the variation between schools is reduced. In fact closer examination suggests this is the case. As expected, once we include more controls, the between school standard deviation does indeed decrease (sigma_u). However the within school between pupil standard deviation (sigma_e) also decreases as we explain more and more of the variation between pupils, particularly when we add the rich LSYPE controls. As a result rho changes very little.

We also want to explore the characteristics of schools that may influence value added achievement between Key Stage 2 and 4. In column 8 we estimated the random effects model and added school characteristics as shown in Table 5 below. By and large the school characteristics included in the model are not significant, suggesting that schools that are more effective in terms of progressing children from Key Stage 2 to Key Stage 4 do not have systematically higher (or lower) pupil teacher ratios or proportions of children eligible for free school meals, for example. The only school characteristic that is significant is whether the school is a Voluntary Aided, Foundation or City Technology School. These institutions tend to be more autonomous than community schools and they appear to have more positive school effects in this value added achievement model. That said, the issue of causality that we referred to earlier is important here. It may be that children who enrol in these schools have different characteristics that are not fully taken account of in our model i.e. not accounted for by prior KS2 achievement. If this is the case, we may be observing the effect of higher achieving children selecting into these schools rather than a causal impact from these schools on pupils' achievement. It is also important to note that the LEA dummy variables are jointly significant and substantially improve the fit of the model. Thus it would

[22] These estimates of the across school variation in achievement are different compared with the estimates we obtain when modelling a similar model in the full population. Using the full population from NPD/PLASC we obtain a rho equal to 0.264 in the empty model (without any covariates) but this estimate almost halves in the value added model when we include prior attainment at KS2 (rho=0.122) and further reduces when we add other pupils' characteristics (rho=0.091). Therefore it seems that LSYPE data overestimate the extent of the variation across schools in the full specification.

appear that there are mean differences in school effects across different local areas. Interpretation is difficult: it could be due to different LEA education policies or more likely it is due to differences in the characteristics of different areas that are not fully taken account of in the model.

Enjoyment of school

Table 6 models the determinants of pupils' enjoyment of school, where their enjoyment of, and attitudes towards, school is measured by a series of questions posed to the young people at ages 14 and 16 in the LSYPE (discussed in the data section above). Since we have two measures of enjoyment over time we can adopt the same value added strategy that we applied to our model of educational achievement, including pupils' lagged attitude towards school in the model. Similarly to Table 4, as we move from left to right across the table, we first add covariates from the administrative data and then the richer LSYPE variables. Again our focus is primarily on the inter-relationships between the various cognitive and non cognitive outcomes.

To investigate the inter-relationships between the ECM outcomes we include lagged measures of both academic achievement (as measured by Key Stage 2 test scores) and bullying in the model. The results suggest that prior achievement at Key Stage 2 is very highly positively correlated with subsequent enjoyment of school. Children who achieve more in age 11 tests go on to enjoy school to a greater extent at age 16. The magnitude of this effect is reduced substantially however, when LSYPE controls are added to the model, indicating that some of the apparent relationship between prior education achievement and enjoyment of school is spurious. It is simply picking up the effects of social class and parental attitudes that are not included as covariates in models 1 to 6. This also indicates the problem with relying only on administrative data for such models, as the controls that are in the PLASC data are insufficient to take account of all the determinants of enjoyment and as a result the apparent impact from prior educational achievement is upward biased. The magnitude of the coefficient on prior educational achievement is nearly halved once we include the richer set of LSYPE controls.

We can go further to establish causality however. As discussed in the methodology section, we have a suitable instrumental variable with which to predict educational achievement at Key Stage 2, namely month of birth. Children born in the summer achieve less at school academically but we hypothesise there is no reason to believe they will enjoy school any less simply due to being born at that time of year. When we instrument their Key Stage 2 test score with month of birth the coefficient on lagged education achievement becomes insignificant (see table A5.1 in Appendix 5). Thus quasi experimental evidence suggests that there is no genuine causal relationship between academic achievement and subsequent enjoyment of school. Thus, the observed relationship between academic attainment and attitude toward school may be just due to pupils' unobserved characteristics that affect both the variables, such as motivation and aspirations.

The results also indicate that children who were bullied at age 14 are significantly less likely to enjoy school at age 16. We do not have an instrumental variable for bullying at age 14 and therefore we are not so sure that this result is causal. The magnitude of the effect indicates that a 1SD increase in the level of bullying being experienced by the child in the previous period is associated with a 0.2SD reduction in their enjoyment of school.

As well as the key ECM outcomes above, the model also includes a measure of unauthorised absence. This is highly significant in the model. Children with higher levels of unauthorised absence have markedly lower levels of school enjoyment. This relationship is particularly strong. A 1SD increase in unauthorised absence is associated with a 1.6 SD lower level of pupil enjoyment of school. However, clearly the direction of causality is not necessarily clear. Once we instrument the number of absences using the change in the total number of absences at the Local Authority level (as described above), the coefficient becomes insignificant (see table A5.1). This seems to suggest that, while school absences have a clear causal impact on pupils' achievement they do not directly impact on their enjoyment. Pupil health is also significantly correlated with their enjoyment of school. Pupils who self report being healthier do have higher levels of school enjoyment. Interestingly hours of paid work are negatively associated with school enjoyment: children who do more paid work are less happy at school although the direction of causality is not clear here. Children whose parents have high aspirations of their education also tend to enjoy school more.

We now consider the role of schools specifically in determining pupil enjoyment of school. The above model suggests that the raw between school variation in attitudes and enjoyment of school is less than the between school variation in education achievement. In other words, consistent with previous literature, the school effect on pupil enjoyment is less than the school effect on academic achievement. Relying on the random effects model in column 2, the intra class correlation is just 0.05. This implies that most of the differences between pupils in their enjoyment of school are not attributable to between school differences. When full controls are added to the model, it seems that only 3% of the variation in pupil enjoyment of school is attributable to differences across schools (col. 8). We add a note of caution here however. LSYPE models appear to overestimate the extent of between school variation in achievement and if this is also the case for such non cognitive outcomes, these estimates of the between school variation are likely to be upward biased.
As we did in the case of education achievement, we also explored the role of school characteristics using the random effects model from column 8. Only the pupil teacher ratio is significant at the 5% level. This implies that schools where pupils are experiencing higher than average gains in enjoyment between KS2 and KS4 also tend to have lower pupil to teacher ratios.

Bullying

The final outcome we consider in Table 8 is the extent of bullying experienced by the young person at age 16 (see data section for a description of the variable). Again we have a prior measure of bullying experienced by the pupil measured at age 14 and we are therefore able to adopt a value added specification. The results strongly suggest that pupils who experienced a greater degree of bullying at age 14 were, unsurprisingly perhaps, likely to experience a greater degree of bullying at age 16.

The coefficients on the other lagged ECM outcome variables suggest firstly that academic achievement at age 11 is uncorrelated with the degree of bullying the child experiences at age 16. When we instrument this lagged educational achievement variable (with our month of birth instrument), the coefficient remains insignificant (see table A5.1). Thus the pupil's own prior academic achievement does not, in and of itself, appear to cause them to be

more or less likely to be bullied at age 16. High achieving pupils are no more likely to be bullied, nor those with lower levels of achievement.

In terms of other potential ECM outcomes, pupils who have more unauthorised absence at age 14 are no more likely to report a higher degree of bullying at age 16. The results do, however, suggest that pupils who report health problems at age 14 are significantly more likely to report being bullied at age 16. Whilst we cannot be confident of causality here this is an issue that needs further investigation, particularly as our results (not shown) also indicate that children with Special Educational Needs are more likely to experience bullying at age 16 (even taking account of whether they were bullied at age 14).

In general the results in Table 8 also suggest that there is virtually no variation in the bullying outcome that is attributable to differences between schools. In the random effect models from table 8, the intra class correlation was essentially zero. Table A3.3.in the appendix reports the same regressions using a measure of bullying based on young people reports to questions (see paragraph 5) and confirms that the results are not sensitive to the scale used.

As we did in previous models, we explored the role of school characteristics based on the random effects model from column 8, these are presented in Table 9. Schools in which pupils experienced a higher increase in the incidence of bullying between age 14 and 16 tended to have lower proportions of children eligible for Free School Meals. Single sex schools seem to have experienced lower increases in the incidence of bullying between age 14 and 16. When we include LA dummies (jointly not significant) we also find a negative coefficient on pupil teacher ratio. Whilst disadvantaged schools and large schools with higher pupil teacher ratios (and potentially less supervision) do tend to have higher levels of bullying, we are examining *changes* in the incidence of bullying during secondary school and pupils in disadvantaged schools do not appear to experience a greater increase in bullying between ages 14 and 16.

Correlation between fixed effects from different ECM models

In this last section, we determine the correlations between the mean school effects from the different models. This enables us to ask whether schools that have high mean school value added on, say, education achievement also have high value added in pupils' enjoyment of school. The results indicate that all the school effects from the different models are significantly correlated[23]. However, the strongest relationship is between the fixed effects from the model on school enjoyment and achievement. Schools that add greater value in terms of pupil enjoyment also add greater value in terms of academic achievement. The other relationships as described in Figures 2 and 3 are less pronounced. We need to be cautious here however. Firstly where sample sizes per school are small fixed effects are likely to be biased. Secondly, in our instrumental variable approach described above, we found no significant relationship between pupils' prior achievement and their subsequent enjoyment of school. However in a standard OLS we did find a positive relationship between pupil lagged achievement and their subsequent school enjoyment. This implies that the OLS model was showing spurious correlation because pupils with high academic achievement and positive enjoyment of school have similar unobserved characteristics that we cannot fully account for in the OLS model. If we face a similar problem here, it may be that schools with high mean value added in achievement also have high mean value added in school enjoyment because of the unobserved characteristics of the pupils that attend such schools. We should not therefore interpret these correlations as causal but simply informative.

7 Conclusions

In this report we considered the determinants of a range of outcomes in school age children and looked in particular at the role of schools in determining academic achievement, enjoyment of school and the risk of being bullied. We also attempted to identify potential complementarities and trade-offs between different ECM outcomes.

[23] The table of correlations is given in the Appendix.

