

Do low attaining and younger students benefit most from small classes? Results from a systematic observation study of class size effects on pupil classroom engagement and teacher pupil interaction

Peter Blatchford, Paul Bassett and Penelope Brown

*School of Psychology and Human Development,
Institute of Education,
University of London
25 Woburn Square,
London, WC1H 0AA
UK*

Email: P.Blatchford@ioe.ac.uk

www.ioe.ac.uk/PHD

**Paper to symposium: ‘Class size effects: new insights into classroom, school and
policy processes’.**

American Educational Research Association Annual Meeting 2008, New York

Abstract

It is now recognised by many that we need to know more about effects of class size on classroom interactions and pupil behaviour. This paper extends research in several ways: 1. it compares effects on two main types of behaviours – pupil classroom engagement and teacher to pupil interaction; 2. it examines if effects vary by pupil attainment level; 3. it examines effects of class size on classroom processes across the whole of the primary and secondary school years; 4. it studies effects across the full range of class sizes found in UK schools; and 5. it uses systematic observation data to capture effects of class size on moment by moment behaviours and employs sophisticated multilevel statistical analyses that controls for possibly confounding factors and deals with the clustered nature of observation data within pupils and within classrooms within schools. Results showed that as class sizes became smaller there were more times when pupils were the focus of a teacher’s attention, and more times when they were engaged in active interaction with teachers. This effect was found for all groups at both primary and secondary levels. It was also found that pupils’ classroom engagement decreased in larger classes and this problem was particularly marked for the pupils who are already attaining at lower levels. This, in turn, was accompanied by teachers seeking to control low attainers more than other groups in larger classes. It is suggested that small classes can be a valuable educational initiative right through school, but could be particularly targeted at lower attaining pupils at secondary level.

Introduction

In many countries over the world there has been a hotly contested and widely reported debate over the educational consequences of class size differences. Opinions vary from those academics and policy makers who argue that class size reduction is not cost effective to those who argue that it should be a cornerstone of educational policy. In some countries policy has changed in favour of small classes. In the U.S.A, 33 states have enacted legislation for class size reduction (CSR) programs. Current Government policy in England and Wales is for a maximum class size of 30 at Reception and KS1 (4-7 years), and larger cuts are planned

in Scotland. There have been initiatives involving class size or pupil to adult ratio reductions in the Netherlands and New Zealand. In East Asia, many countries and cities (including Shanghai in the Chinese Mainland, Hong Kong, Macau, Taiwan, Korea and Japan) have implemented 'small class teaching' initiatives.

There is some agreement, drawing on experimental (e.g. Finn & Achilles, 1999) and naturalistic studies (Blatchford, Bassett, Goldstein & Martin, 2003), that smaller classes have positive effects on pupil academic performance, if introduced immediately after school entry, that is, with the youngest children in school. However, it is now recognised by many – and not just critics of class size reductions - that we need to know more about effects of class size on classroom interactions and pupil behaviour. There are now several helpful reviews of research (Anderson (2000); Biddle and Berliner (2002); Blatchford and Mortimore (1993); Blatchford, Goldstein & Mortimore (1998); Blatchford, Russell and Brown (in press); Ehrenberg, Brewer, Gamoran and Willms (2001); Finn, Pannozzo and Achilles (2003); Galton (1998); Grissmer (1999), Hattie (2005)). Unfortunately a theme to emerge from these reviews is that there are methodological weaknesses in much research in this area. Studies have been relatively anecdotal with a reliance on teacher opinion and comment (Blatchford, Goldstein and Mortimore, 1998). Finn et al (2003) have pointed out that there is relatively little strong systematic observational research which would permit objective study of relationships between class size, teaching practices and student behaviour.

Effects of class size on classroom processes tend to fall into two main camps. First, there are those concerned with classroom interactions and in particular teacher pupil interactions. It seems likely that bigger classes will decrease the amount of time that can be spent on instruction and dealing with individual children. This is consistent with teachers' views (Bennett, 1996, Pate-Bain, Achilles, Boyd-Zaharias and McKenna, 1992), and some previous research (Achilles, 1999, Glass, Cahen, Smith & Filby, 1982; Cooper, 1989, Molnar, Smith, Zahorik, Palmer, Halbach & Ehrle, 1999). Anderson's (2000) model of possible factors linking class size to student achievement accords a central place to aspects connected to teaching. On the basis of a programme of research in England (the Class Size and Pupil Adult Ratio (CSPAR) project, see Blatchford, 2003a), it was proposed that in smaller classes there was more likelihood of *teacher support for learning* (Blatchford, Moriarty, Edmonds & Martin, 2002). Pupils of primary school age in smaller classes were more likely to interact with their teachers, there was more one-to-one teaching, and pupils were more often the focus of a teacher's attention. Individual children in small classes therefore received more interactions with their teachers of a task-related nature.

Despite this evidence, Shapson, Wright, Eason & Fitzgerald (1980), in a widely cited study, found no statistically significant differences between class sizes for most teacher activities, and this was at odds with teachers' own views. This is line with the reviews of Ehrenberg et al (2001) and Slavin (1989) who conclude that effects of class size reductions on teaching are minimal.

The second set of factors related to class size differences concerns pupils' classroom engagement. Finn et al (2003) have argued, on empirical and conceptual grounds, for a connection between smaller classes and increases in pupil classroom engagement and on task behaviour. In the English CSPAR research, effects were not so clear cut in the sense that a connection was found with the younger pupils (aged 4/5 yr olds) but not older primary pupils (aged 10/11 years) (Blatchford, Bassett and Brown, 2005).

There is then dispute about the effects of class size differences on classroom processes. This paper extends research on class size effects in several ways.

1. Effects on teaching vs classroom engagement. It compares in a systematic way the effects on classroom engagement and teacher to pupil interactions. It also looks in a systematic way at effects on different types of on and off task behaviour – whether with teachers, other pupils or when not interacting, and whether passive (internalising) or active (externalising).

