

**Cognitive Achievement and Behaviour in School**  
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**Abstract**

This study shows that student and parent reports of behaviour in and out of school are significantly linked to student learning between the ages of 11 and 14 - despite the discrepancy between student and parent accounts of bullying and school discipline. The results are obtained after controlling for pupil and school characteristics. Quantitative evidence is provided of the change in value-added between key stage 2 and key stage 3 brought about by such behaviour as number of days a week spent doing homework, unauthorised absences and the experience of disrupted teaching. The probability of bullying, truanting and disrupted teaching are also explained

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## Cognitive Achievement and Behaviour in School<sup>#</sup>

Much quantitative analysis of educational performance has focussed on characteristics of pupils or schools, in part because they are readily measurable<sup>1</sup>. But behaviour is more fundamental. When students disrupt lessons then learning may well suffer, whatever the objective features of the school or pupil. On the other hand perhaps hard-working pupils, from whatever backgrounds, might perform better than less focussed students. Systematic information about such behaviour is not easily obtained. Those charged with being in control, who influence information flows and policy, may be unwilling to admit any loss of behavioural control. A notable finding of the recent study of Scottish schools is that the extent of a problem identified typically increased the lower the level of the hierarchy questioned (Wilkin et al 2006).

Behavioural failings can be pervasive and very real with harmful long term consequences, as studies of school bullying and intimidation demonstrate. In the Youth Lifestyle Survey one third of 12- to 16-year-olds reported being bullied at school in the past year and nine per cent reported bullying others. A recent survey found that more than half of secondary school children thought that bullying was 'a big problem' or 'quite a problem' in their school (Thomas Coram Research Unit 2003). There is evidence that children with special needs are both much more likely to be bullied and themselves too bully.

Bullying not only damages victims but also may encourage behaviour that eventually leads in later life to prison. A Home Office study found that those who admitted bullying were more likely to offend. School bullies were also more likely to be current offenders after they left school (Flood-Page et al 2000 Table 3.4).

Bullying and more generally a reduction of control at school are hard to define. This is one reason that measurement is problematic. Bullying has been defined as the repeated oppression of a less powerful person by a more

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<sup>1</sup> Examples include studies of the effect of school size and type or race, controlling for free school meal eligibility and special educational needs status of pupils (Bradley et al 2000; Spielhofer, Benton, and Schagen 2004).

powerful one. In practice, often who is more powerful may be a matter of opinion, as is what constitutes oppression rather than the legitimate exercise of authority or power. A second reason measurement of bullying is difficult is that children are often unwilling or unable to report it- hence the popularity of 'Childline', which receives around 20,000 calls a year about bullying.

Yet both bullying and loss of effective authority in a school may have objective consequences that are measurable in principle. In order to learn, students require a controlled environment both within and outside the classroom. Disruptions broadly defined may well be reflected in their ability to learn and therefore in their exam performance.

The longitudinal study of young people in England (LSYPE) wave 1 is a remarkable source about these disruptions, so long as we are prepared to credit students and their parents with tolerable memories, perceptions and honesty. The present study therefore utilises LSYPE to assess what determines significant disorder, whether it varies with measurable student and school characteristics and whether it has adverse educational consequences. First we discuss the 'control loss' measures, then we assess their educational impact and finally we consider their determinants.

### ***Control loss***

The LSYPE wave 1 surveyed more than 15000 students in over 600 schools. Students' and parents' interview responses can be linked to school data. Questions pertinent to control loss include the proportion of lessons disrupted by misbehaviour or trouble making. Some of the questions allow checks on the significance of answers to other questions. For example, parents are asked similar questions about students' experiences as are students. Student assessment of frequency of misbehaviour or troublemaking in classes (by others) was that 71 percent experienced this in half or more classes. But when it comes to whether this disruption upset teaching - 'How often in last year has it been difficult to study or follow teacher because of bad behaviour by others'- a much lower, but still large proportion, 45.9 percent, answered that half or more classes were affected. What counts as

‘troublemaking’, and judgements as to when it prevented a student learning, are likely to vary between students<sup>2</sup>.

The cross-tabulation (Table 1) shows that by and large ‘classroom trouble’ occurs without disrupted teaching (only 800 cases), But disrupted teaching (‘aggro’) is usually associated with classroom trouble, indicating that answers to these two questions are reasonably consistent.

**Table 1 Class room trouble ( proportion of lessons) (‘troub\*’) and disrupted teaching and learning(‘ aggro’) crosstabulation**

		aggro		Total	
		No	Yes		
troub	No	<b>Count</b>	<b>3992</b>	<b>802</b>	<b>4794</b>
		<i>Expected Count</i>	2640.8	2153.2	4794.0
	Yes	<b>Count</b>	<b>4695</b>	<b>6281</b>	<b>10976</b>
		<i>Expected Count</i>	6046.2	4929.8	10976.0
Total		<b>Count</b>	<b>8687</b>	<b>7083</b>	<b>15770</b>
		<i>Expected Count</i>	8687.0	7083.0	15770.0

In view of the widespread reported disruption of lessons, parents might seem remarkably complacent, or undemanding, perhaps because, as apparently in the cases of bullying, they do not know what goes on at school. Over 80 percent were very or fairly satisfied with the level of discipline in the young person’s school. Yet this view was closely mirrored by students. Only 16 percent of students believed discipline was not strict enough. Parental attitudes towards school were even more favourable; over 90 percent of parents were very or fairly satisfied with the young person’s progress at school generally.

These survey findings can be interpreted in at least two ways. One is that students and parents do not know the necessary conditions for effective learning at school – hence their lack of interest in more discipline and their

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<sup>2</sup> These results may be compared with the less quantitative Scottish behaviour survey (Wilkin et al 2006) Table 4.3 1 which found that, in answer to the question ‘**Table 4.3** how many lessons do you consider pupils to be badly behaved and/or difficult to deal with?’ pupils responded 2% ‘all’, 16% ‘most’ and 36% ‘some’, cumulatively 54%.

general satisfaction. The other is that reported classroom disruptions and bullying are not important to learning; they are simply components of everyday life and part of growing up.

Table 2 How do student ('DISCSTUD') and parental ('discp') assessments of school discipline compare?

discstud \* discp Crosstabulation

			discp		Total
			satisfactory	Inadequate	
discstud	satisfactory	Count	12695	612	13307
		Expected Count	12462.3	844.7	13307.0
	Discipline inadequate	Count	2074	389	2463
		Expected Count	2306.7	156.3	2463.0
Total		Count	14769	1001	15770
		Expected Count	14769.0	1001.0	15770.0

The cross-tabulation of Table 2 is consistent with parents not being well informed about what goes on at school; 2074 students believe discipline inadequate when parents do not. But this does not seem to stem from the parents scale allowing finer gradations than the students. (see Table 3 below).

Table 3

discstud \* Satisfaction with: discipline at YP's school Crosstabulation

			Satisfaction with: discipline at YP's school					Total
			Very satisfied (100)	Fairly satisfied (66.67)	Fairly dissatisfied (33.33)	Very dissatisfied (0)	Can't say (0)	
discstud	.00	Count	5885	5080	1331	612	235	13143
		Expected Count	5417.8	5068.6	1556.9	844.2	255.5	13143.0
	1.00	Count	539	930	515	389	68	2441
		Expected Count	1006.2	941.4	289.1	156.8	47.5	2441.0
Total		Count	6424	6010	1846	1001	303	15584
		Expected Count	6424.0	6010.0	1846.0	1001.0	303.0	15584.0

Similarly with the assessments of bullying, there were very considerable discrepancies between parental and pupil reports. This could be because communication on the matter between parent and student may be limited, or because of forgetting. It might be because of the use of different definitions of bullying by parent and student. A bullying question put to both was whether the young person had actually been hit in the last year. But it is

possible for a young person to be hit because they hit someone else first; in which case the counter-strike would not necessarily be bullying.

Turning to a less extreme and more common form of bullying, name calling, the discrepancy between parent and student is remarkable (Table 4 below). Not much less than one half of students whose parents mentioned victimization by name calling, denied being upset by it, while almost the same number had been distressed but their parents did not concede the point. On the other hand, the proportions reported were similar; parents 29 percent, students 28 percent.