In general we found that whilst schools clearly play an important role in determining pupil achievement, variation across schools in the other non cognitive outcomes is much less. For enjoyment of school, only around 3% of the variation across pupils was attributable to differences across schools. This is similar in magnitude to results found by Gibbons and Silva (2008) and Opdenakker and Van Damme (2000) although we have reason to believe even this may be an overestimate of the true variation across schools. A key message from the analysis is therefore that whilst schools are an obvious and important policy lever to raise pupil achievement, currently schools may not be playing as large a role in determining pupils' enjoyment of school and whether or not pupils get bullied. This does not mean that schools cannot exert a greater impact on these non cognitive outcomes but rather that this does not happen currently. When we investigated how schools varied in their effectiveness in producing the three ECM outcomes (academic achievement, enjoyment and bullying), we found that in general schools that had high value added on academic achievement also had high value added in terms of enjoyment. We found no evidence of trade-offs between the outcomes under consideration: in general the relationship between school attended and bullying and enjoyment was very weak.

Another issue of policy interest is the inter-relationship between the specific ECM outcomes that we considered. Although we focused on academic achievement, enjoyment of school and bullying as our main outcome variables, we were able to look at interactions between a much wider range of potential ECM outcomes. Specifically, we also considered the role of health, extra curricular activities, paid employment and unauthorized absence on the three main ECM outcomes of interest.

Our results suggest that pupils with higher levels of school enjoyment also have higher levels of academic achievement, although the effect is not overly large. The reverse was also true: children who had higher academic achievement at 14 went on to have higher levels of enjoyment at age 16, although this result disappeared when we used the more robust method of instrumental variables. There is a significant but weaker relationship between bullying and other outcomes, namely pupils who experience bullying have subsequently lower levels of academic achievement and lower levels of enjoyment of school. The reverse is not true. Pupils with higher levels of academic achievement at age 14 are no more likely to experience bullying at age 16.

Pupils' health was also found to be positively correlated with academic achievement and enjoyment. Pupils with health problems at age 14 or who had Special Educational Needs were significantly more likely to report being bullied at age 16.

Extracurricular activities, including tuition, were positively related to academic achievement. However, pupils who worked more hours in paid employment had lower levels of enjoyment of school.

There was a strong negative link between unauthorised absence in the previous period and subsequent academic achievement and an even stronger negative link with school enjoyment. Clearly unauthorised absence is a marker for subsequent poor achievement and lower pupil well being.

In summary, our findings suggest that whilst the role of schools in promoting some ECM non-cognitive outcomes is limited (e.g. school enjoyment), nonetheless there are important inter-relationships between the different ECM outcomes. We highlight two policy implications from our results.

Firstly, academic achievement and school enjoyment are positively correlated both at an individual level and at school level. This would seem to imply that focusing policy on academic achievement and improving school effectiveness in the academic sphere may also benefit children in terms of their enjoyment of school, although of course it is possible that schools might be reorganised to play a greater role in ensuring children's enjoyment of school. Also, we might ideally want to focus on a more general measure of child well being which is not available in the data and is something that clearly merits future research attention.

The second policy implication is that some non-cognitive indicators can be potentially used pro-actively to target pupils at risk of future cognitive and non cognitive difficulties. Those with high levels of unauthorised absence go on to have lower levels of academic achievement and school enjoyment. Those with poor health (especially with Special

Educational Needs) go on to have worse academic and non cognitive outcomes. Thus these indicators might be used to work with pupils at greater risk of poor outcomes.

References

Arulampalam, W., Naylor, R. & Smith, J. (2008): "Am I Missing Something? The Effects of Absence from Class on Student Performance," *IZA Discussion Papers* 3749, Institute for the Study of Labor (IZA).

Barreau, S., P. Carneiro, H. Chowdry, C. Crawford, L. Dearden, A. Goodman, P. Gregg, L. Macmillan, L. Sibieta, K. Sylva & L. Washbrook (2008) "The socio-economic gradient in child outcomes: the role of attitudes, behaviours and beliefs", Interim Report for the Joseph Rowntree Foundation, July 2008.

Blanchflower, D. and A. Oswald (2004): "Wellbeing over time in Britain and the USA", *Journal of Public Economics*, vol. 88, 1359-1386.

Blanden, J., P. Gregg and S. Machin (2005) 'Educational Inequality and Intergenerational Mobility' in Stephen Machin and Anna Vignoles (eds.) *What's the Good of Education? The Economics of Education in the UK*, Princeton University Press.

Bond, L, Carlin, J.B, Thomas, L, Rubin, K and Patton, G (2001) "Does bullying cause emotional problems? A prospective study of young teenagers", *British Medical Journal*, Vol 323: 480-484.

Bosworth, D.L. (1994): "Truancy and Pupil Performance" *Education Economics*, Vol. 2 (3), pp. 243-265

Brown, J. and Gutman, L. (2008): "The importance of social worlds: an investigation of peer relationships", Centre for Research on the Wider Benefits of Learning (WBL) Research Report, No. 29

Brown, Sarah & Taylor, Karl (2008) "Bullying, Education and Earnings: Evidence from the National Child Development Study", *Economics of Education Review*, Vol 27(4): 381-401.

Burgess, S., Gardiner, K., Propper, C. (2002) "The Economic Determinants of Truancy", Centre for Analysis of Social Exclusion, CASE paper 61

Burgess, S. & Propper, C. & Rigg, J. (2004) "The Impact of Low-Income on Child Health: Evidence from a Birth Cohort Study," The Centre for Market and Public Organisation (CMPO) 04/098, Department of Economics, University of Bristol, UK

Buscha, F. (2008): "The Impact of Part-time Work and Truancy on Educational Attainment: Evidence from the Youth Cohort Study of England and Wales", paper presented at

Work Pensions and Labour Economics (WPEG) Conference, http://wpeg.group.shef.ac.uk/papers2008/35Buscha.pdf

Cabello, B. and Terrel, R. (1994): "Making students feel like family: how teachers create warm and caring classroom climates", *Journal of Classroom Interaction*, 29, 17-23.

Chowdry, H., C. Crawford & A. Goodman (2008): "Drivers and Barriers to Educational Success: Evidence from the Longitudinal Study of Young People in England", Interim Report for the Department for Children, Schools and Families, September 2008.

Clark, D. and Royer, H. (2008) "The Effect of Education on Adult Mortality and Health: Evidence from the United Kingdom", University of Florida mimeo, http://economics.ucr.edu/seminars/fall08/ae/Clark.pdf .

Crawford, C., Dearden, L. and Meghir, C. (2007): "When You Are Born Matters: The Impact of Date of Birth on Child Cognitive Outcomes in England", *CEE Discussion Paper* N. 0093, Centre for the Economics of Education, LSE, London.

Cunha F. and Heckman, J. (2008): "Formulating, identifying, and estimating the technology of cognitive and non-cognitive skill formation", *Journal of Human Resources,* Vol. 43(4).

Cunha, F. and Heckman, J., (2007): "The Technology of Skill Formation". *American Economic Review* 97(2): 31-47.

De Coulon, A., Meschi, E. and Vignoles, A. (2008): "Parents' Basic Skills and Children Cognitive Outcomes", *CEE Discussion Paper* N.104, Centre for the Economics of Education, LSE, London.

Dee, T. and West, M. (2008): "The Non-Cognitive Returns to Class Size," *NBER Working Papers* N. 13994, National Bureau of Economic Research, Inc.

Denny, K. (2004): "Born to be wild? The Effect of Birth Order, Families and Schools on Truancy," Working Papers N. 200421, School Of Economics, University College Dublin

Dustman, C., Rajah, N. and Smith, S. (1997). "Teenage Truancy, Part-time Working and Wages", *Journal of Population Economics*, Vol. 10, No. 4, pp. 425-442

Dweck, Carol S., and Ellen L. Leggett (1988): "A social-cognitive approach to motivation and personality." *Psychological Review* Vol. 95, No. 2, 256-273.

Epstein, J. L. (1981): The Quality of School Life. Lexington Books/D. C. Heath, Lexington.

Fielding, A. (2004): "The Role of the Hausman Test and whether Higher Level Effects should be treated as Random or Fixed", *Multilevel Modelling Newsletter*, Vol. 16 No. 2.

Fisher, D. L. and Fraser, B. J. (1991): “Validity and use of school environment instruments”, *Journal of Classroom Interaction*, Vol. 26, 13-18.

Fraser, B. J., Docker, J. G. and Fisher, D. L. (1988) Assessing and improving school climate. *Evaluation and Research in Education*, Vol. 2, 109-122

Fredricks, J.A., Blumenfeld, C. and Paris, A. (2004): “School Engagement: Potential of the Concept, State of the Evidence”, *Review of Educational Research* 74(1): 59-109.

Gibbons, S. and Silva, O. (2008) “School quality, child well being and parents’ satisfaction”, CEE Discussion Papers, CEEDP0103. London School of Economics and Political Science, London, UK.

Gilman, R. and Huebner, E.S. (2006): “Characteristics of adolescents who report very high life satisfaction”, *Journal of Youth and Adolescence*, 35(3), 311-319.

Good, T. L. and Brophy, J. E. (1986) School effects. In Wittrock, M. C. (ed.), Handbook of Research on Teaching, 3rd edn. Macmillan, New York, pp. 570-602.

Goodman, E., Slap, G.B., and Huang, B. (2003): **“**The Public Health Impact of Socioeconomic Status on Adolescent Depression and Obesity”, *American Journal of Public Health*, Vol 93, No. 11 1844-1850.

Goodman, A. & B. Sianesi (2005), “Early education and children's outcomes: low long do the impacts last?”, *Fiscal Studies*, Vol. 26, No. 4, pp. 513-548

Gutman, L. and Feinstein, L. (2008): **“**Children’s Well-Being in Primary School: Pupil and School Effects”, Centre for Research on the Wider Benefits of Learning (WBL) Research Report, No. 25

Gregg, P. & Washbrook, E. (2003): "The Effects of Early Maternal Employment on Child Development in the UK," The Centre for Market and Public Organisation (CMPO) 03/070, Department of Economics, University of Bristol, UK

Gregg P, Washbrook E, Propper C, Burgess S (2005): “The effects of a mother’s return to work decision on child development in the UK”, *The Economic Journal* **115**:F48-F80.