2. Pupil prior attainment. Research has found that effects of class size on academic outcomes can vary by pupil characteristics such as prior attainment level, disadvantage and minority group status (Blatchford et al, 2003; Ehrenberg et al, 2003; Finn and Achilles, 1999; Molnar et al, 1999). Research in England found that the initially lowest attaining pupils benefited most from small classes (Blatchford, Bassett, Goldstein and Martin, 2003) in the first year of school. One of the justifications of small classes is the hope that it will help those with most ground to make up academically receive more individual attention and concentrate. In this study we wanted to see whether effects on classroom interactions and pupil engagement varied by initial attainment level, and in particular whether lower attaining pupils experienced more individualised attention and showed higher levels of classroom engagement in smaller classes, and, conversely, whether they suffered most in larger classes on the same dimensions.

3. Age effects. Research suggests that the youngest pupils benefit most in terms of academic outcomes from small classes (Finn and Achilles, 1999; Blatchford et al, 2003; Ehrenberg et al, 2001). But most evidence comes from primary aged pupils, and we know very little about effects of class size on older school pupils, e.g., secondary age pupils aged 11 – 16 years. Still less is known about age differences in class size effects on classroom processes such as teacher and pupil interactions and classroom engagement. There is a suggestion that effects become weaker with age (Finn et al, 2003) but this also requires further study involving older pupils. One of the features of this paper is that it examines, within one study, the effects of class size on classroom processes at four age levels that cover the whole of the primary and secondary school years.

4. Class size thresholds. It is often assumed that class sizes need to fall below a certain number (the figure of 20 is often mentioned) before they can have an impact on educational outcomes. However, this is likely to have much to do with the class sizes chosen in research. The STAR project, for example, pre-selected and compared classes of about 17 with class sizes of about 23 – and this is probably a main reason why the mid-point between the two is seen as important. However, this range of class sizes is not common in many countries, even in the USA, and an alternative approach is to examine effects of class size across the full range of class sizes, rather than presuppose class sizes likely to be important. Shapson et al (1980) studied several different class sizes but when the range of class sizes is wide, as it is in the UK, then this kind of design can become unwieldy. It is therefore potentially more insightful and valid to employ naturalistic studies within which class sizes vary according to the real world of education, and which therefore allow estimates of effects that use of data across the full class size distribution. Using this approach, earlier English research suggested that 25 or less was important for lower attaining pupils in literacy (Blatchford et al, 2003), but very little is known about class size thresholds below or above which effects on classroom processes are evident.

5. Research methods. Finn et al. point to the need for studies that make use of strong data, such as that provided by systematic observations, in order to provide reliable evidence on effects of

class size on classroom processes, and they identify the observational study by Blatchford (2003b) as one of the few studies of sufficient quality to be included in their review. The current paper builds on this earlier work. In contrast to other forms of data collection it builds up data on the basis of careful recording of on-going behaviour (rather than, say, ratings or judgments). Criticisms of systematic observation have usually centred on validity issues (e.g. Delamont & Hamilton, 1986), but it can be a useful research tool when answering specific research questions where data are needed on relatively easily observed behaviours (Croll, 1986; McIntyre & Macleod, 1986). This was the method used by Shapson et al (1980) and by Bourke (1986) and, though both studies are widely cited, they are rather dated now.

A feature of this paper is that it also employs more sophisticated statistical analyses than many previous studies and examines effects of class size on moment by moment behaviours, while controlling for other possibly confounding factors, particularly student prior attainment. It is also important to recognise that observations are not always independent of each other and that multilevel statistical models are required that deal with the clustered nature of observation data within pupils and within classrooms within schools. More details are given in the method section below.

A contextual approach

There is an underlying assumption in many studies involving teaching and its effects of a direct model, with teaching affecting pupils' achievements and learning in a causal way (Blatchford, Kutnick, Baines & Galton, 2004). But teachers do not meet pupils out of context, and class size, or the number of children in the classroom, can be seen as one contextual influence on classroom life, which plays a part in affecting the behavior of teachers and pupils. Class size is positioned as one such 'context' factor in Dunkin and Biddle's (1974) early seminal model of effects on teaching. The conceptual roots of this view can also be found in Bronfenbrenner (Bronfenbrenner, 1979) and the ecological psychology approach of Barker and Gump. The basic idea is that the classroom context has distinctive forces or 'signals', different to other contexts, which pull events and participants along with them (Kounin & Gump, 1974). Different aspects of the class environment, such as the number of pupils in a class, can exert distinct pressures on teachers and pupils. This study is also conceived in the context of theory and research on effective teaching (Creemers, 1994), and cognitive psychological approaches (Wood, 1998).

Two aspects of teacher and pupil behavior are considered in this study.

1. Pupil Classroom Engagement and Off-Task Behavior

a. On and Off task behaviour

One main element of children's successful adjustment to school is likely to involve their productive engagement in class, as reflected in the extent of their work related interactions with teachers, other pupils and when working on their own. Many studies support the view that engagement, active learning time, time on task or some equivalent term (e.g. Creemers, 1994) are key aspects necessary for educational success. There is a good deal of evidence that on task behaviour relates positively to pupils' academic progress (Rowe, 1995).

Common sense and logic suggest that with more children in the class there will be more potential for distraction, and more possibility of being off task. Conversely in small classes there will be more opportunities to engage children and keep them on task. Finn et al. (2003) develop a theoretical and empirical case for why student classroom engagement is the key process that explains why smaller classes lead to better attainment. They conclude that students in small classes in the elementary grades are more engaged in learning behaviors, and

display less disruptive behavior than do students in larger classes. They conclude that class size seems to affect student engagement more than teaching. Cooper (1989) in his review found studies to support this view, but there are limitations in much previous research because of the often informal designs and reliance on teacher reports (Finn et al., 2003).

A different view comes from Bourke (1986) who found in an Australian study no class size effect on primary school student engagement. The CSPAR study found an age effect in the sense that 4/5 year old pupils showed more off task behaviour in larger classes but no effects were found on pupil attentiveness in 10/11 year old pupils.

There are limitations in many conceptualizations of on and off task behaviour, in that the generic terms may conflate separate forms of behaviour. There are three main contexts through which pupil on and off task behaviours will be expressed: when with teachers, other pupils or when on their own. It is helpful to know if these are connected in similar or different ways to class size differences. In the earlier CSPAR study, in the case of 4/5 year old pupils, there was more off task behaviour in larger classes, but especially more passive off task behaviour - more disengagement - when working on their own (Blatchford, Bassett and Brown, 2005).

On the basis of these results it was predicted that there would be more general off task behaviour in large classes. There were not strong grounds for predictions about age or type of pupil effects, but it was anticipated that effects would be most marked at primary level, and be most evident for the lower attaining pupils.