Table 4 Name-calling Bullying: parental and student reports compared

		Whether have been upset by name-calling inc text or email in last 12 months (student)			Total
		Don't know	Yes	No	
Whether YP has in last 12 months been called names by other pupils at school (parent)	no	241	1661	7632	9534
	yes	106	2183	1704	3993
Total		347	3844	9336	13527

Perhaps the most extreme form of oppression, and therefore the most accurate for measurement of bullying, is the experience of having money or property forcibly taken. Here, the divergence between student and main parent is also most extreme. The numbers admitting to this form of victimisation are very small. 403 students said they had suffered, while their parents said they had not. More surprisingly 160 students said they had not, when their parents said they been so victimised. Only 60 out of 13660 students agreed with their parents that they had been (Table 5).

Table 5 Robbery: parental and student reports compared

		Whether have been made to hand over money or possessions in last 12 months (student)			Total
		Don't know	Yes	No	
Whether YP has in last 12 months been made to give other pupils their money or belongings (parent)	no	138	403	12890	13431
	Yes	9	60	160	229

Total	147	463	13050	13660
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### *Student Performance*

Pupil performance is multidimensional but what is available in LSYPE is KS3 exam scores of pupils (aged 14) which can be compared with KS2 exam results (aged 11). The improvement of a student's score between the two assessments provides a measure of school value added and student learning (VA). The survey also supplies a ready made value added measure, K3VASCO\_REP; 'the distance between a pupil's actual KS3 average point score and the median KS3 average point score for pupils with the same or similar prior attainment.'

K3 vascorep has greater dispersion and more negative numbers than VA, the value added score based on ks3 average points score minus ks2 average points score. Quite a number of K2 average point scores are missing, the sample size is smaller than the official value added measure, where the median figure is apparently substituted for missing K2 scores

To illustrate with table 6 below, the first row pupil has an input score of 15 from KS2 and an output score of at KS3 of 17, so one measure of value added, VA – output minus input- the score is 2. However the median score at KS3 of pupils with 15 at KS2 is 17, everybody went up. Consequently relative to this general rise there is no improvement and 'K3vascorep' records a zero. In the case of the pupils in the second and third rows there are zeros recorded for KS2 and therefore the students are implicitly awarded the 'compensatory' score of 15, so that the KS3 score of 17 also amounts to no value added. If the KS3 average points score is missing then no value added VASCOREP is recorded. For the student who scored 25 at KS2 and 27 at KS3, VASCOREP records a negative value added ( -4), although a simple value added score would be positive (2). This is because the median student who scored 25 at KS2 went on to score 31(>27) at KS3. In short K3Vascorep has more entries, a lower mean value and greater dispersion because of the referencing of the measure against the median performance, compared with a simple value added measure<sup>3</sup>.

Table 6 Value added score calculations compared

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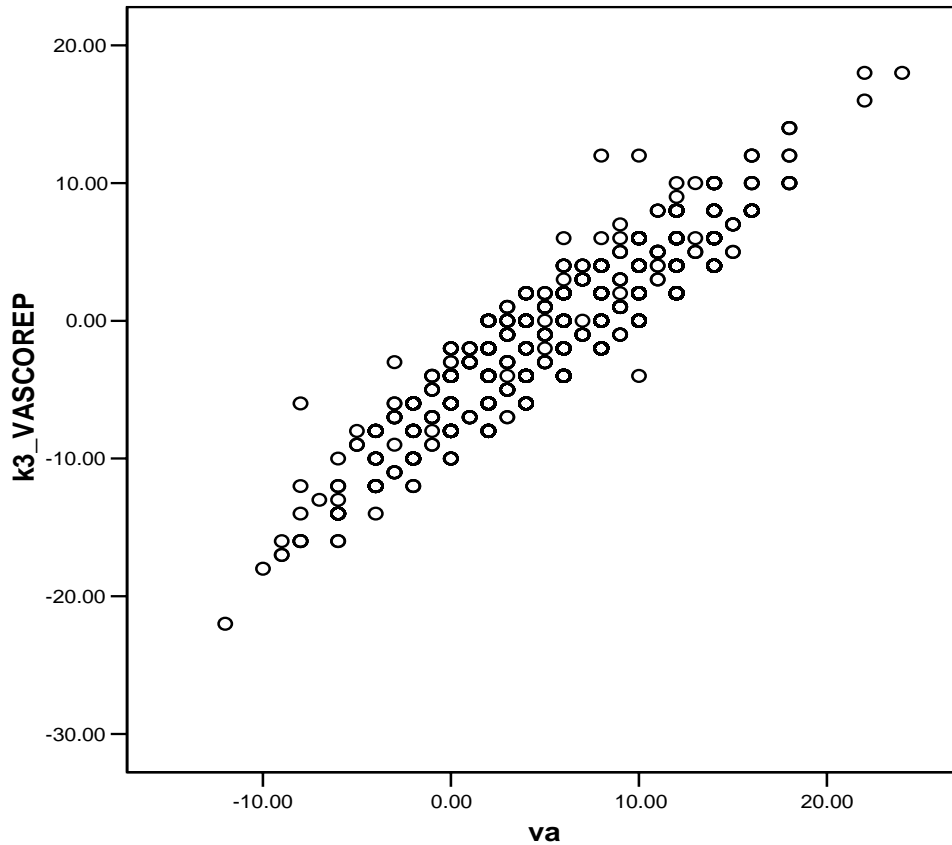
<sup>3</sup> Because of the way the points are allocated both of the indices have rather peculiar frequency distributions. In the analysis that follows they will be treated as continuous distributions nonetheless.

va in	va out	median	K3vascorep	VA
15	17	17	0	2
	17	17	0	-
	17	17	0	-
15	19	17	2	4
25	27	31	-4	2
29	36	37	-1	7
21	27	25	2	6
21	.	25	.-	-
25	35	31	4	10
.	25	.	.-	-

Figure 1 shows the correlation between the two measures is not perfect because the median adjustment moves up with the score. Although the highest scorer on K3VASCOREP (4) is also the highest scorer on VA (10), this is not true of the second highest scorer. On K3Vasco rep, there are two candidates with scores of 2, but on VA the second highest scoring candidate has 7 but only achieves -1 on the K3Vascorep. This student 'should' have performed better because of the high achievement at KS2 (29). Students like that elsewhere boosted their KS3 scores much more, on average, than students with lower scores. So the two value added indicators measure slightly different things. The vertical width of the scatter plot confirms that this gives rise to a substantial range of K3VASCOREP corresponding with a given VA score and vice versa.

Figure 1 Value added score association





***Schools***

Turning now to the schools, the distribution of school sizes is centred on a mean of 1110 pupils, with a few very small schools, see figure 2. With the exception of Community Special schools the principal types of school in the survey do not differ greatly in their mean sizes (Table 7). Most are Community schools but significant numbers of students also attended voluntary aided and Foundation schools. About one tenth of students in the sample are in schools with 700 pupils or fewer (figure 2).