Gregg, P., Janke, K. & Propper, C. (2008): "Handedness and Child Development," The Centre for Market and Public Organisation 08/198, Department of Economics, University of Bristol, UK.

Gregg, P. & Propper, C. & Washbrook, E. (2008): "Understanding the Relationship between Parental Income and Multiple Child Outcomes: a decomposition analysis," The

Centre for Market and Public Organisation 08/193, Department of Economics, University of Bristol, UK.

Griffiths, L.J., Wolke, D., Page, A.S., Horwood, J.P., the ALSPAC Study Team (2006) "Obesity and bullying: different effects for boys and girls", *Archives of Disease in Childhood*, **91** pp.121-125.

Hanushek, E.A. (1997): 'Effects of School Resources on Economic Performance', Education Evaluation and Policy Analysis, 19(2), pp.141-164

Hanushek, E.A. (2003): "The Failure of Input-Based Schooling Policies," *Economic Journal*, 113(485), pp. F64-F98.

Haveman, R. and Wolfe, B., (1995): "The Determinants of Children's Attainments: A Review of Methods and Findings." *Journal of Economic Literature*, 33(4): 1829-1878.

Hausman, J. A. (1978): "Specification tests in econometrics"*, Econometrica*, **46**, 1251-1271.

H M Government (2008) New Opportunities White Paper - Fair Chances for the Future, White Paper, Cabinet Office: http://www.hmg.gov.uk/newopportunities.aspx

Janssen, I., Craig, W.M., Boyce, W.F., and Pickett, W. (2004): "Associations between overweight and obesity with bullying behaviours in school-aged children", *Pediatrics*, **113,** pp.1187-1194.

Juvonen, J., Graham, S., Schuster, M. A. (2003): "Bullying Among Young Adolescents: The Strong, the Weak, and the Troubled", *Paediatrics* 112: 1231-1237.

Kottkamp, R. B. and Mulhern, J. A. (1987): "Teacher expectancy motivation, open to closed climate and pupil control ideology in high schools", *Journal of Research and Development in Education* Vol. 20, pp. 9-18.

Layard, R. (2006): "Happiness: Lessons from a New Science", Penguin Group Publisher, London.

Millstein, S. G., Nigthingale, E. O. and Petersen, A. C. (1993): "Promoting the healthy development of adolescents", *Journal of the American Medical Association*, 269, 1413—1415.

Mortimore, P., Sammons, P., Stoll, L., Lewis, D. and Ecob, R. (1988): "School Matters", Paul Chapman, London.

Opdenakker, M. and Van Damme, J. (2000) 'Effects of Schools, Teaching Staff and Classes on Achievement and Well-Being in Secondary Education: Similarities and Differences Between School Outcomes', *School Effectiveness and School Improvement*, Vol. 11, No. 2, pp. 165–196.

Oswald, A.J., Proto, E. and Sgroi, D. (2008): “Happiness and Productivity”, University of Warwick Economic Research Papers No 882.

Peck, J. and Foreman-Peck, L. (2007): “Cognitive Achievement and Behaviour in School”, paper presented at the PAS/NPD user Group workshop, University of Bristol, http://www.bris.ac.uk/Depts/CMPO/PLUG/

Propper C, Rigg J, Burgess S, (2005) ‘Health Supplier Quality and the Distribution of Child Health’ CMPO Working Paper No. 05/123

Propper, C. & Rigg, J. & Burgess, S. (2007): "Child health: evidence on the roles of family income and maternal mental health from a UK birth cohort," *Health Economics*, **16**(11), pp. 1245-1269

Resnick, M. D., Harris, L. J. and Blum, R. W. (1993): “The impact of caring and connectedness on adolescent health and well-being”. *Journal of Paediatric and Child Health*, 29, 3-9.

Rivkin, S. G., Hanushek, E. A. and Kain, J. F. (2005): “Teachers, schools, and academic achieve- ment”, *Econometrica,* 73(2), pp. 417-458.

Rothstein, J. (2008): "Teacher Quality in Educational Production: Tracking, Decay, and Student Achievement," NBER Working Papers 14442.

Rutter, M., Maughan, B., Mortimore, P., Ouston, J. and Smith, A. (1979) Fifteen Thousand Hours: Secondary Schools and their Effects on Children. Open Books, Somerset

Story, M. (1999): “School-based approaches for preventing and treating obesity”, *International Journal of Obesity*, Vol. 23 (2), pp. s43-s51.

Suldo, S., Riley, K, Shaffer, E . Academic Correlates of Children and Adolescents' Life Satisfaction Suldo et al. School Psychology International.2006; 27: 567-582

Teddlie, C. and Reynolds, D. (2000): *The International Handbook of School Effectiveness Research*, Reynolds, Falmer Press, London and New York.

Todd, P. and Wolpin, K. (2003): “On the Specification and Estimation of the Production Function for Cognitive Achievement”, *Economic Journal*, Vol.113, No. 485, F3-33

Todd, P. and Wolpin, K., (2007): “The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps”, *Journal of Human Capital*, 1(1), 91-136.

Verkuyten, M. & Thijs, J. (2002): “School satisfaction of elementary school children: The role of performance, peer relations, ethnicity, and gender”, *Social Indicators Research*, 59(2), 203-228.

Vignoles, A., Levacic, R., Walker, J., Machin, S., and Reynolds, D. (2000): "The Relationship between Resource Allocation and Pupil Attainment: A Review," *CEE Discussion Papers 0002*, Centre for the Economics of Education, LSE.

Wardle, J., Waller, J. and Jarvis, M.J. (2002) 'Sex differences in the association of socioeconomic status with obesity', *Am J Public Health*, 92(8):1299-304.

Washbrook, E. (2007): "Fathers, Childcare and Children's Readiness to Learn," The Centre for Market and Public Organisation 07/175, Department of Economics, University of Bristol, UK.

Wooldridge, J. (2002): "Econometric Analysis of Cross Section and Panel Data", MIT Press, Cambridge, Mass.

Table 1: correlation between outcomes

	Achievement	Attitude	Bullying
Achievement	1		
Attitude	0.4063***	1	
Bullying	-0.1047***	-0.1033***	1

Table 2: Variation of outcomes across and within schools at the beginning of secondary school

	KS2 (standardised score)	School enjoyment	Bullying
Constant (mean)	-0.022	34.028***	0.766***
	(0.022)	(0.091)	(0.016)
Observations	14360	15177	14104
Number of schools	628	657	656
within school between pupil s.d.	**0.884**	**7.106**	**1.255**
between school s.d.	**0.519**	**1.787**	**0.304**
Rho	**0.256**	**0.0595**	**0.0554**

Table 3: Variables in the analysis

Key outcomes' measures
KS4 total point score
Attitude to school scale at age 16
Bullying scale at age 16

Prior outcomes' measure
KS2 total point score
Attitude to school scale at age 14
Bullying scale at age 14

Other ECM variables
Self rated health
Whether takes extra-curriculum courses (in supplementary subjects)
Whether takes extra-curriculum courses (in subjects they also do at school)
Number of (unauthorised) absences

Administrative covariates (from PLASC)
Gender
Statement of special education needs
Ethnic group
English as a first language
Free school meals eligibility
LEA identifier

Socio-demographic covariates (From LSYPE)
Main parent's social class
Whether main parent is unemployed
Mother's highest education qualification
Father's highest education qualification
Financial difficulties (whether parents receive means tested benefits)
Number of hours worked per week during term time
Parents' aspiration (Parent wants YP to stay in FTE at 16)

School-level covariates
Institution type
Whether single sex school
Pupil-teacher ratio
Average score in KS2
Proportion of pupils receiving FSM
Proportion of non-white British pupils
School size (total number of pupils enrolled)

Table 4: Academic achievement age 16: School fixed (FE) and random (RE) effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Empty Model		***Value Added Model***		***Augmented Value Added model*** *Add PLASC covariates*		*Add LSYPE covariates*	
	FE	***RE***	***FE***	***RE***	***FE***	***RE***	***FE***	***RE***
KS2 (std scores)			0.658***	0.665***	0.593***	0.600***	0.517***	0.521***
			(0.010)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Other ECM variables								
N. of (unauth.) absences					-0.031***	-0.031***	-0.025***	-0.025***
					(0.002)	(0.001)	(0.001)	(0.001)
School attitude (t-2)							0.015***	0.015***
							(0.001)	(0.001)
Bullying (t-2)							-0.030***	-0.029***
							(0.006)	(0.006)
Extra curric. courses							0.083***	0.087***
							(0.021)	(0.020)
Tuition							0.069***	0.063***
							(0.019)	(0.019)
Self rated health							0.093***	0.089***
							(0.013)	(0.013)
Other controls								
Female					V	V	V	V
Ethnicity					V	V	V	V
FSM					V	V	V	V
SEN					V	V	V	V
EAL					V	V	V	V
MP social class							V	V
Mother's highest qual.							V	V
Father's highest qual.							V	V
MP unemployed							V	V
MT benefit recipient							V	V
MP wants YP to stay in FTE after 16							V	V
Hours worked by YP							V	V
Observations	5719	5719	5719	5719	5719	5719	5719	5719
Number of schools	602	602	602	602	602	602	602	602
R-squared overall	0	0	0.471	0.471	0.538	0.539	0.585	0.586
R-squared between	0	0	0.460	0.460	0.519	0.521	0.539	0.542
R-squared within	0	0	0.468	0.468	0.541	0.541	0.594	0.594
sigma_e	0.767	0.767	0.559	0.559	0.520	0.520	0.490	0.490
sigma_u	.	0.425	.	0.314	.	0.298	.	0.298
Rho	.	0.235	.	0.240	.	0.247	.	0.269
BP test (X^2)				1222.7***		1326.8***		1376.2***
Hausman test				*6.29***		*18.67*		*34.52*

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
BP test: Breusch and Pagan Lagrangian multiplier test for random effects (H0: Var(u) = 0) . YP= Young Person; MP= Main parent; MT= Mean tested; Extra curric. courses refers to extra curriculum courses in supplementary subjects, while tuition refers to extra curriculum courses in subjects they also do at school