2. Teacher-Pupil Interactions

a. Overall amount of teaching

On logical and common sense grounds it seems likely that the number of children in a class will decrease the amount of time that can be spent on instruction and dealing with individual children. This expectation is consistent with teachers' views (Bennett, 1996; Pate-Bain et al, 1992, and some previous research (Glass et al, 1982; Cooper, 1989). However, Shapson et al (1980) found that there were no statistically significant differences between class sizes for most teacher activities, and teachers did not alter the proportion of time spent interacting with the whole class, with groups or with individuals. This conflicted with teachers' own experiences - there was, therefore, a gap between professional judgment and observational research findings.

In the CSPAR research (Blatchford, 2003a; Blatchford, Bassett and Brown, 2005) it was found that more teaching took place overall in smaller classes but this was restricted to the youngest age group studied (4/5 years). In this study we wanted to clarify any possible longer term age effects by examining effects through primary and secondary school stages, and to see whether low attaining pupils, as might be expected, experience more teaching overall in smaller classes, in order to help them catch up.

b. Teacher Individual Attention to Pupils

Perhaps the most consistent finding concerning class sizes effects on classroom processes is that reduced class size is related to individualisation of teaching (Ehrenberg et al, 2001; Molnar et al, 1999; Betts & Shkolnik, 1999). Results from the CSPAR systematic observation studies (Blatchford, 2003b; Blatchford, Bassett and Brown, 2005) showed that although there was a heavy reliance on whole class teaching and individual work in primary schools, pupils in small classes were more likely to experience one-to-one teaching and were more often the focus of a teacher's attention. In the same vein a recent multi-method study

by NICHD Early Child Care Research Network (in press) summarises data collected by arguing that smaller first grade classrooms appear more child-centred than larger classes, and that larger classes become more structured. Anderson (2000) argued that small classes encourage a more personalised and appropriate curriculum for individual pupils.

However, it might be expected that as pupils progress through primary into secondary school, the more structured and centralised curriculum, and the preparation for public examinations, will reduce any effect of smaller classes on individualised attention. Yet studies such as STAR (Finn and Achilles, 1999), SAGE (Molnar et al, 1999) and CSPAR (Blatchford et al, 2003) suggest that CSR tends to benefit lower attaining and disadvantaged pupils, and it might be expected that more individual support in smaller classes will be targeted at the lowest attaining pupils. This study therefore examined whether effects of class size on individual attention were present at both primary and secondary level, and whether lower attaining pupils experienced more individual attention.

c. Pupil active involvement with teacher

Larger classes can lead to pupils having a passive role in class. Research in the UK found that children in large primary classes were more likely to engage in passive behaviour, listening to the teacher, while in smaller classes pupils were more likely to interact in an active, sustained way with teachers (Blatchford, Bassett and Brown, 2005). This can be considered another aspect of classroom engagement. This was a consistent finding at both the beginning and end of the primary stage (4/5 and 10/11 years). Bourke (1986) found more student questions to teachers in large classes but these were mostly requests for clarification or for other help from the teacher. In this study we wanted to check whether there was more active involvement with the teacher through primary and secondary education, and whether this varied by pupil attainment level.

d. Easier Classroom Control and Management – dealing with negative behaviour

A number of studies have reported that pupil discipline tends to be more difficult in large classes and more of an intrusion into the teaching and learning process (see reviews cited above). In contrast, smaller classes tend to be quieter and more easily managed. Bourke (1986) found more non-academic procedural arrangements were necessary in large classes. It was expected that there would be less need for critical comments from teachers in smaller classes, reflecting fewer difficulties in classroom management. In general, it might be anticipated that lower attainers would be more off task, and so may be expected to receive more critical comments from the teacher, but it was not clear whether this would be affected by size of class.

Predictions

It was predicted that in larger classes there would be less on task and more off task behaviour and that this latter result would be particularly seen through distracted, passive forms of off task behaviour. Predictions regarding attainment group and primary vs secondary were less clear cut but generally it was anticipated that effects would be most obvious for low attaining and primary students.

It was predicted that in larger classes there would be less teaching overall, less individual attention from teachers, a less active role in interactions with teachers, and more teacher talk about negative behaviour. Predictions regarding attainment group and primary vs. secondary

were not clear cut but generally it was anticipated that effects would be most obvious for low attaining and primary students.

Method

Results come from a large scale study of the deployment and impact of support staff (called the DISS project) in primary and secondary schools in England and Wales. The DISS project had two components. Strand 1 provided comprehensive information on the characteristics and deployment of all support staff in schools in England and Wales over a key 5 year period (2003-8) (see Blatchford, Bassett, Brown, Martin, Russell and Webster (2007). Strand 2 comprised a multi method analysis of deployment and impact, and it is data from the systematic component of this part of the study that is used in this paper.

Research design

As described above, the overall strategy was to randomly select participating schools, measure effects of naturally occurring differences in class sizes using measures carefully drawn up on the basis of previous research and pilot work, and control statistically for factors likely to interact with or confound any class size effect. A naturalistic design can be useful in addressing policy issues in that it is more 'authentic', and reflects adjustments and processes as they occur under normal circumstances. It can record class size differences as found on an everyday basis in schools and so allow modelling of effects in the real world rather than relatively artificial comparisons.

Sample

Schools

Systematic observations were carried out over 2005/6 in 49 mainstream schools. These schools were originally chosen at random from a national survey as part in the DISS project and they then agreed to field visits by researchers. There were 27 primary schools and 22 secondary schools. Two year groups were generally observed in each school, either Year 1 and Year 3 (5/6 and 7/8 years) or Year 7 and Year 10 (11/12 and 14/15 years). Observations were conducted in 88 year groups.

Characteristics of pupils

The observations were on a sample of eight pupils per class in three categories: 1. pupils with SEN (statemented or registered as School Action or School Action Plus), 2. pupils with some support (i.e., get extra help but who are not in the SEN group, e.g., children with EAL), and 3. pupils selected at random from the class list. There were two pupils from each of the first two categories and four from the third. There were 686 pupils observed in total. Details of the sample are given in Table 1. In addition to the number of pupils and prior attainment (see below), the variables listed were also included in the analyses. Information was obtained from Government data sets or from schools themselves.