Table 7 School Types and Sample School Sizes

	All Schools	Voluntary Controlled	Foundation	Voluntary Aided	City Technology College	Community Special
Number of students	15086	381	2290	1683	103	120
Average	1110	1367	1220	1010	1190	190

school size						
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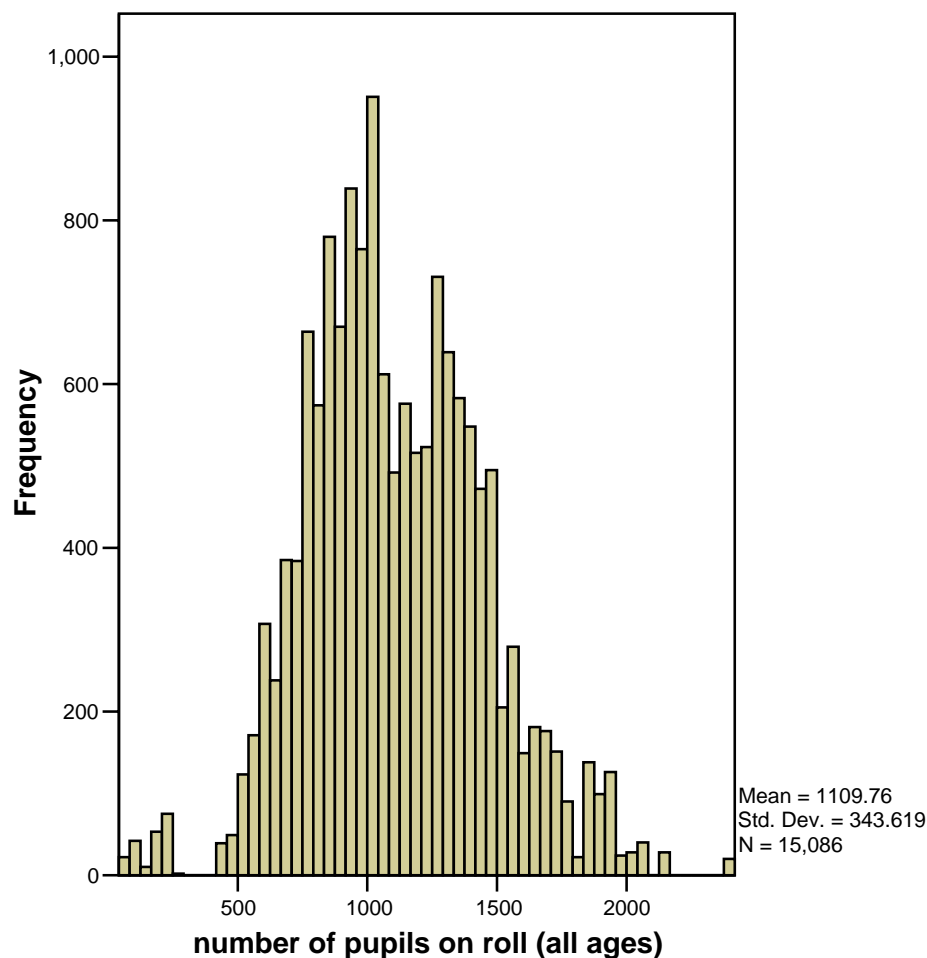


Figure 2

An important consideration is what to do about ‘school effects’. It may be that in a properly specified model, school effects would be zero because the reasons and causes of differences in performance for similar pupils in different schools will have been identified, measured and controlled<sup>4</sup>. In practice this proves problematic and school effects become ‘coefficients of ignorance’. Here we cannot measure the effect of the age, training and experience of teaching teams, of teaching styles or even many aspects of

<sup>4</sup> The data set has been restricted for the regression analysis so that a minimum of 7 students per school are available in order to identify school effects.

student intake. All these may be captured by individual school effects in the analysis.

Even in a properly specified model however individual schools may be more or less effective at influencing the behaviour of students with a wide range of different characteristics. So in principle allowance should be made for interactions between individual school effects and each of determinants of the behaviour under consideration. That is to say, even controlling for family background, peer group and innate ability, not only some schools may be better than others at positively influencing pupil behaviour, but some schools may be better or worse for pupils with special educational needs, or for those with high or low initial KS2 scores.

Measures of school effects can be interpreted as school efficiency indicators (cf Smith and Street 2006), although the indicators will vary substantially with the model specification. For example, as the results below imply, a school that has a high proportion of students whose first language is not English will appear more 'efficient' than those with a low proportion, other things being equal, if this variable is not explicitly measured. The school could be wrongly attributed a better educational performance, judged more 'efficient', when the driver, a pupil characteristic, is independent of the school.

Fixed effects estimators address only variation among pupils, not between schools, so influences that vary between schools like size but not between pupils cannot be considered. Excluding fixed effects may lead to inconsistent parameter estimates because of omitted variable bias. Yet in a sample such as the present there is potential collinearity of fixed effects with other independent variables, such as school size and class size.

An alternative way of measuring school effects, is assuming them to be random; that is, every school has a random effect, independent of other influential variables (eg Aitken and Longford 1986). But if they are not independent, estimators will be biased. A school's effects might be treated as random if the values of the variable included in the study are a sample drawn from some larger conceptual population that could in principle have been selected. If the interest lies in individual school effectiveness, making explicit comparisons of one school against another, then fixed effects are appropriate. If, on the other hand, the concern is with the effects of other variables or treatments across the levels of a factor (e.g. the effect of school

size or homework on key stage value added, across samples from several schools), then the "control" variable, school, might be treated as a "random" effect. In this example, the dependent variable is value added, the independent variables school size or homework (which would be treated as fixed factors so that students doing more and less homework, or in larger or smaller schools may be compared), and the school context might be treated as a random factor.

### ***The Cognitive Achievement Production Function***<sup>5</sup>

Four groups of influences upon learning are considered.

- Home environment- poverty (fsm eligibility), race, language, parental attitudes and support
- School environment- the control or lack of control that concern us centrally in this paper measured by truancy rates, school size (K4ABSPUPS), sixth form, bullying ('In the last 12 months, have other students ever ACTUALLY hit you, kicked you or used any other form of violence against you?' 'bullyhit'; 'In the last 12 months, have other students at your school ever made you give them money or personal possessions?'- 'rob'-') race,
- Classroom environment- 'aggro'('difficult to learn or follow teacher in 50 percent or more of classes'), 'troub' ( 'trouble in half or more lessons'), class size
- Pupil motivation and capacities (not wholly independent of the above) homework, truanting ( 'In the last 12 months have you missed any school without permission?'), SEN

The hypothesis is that unhappy students in a disrupted environment will not learn as well as they might. One of the objectives is to test whether the questionnaire results- both from parent and student, give evidence of this unhappiness so identified. Some of these variables may well depend on each other. In particular, control loss variables, truanting, bullying, trouble and disrupted learning in classrooms might depend upon school size.

The approach is to estimate a 'cognitive achievement production function' (Todd and Wolpin 2003), an equation that predicts and explains individual learning performance. This is undertaken with an exam performance equation to establish what 'school control' variables matter. Then the

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<sup>5</sup> The statistical analysis of the following sections is conducted with STATA.

influences on these control variables themselves are assessed (by binary logistic or logit regression).

The 'output' variable for cognitive achievement, is measured both as normalized value added between 11 and 14 and as simple value added. Time spent studying must be and is important. Number of days a week students claim to undertake homework is a major influence on value added performance (table 8). A student who does homework four or five days a week ('hmkfive' etc.) gains on average about two value added points (compared with an average for this dependent variable of seven). This offsets the combined disadvantages of being male, eligible for free school meals and SEN status. Conversely, time away from studying, any unauthorised absence, accounts for a loss of three quarters of a value added point, more than is gained by the first day a week of homework. The relative importance of more versus less homework, and homework versus other influences, appears something of a contrast with the findings of Tymms and FitzGibbon (1992) for A level students, and more consistent with Holmes and Croll (1989) for third year secondary boys.

Main or sole speakers of English language are at a disadvantage in learning- presumably a migrant selection effect. Those whose first language is not English will have been relatively recent arrivals in the UK and on average a non-random sample from the population from where they originated. They are likely to be more concerned with personal achievement than the average; they or their families migrated to better their lot. So insofar as the UK average in this respect is fairly similar to those of countries of immigration, families or individuals electing to move to the UK will be more achievement-orientated than the UK average. The language effect then measures this selection according to motivation for self-improvement.

Attending a school with a higher proportion of 'white' students appears to be a small advantage in the random effects model – but this disappears in the fixed effects estimation. Pupils at schools with poor attendance records are at a significant disadvantage. The random effects coefficient of -0.25 implies that a one standard deviation increase in this percentage (1.47) lowers value added by three eighths of a point. Whether this measure is a symptom of 'control loss' depends on what control a school can exercise over such absences and indeed on policy on authorisation. One interpretation is that it is simply a measure of a challenging student intake. But the fact that the effect is independent of those of other characteristics may undermine this

view. In any case school unauthorised absences appears to be a case of a negative peer effect because the impact is independent of whether the pupil under consideration has truanted at least once.