Table 5: Academic achievement at age 16 and school characteristics. Random Effects model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
School type: VC	0.028							0.024	0.105
	(0.088)							(0.091)	(0.105)
School type: FD VA CTC	0.093***							0.095***	0.133***
	(0.032)							(0.033)	(0.040)
School % FSM		-0.064						-0.011	0.143
		(0.104)						(0.152)	(0.217)
School mean KS2			0.021					-0.023	0.024
			(0.035)					(0.046)	(0.055)
Pupil-teacher Ratio				0.000				0.002	0.005
				(0.008)				(0.008)	(0.010)
Single sex school					0.024			0.028	0.042
					(0.044)			(0.048)	(0.056)
School % non-white British						0.004		-0.010	0.033
						(0.059)		(0.072)	(0.112)
School Size							0.000	0.000	0.000
							(0.000)	(0.000)	(0.000)
All other pupils characteristics	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***Yes***
LA dummies	***no***	***no***	***no***	***no***	***no***	***no***	***no***	***no***	***Yes***
Joint significance of LA dummies: Chi2 (Prob > chi2)	-	-	-	-	-	-	-	-	*175.02** (0.035)*
Observations	5731	5719	5778	5778	5778	5778	5778	5719	5719
Number of schools	604	602	610	610	610	610	610	602	602
R-squared overall	0.589	0.586	0.586	0.586	0.586	0.587	0.587	0.588	0.627
R-squared within	0.594	0.594	0.592	0.592	0.592	0.592	0.592	0.594	0.594
R-squared between	0.554	0.542	0.550	0.550	0.551	0.551	0.551	0.548	0.670
sigma_e	0.491	0.490	0.492	0.492	0.492	0.492	0.492	0.490	0.490
sigma_u	0.296	0.298	0.298	0.299	0.298	0.299	0.298	0.297	0.284
rho	0.266	0.270	0.269	0.270	0.269	0.270	0.269	0.269	0.251

Table 6: Attitude towards school; school fixed effects (FE) and random effects (RE)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	***RE***	***FE***	***RE***	***FE***	***RE***	***FE***	***RE***
School attitude (t-2)			0.630***	0.643***	0.587***	0.592***	0.562***	0.566***
			(0.013)	(0.012)	(0.013)	(0.012)	(0.013)	(0.012)
Other ECM outcomes								
KS2 (std scores)					0.611***	0.697***	0.322***	0.351***
					(0.120)	(0.109)	(0.125)	(0.115)
N. of (unauth.)					-	-	-	-
absences					0.183***	0.181***	0.165***	0.161***
					(0.018)	(0.016)	(0.017)	(0.016)
Bullying (t-2)							-	-
							0.277***	0.313***
							(0.070)	(0.066)
Extra curric. courses							0.022	0.143
							(0.250)	(0.234)
Tuition							0.179	0.128
							(0.232)	(0.219)
Self rated health							1.134***	1.137***
							(0.153)	(0.145)
Controls								
Female					v	v	N	N
Ethnicity					v	v	N	N
FSM					v	v	N	N
SEN					v	v	N	N
EAL					v	v	N	N
MP social class							N	N
Mother's highest qual.							N	N
Father's highest qual.							N	N
MP unemployed							N	N
MT benefit recipient							N	N
MP wants YP to stay in FTE after 16							N	N
Hours worked by YP							N	N
Observations	5690	5690	5690	5690	5690	5690	5690	5690
Number of schools	602	602	602	602	602	602	602	602
R-squared overall	0	0	0.335	0.335	0.368	0.368	0.390	0.391
R-squared between	0	0	0.381	0.381	0.406	0.413	0.426	0.439
R-squared within	0	0	0.323	0.323	0.350	0.350	0.373	0.372
sigma_e	7.380	7.380	6.073	6.073	5.958	5.958	5.871	5.871
sigma_u	.	2.037	.	1.431	.	1.272	.	1.050
Rho	.	0.0708	.	0.0526	.	0.0436	.	0.0310
BP test				56.05***		33.02***		28.29***
Hausman test				*10.97****		*14.06*		*40.94*

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
BP test: Breusch and Pagan Lagrangian multiplier test for random effects (H0: Var(u) = 0) . YP= Young Person; MP= Main parent; MT= Mean tested; Extra curric. courses refers to extra curriculum courses in supplementary subjects, while tuition refers to extra curriculum courses in subjects they also do at school

Table 7: Attitude toward school at age 16 and school characteristics. Random Effects model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
School type: VC	0.121							0.078	0.386
	(0.531)							(0.543)	(0.672)
School type: FD VA CTC	0.423**							0.363*	0.484*
	(0.205)							(0.214)	(0.264)
School % FSM		-0.726						-0.673	0.413
		(0.805)						(1.088)	(1.567)
School mean KS2			0.342					0.169	0.359
			(0.247)					(0.319)	(0.393)
Pupil-teacher Ratio				-0.108**				-0.114**	-0.138**
				(0.052)				(0.054)	(0.070)
Single sex school					-0.252			-0.383	-0.692*
					(0.299)			(0.322)	(0.399)
School % non-white British						-0.025		0.179	0.643
						(0.474)		(0.548)	(0.839)
School Size							0.000	-0.000	-0.000
							(0.000)	(0.000)	(0.000)
									(2.509)
All other pupils characteristics	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
LA dummies	***no***	***no***	***no***	***no***	***no***	***no***	***no***	***No***	***yes***
Joint signif of LA dummies: Chi2 (Prob > chi2)	-	-	-	-	-	-	-	-	*141.89 (0.510)*
Observations	5702	5690	5749	5749	5749	5749	5749	5690	5690
Number of schools	604	602	610	610	610	610	610	602	602
R-squared overall	0.392	0.391	0.394	0.394	0.394	0.394	0.394	0.393	0.412
R-squared within	0.372	0.372	0.373	0.373	0.373	0.373	0.373	0.372	0.372
R-squared between	0.445	0.438	0.449	0.455	0.451	0.451	0.450	0.443	0.554
sigma_e	5.871	5.871	5.863	5.863	5.863	5.863	5.863	5.871	5.871
sigma_u	1.058	1.053	1.062	1.059	1.052	1.043	1.066	1.043	1.013
Rho	0.0314	0.0312	0.0318	0.0316	0.0312	0.0307	0.0320	0.0306	0.0289

Table 8: Bullying: school fixed effects (FE) and random effects (RE)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	***RE***	***FE***	***RE***	***FE***	***RE***	***FE***	***RE***
Bullying (t-2)			0.201***	0.201***	0.193***	0.193***	0.189***	0.188***
			(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Other ECM variables								
KS2 (std scores)					-0.017	-0.008	-0.022	-0.015
					(0.013)	(0.011)	(0.014)	(0.012)
N. of (unauth.) absences					0.002	0.001	0.001	0.001
					(0.002)	(0.002)	(0.002)	(0.002)
School attitude (t-2)							-0.000	-0.000
							(0.001)	(0.001)
Extra curric. Courses							-0.048*	-0.034
							(0.028)	(0.025)
Tuition							0.024	0.025
							(0.026)	(0.024)
Self rated health							-	-
							0.061***	0.075***
							(0.017)	(0.016)
Controls								
Female					v	v	v	v
Ethnicity					v	v	v	v
FSM					v	v	v	v
SEN					v	v	v	v
EAL					v	v	v	v
MP social class							v	v
Mother's highest qual.							v	v
Father's highest qual.							v	v
MP unemployed							v	v
MT benefit recipient							v	v
MP wants YP to stay in FTE after 16							v	v
Hours worked by YP							v	v
Observations	5571	5571	5571	5571	5571	5571	5571	5571
Number of schools	599	599	599	599	599	599	599	599
R-squared overall	0	0	0.134	0.134	0.139	0.140	0.147	0.148
R-squared between	0	0	0.178	0.178	0.172	0.180	0.176	0.197
R-squared within	0	0	0.129	0.129	0.136	0.135	0.145	0.144
sigma_e	0.692	0.692	0.646	0.646	0.644	0.644	0.643	0.643
sigma_u	.	0	.	0	.	0	.	0
Rho	.	0	.	0	.	0	.	0
BP test				*0.43*		*0.30*		*0.36*
Hausman test				*0.09*		*14.59*		*35.95*

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
BP test: Breusch and Pagan Lagrangian multiplier test for random effects (H0: Var(u) = 0) . YP= Young Person; MP= Main parent; MT= Mean tested; Extra curric. courses refers to extra curriculum courses in supplementary subjects, while Extra curric. Tuition refers to extra curriculum courses in subjects they also do at school

Table 9: Bullying and school characteristics. Random Effects model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
School type: VC	0.026							0.025	0.033
	(0.048)							(0.049)	(0.063)
School type: FD VA CTC	-0.017							-0.028	-0.049**
	(0.019)							(0.020)	(0.025)
School % FSM		-0.147*						-0.184*	-0.074
		(0.081)						(0.108)	(0.155)
School mean KS2			0.033					0.026	0.023
			(0.024)					(0.031)	(0.039)
Pupil-teacher Ratio				-0.006				-0.008	-0.015**
				(0.005)				(0.005)	(0.007)
Single sex school					-0.052*			-0.069**	-0.046
					(0.029)			(0.031)	(0.040)
School % non-white British						-0.040		0.021	-0.009
						(0.049)		(0.055)	(0.085)
School Size							-0.000	-0.000	-0.000
							(0.000)	(0.000)	(0.000)
All other pupils characteristics	yes	yes	yes	yes	yes	Yes	yes	yes	Yes
LA dummies	no	no	no	no	no	No	No	no	yes
Joint signif of LA dummies: Chi2 (Prob > chi2)	-	-	-	-	-	-	-	-	*147.17 (0.3884)*
Observations	5582	5571	5628	5628	5628	5628	5628	5571	5571
Number of schools	601	599	607	607	607	607	607	599	599
R-squared overall	0.148	0.149	0.148	0.148	0.148	0.148	0.148	0.151	0.173
R-squared within	0.143	0.144	0.143	0.143	0.143	0.143	0.143	0.144	0.144
R-squared between	0.196	0.199	0.190	0.200	0.200	0.198	0.198	0.215	0.377
sigma_e	0.642	0.643	0.641	0.641	0.641	0.641	0.641	0.643	0.643
sigma_u	0	0	0	0	0	0	0	0	0
Rho	0	0	0	0	0	0	0	0	0