Visits lasted 4 days except when observations were only possible in one year group (such as infant or junior schools) – they then lasted 2 days - and observations were made in maths, English, science and Welsh lessons.

Table 1: Systematic Observation Component: Characteristics of pupils

Characteristic	Category	Number	Percentage
Year	1	200	29%

	3	183	27%
	7	152	22%
	10	151	22%
Gender	Female	335	49%
	Male	351	51%
SEN status	None	319	55%
	School Action	141	24%
	School Action +	57	10%
	Statement	68	12%
Attainment group	Low	123	21%
	Medium	241	41%
	High	221	40%

Class size

At the time of each observation (i.e., each ten second time interval) a note was made of the number of children in the classroom; the term ‘class size’ therefore describes the number of pupils in the classroom at the time (what we have called the ‘experienced’ class size), rather than a notional number on the register.

Pupil attainment group

Pupils were divided into three attainment groups based on a classification made by the teacher. Pupils were split into either low, medium or high attainment groups.

Observation system

The observations provided a moment by moment description of each pupil’s behaviour. The basic principle was to observe when classroom-based activities took place, and to provide a representative and systematic account of pupils’ behaviour. Observations were conducted on each child in turn in blocks of 10 ten-second time intervals, with gaps of twenty seconds between observations to allow recording of what took place in the previous ten seconds. There were 34,420 ten-second observations in total.

The observation categories were devised on the basis of well established systems, as used in the CSPAR and SPRinG studies (e.g., Blatchford, Bassett and Brown, 2005; Blatchford, Baines, Rubie-Davies, Bassett and Chowne, 2006). It provided a quantitative account of pre-specified categories of behaviour, including time pupils spent in three social ‘modes’ - with teachers, with other children and when not interacting. Within each of these three ‘modes’ were categories that covered work, procedural, social and off task activity. The categories referred to the ‘target’ child; teachers, support staff and other children were observed only when they came into contact with them. The schedule employed a form of predominant activity sampling with those behaviours selected within sets of behaviours (e.g., social modes) occurring for the longest period within the ten-second interval. Behaviours within sets were mutually exclusive and exhaustive. Not all categories feature in this paper and brief definitions of categories used in this paper are as follows:

Teacher/pupil interaction

Teacher to child talk

Teacher 'Teach'. Behaviour directly concerned with the substantive content of subject knowledge, i.e. communicating concepts, facts or ideas by explaining, informing, demonstrating, questioning, suggesting.

Teacher 'on task'. As Teacher 'Teach' plus *task preparation*, i.e., contacts concerning the organization and preparation of children's task activities.

Dealing with negative behaviour. When teacher had to correct the target child or a group within which the target child belonged. This could include correcting all types of behaviours, task related, procedural or social.

Child Role

Child 'Focus'. Target child is the focus of the teacher's attention, and this could be in the context of one-to-one, group or whole class sessions.

Child to Teacher Interaction

Child active interaction with teacher. The sum of *initiate* (begins an interaction), *respond* (responds to an adult initiation), and *sustains* (i.e., interaction extends over a ten-second time interval).

Child on task to teacher. All child behaviours in contact with adult that are concerned with work, including listening to the teacher teach.

Child off task to teacher. Child behaviour when in contact with the adult obviously inappropriate or unrelated to situation either passively (e.g. not attending) or actively (e.g., talking).

Pupil-Pupil Interaction

Target and child on task. All contacts with other children that are concerned with work and allocated tasks.

Target to child off task. Behaviour with other children that is deliberately off-task; it would include mucking about and fooling around and times the target child is aggressive (verbally or physically) towards other child(ren).

Individual Behavior/Not Interacting

Individual on task. Target child is involved in own work activity.

Individual off task (active). Target child focuses on something other than task in hand.

Individual off task (passive). Target child is disengaged during task activity, for example, daydreaming.

Computed Categories

Child on task. Total on task behaviours, i.e., behaviours related to the substantive nature of allocated work or preparation for the work across the three social modes, i.e. child to teacher on task, target and child on task, and individual on task.

Child off task. Total off task behaviours, i.e., all off-task behaviours in the three social modes, i.e., child to teacher off task (active or passive), target to child off task, and individual off task (active and passive).

Observers

There were two observers. They were experienced researchers who were familiar with working in schools, and able to explain the research and put teachers and pupils at their ease. The basic aim was to avoid passing judgments, and to use the schedule as intended. One observer had worked earlier on the CSPAR study and had extensive experience of field work in schools involving systematic observations. The other observer had initial training in which they were provided with an observation manual of categories, conventions and procedures, as well as tips acquired during previous use. Conventions were discussed and there was work on videotapes, accompanied by periodic checks of accuracy and understanding of how to use categories. This was followed by four day's observation of the same pupils in a class, and follow up sessions to iron out any difficulties.

Reliability checks

Reliability coefficients for the main sets of mutually exclusive categories, e.g., teacher-child talk, 'child role', child to teacher interaction, not interacting', were all high, with reliability coefficients (kappa) greater than 0.80. Kappa for pupil-pupil interaction was 0.77.

Statistical methods and analysis of Systematic Observation data

The limitations of much previous research, that makes use of observational data, are not always appreciated. A feature of the analysis of the observation data in this paper was the way that it was conducted with the 10-second observation interval as the unit of analysis. This allows a greater accuracy and flexibility than simple, but more commonly used, total frequencies of behaviours for each pupil. In particular it provides the basis for powerful analyses of the co-occurrence of behaviours. This kind of analysis is not possible when simple totals for each pupil are used. The observation variables took the form of binary variables, in the sense of each either being performed, or not being performed, during one time interval. A further feature of this observation study, in contrast to previous research, is that it used multilevel statistical models. These were required as it is likely that observations from pupils in the same class will be more similar than two observations from pupils in different classes. Similarly, two observations from the same pupil are more likely to be similar than two observations from differing pupils. Therefore, the observations cannot be regarded as independent of each other, and so multilevel statistical methods (Goldstein, 1995) are required. Failure to allow for the structure of the data can lead to misleading parameter estimates, and also an exaggeration of the significance of the results (Paterson & Goldstein, 1991).

Three level models were used for the analysis, with individual observations contained within pupils, contained within classes. A potential fourth level (the observation sheet) was also considered. However, the results had more stability when only there were only three levels, and so this option was not used.