Other significant general school effects are sixth forms and size. In the random effects model a sixth form in a school is beneficial for younger students. Problems of control are likely to be less for sixth formers because they have chosen to remain at school, whereas for younger pupils attendance is obligatory. For this reason a school with a given number of pupils and a sixth form might be expected to perform better than one without a sixth form. But the size control variable in this model is pupils of compulsory school age. So the apparently large effect of 0.7 of a value added point reflects something else, such as the boost to the quality of teaching 11-16 year olds from also being able to offer teaching for 17-18 year olds. Alternatively or additionally the coefficient captures otherwise unmeasured social features of the school catchment area that allows a viable sixth form to be maintained.

Greater size (in the random effects estimate) is harmful to exam score value added; the coefficient of -0.54 implies that an individual at a school of 1800 (compulsory school age) pupils would achieve 0.37 of a value added point less than had they attended a school of 900. This finding contrasts with those of studies indicating an optimum school size (EPPI 2004, Foreman-Peck and Foreman-Peck 2006)). A squared size term was not statistically significant and therefore there is no reliable evidence of a turning point in the size-performance relationship in these data. In view of the greater opportunity for employing specialised resources, including teachers, in larger schools, the negative coefficient implies quite substantial offsetting factors. If school control was completely measured then the result would be surprising, but the limited measurement in this model leaves scope for control loss increasing with size as an explanation for the negative coefficient. One of the results reported below of the relationship between size and measured control loss indicates that the negative coefficient here is an understatement of the full school size – pupil performance effect.)

### **Table 8 about here**

The impact on value added of student and parent reports of bullying are notable. Despite the discrepancy in the cross-tabulation above, their effects are in the same direction for robbery (student='rob', parent='prob'); the

students report is harmful (0.68-0.69 of a value added point lost) and so independently is the parent reports (0.50-0.52). A single event may not be decisive for educational performance over four years. More likely the influence is the persistent climate of fear in which the reported incident took place. The robbery measure in any case is an instance of loss of control of the learning environment by school authorities

A contrasting result is that pupil reports of bullying by name calling ('names2') ('have you ever been called hurtful names etc in the last 12 months') shows a big positive association with value added (one third of a point gain). There may be another selection process at work here; diligent students, who do not bow to popular school sub-cultures, may experience abuse - but it is not the abuse that improves their performance. Consistent with the hypothesis that parents are not aware of much that goes on at school, and only may become aware when their child is obviously unhappy, parent reports ('pname') of name-calling bullying are significantly negatively associated with value added (one quarter of a point loss).

Similarly, divergence between pupil and parent reported bullying impacts occurs with being hit. Student reports ('bullyhit') are positive and weakly significant, but parent reports (at the same time, 'phit') are associated with significant adverse educational performance. What may be recorded for the student is an imprecise question for eliciting bullying experience. As noted in the introduction, being hit may be a mark of aggression being met with aggression (and by implication, a certain amount of aggression may be helpful for learning). On the other hand a parent may become aware a pupil is unhappy or fearful because of bullying (the experience is more filtered), and the unhappiness impinges upon learning ability.

If the pupil thinks discipline at school inadequate ('discstud') then that student will do well. On the other hand if a student's parent thinks discipline inadequate (more rarely) ('discp'), the student will perform worse than otherwise. Again it seems likely that questions elicit different things. A pupil concerned about discipline is likely to be conscientious and committed to learning, characteristics that will assist educational achievement. Parental concern about discipline by contrast is likely to arise from what is inferred about their child's experience and behaviour, rather than their attitude.

Student statements that in at least half their lessons disruptions hampered their learning ('aggro') was a highly significant adverse influence upon KS3

improvement over KS2. So too was reporting disrupted learning in all lessons ('aggrall'). A student that indicates trouble in all lessons ('troub1') will perform worse, independently of telling of teaching and learning disrupted in all or at least half of lessons. On the other hand simply reporting trouble in half or more lessons ('troub') was not associated with poorer performance.

There is a large autoregressive component to achievement. Exam performance at 11 carries over to exam performance at 14. Presumably this reflects not only innate ability and personality, but also persistent factors between schools, such as the home background and perhaps peer group. The coefficient on KS2 of 0.2 not only indicates persistence in good or bad student performance, but, because the dependent variable is value added, implies that initial differences are exacerbated; high initial achievers learn better than low initial achievers. This result contrasts with the next equation because of the different measurement of value added. It is worth noting that in principle KS2 could be an excellent predictor of KS3 but of no use in predicting value added- either at the school or the pupil level. When the regression coefficient on KS2 is unity, however high the proportion of explained variance, KS2 will not predict value added defined as  $KS3-KS2$  (cf. Gorard 2006)<sup>6</sup>.

The results for normalised value added (KS3 Vasco Table 8b) are generally very similar to the VA2 equation, except for the impact of the student's past achievement, which changes sign. That is to say, with this definition of value added, which attempts to correct for higher initial achievers learning better, students with high ks2 scores perform less well than those with low ks2 score, controlling for other influences. This may raise questions about the appropriateness of the value added measure.

Another difference is that the significance of the gender effect is considerably reduced and the magnitude of impact of SEN status is increased to more than 1.5 normalised points. The mean of normalised

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<sup>6</sup> Suppose the (well-fitting) regression is  
 $KS3 = a + bKS2$

where a and b are parameters. If  $b=1$  a regression on value added as defined below will yield a zero coefficient on KS2 ( $b-1=0$ ).

$KS3-KS2 = a + (b-1) KS2$

The overall explained variance of the first specification (plus sen status, free school meal eligibility, and proportion 'white' ) with these data is 73 percent compared with 26 percent for the more fully specified random effects model of Table 8a.



points should be zero across the country but is in fact -0.2 in this sample, the standard deviation at 3.5 is slightly less than for VA2 (3.8).

With both dependent variables, the greater part of the explained variation in pupil value added is between, rather than within, schools, both with fixed and random effects. This could be interpreted as underlining differences in school efficiency, or the importance of influences unmeasured in this model. Ofsted's (2006) 'Pupil Achievement Tracker', in which one key stage score is used to predict a subsequent expected key stage score on the basis of average experience, controlling for race, free school meal eligibility and SEN status to set targets for individual pupil performance is subject to the same different interpretations, although the method of prediction is different.

### *Explaining Control Loss*

Turning now to selected influential control loss variables, all the variables to be explained, disrupted learning, truanting and parental reports of bullying by name-calling, are binary. A logit (or binary logistic) model is therefore employed. This model explains changes in the log odds ratio. Parameter estimates are logits of explanatory variables used in the logistic regression equation to estimate the log odds that the dependent equals 1. If the logit for a given independent variable is  $b_1$ , then a unit increase in the independent variable is associated with a  $b_1$  change in the log odds of the dependent variable (the natural log of the probability that the dependent = 1 divided by the probability that the dependent = 0).

A logit can be interpreted by conversion to an odds ratio using the  $\exp()$  function. An odds ratio above 1.0 refers to the odds that the dependent = 1 in the logit regression. The closer the odds ratio is to 1.0, the more the independent variable's categories are independent of the dependent variable. 1.0 represents full statistical independence ( $\ln(1)=0$ ); two exclusive and exhaustive categories have equal, 50%, chances. For instance, in the equation for student statements of disrupted teaching (Table 9), the logit for the student reporting trouble in half or more classes ('troub') is 1.43 (random effects) which implies an odds ratio of 4.17. When the independent variable increases one unit, the odds that the dependent = 1 (student experiences 'trouble') increase by a factor of 4.17, when other variables are controlled.

If  $b$  is positive, then as the dichotomous variable moves from 0 to 1, the log odds (logit) of the dependent also increase. If the odds ratio is 1.21 ( $\exp(.19)$

for Pname (1=parent reports name calling, 0 = not), for instance, in the 'aggro' equation, (table 9), the odds of a student whose parent reports this type of bullying also reporting that learning and teaching are disrupted in half or more classes are 1.21 times the odds of a student whose parent does not report such bullying.