Figure 1: FE achievement and FE attitude

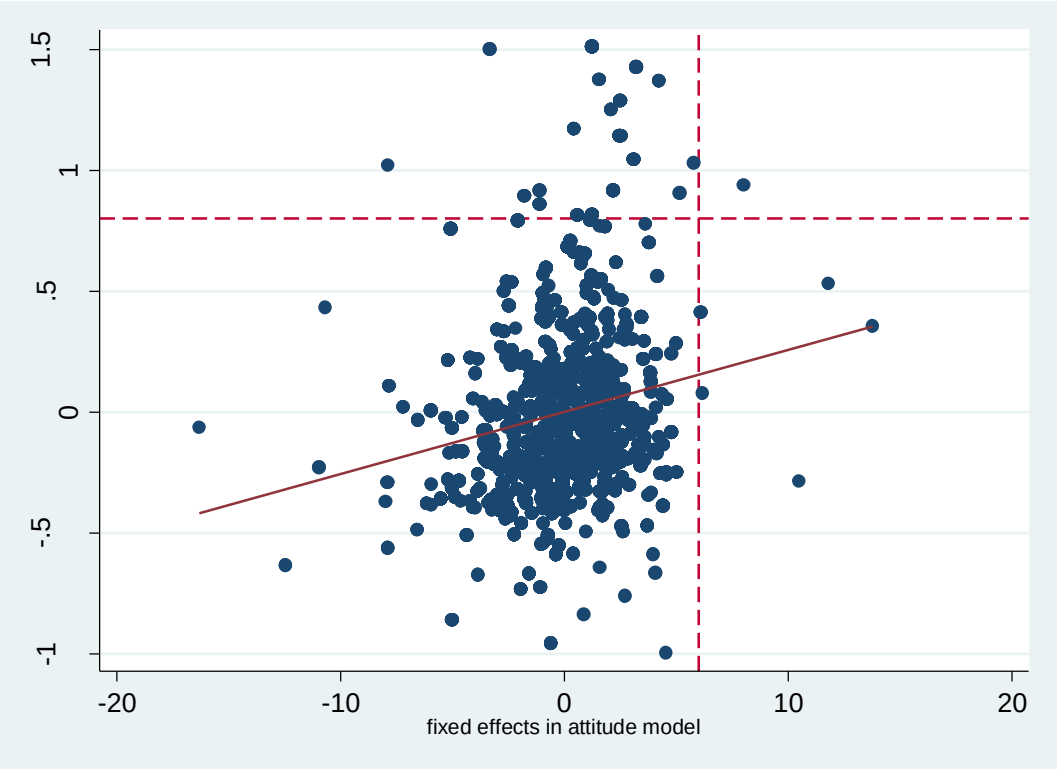


Figure 2: FE achievement and FE bullying

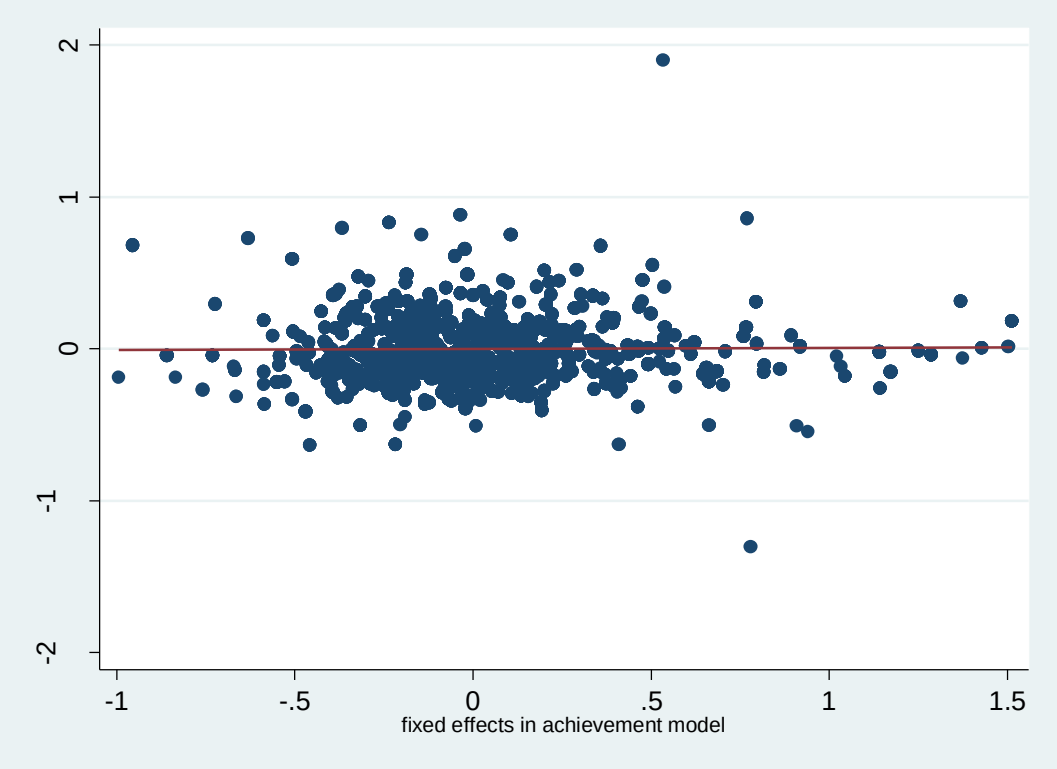
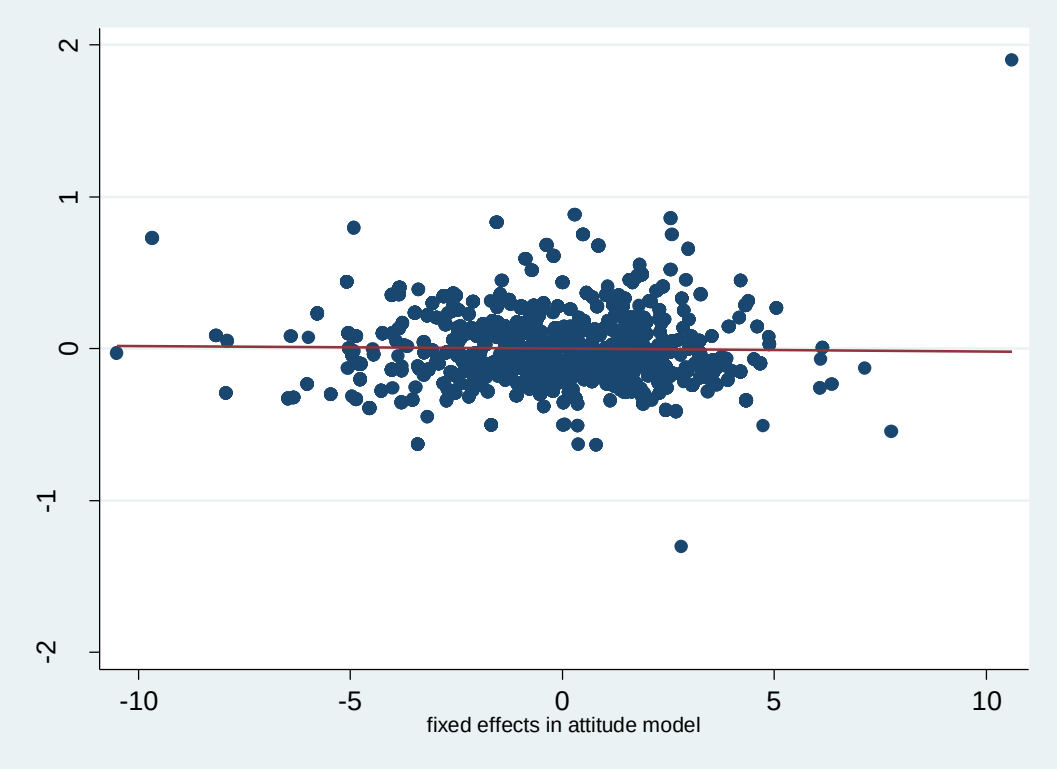


Figure 3: FE bullying and FE attitude



Appendices

Appendix 1: Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
KS4 (total score-standardized)	15399	0.000	1.000	-2.317	4.335
KS2 (total score-standardized)	14382	0.000	1.000	-3.281	1.926
PLASC CONTROLS					
Female	15431	0.491	0.500	0	1
Whether receive FSM	15203	0.207	0.405	0	1
Whether SEN	15581	0.173	0.378	0	1
White British (REFERNCE)	19110	0.626	0.484	0	1
Other white	14798	0.017	0.128	0	1
Bangladeshi	14798	0.052	0.222	0	1
Caribbean	14798	0.044	0.204	0	1
Chinese	14798	0.002	0.049	0	1
Indian	14798	0.066	0.248	0	1
Pakistani	14798	0.068	0.252	0	1
African	14798	0.045	0.207	0	1
Mixed	14798	0.059	0.236	0	1
Other	14798	0.015	0.122	0	1
Whether EAL	14755	0.224	0.417	0	1
Number of unauthorized absences (t-1)	14600	2.856	9.906	0	144
LSYPE CONTROLS					
Attitude to school scale (t-1)	13165	32.395	7.603	0	48
Bullying scale (wave 1)	14122	0.772	1.279	0	7
Bullying scale (wave 3)	11362	0.267	0.707	0	7
Main parent social class					
Managers and senior officials	8497	0.125	0.330	0	1
Professional occupations	8497	0.112	0.316	0	1
Associate professional and technical occupations	8497	0.146	0.353	0	1
Administrative and secretarial occupations	8497	0.168	0.374	0	1
Skilled trades occupations	8497	0.052	0.222	0	1
Personal service occupations	8497	0.169	0.374	0	1
Sales and customer service occupations	8497	0.076	0.264	0	1
Process, plant and machine operatives	8497	0.042	0.202	0	1
Elementary occupations (REFERENCE)	8497	0.111	0.314	0	1
whether main parent unemployed	15500	0.026	0.158	0	1
Self rated health	12283	3.585	0.567	1	4
Mother's highest qualification					
Degree or equivalent	12892	0.111	0.314	0	1
Higher education below degree level	12892	0.126	0.332	0	1