As all outcome variables were binary in nature, logistic regression models were used to examine the effects of the various explanatory variables upon the outcomes.

Let y_{ijk} be the observed binary response (0, 1) of observation i from pupil j in class k , and let the probability of a particular outcome being observed be denoted by π_{ijk} , where $\pi_{ijk} = [\Pr(y_{ijk}=1)]$.

The basic form of the regression equation used in the analysis for a single explanatory variable x is given by:

$$\text{logit}(\pi_{ijk}) = \beta_0 + \beta_1 \cdot x_{ijk} + u_k^{(3)} + u_{jk}^{(2)}$$

where $u_k^{(3)}$ is the random effect at the class level, and $u_{jk}^{(2)}$ the random effect at the pupil level. All random effects are assumed to be normally distributed as follows:

$$u_k^{(3)} \sim N(0, \Omega_k^{(3)}), \quad u_{jk}^{(2)} \sim N(0, \Omega_{jk}^{(2)}),$$

The regression models were fitted using the MLwiN software package (Goldstein, Rasbash, Plewis, Draper, Browne, Yang, Woodhouse & Healy, 1998)

The main explanatory variable of interest was class size. The effect of class size and other explanatory factors thought likely to influence the observation outcomes were examined jointly. The aim was to estimate the effect of class size, controlling for the effects of the

other explanatory factors. In addition to class size, the following variables were also included in the analyses:

- Pupil level of attainment at the start of year (low, medium or high)
- SEN status of pupils (none, school action, school action plus/SEN)
- Gender
- Number of teachers
- School Subject
- Support staff presence

The advantage of including these variables in the analysis is that the effect of class size on the outcomes is adjusted to account for any effects that these variables might have on the outcomes, and any overlap with the effect of class size. This therefore tells us whether size of class has an independent effect.

The interaction between class size and pupil attainment was assessed. This examined if the effect of class size varied for pupils of different attainment levels. Where significant interactions were found, the results are reported separately for each subgroup; otherwise the results are presented for all pupils combined.

The shape of the relationship between class size and the outcome was examined, and where necessary, quadratic and cubic terms were included to capture the relationship between variables.

For each of the outcomes, the analyses were performed separately for primary and secondary schools.

For the analyses reported in this paper outcomes are considered in relation to all observations in the analysis, rather than just those from a sub-set. The result of this is the analyses effectively examine the effect of class size on outcomes as a proportion of all observations.

In the tables below (in the results section), the size of effect is in terms of odds ratios, and these indicate the change in the odds of the outcome occurring for a 5 pupil increase in class size. When a simple linear relationship is used, an odds ratio greater than one means that class size was positively associated with the outcome occurring, and an odds ratio less than one means class size was negatively related to the observation outcome. For example, an odds ratio of 1.25 means that a five pupil increase in class size was associated with the odds of an observation outcome increasing by 25%. Also given are 95% confidence intervals for each odds ratio, as well as p-values indicating the significance of each result. Note that when a non-linear relationship was required the odds ratios do not have such an easy interpretation, and the shape of the relationship is best illustrated by graphical plots.

It is also possible in the graphs to read off the probability of a behaviour occurring for any given size of class, e.g., to compare the probability of a behaviour occurring in a class of 30 vs. a class of 15. These probabilities are useful, and easily interpretable, i.e., it can be taken as the occurrence of any given behaviour occurring, as a proportion of the total number of observations. For example, a probability of 0.8 for an observation outcome occurring at a class size of 30 means that the outcome occurred in 80% of all observations. However, some caution should be exercised when interpreting the probabilities, as these will be dependent on the other terms in the models (e.g. pupil level of support, SEN status etc.).

The graphs show the probabilities for a female pupil of medium attainment, with no SEN and no support, in English lessons.

Results

We first present the frequency of each of the behaviours in Table 2, expressed in terms of the numbers of observations in each category, plus the percentage of the total observations that this represents.

Table 2. Frequencies and percentages of occurrence of each behaviour

Behaviour	Primary Number (%)	Secondary Number (%)
On and Off task behaviour		
Total On task	15,269 (86%)	13,262 (80%)
On task- pupil to teacher	10,286 (58%)	7,983 (48%)
On task – pupil-pupil	1,835 (10%)	1,846 (11%)
On task – not interacting	3,501 (20%)	3,751 (23%)
Total Off task	1,931 (11%)	2,765 (17%)
Off task – pupil to teacher	997 (6%)	1,078 (6%)
Off task – pupil-pupil	679 (4%)	1,345 (8%)
Off task – not interacting active	373 (2%)	573 (3%)
Off task – not interacting passive	749 (4%)	668 (4%)
Teacher-pupil interaction		
Teacher teach	7,524 (42%)	7,288 (44%)
Pupil focus of Teacher	840 (5%)	942 (6%)
Pupil active interaction with teacher	791 (4%)	910 (6%)
Teacher deal with negative behaviour	276 (2%)	423 (3%)

Note: The on and off task sub-categories slightly exceed the total, as in some observations more than one sub-category was coded. Total on and off task behaviours were calculated by summing time intervals in which these behaviours occurred, whether or not they occurred more than once.

It can be seen that pupils at both primary and secondary stages spent a large portion of their time engaged in on task activities. The bulk of this involved on task pupil to teacher, which for the most part involved listening to the teacher. In contrast, off task behaviour occupied far less time, though more at secondary than primary (17% vs. 11% of all observations). In the case of the teacher to pupil categories, in just under half of observations pupils were involved in teaching interactions – in which teachers covered the substantive content of school subjects. By contrast, the three categories which denoted individual interactions with target pupils were infrequent, only occurring in between 2 – 6% of all observations. In particular, teachers rarely criticised individual pupils, as a proportion of all observations.

1. Classroom engagement

a) Total Pupil On Task

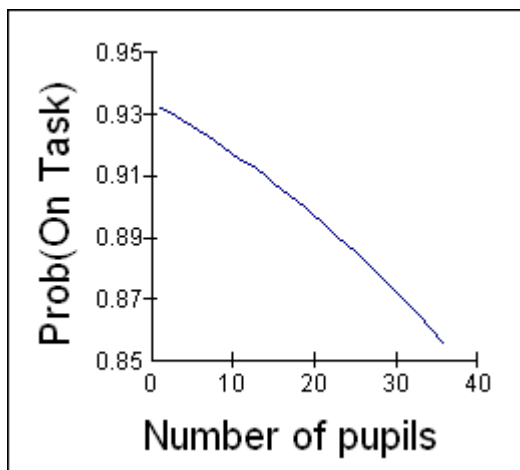
The first outcome was total on task behaviour (i.e., behaviours related to the substantive nature of allocated work or preparation for the work across the three social modes - child to teacher on task, target and child on task, and individual on task).