### **Table 9 about here**

When the logit is transformed into an odds ratio, it may be expressed as a percentage increase in odds. In the case of log size (K4abspups) the logit coefficient is 0.22 and the odds ratio 1.246 (Table 9). An increase in the number of pupils of compulsory school age from 800 to 1600 boosts the odds of teaching being disrupted in half or more classes by 17%.  $(0.246 * (\ln(1600) - \ln(800))) = 0.17$ . The original probability of the dependent variable 'aggro' is 44.9%. This corresponds to an odds of  $44.9/55.1 = 0.815$ . Thus the odds of 0.815 multiplied by the odds ratio of 1.246 = a new odds of the dependent of 1.015. Let x be the new probability.  $x/(1-x) = 1.015$  since the odds are defined as the probability divided by the not-probability (which is thus 1-x). Solving for x, yields about one half. Thus for an original probability of 44.9%, a logistic b coefficient of 0.22 means that a unit increase in log size variable (say from 700 to 1900) boosts the probability to one half, an increase of about 5 percent. Controlling for other variables in the model the chances of disruption in half or more of classes are increased, but not by much, 5 percent.

Explaining disrupted learning in half or more of classes response, 'aggro', matters because the contributors exercise an indirect effect on value added, even when they do not affect it directly. Student reports of being hit ('bullyhit') affect disruption (table 9) but only affect value added directly weakly. Parental reporting of bullying other than name calling are not significant predictors of disruption, nor is students' SEN status or class size. On the other hand student reporting of other forms of bullying, name calling and robbery, are significant predictors. Females are less prone to testify to disruption (possibly because of segregated schools) and so are those whose first language is English. Deprived students ('fsmel') more probably report disruption, perhaps because of their schools, their location and catchment areas – even controlling for school effects. Not surprisingly students reporting trouble in all their lessons are more likely also to experience disrupted teaching in at least half their classes. The conscientiousness of students in doing homework is unrelated to reporting disruption.

From the truancy equation (table 10) it is apparent that students from families, the first or main language of which is English, are more likely to take unauthorized absences ('englang'=1 if first language English), as are females, those eligible for free school meals, those that report trouble in the classroom (but not disrupted learning) and being robbed. The greater female truancy chance is consistent with McAra (2004), who found that males were more likely to be excluded, than to truant, from Edinburgh secondary schools.

Parental reports of bullying are not significant indicators, nor is school or class size or proportion of 'whites'. Parental concerns about school discipline are strongly associated with truancy ('discp'), as are student reports of being hit ('bullyhit'), and to a lesser extent name-calling ('names2').

Days spent on homework are strong negative predictors of truancy, as is student concern about school discipline ('discstud')- consistent with these variables identifying attitudes and motivation of pupils. Peer group effects matter, according to the significant coefficient on school proportion of unauthorized absences (ks4\_absu with a coefficient of +0.048). This last group of variables may in part reflect unmeasured variables, smoking, substance misuse and alcohol drinking, associated with truancy (McAra 2004). Time spent doing homework is time not available for these activities, or for associating with peers participating in them.

### **Table 10 about here**

Parental reporting of bullying by name calling ('pnames') is more likely for females, for English first language speakers and for those with special educational needs (table 11). This last is a common finding – for example de Monchy et al (2004). The higher the proportion of 'whites' in a school, the more likely parents are to report this form of bullying. The most powerful predictors are whether the student also has testified to this type of bullying and whether the parent reports other kinds as well. Homework is negatively associated with this form of bullying. Both parental and student concerns about discipline are linked with hurtful name bullying, as is disrupted teaching in half or more of classes. Deprivation ('fsmel'), school size, class size and school absenteeism rates do not seem to be associated.

## Table 11 about here

### Conclusion

The basic model adopted consists of two types of relationship; a two level model of value added, and equations to explain the control loss variables, such as pupil reported frequency of disrupted lessons. So the idea was to examine indirect effects on individual performance. School size appears to influence whether a student experiences half or more of lessons disrupted so as to affect teaching and learning and this in turn affects 'value added'. There is also a direct effect of school size on value added, though in both cases they are of modest magnitudes.

The main findings of the study are as follows.

- The student-level value added equation shows a large number of significant influences, including school size (negatively), even though only a small proportion of the variance is explained.
- The largest coefficients are obtained on the pupils' admitted average days a week of homework variables. Disrupted lessons reduce value added significantly. Non-English first language speakers perform rather better.
- Bullying when reported by the parent in all cases exercised an adverse effect on student learning. This was not always the case when the student reported. There were very considerable discrepancies between parental and pupil bullying reports.
- School characteristics such as percentage of pupils eligible for FSM and SEN, and unauthorised absences, have the expected negative impacts.
- A binary measure of disruption appears to be significantly influenced by school size (though not by much), but neither truancy nor bullying by hitting are.
- There is likely to be a selection element in many of the results, such as non-English first language and whether students report bullying by

name calling, or regard discipline as insufficiently stringent. This influences the interpretation of the results.

The richness of the LSYPE data set means that there are a very large number of pupil and parent characteristic and attitude variables, as well as those of the school, not all of which have been examined.

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**Appendix A: Calculation of Value Added Score K3 VASCOREP**

<p>VAINPUT (new for 2003/2004)</p>	<p>Key Stage 2 average point score (Value Added input) – calculated using the Final Test level for each subject.            Point Score – All Subjects            5 = 33            4 = 27            3 = 21            Compensatory 2 = 15            Below the level assessed by the test (B) = 15            Not awarded test level (N) = 15            Unable to access test (T), (or Disapplied (D) for KS2-KS3 VA) - Disregard            Absent (A) – Disregard            Missing (M) – Disregard</p>
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	Malpractice (Q) – Disregard Lost/Stolen script (X) - Disregard Ineligible (Y or Z) - Disregard (0.0 to 33.0)																																																																
VAOUTPUT (new for 2003/2004)	Key Stage 3 average point score (Value Added output) – calculated using the Final Test level for each subject.  <table border="1"> <thead> <tr> <th>Test Level</th> <th>English</th> <th>Maths</th> <th>Science</th> </tr> </thead> <tbody> <tr><td>8</td><td>NA</td><td>51</td><td>NA</td></tr> <tr><td>7</td><td>45</td><td>45</td><td>45</td></tr> <tr><td>6</td><td>39</td><td>39</td><td>39</td></tr> <tr><td>5</td><td>33</td><td>33</td><td>33</td></tr> <tr><td>4</td><td>27</td><td>27</td><td>27</td></tr> <tr><td>3</td><td>NA</td><td>21</td><td>21</td></tr> <tr><td>2</td><td>NA</td><td>NA</td><td>NA</td></tr> <tr><td>Below Level of Test (B)</td><td>21</td><td>15</td><td>15</td></tr> <tr><td>Not Awarded (N)</td><td>21</td><td>15</td><td>15</td></tr> <tr><td>Unable to Access Test (T)</td><td colspan="3">Disregard</td></tr> <tr><td>Malpractice (Q)</td><td colspan="3">Disregard</td></tr> <tr><td>Missing (M)</td><td colspan="3">Disregard</td></tr> <tr><td>Lost/Stolen (X)</td><td colspan="3">Disregard</td></tr> <tr><td>Mixed Tier (V)</td><td colspan="3">Disregard</td></tr> <tr><td>Ineligible (Y/Z)</td><td colspan="3">Disregard</td></tr> </tbody> </table>	Test Level	English	Maths	Science	8	NA	51	NA	7	45	45	45	6	39	39	39	5	33	33	33	4	27	27	27	3	NA	21	21	2	NA	NA	NA	Below Level of Test (B)	21	15	15	Not Awarded (N)	21	15	15	Unable to Access Test (T)	Disregard			Malpractice (Q)	Disregard			Missing (M)	Disregard			Lost/Stolen (X)	Disregard			Mixed Tier (V)	Disregard			Ineligible (Y/Z)	Disregard		
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MEDIAN (new for 2003/2004)	Median Key Stage 3 average point score for pupils with the same or similar KS2 average point score. These fields will only contain values for amended and final data.																																																																
VASCOREP (new for 2003/2004)	Value Added score – calculated as the distance between a pupil’s actual KS3 average point score and the median KS3 average point score for pupils with the same or similar prior attainment.																																																																

## Appendix B: Data

The question ‘squiet’ ‘how often trouble’ has 5 options and a ‘don’t know’. ‘Troubl’ is coded 1 for ‘most’, zero otherwise. ‘Troubmh’ is coded 1 if the student opts for ‘more than half’ but less than ‘most’. ‘Troubhf’ is ‘about half’. The three added together are ‘troub’, ‘trouble in half or more lessons’.