GCE A Level or equiv	12892	0.128	0.334	0	1
GCSE grades A-C or equiv	12892	0.266	0.442	0	1
Qualifications at level 1 and below	12892	0.090	0.286	0	1
Other qualifications	12892	0.032	0.177	0	1
No qualification (REFERENCE)	12892	0.248	0.432	0	1
Father's highest qualification					
Degree or equivalent	9583	0.150	0.357	0	1
Higher education below degree level	9583	0.106	0.308	0	1
GCE A Level or equiv	9583	0.173	0.378	0	1
GCSE grades A-C or equiv	9583	0.203	0.402	0	1
Qualifications at level 1 and below	9583	0.087	0.281	0	1
Other qualifications	9583	0.031	0.172	0	1
No qualification (REFERENCE)	9583	0.252	0.434	0	1
N. of hours worked per week during term time (0 if the pupil never works)	12233	1.698	3.737	0	37
Whether takes extra-curriculum courses (in supplementary subjects)	12281	0.125	0.331	0	1
Whether taking tuition	12284	0.157	0.364	0	1
Parent wants YP to stay in FTE at 16	15770	0.648	0.478	0	1
Whether benefit recipient	12293	0.199	0.399	0	1
SCHOOL-LEVEL VARIABLES (in 2004)					
Proportion of pupils receiving FSM	15556	0.186	0.165	0	0.833
Inst type: City Technology College	15087	0.007	0.082	0	1
Inst type: Foundation schools	15087	0.154	0.361	0	1
Inst type: Voluntary Aided	15087	0.114	0.318	0	1
Inst type: Voluntary Controlled	15087	0.025	0.157	0	1
Inst type: Community (REFERENCE)	15087	.6905	.4623	0	1
Average score in KS2	15222	-0.01	0.51	-3.28	1.42
Pupil-teacher ratio	15206	16.987	2.067	1.16	29.01
Single sex school	15206	0.124	0.330	0	1
Proportion non-white	15206	0.28	0.30	0	1
School size	15206	1106.9	344.64	80	2382

Appendix 2: Fixed or Random Effect

For each outcome we presented both fixed effect and random effect models and compare results using the different approaches. We then applied a Hausman test to determine which model is appropriate. Hausman (1978) proposed a test based on the difference between the random effect and fixed effects estimates. As we discussed in section 4, the RE model requires the exogeneity assumption, i.e. zero correlation between the school effects and the observed explanatory variables. Under this assumption (the null hypothesis of the Hausman test), RE and FE estimators should be similar because both are consistent. However if the exogeneity assumption is violated FE is consistent but RE is inconsistent and hence a statistically significant difference is interpreted as evidence against the RE assumption (Wooldridge, 2002, p. 288). Therefore a significant Hausman test suggests RE effects should be abandoned in favour of a fixed effects model.

In the model on achievement (table 3), the Hausman test suggests that we should use the fixed effect model when we have no controls or only the prior measure of achievement. However, when we include other controls, the Hausman test suggests that we cannot reject the random effects model. This would seem to imply that if researchers can access very rich data which controls for myriad factors that might influence education achievement then the random effects model is appropriate since the random effects are then less likely to be correlated with the included covariates. Further confirmation of the appropriateness of the random effects model, at least in some specifications, is the fact that the school effects are approximately normally distributed, which is one of the necessary assumptions of the random effects model (see Figure A2.1 which shows the school effects from the model in column 7). Similar results were obtained for other specifications.

In the model for school attitude and enjoyment (table 5) - as was the case in the model of achievement - we can reject the random effects model when we have only a very limited number of covariates. However, when we use the full set of covariates we can no longer reject the random effects model. A plot of the distribution of the school effects from the model in Table 5 (column 7) also suggests that the school effects are broadly normally distributed (see figure A2.2), again confirming the validity of the assumptions behind the random effects model.

In the model for bullying presented in table 7, we could also not reject the random effects model in each case. The RE model suggested no systematic variation in bullying across schools (sigma_u

was zero and the BP pagan test is never significant). Again, the school effects are approximately normally distributed (see Figure A2.3).

Figure A2.1: distribution of school effect for model on achievement (table 3; col.7)

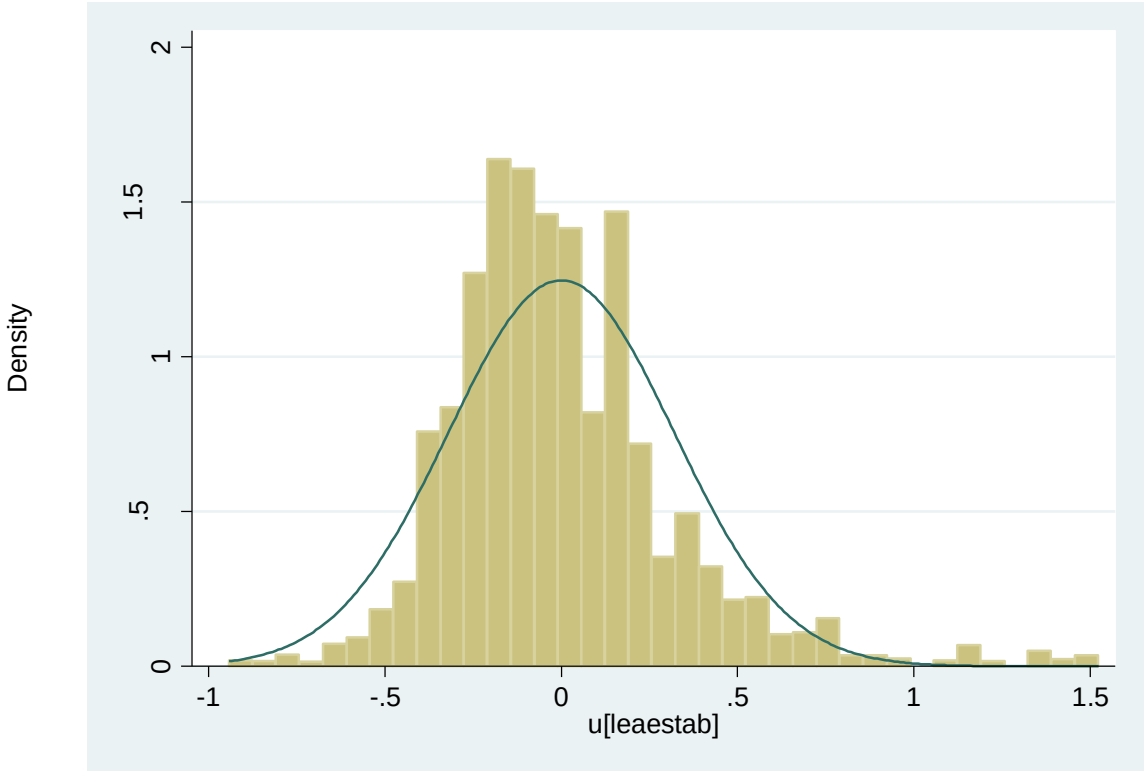


Figure A2.2: The distribution of school effects from the model of school enjoyment (Table 5 Col 7)

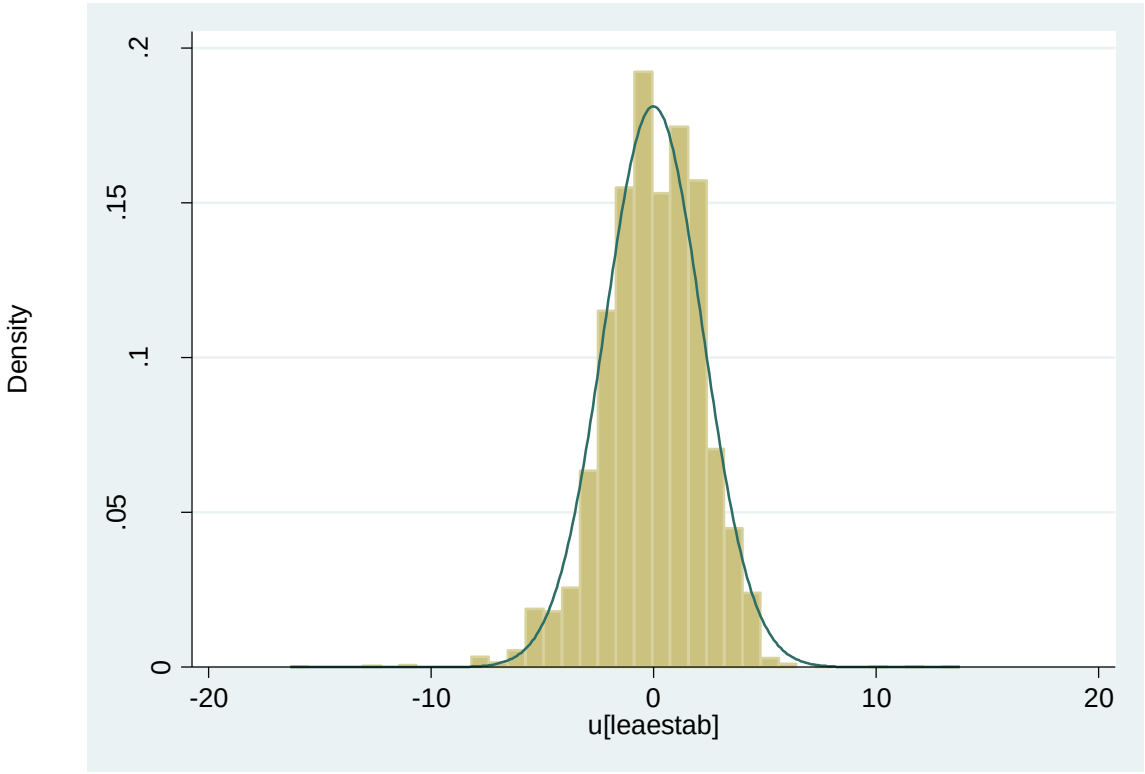
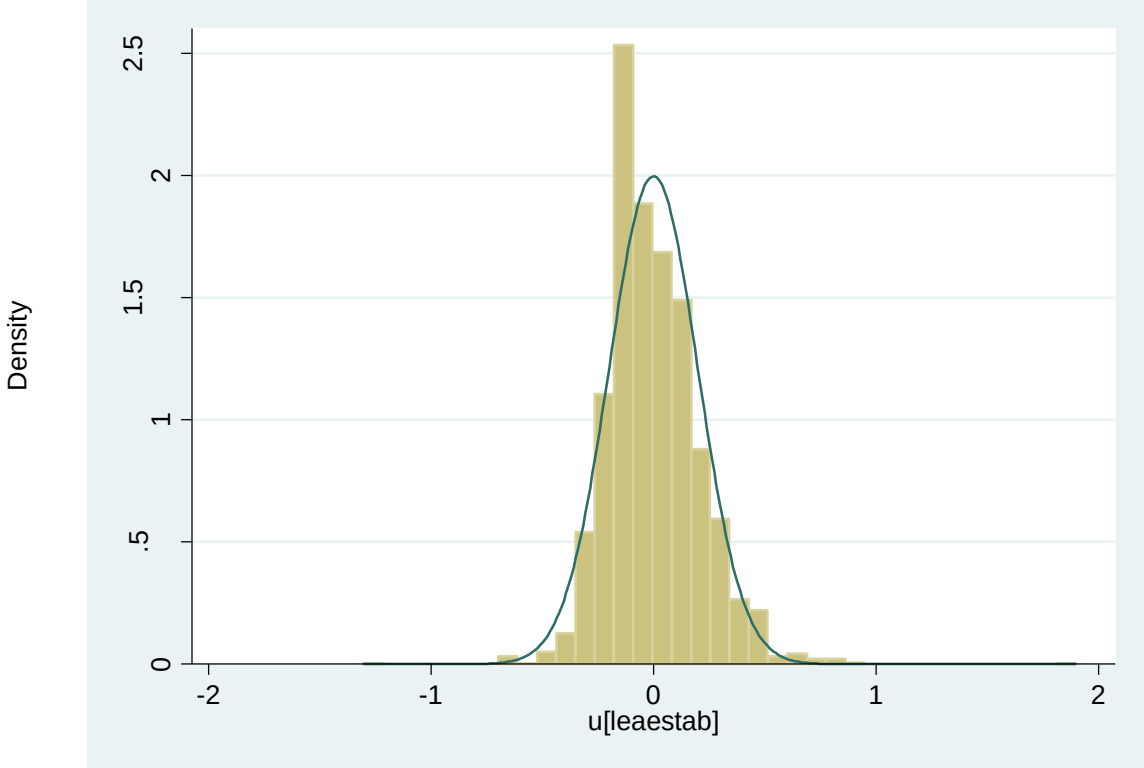