Table 3. Class size and total on task behaviour

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	All pupils	Linear	0.88 (0.82, 0.94)	0.04
Secondary	Low Medium High	Linear	0.78 (0.71, 0.86)	<0.001
		Linear	1.01 (0.89, 1.15)	0.86
		Linear	1.12 (0.92, 1.38)	0.26

The results (See Table 3) indicated that for primary schools there was no significant interaction between attainment group and class size, and that the effect of class size did not therefore vary by attainment group. There was a statistically significant association between number of pupils and on task behaviour ($p < 0.001$). A higher number of pupils was associated with a decreased occurrence of on task behaviour. This result is illustrated in Fig. 1.

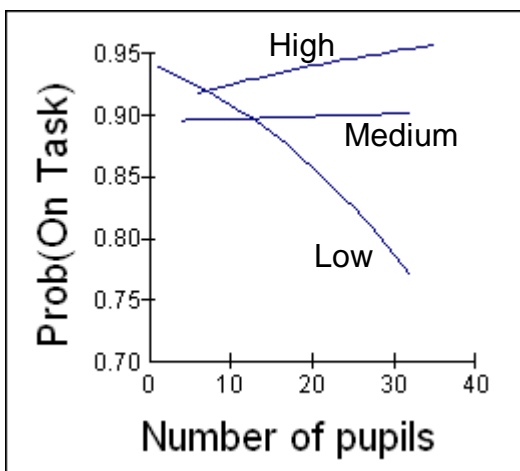
Fig. 1. Class size and total on task behaviour (Primary).



The results for secondary pupils indicated that the effect of attainment group varied by attainment group. There was no significant effect of class size for pupils in the medium and high attainment groups. However, for pupils in the low attainment group, a larger number of pupils was associated with a decreased occurrence of on task behaviour. The relationship between the variables is illustrated in the subsequent graph. A five pupil increase in class size was associated with the odds of on task behaviour decreasing by almost a quarter.

Looking at Fig. 2 shows that the difference between 30 and 15 is about 78% vs. 88%, i.e., a 10% difference for low attaining pupils – a larger difference in comparison to primary schools.

Fig 2. Class size and total on task behaviour (Secondary).



b) Total Pupil Off Task

The relationship between the number of pupils and occurrence of total off task behaviour was examined for primary and secondary pupils separately, and a summary of the results is given in Table 4.

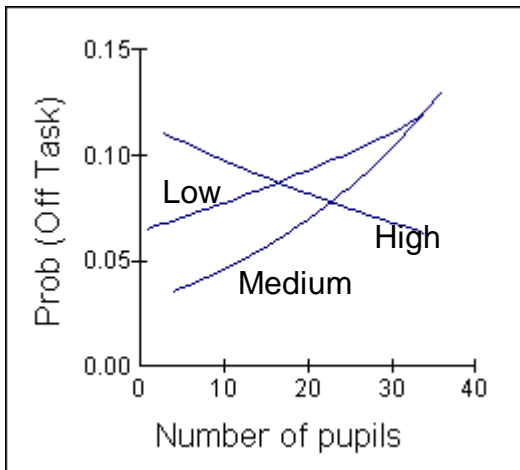
Table 4 Class size and total off task behaviour

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	Low	Linear	1.11 (1.02, 1.21)	0.01
	Medium	Linear	1.25 (1.07, 1.47)	0.005
	High	Linear	0.91 (0.77, 1.06)	0.23
Secondary	Low	Linear	1.41 (1.27, 1.57)	<0.001
	Medium	Linear	0.96 (0.84, 1.10)	0.57
	High	Linear	0.81 (0.64, 1.01)	0.07

The results indicated that the effect of class size varied for pupils of differing attainment.

For primary schools there was an increase in off task for low and medium attaining pupils. For the low attainment group, a five pupil increase in class size was associated with the odds of off task increasing by 11%. There was no significant effect of class size for the high attainers. The results for primary schools are illustrated in Fig. 3.

Fig 3. Class size and total off task behaviour (Primary)

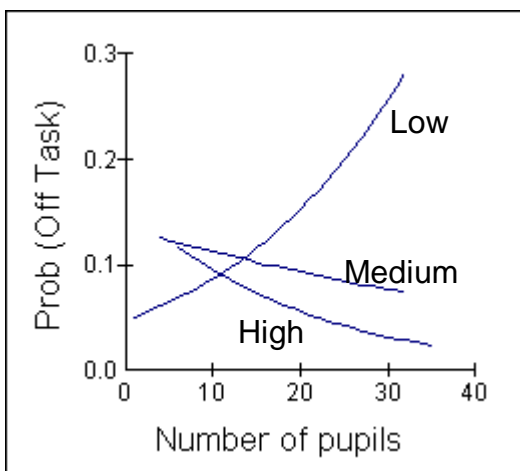


The results for secondary schools indicated a highly significant effect of class size for low attaining pupils only. A five pupil increase in class size was associated with the odds of off task behaviour increasing by 40% for this group.

Looking at this in terms of probabilities of occurrence with 15 vs. 30 in a class (see Fig. 4) shows that about 0.26 of observations were off task for a class size of 30, but only 0.11 of observations were off task with 15 in a class. This is the difference between 26% and 11% of all observations. Low attainers therefore spend more than twice as much time off task in large vs small classes, a sizeable difference.

There was no strong evidence of an effect of class size for either the medium or high groups, although there was slight evidence that off task was less likely in larger classes for the high attainers. However, this result was not quite statistically significant ($p=0.07$).