The question ‘Snodis’ is about disrupted teaching, coded in the same way. ‘Aggroall’ is coded 1 for pupils reporting that in ‘most’ lessons teaching was disrupted, aggrohpl is coded 1 for ‘more than half’, aggrohaf is coded 1 for ‘about half’. ‘Aggro’ is the aggregated measure for ‘half or more lessons’.

The 'sdisc' question is whether the student is satisfied with school discipline. It is coded 1 if a 3 was recorded in the questionnaire (not strict enough) (discstud). Discst2 codes 0 missing observations and anything else other than 2 (OK). Discst1 codes 1=1 else 0, so is 'too strict'.

'dispar' is 1=1 else 0 ('satisfied with discipline at YPs school')

'Discp' is 5=1 else 0- very dissatisfied

Sen1 pupil level s=1 else 0

Sex gender 04 m=0 f=1

Englang =1 if main language of household English

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
k3_VASCOREP	14160	-22.00	24.00	-.2045	3.56973
% of half days missed due to unauthorised absence (2004)	15421	.00	14.30	1.3435	1.47457
% of pupils in school - White	15556	.00	100.00	71.9844	30.91297
logsize	15421	3.30	7.66	6.8486	.38789
sex	14992	.00	1.00	.4909	.49993
va2	14141	-12.00	24.00	6.9765	3.85662
fsmel	14992	.00	1.00	.2059	.40438
hmwkfive	15770	.00	1.00	.1767	.38140
hmwkfour	15770	.00	1.00	.1313	.33777
hmwkthre	15770	.00	1.00	.2540	.43533
hmwktwo	15770	.00	1.00	.1855	.38875
hmwkone	15770	.00	1.00	.1158	.31998
aggroall	15770	.00	1.00	.1316	.33811
troub1	15770	.00	1.00	.3048	.46032
troub	15770	.00	1.00	.6960	.46000
sen1	15770	.00	1.00	.0323	.17674
rob	15770	.00	1.00	.0337	.18039
discstud	15770	.00	1.00	.1571	.36394
discp	15770	.00	1.00	.0589	.23546
number of pupils on roll (all ages)	15087	80	2382	1109.75	343.610
KS3 average points score	14833	15.00	48.00	33.8355	6.90061
KS2 average points score	14304	15.00	39.00	27.0678	4.20894
truant	15771	.00	1.00	.1411	.34818
bullyhit	15771	.00	1.00	.1631	.36945
aggro	15770	.00	1.00	.4491	.49742
englang	15771	.00	1.00	.8353	.37089



number of pupils on roll of compulsory school age (2004)	15421	27	2124	999.99	297.840
EduBase.EduBase - Sixth Form Indicator	15556	0	1	.55	.498
ASC_School_04.Classes - Average size of 1 teacher classes - 2004	14901	16.2	29.0	22.090	2.1058
Valid N (listwise)	13607				

Differences in numbers between the different files due to non-matching cases

**Table 8a Fixed and Random Effects estimates of student level value added, age 11-14**

va2 (random effects)	Coef.	Std. Err.	z	P> z	Fixed effect	va2	Coef.	Std. Err.	t	P> t
ks2_aps	0.218881	0.007806	28.04	0.000	ks2_aps		0.209746	0.007963	26.34	0.000
englang	-0.32697	0.094271	-3.47	0.001	englang		-0.32568	0.096983	-3.36	0.001
sex	0.120921	0.060412	2.00	0.045	sex		0.135264	0.062242	2.17	0.030
logsize	-0.53199	0.168891	-3.15	0.002	logsize	(dropped)				
asc04acs	0.052071	0.027776	1.87	0.061	asc04acs average class size	(dropped)				
asc04whi	0.004457	0.001767	2.52	0.012	asc04whi proportion white		-0.00351	9.98E+08	-0.00	1.000
sen1	-0.98128	0.191292	-5.13	0.000	sen1		-1.03592	0.192442	-5.38	0.000
fsmel	-0.90318	0.077684	-11.63	0.000	Fsmel		-0.78823	0.079149	-9.96	0.000
aggro	-0.39705	0.066564	-5.96	0.000	Agro		-0.35759	0.066979	-5.34	0.000
hmkwfive	2.15261	0.113792	18.92	0.000	Hmkwfive		1.960349	0.116562	16.82	0.000
hmkwfour	1.989917	0.115332	17.25	0.000	Hmkwfour		1.844401	0.117193	15.74	0.000
hmkwthre	1.510532	0.099785	15.14	0.000	Hmkwthre		1.455566	0.101211	14.38	0.000
hmwktwo	0.942167	0.103173	9.13	0.000	Hmwktwo		0.918974	0.104292	8.81	0.000
hmkwone	0.666557	0.113933	5.85	0.000	Hmkwone		0.647007	0.114887	5.63	0.000
discp	-0.49309	0.124202	-3.97	0.000	Discp		-0.44385	0.12524	-3.54	0.000
discstud	0.616932	0.080737	7.64	0.000	Discstud		0.671308	0.081799	8.21	0.000
truant	-0.75325	0.082835	-9.09	0.000	Truant		-0.75975	0.083361	-9.11	0.000
aggroall	-0.50776	0.095079	-5.34	0.000	Aggroall		-0.5055	0.095842	-5.27	0.000
troub	-0.03414	0.070798	-0.48	0.630	Troub		-0.00905	0.071434	-0.13	0.899
troub1	-0.17162	0.071811	-2.39	0.017	troub1		-0.16323	0.072331	-2.26	0.024
names2	0.370867	0.072497	5.12	0.000	names2		0.346781	0.072842	4.76	0.000
sixthform	0.725162	0.118361	6.13	0.000	Sixthform	(dropped)				
phit	-0.21319	0.104848	-2.03	0.042	Phit		-0.17653	0.105373	-1.68	0.094
prob	-0.50709	0.234609	-2.16	0.031	Prob		-0.52115	0.235612	-2.21	0.027
pnames	-0.25811	0.072904	-3.54	0.000	Pnames		-0.27835	0.073414	-3.79	0.000
rob	-0.69449	0.159935	-4.34	0.000	Rob		-0.68482	0.160788	-4.26	0.000
bullyhit	0.1824	0.085556	2.13	0.033	Bullyhit		0.169922	0.085992	1.98	0.048
ks4_absu	-0.2546	0.033008	-7.71	0.000	ks4_absu school	(dropped)				
_cons	2.648726	1.201042	2.21	0.027	_cons		1.075388	7.52E+10	0.00	1.000
sigma_u	0.854699				sigma_u		1.356574			
sigma_e	3.161036				sigma_e		3.161036			
rho	0.068128	(fraction	of variance	due	to	Rho	0.155529	(fraction	of variance	due to
Random-effects	GLS regression	Number of obs		13568	Fixed-effects	Number of obs		13568		
Group variable	(i): school	Number of groups		596	Group school	Number of groups		596		
R-sq: within	0.1701	Obs per group: min		7	R-sq: within =	Obs per group: min		7		
between	0.6088	Avg =		22.8	between = 0.6085	avg		22.8		
overall	0.264	Max =		46	overall = 0.2437	max		46		
Random effects	u_i ~ Gaussian	Wald chi2(28) =		3626.47		F(24,12948)		110.87		
corr(u_i, X)	= 0 (assumed)	Prob > chi2 =		0	corr(u_i, Xb) = 0.2375	Prob > F =		0		

Breusch and Pagan Lagrangian multiplier test for random effects:

$$va2[school,t] = Xb + u[school] + e[school,t]$$

Estimated results:

	Var	sd = sqrt(Var)
va2	14.81128	3.848543
e	9.992146	3.161036
u	.7305108	.8546993

Test:  $Var(u) = 0$

chi2(1) = 915.93

Prob > chi2 = 0.0000

**Table 8b Dependent variable normalized value added K3\_Vasco**

random				fixed			
k3_vasco	Coef.	Std. Err.	z P> z	k3_vasco	Coef.	Std. Err.	t P> t
ks2_aps	-0.18674	0.007901	-23.64 0.000	ks2_aps		-0.19604	0.008059 -24.33 0.000
englang	-0.26561	0.095289	-2.79 0.005	englang		-0.25674	0.098023 -2.62 0.009
sex	0.082006	0.061072	1.34 0.179	sex		0.099198	0.062916 1.58 0.115
logsize	-0.55091	0.171091	-3.22 0.001	logsize	(dropped)		
asc04acs	0.045101	0.028144	1.60 0.109	asc04acs	(dropped)		
asc04whi	0.005262	0.00179	2.94 0.003	asc04whi		-0.00406	1.98E+09 -0.00 1.000
sen1	-1.45872	0.193961	-7.52 0.000	sen1		-1.51365	0.195146 -7.76 0.000
fsmel	-0.86175	0.078551	-10.97 0.000	fsmel		-0.74365	0.080033 -9.29 0.000
aggro	-0.38358	0.067267	-5.70 0.000	aggro		-0.34433	0.067684 -5.09 0.000
hmkfive	2.067454	0.115049	17.97 0.000	hmkfive		1.880072	0.11784 15.95 0.000
hmkfour	1.902475	0.116531	16.33 0.000	hmkfour		1.761182	0.118404 14.87 0.000
hmkthre	1.41781	0.100866	14.06 0.000	hmkthre		1.370185	0.102304 13.39 0.000
hmktwo	0.859196	0.104272	8.24 0.000	hmktwo		0.841921	0.105409 7.99 0.000
hmkone	0.647568	0.115231	5.62 0.000	hmkone		0.635646	0.116202 5.47 0.000
discp	-0.48233	0.125672	-3.84 0.000	discp		-0.44375	0.126744 -3.50 0.000
discstud	0.596886	0.081598	7.32 0.000	discstud		0.6501	0.082661 7.86 0.000
truant	-0.75388	0.083818	-8.99 0.000	truant		-0.75969	0.084355 -9.01 0.000
aggroall	-0.50031	0.096178	-5.20 0.000	aggroall		-0.49692	0.096943 -5.13 0.000
troub	-0.02551	0.071551	-0.36 0.721	troub		-0.00289	0.072188 -0.04 0.968
troub1	-0.16532	0.072575	-2.28 0.023	troub1		-0.15434	0.0731 -2.11 0.035
names2	0.346918	0.073312	4.73 0.000	names2		0.31946	0.073659 4.34 0.000
sixthform	0.708946	0.119876	5.91 0.000	sixthform	(dropped)		
phit	-0.19344	0.106035	-1.82 0.068	phit		-0.15553	0.106573 -1.46 0.144
prob	-0.73604	0.23727	-3.10 0.002	prob		-0.74464	0.238295 -3.12 0.002
pnames	-0.24758	0.073692	-3.36 0.001	pnames		-0.26588	0.074205 -3.58 0.000
rob	-0.6672	0.161424	-4.13 0.000	rob		-0.6591	0.162293 -4.06 0.000
bullyhit	0.174652	0.086514	2.02 0.044	bullyhit		0.165959	0.086962 1.91 0.056
ks4_absu	-0.24245	0.033457	-7.25 0.000	ks4_absu	(dropped)		
_cons	6.701224	1.216698	5.51 0.000	_cons		4.944528	1.49E+11 0.00 1.000
sigma_u	0.867036			sigma_u		1.372567	
sigma_e	3.188946			sigma_e		3.188946	
Rho	0.068835	(fraction	of variance due	to	rho	0.156301	(fraction of variance due
Random-effects	GLS regression	Number of obs =		Fixed-effects (within) regression	Number of obs =		
Group variable	(i): school	Number of groups =		Group variable (i): school	Number of groups =		
R-sq: within	0.0887	Obs per group: min =		R-sq: within =	Obs per group: min =		
between	0.324	avg =		22.7 between = 0.1182	avg =		
overall	0.1255	max =		46 overall = 0.0939	max =		
Random effects	u_i ~ Gaussian = 0	Wald chi2(28) =		1568.17	F(24,12902) =		
corr(u_i, X)	(assumed)	Prob > chi2 =		0 0.0206	corr(u_i, Xb) =		
				F test that all u_i=0:	F(595, 12902) =	3.09	Prob > F = 0.0000

Table 9 Student-Reported Disrupted Teaching : Fixed and Random Effects

random effects					fixed effects				
aggro	Coef.	Std. Err.	z	P> z	aggro	Coef.	Std. Err.	z	P> z
englang	-0.21261	0.062327	-3.41	0.001	englang	-0.16451	0.065885	-2.5	0.013
sex	-0.12818	0.041169	-3.11	0.002	sex	-0.13486	0.043622	-3.09	0.002
logsize	0.224308	0.087771	2.56	0.011					
asc04acs	0.017533	0.014324	1.22	0.221					
asc04whi	-0.00258	0.000949	-2.72	0.007					
sen1	0.170449	0.126757	1.34	0.179	sen1	0.16129	0.128491	1.26	0.209
fsmel	0.233011	0.052148	4.47	0	fsmel	0.185205	0.054024	3.43	0.001
bullyhit	0.160242	0.058612	2.73	0.006	bullyhit	0.185703	0.059462	3.12	0.002
hmwkwfive	0.045179	0.077903	0.58	0.562	hmwkwfive	0.164907	0.082125	2.01	0.045
hmwkwfour	-0.09853	0.07945	-1.24	0.215	hmwkwfour	-0.00965	0.08253	-0.12	0.907
hmwkwthre	0.003295	0.068378	0.05	0.962	hmwkwthre	0.057822	0.070628	0.82	0.413
hmwkwtwo	0.15472	0.070806	2.19	0.029	hmwkwtwo	0.193455	0.072681	2.66	0.008
hmwkwone	0.0244	0.07813	0.31	0.755	hmwkwone	0.062687	0.079772	0.79	0.432
discp	0.042672	0.086156	0.5	0.62	discp	0.012608	0.087995	0.14	0.886
discstud	0.544857	0.054876	9.93	0	discstud	0.508288	0.056391	9.01	0
troub	1.430031	0.051084	27.99	0	troub	1.367945	0.052142	26.23	0
troub1	0.887814	0.045299	19.6	0	troub1	0.871508	0.046396	18.78	0
names2	0.461656	0.049173	9.39	0	names2	0.466472	0.050061	9.32	0
sixthform	-0.14254	0.061293	-2.33	0.02					
pnames	0.188562	0.050119	3.76	0	pnames	0.190066	0.051189	3.71	0
prob	0.200415	0.16635	1.2	0.228	prob	0.217453	0.168589	1.29	0.197
phit	0.022629	0.072619	0.31	0.755	phit	0.00461	0.073915	0.06	0.95
rob	0.308332	0.112774	2.73	0.006	rob	0.289358	0.114686	2.52	0.012
ks4_absu	0.115167	0.017345	6.64	0					
truant	0.0023	0.056527	0.04	0.968	truant	0.001911	0.057642	0.03	0.974
_cons	-3.47937	0.61835	-5.63	0					
/Insig2u	-2.31817	0.195356							
sigma_u	0.313773	0.030649							
rho	0.029057	0.005512							
ndom-effects logistic regression Group variable (i): school	Number of obs =		14356		Conditional fixed-effects logistic regression Number of groups		592	Number of obs	14290
Random effects u_i ~ Gaussian	Obs per group: min	7			Obs per group: min	7			
	avg	24.1			avg	24.1			
	max	47			max	47			
Log likelihood = -8207.9265	Wald chi2(25)	2402.74			LR chi2(20)	2575.64			
	Prob > chi2	0			Log likelihood = -6800.822	Prob > chi2	0		

te: multiple positive outcomes within groups encountered.  
note: 4 groups (66 obs) dropped due to all positive or  
all negative outcomes.

note: ks4\_absu omitted due to no within-group variance.

note: sixthform omitted due to no within-group variance.

note: asc04whi omitted due to no within-group variance.

note: asc04acs omitted due to no within-group variance.

note: logsize omitted due to no within-group variance.