Figure A2.3: distribution of school effect from regressions on bullying (Table 7, col 7)



Overall in our estimates the Hausman test tends to endorse the adoption of RE model, once we control for our set of covariates. However, the literature has recognised major limitations of the Hausman test[24] (see Fielding, 2004 for a summary) and this causes us to be cautious in the interpretation of the test. Therefore, we have taken a programmatic approach and compared results from both the fixed effect and random effect models and find that in practice they are extremely similar.

[24] For example, an important shortcoming of the Hausman test is that it requires the RE estimator to be efficient, which in turns requires that the individual effect ϑi and εij are i.i.d (independent and identically distributed), an invalid assumption if cluster-robust standard errors for the RE estimator differ substantially from default standard errors (Cameron and Trivedi, 2009, p. 261).

Appendix 3: Robustness Checks

We undertook a number of robustness tests to check the analyses. We undertook these robustness checks for all three outcomes that we model. However, for reasons of brevity we only discuss them here for the education achievement model.

In order to further investigate the issue of how to model school effects, we estimated models that enable the school effect to vary across pupil type (random coefficient models). These models, unlike the standard random effect model (random intercept models), do not assume that schools are similarly effective for all pupils. Specifically, we tested whether school effectiveness varied across pupil ability as measured by Key Stage 2 score. A plot of the estimated linear regression lines from a model of Key Stage 4 against Key Stage 2 (Figure A3.1) suggests that schools are differentially effective according to pupils' prior ability; i.e. there is variability between the estimated intercept and slopes.

Figure A3.1: Least squared regression lines for all schools

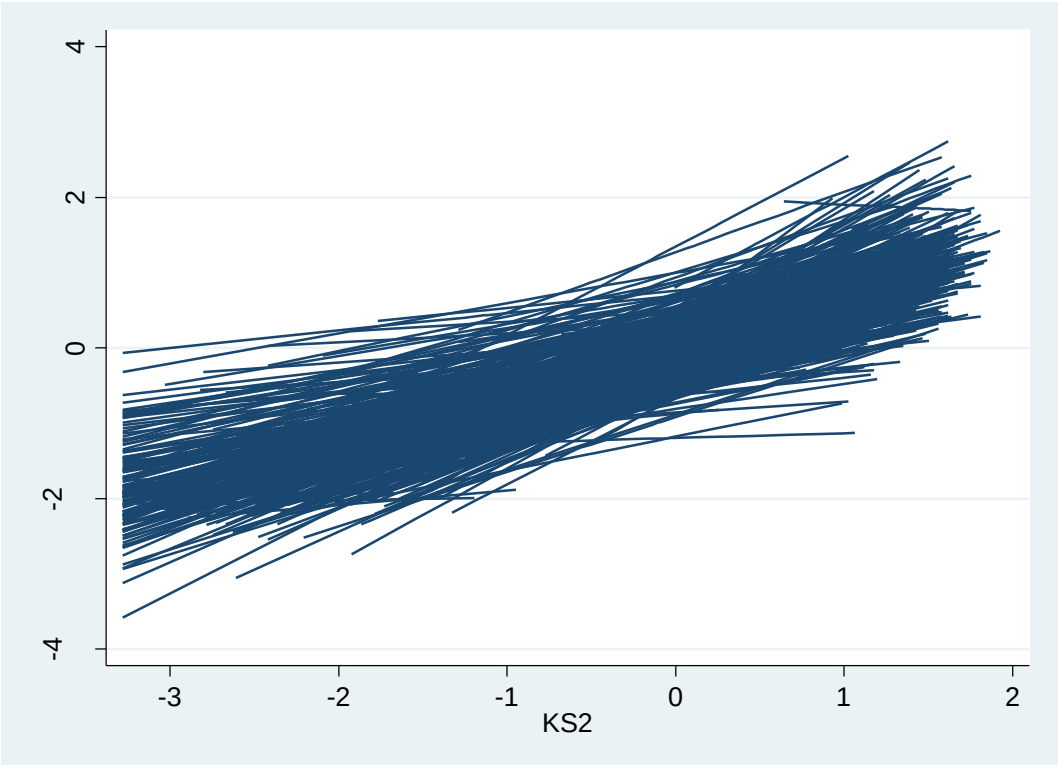
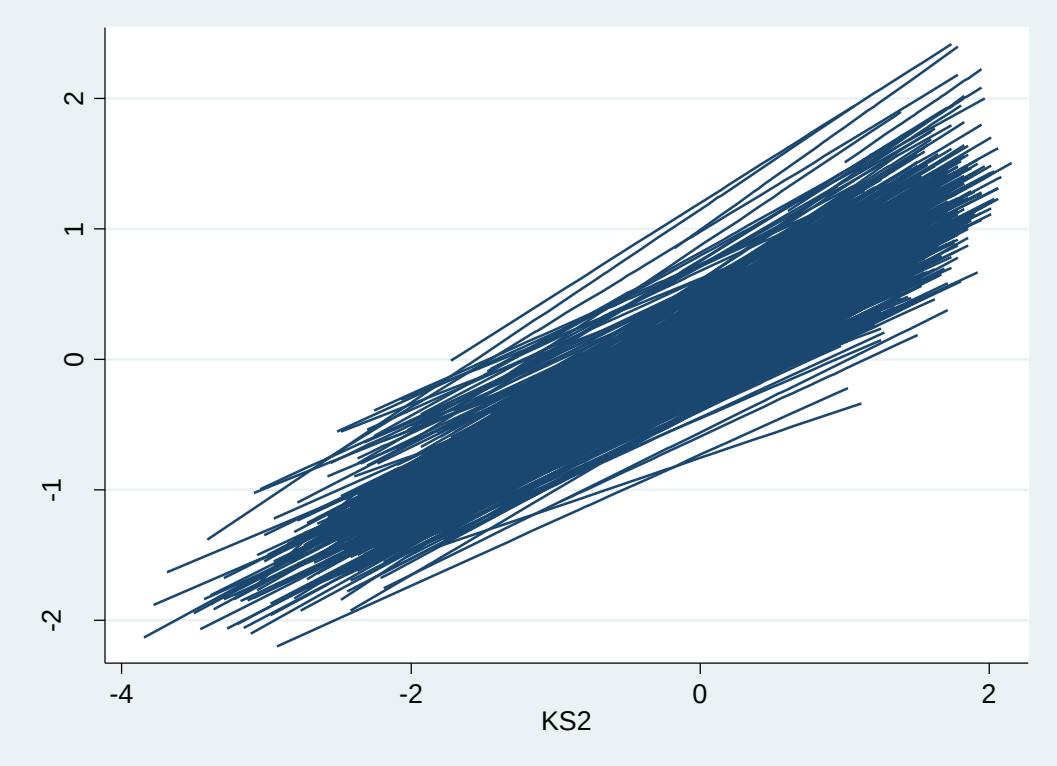


Figure A3.2: RC model



In order to take this variability into account, one could estimate a fixed effect model and simply interact the school dummies with pupils' age 11 Key Stage 2 scores. This would produce school specific slopes but is computationally expensive. Another option is to run a random coefficient model, adding a random slope to the KS2 variable. This is shown in equation 2, where x is the pupil's age 11 Key Stage 2 test score and y is the pupil's Key Stage 4 (age 16) test score. ζ_{2j} is the deviation of school j slope from the mean slope $\beta_{2.}$

$$\text{RI: } y_{ij} = (\beta_1 + \zeta_{1j}) + \beta_2 x_{ij} + \varepsilon_{ij} \qquad (1)$$

$$\text{RC: } y_{ij} = (\beta_1 + \zeta_{1j}) + (\beta_2 + \zeta_{2j}) x_{ij} + \varepsilon_{ij} \qquad (2)$$