Fig. 4. Class size and total off task behaviour (Secondary)



c. Separate categories of on and off task behaviour

Separate analyses were conducted on each of the seven individual on and off task categories, i.e. pupil to teacher on task, pupil-pupil on task, and not interacting on task, and pupil to teacher off task, pupil-pupil off task, and not interacting off task active and passive. In the interests of space these results are not reported in full here. Pupil to teacher on and off task behaviours were the most consistent with the total on and off task behaviour results. This is not surprising as pupil to teacher behaviour was the most common of the three ‘social modes’ (i.e., more than when with peers or when not interacting). Interestingly there was a tendency for both pupil to pupil on and off task behaviours to increase with size of class, indicating that pupils tended to interact more with each other, in both on and off task ways, as the number of pupils in the class increased.

2. Teacher pupil interactions

a) Teacher teach

Similar analyses were performed to examine the effect of class size on the total amount of teacher teach (see Table 5).

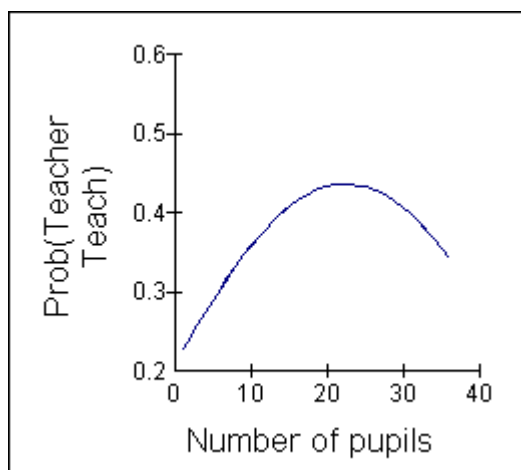
Table 5. Class size and teacher ‘teach’

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	All pupils	Linear	1.05 (0.98, 1.12)	<0.001
		Quadratic	0.95 (0.92, 0.98)	
Secondary	All pupils	Linear	1.08 (1.02, 1.15)	0.01

The results indicated that there was no evidence of an interaction between class size and either of support staff or attainment group for either school phase.

There was a significant effect of class size on teacher teach in primary schools. The nature of this relationship is shown in Fig. 5.

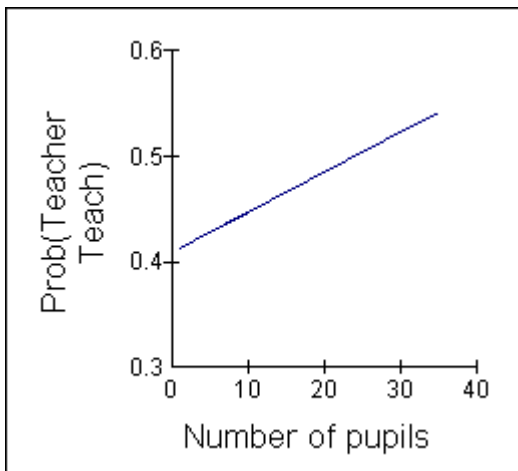
Fig. 5. Class size and teacher ‘teach’



The graph indicates that there was generally more teacher teach in larger classes, although this did tail off for larger classes.

There was also a significant effect of class size for secondary schools, and again there was a positive association between class size and the amount of teacher teach (see Fig. 6). An increase in class size of 5 pupils was associated with the odds of teacher teach increasing by 8%. An illustration of this result is shown in Fig. 6. Roughly speaking the difference between 30 and 15 in the class means a difference between 52% and 45% of all observations – i.e., in the smaller class there is around 7% less ‘teach’ occurring.

Fig. 6. Class size and teacher ‘teach’ (Secondary)



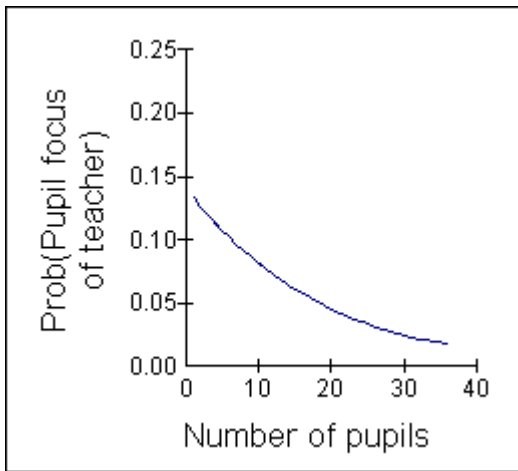
b. Pupil focus of teacher

Table 6. Class size and pupil focus of teacher’s attention

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	All pupils	Linear	0.73 (0.68, 0.79)	<0.001
Secondary	All pupils	Linear	0.72 (0.66, 0.80)	<0.001

There was a highly significant association between class size and pupil being the focus of a teacher’s attention (see Table 6). Though ‘focus’ did not occur very frequently, it noticeably increased as class size decreased. The results were displayed in graphical form in Fig. 7. The difference between 30 and 15 in the class represented a difference of about 7% vs. 3% of all observations, i.e., focus was more than halved in a large vs. a small class.

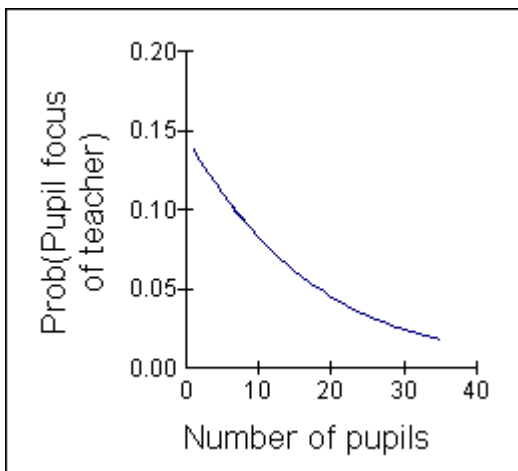
Fig. 7. Class size and pupil focus of teacher’s attention (Primary)



There was a statistically significant effect of class size at secondary. An increase in class size of five pupils resulted in the odds of pupil being focus of teacher decreasing by about a quarter. An illustration of this result is given in Fig. 8.

There were no interactions with pupil attainment at either primary or secondary.

Fig. 8. Class size and pupil focus of teacher's attention (Secondary)



c) Pupil active interaction with teacher

We next examined the effects of class size and on the amount of pupil active interaction with the teacher (see Table 7). As with the other results, the figures show the change in the odds of the outcome occurring for a 5-pupil increase in class size.