Iteration 0: log likelihood = -7570.6197

Iteration 1: log likelihood = -6817.0788

Iteration 2: log likelihood = -6800.8626

Iteration 3: log likelihood = -6800.822

Iteration 4: log likelihood = -6800.822

Table 10 Explaining Student- Reported Truanting

random					fixed				
truant	Coef.	Std. Err.	z	P> z	truant	Coef.	Std. Err.	z	P> z
englang	0.259896	0.084818	3.06	0.002	englang	0.255068	0.0897607	2.84	0.004
sex	0.171471	0.053644	3.2	0.001	sex	0.182293	0.056735	3.21	0.001
logsize	0.069492	0.10964	0.63	0.526					
asc04acs	0.009798	0.017491	0.56	0.575					
asc04whi	-0.00201	0.001168	-1.72	0.086					
sen1	-0.03933	0.146538	-0.27	0.788	sen1	-0.02837	0.1502896	-0.19	0.85
fsmel	0.451956	0.061443	7.36	0	fsmel	0.439679	0.064656	6.8	0
bullyhit	0.500016	0.069179	7.23	0	bullyhit	0.497268	0.0707334	7.03	0
hmkfive	-1.63275	0.106267	-15.36	0	hmkfive	-1.63761	0.1124957	-14.56	0
hmkfour	-1.35044	0.103964	-12.99	0	hmkfour	-1.3825	0.1083092	-12.76	0
hmkthre	-1.06298	0.078247	-13.58	0	hmkthre	-1.10716	0.0817214	-13.55	0
hmktwo	-0.78244	0.078746	-9.94	0	hmktwo	-0.79831	0.081652	-9.78	0
hmkone	-0.35848	0.082623	-4.34	0	hmkone	-0.36216	0.0852044	-4.25	0
discp	0.467494	0.091152	5.13	0	discp	0.450644	0.0936899	4.81	0
discstud	-0.37344	0.072728	-5.13	0	discstud	-0.40389	0.0751389	-5.38	0
troub	0.403118	0.071471	5.64	0	troub	0.387883	0.0731266	5.3	0
troub1	0.268339	0.060872	4.41	0	troub1	0.263106	0.0624499	4.21	0
names2	0.159196	0.063217	2.52	0.012	names2	0.151064	0.0644855	2.34	0.019
sixthform	0.033319	0.075029	0.44	0.657					
phit	0.08901	0.085613	1.04	0.298	phit	0.077653	0.0877924	0.88	0.376
pnames	-0.0724	0.065073	-1.11	0.266	pnames	-0.085	0.0667385	-1.27	0.203
prob	0.261889	0.168835	1.55	0.121	prob	0.287016	0.1732515	1.66	0.098
Rob	0.546722	0.116934	4.68	0	rob	0.514512	0.1213073	4.24	0
ks4_absu	0.047769	0.019548	2.44	0.015					
Agro	0.000044	0.060193	0	0.999	aggro	-0.00262	0.0617899	-0.04	0.966
Aggroall	-0.00083	0.077532	-0.01	0.991	aggroall	0.000751	0.0798034	0.01	0.992
_cons	-2.60203	0.7679	-3.39	0.001					
/lnsig2u	-2.32965	0.286821							
sigma_u	0.311977	0.044741							
rho	0.028735	0.008005							

Random-effects	logistic regression	Number of obs =	14356	onditional fixed-effects logistic regression	Number of obs =	13497
Group variable	(i): school	Number of groups =	596	Group variable (i): school	Number of groups =	559
Random effects	u_i ~ Gaussian	Obs per group: min =	7		Obs per group: min =	10
		avg =	24.1		avg =	24.1
		max =	47		max =	47

Likelihood-ratio test of rho=0: chibar2(01) = 17.41 Prob >= chibar2 = 0.000

note: multiple positive outcomes within groups encountered.

note: 37 groups (859 obs) dropped due to all positive or  
all negative outcomes.

note: ks4\_absu omitted due to no within-group variance.

note: sixthform omitted due to no within-group variance.

note: asc04whi omitted due to no within-group variance.

note: asc04acs omitted due to no within-group variance.

note: logsize omitted due to no within-group variance.

Iteration 0: log likelihood = -4478.7112

Iteration 1: log likelihood = -4186.182

Iteration 2: log likelihood = -4184.0871

Iteration 3: log likelihood = -4184.0865



Table 11 Explaining Parental Reporting of Bullying by Name-Calling

Random Effects					Fixed Effects				
Pnames	Coef.	Std. Err.	z	P> z	pnames	Coef.	Std. Err.	z	P> z
englang	0.909192	0.089331	10.18	0	englang	0.900254	0.095287	9.45	0
sex	0.483173	0.048308	10	0	sex	0.486778	0.050887	9.57	0
logsize	0.001606	0.096241	0.02	0.987					
asc04acs	-0.00633	0.015902	-0.4	0.691					
asc04whi	0.010824	0.001157	9.36	0					
sen1	0.812531	0.13372	6.08	0	sen1	0.794249	0.13828	5.74	0
fsmel	-0.00328	0.063399	-0.05	0.959	fsmel	0.022433	0.066577	0.34	0.736
bullyhit	0.269885	0.063397	4.26	0	bullyhit	0.27606	0.064581	4.27	0
hmwkfive	-0.28773	0.088741	-3.24	0.001	hmwkfive	-0.26424	0.094989	-2.78	0.005
hmwkfour	-0.26165	0.09045	-2.89	0.004	hmwkfour	-0.25094	0.094517	-2.65	0.008
hmwkthre	-0.31439	0.077717	-4.05	0	hmwkthre	-0.33238	0.081125	-4.1	0
hmwktwo	-0.17795	0.080036	-2.22	0.026	hmwktwo	-0.19606	0.082913	-2.36	0.018
hmwkone	-0.11092	0.087998	-1.26	0.208	hmwkone	-0.11473	0.090562	-1.27	0.205
discp	0.522294	0.092305	5.66	0	discp	0.49259	0.095408	5.16	0
discstud	0.127506	0.061511	2.07	0.038	discstud	0.134003	0.063931	2.1	0.036
troub	0.094275	0.059499	1.58	0.113	troub	0.074506	0.061045	1.22	0.222
troub1	0.062834	0.055703	1.13	0.259	troub1	0.059172	0.057245	1.03	0.301
names2	1.389206	0.050304	27.62	0	names2	1.374873	0.051473	26.71	0
sixthform	0.008405	0.068067	0.12	0.902					
phit	2.111025	0.075297	28.04	0	phit	2.069398	0.076965	26.89	0
prob	1.689997	0.199946	8.45	0	prob	1.646283	0.206042	7.99	0
rob	-0.26669	0.125643	-2.12	0.034	rob	-0.24994	0.127543	-1.96	0.05
ks4_absu	0.000544	0.019016	0.03	0.977					
aggro	0.177554	0.053251	3.33	0.001	aggro	0.177931	0.054656	3.26	0.001
aggroall	0.078221	0.072452	1.08	0.28	aggroall	0.099742	0.074881	1.33	0.183
truant	-0.07021	0.06535	-1.07	0.283	truant	-0.075	0.067046	-1.12	0.263
_cons	-3.63058	0.678401	-5.35	0					
/lnsig2u	-2.41357	0.258967							
sigma_u	0.299158	0.038736							
rho	0.026483	0.006677							
random-effects logistic regression	Number of obs =	14356			Conditional fixed-effects logistic regression	Number of obs =	14026		
Group variable (i): school	Number of groups =	596			Group variable (i): school	Number of groups =	579		
Random effects u_i ~ Gaussian	Obs per group: min =	7				Obs per group: min =	11		
	avg =	24.1				avg =	24.2		
	max =	47				max =	47		
	Wald chi2(26) =	2430.1				LR chi2(21) =	3023.4		
Log likelihood = -6408.4467	Prob > chi2 =	0			Log likelihood = -5141.3555	Prob > chi2 =	0		
Likelihood-ratio test of rho=0: chibar2(01) = 22.29 Prob >= chibar2 = 0.000									

note: multiple positive outcomes within  
note: 17 groups (330 obs) dropped due to  
all negative outcomes.  
note: ks4\_absu omitted due to no within  
note: sixthform omitted due to no within  
note: asc04whi omitted due to no within  
note: asc04acs omitted due to no within-  
note: logsize omitted due to no within-g