Table A3.1: Random Coefficient (RC) models VS Random Intercept (RI) models

	(1)	(2)	(3)	(4)
	RI	**RC**	**RI**	**RC**
	Value added model		***Augmented value added model (PLASC and LSYPE controls)***	
KS2 (std scores)	0.645***	0.655***	0.506***	0.510***
	(0.0064)	(0.0083)	(0.0100)	(0.011)
Other ECM outcomes				
N. of (unauth.) absences			-0.0219***	-0.0222***
			(0.0014)	(0.0014)
School attitude (t-2)			0.0187***	0.0187***
			(0.0010)	(0.0010)
Extra curric. courses			0.0863***	0.0866***
			(0.020)	(0.020)
Tuition			0.0331*	0.0334*
			(0.018)	(0.018)
Self rated health			0.0719***	0.0712***
			(0.013)	(0.013)
Controls				
Female			v	v
Ethnicity			v	v
FSM			v	v
SEN			v	v
EAL			v	v
MP social class			v	v
Mother's highest qual.			v	v
Father's highest qual.			v	v
MP unemployed			v	v
MT benefit recipient			v	v
MP wants YP to stay in FTE after 16			v	v
Hours worked by YP			v	v
Observations	14126	14126	5313	5313
Number of schools	628	628	603	603
Random-effects parameters				
School				
sd(z_ks2totp)		0.1064		0.0875
Sd(_cons)= (sigma_u)	0.289	0.2872	0.2897	0.2839
Corr(KS2 std score,_cons)		0.2916		0.2475
Sd(residual)= sigma_e	0.667	0.6608	0.4605	0.4543
rho	0.1581	0.1589	0.2835	0.2808
LR test (p-value)	59.27 (0.000)		22.22 (0.000)	

Full results from the Random Coefficient model are given in the table below (table A3.1). Briefly, the Log Ratio test endorsed the use of the random coefficient model and the results indicate that 95 % of schools have a slope between 0.37 and 0.79 (β2 +/- 1.96*st dev of slope). All the slopes estimated were positive, i.e. the slopes do not have different signs for different schools. 95 % of schools have their intercept in the range of -0.45 and 0.67 (β1 +/- 1.96*st dev of constant). The results clearly indicate that the higher the level of pupil Key Stage 2 score, the greater the slope coefficient. Furthermore, the regression lines become more dispersed as Key Stage 2 scores increase (see figure A3.2). This implies that schools are more differentially "effective" for pupils with high Key Stage 2 scores. There is less difference in school effectiveness for pupils with lower Key Stage 2 scores.

Since we found that schools are differentially "effective" for pupils with different ability, as second robustness check, we re-estimated the (fixed effect) model for children with higher Key Stage 2 scores. The results are shown below. Specifically, the model only includes children with a Key Stage 2 score that is equal or higher than the 75^{th} percentile. The results from this model are similar to Table 2 except that the intra class correlation (rho) is much larger. This suggests that more of the variation in pupil achievement is between schools for higher ability children. Most other results hold in this model but the lagged measure of bullying is no longer significant and nor are the variables measuring extracurricular activities. Thus for high ability children, extracurricular activities are not associated with greater education achievement, nor is bullying significantly related to subsequent academic achievement for these pupils. This latter finding may be because relatively few high ability children experience bullying: where as 36.13% of the total sample experienced bullying at age 14 only 28.35% of the high ability sample did so.

Table A3.2: FE model for high KS2 scoring children

	(1)	(2)	(3)	(4)
	Empty model	Value added model	**Augmented Value added model**	
			Add PLASC covariates	*Add LSYPE covariates*
KS2 (standardised scores)		0.895***	0.870***	0.742***
		(0.069)	(0.066)	(0.064)
Other ECM variables				
N. of (unauth.) absences			-0.052***	-0.033***
			(0.008)	(0.008)
School attitude (t-2)				0.014***
				(0.002)
Bullying (t-2)				-0.007
				(0.013)
Extra curric. courses				0.040
				(0.033)
Tuition				-0.006
				(0.036)
Self rated health				0.075***
				(0.026)
Controls				
Female			v	v
Ethnicity			v	v
FSM			v	v
SEN			v	v
EAL			v	v
MP social class				v
Mother's highest qual.				v
Father's highest qual.				v
MP unemployed				v
MT benefit recipient				v
MP wants YP to stay in FTE after 16				v
Hours worked by YP				v
Observations	1432	1432	1432	1432
Number of schools	456	456	456	456
R squared overall	0	0.119	0.187	0.251
R squared between	0	0.0590	0.0972	0.130
R squared within	0	0.148	0.247	0.348
sigma_e	0.491	0.453	0.429	0.406

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
YP= Young Person; MP= Main parent; MT= Mean tested;

Table A3.3: regressions on bullying using YP-reported scale

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	***RE***	***FE***	***RE***	***FE***	***RE***	***FE***	***RE***
Bullying (t-2)			0.308***	0.310***	0.303***	0.305***	0.296***	0.296***
			(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)
Other ECM variables								
KS2 (std scores)					-0.015	-0.010	-0.023	-0.022
					(0.015)	(0.013)	(0.016)	(0.014)
N. of (unauth.) absences					0.005**	0.005**	0.005**	0.004**
					(0.002)	(0.002)	(0.002)	(0.002)
School attitude (t-2)							-0.002	-0.002
							(0.002)	(0.002)
Extra curric. Courses							-0.021	-0.023
							(0.033)	(0.030)
Tuition							0.063**	0.051*
							(0.030)	(0.028)
Self rated health							-0.129***	-0.136***
							(0.020)	(0.019)
Controls								
Female					v	v	v	v
Ethnicity					v	v	v	v
FSM					v	v	v	v
SEN					v	v	v	v
EAL					v	v	v	v
MP social class							v	v
Mother's highest qual.							v	v
Father's highest qual.							v	v
MP unemployed							v	v
MT benefit recipient							v	v
MP wants YP to stay in FTE after 16							v	v
Hours worked by YP							v	v
Observations	5900	5900	5900	5900	5900	5900	5900	5900
Number of schools	605	605	605	605	605	605	605	605
R-squared overall	0	0	0.168	0.168	0.173	0.173	0.187	0.188
R-squared between	0	0	0.253	0.253	0.239	0.249	0.249	0.272
R-squared within	0	0	0.162	0.162	0.167	0.167	0.182	0.181
sigma_e	0.858	0.858	0.785	0.785	0.784	0.784	0.779	0.779
sigma_u	0.333	0	0.289	0	0.291	0	0.289	0
Rho	0.131	0	0.119	0	0.121	0	0.121	0

Table A3.4: Regressions on Achievement, school enjoyment and Bullying: the role of SEN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Achievement				***School enjoyment***				***Bullying***			
SEN (no statement)	-0.877***	-0.257***	-0.183***	-0.156***	-3.072***	-1.572***	-0.536*	-0.339	0.106***	0.049**	0.034	0.035
	(0.035)	(0.030)	(0.028)	(0.027)	(0.356)	(0.294)	(0.309)	(0.305)	(0.033)	(0.022)	(0.033)	(0.033)
SEN (statemented)	-1.133***	-0.279***	-0.181***	-0.169***	-3.322***	-1.673***	-0.337	-0.237	0.339***	0.148***	0.192***	0.195***
	(0.049)	(0.041)	(0.039)	(0.037)	(0.496)	(0.409)	(0.432)	(0.428)	(0.046)	(0.028)	(0.047)	(0.047)
Past achievement measure of outcome		*v*	*v*	*v*		*v*	*v*	*v*		*v*	*v*	*v*
PLASC controls			*v*	*v*			*v*	*v*			*v*	*v*
LSYPE controls				*v*				*v*				*v*
Constant	0.370***	0.155***	0.054***	-1.043***	33.829***	11.792***	12.756***	7.813***	0.238***	0.110***	0.079***	0.339***
	(0.020)	(0.016)	(0.018)	(0.064)	(0.139)	(0.434)	(0.439)	(0.731)	(0.010)	(0.008)	(0.016)	(0.079)
Observations	5730	5730	5730	5730	5749	5749	5749	5749	5581	10337	5581	5581
Number of schools	603	603	603	603	610	610	610	610	600	631	600	600
sigma_e	0.704	0.554	0.521	0.491	7.317	6.047	5.954	5.863	0.688	0.674	0.643	0.642
sigma_u	0.397	0.317	0.297	0.297	2.121	1.480	1.296	1.066	0	0	0	0
rho	**0.242**	**0.247**	**0.245**	**0.268**	**0.0775**	**0.0565**	**0.0453**	**0.0320**	**0**	**0**	**0**	**0**

Appendix 4: Correlation between fixed effects from the different models

	FE from attitude	FE from bullying	FE from achievement
FE from attitude	1		
FE from bullying	-0.0169	1	
FE from achievement	0.1773***	0.0117	1

Appendix 5: Instrumental Variables estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	Attitude toward school			***Bullying***		
	Achievement instrumented with quarter of birth	*Absences instrumented with differences in abs at LEA level*	*Both achievement and absences instrumented*	*Achievement instrumented with quarter of birth*	*Absences instrumented with differences in abs at LEA level*	*Both achievement and absences instrumented*
z_ks2totp	**0.873**	0.639***	**0.863**	**0.055**	-0.007	**0.011**
	(1.095)	(0.179)	**(1.267)**	**(0.122)**	(0.019)	**(0.127)**
tsu06	-0.160***	**0.382**	**0.370**	0.002	**0.018**	**0.017**
	(0.020)	**(0.242)**	**(0.263)**	(0.002)	**(0.027)**	**(0.030)**
All controls	v	v	v	v	v	v
F first stage	***55.53******	***8.70******	***69.51***	***55.92******	***8.51******	***68.70***
			8.07			***7.86***
Observations	5690	5301	5301	5571	5188	5188
Number of schools	602	602	602	599	599	599