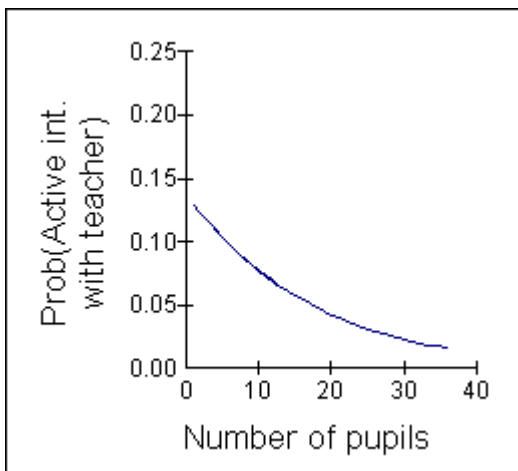
Table 7. Class size and active interactions with the teacher.

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	All pupils	Linear	0.73 (0.70, 0.87)	<0.001

Secondary	All pupils	Linear Quadratic	0.79 (0.71, 0.87) 1.05 (0.99, 1.11)	<0.001
-----------	------------	---------------------	--	------------------

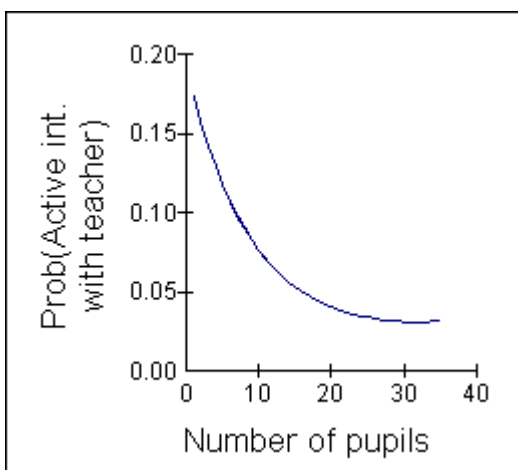
At primary level, there was a significant negative effect of class size, and this result is illustrated in Fig. 9. There was no interaction with attainment level of pupil; the effect was similar for all three groups. The difference between 30 and 15 in the class was about the difference between 2% and 6% of all observations. Though not frequent, there is about three times more active interaction in small classes.

Fig.9. Class size and active interactions with the teacher (Primary).



For secondary schools there was also a highly significant effect of class size on the occurrence of active interaction with the teacher. As in primary schools there was less interaction with the teacher in larger classes. The relationship between the number of pupils in the class and the probability of active interaction with the teacher is given in Fig. 10.

Fig. 10. Class size and active interactions with the teacher (Secondary).



d) Teacher dealing with negative behaviour

The effect of class size on teachers dealing with negative behaviour is shown in Table 8.

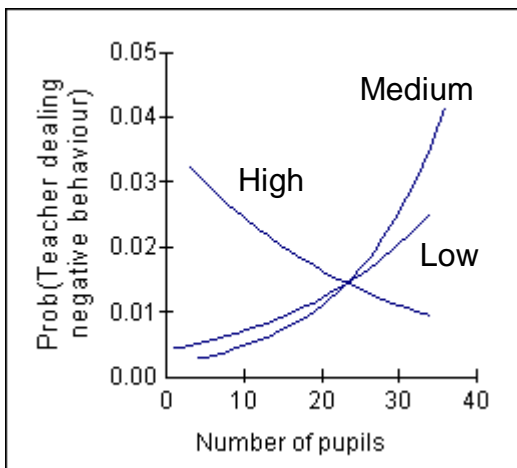
Table 8. Class size and teacher dealing with negative behaviour

School type	Attainment group	Term	Odds Ratio (95% CI)	P-value
Primary	Low	Linear	1.31 (1.01, 1.70)	0.04
	Medium	Linear	1.53 (1.13, 2.07)	0.01
	High	Linear	0.82 (0.58, 1.14)	0.24
Secondary	Low	Linear	1.16 (0.99, 1.37)	0.07
	Medium	Linear	0.80 (0.65, 1.00)	0.04
	High	Linear	0.78 (0.54, 1.13)	0.19

For both school phases the effect of class size varied for pupils with different attainment.

For primary schools there was significantly more teacher dealing with negative behaviour in larger classes for low and medium attaining pupils, but no significant effect for high attainers. For low attaining pupils the odds of a teacher dealing with negative behaviour increase by about 30% for an increase in class size of five pupils. An illustration of the primary results is given in Fig.11.

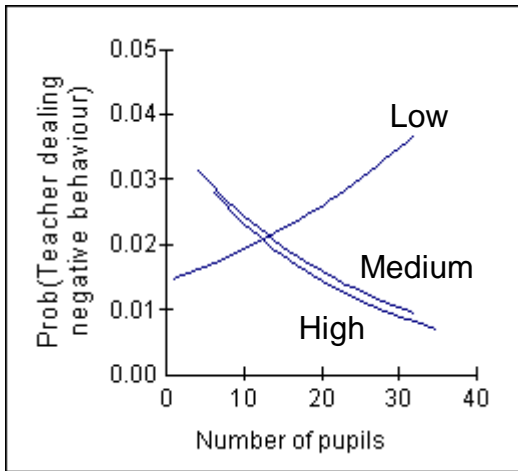
Fig. 11. Class size and teacher dealing with negative behaviour (Primary)



The results for secondary schools indicated that there was significantly less of the teacher dealing with negative behaviour in larger class for medium attaining pupils. Conversely, there was slight evidence that there was more dealing with negative behaviour in large classes for low attaining pupils, although this result was not quite statistically significant.

There was no significant effect for high attainers. A graphical representation of this result is shown in Fig. 12.

Fig. 12. Class size and teacher dealing with negative behaviour (Secondary)



A summary of results is given in Table 9.

Table 9. Summary of effects of increasing class sizes on pupil and adult behaviour, taking into account interactions with initial attainment group of pupils (low, middle and high attainers) and controlling for other factors (gender, SEN status, EAL, FSM, Ethnic group). Primary and Secondary separately.

Behaviour	Primary	Secondary
Total On task	All groups LESS	Low LESS
Total Off task	Low and Medium MORE	Low MORE
<i>Teacher-pupil interaction</i>		
Teacher teach	All groups MORE	All groups MORE
Pupil focus of Teacher	All groups LESS	All groups LESS
Pupil active interaction with teacher	All groups LESS	All groups LESS
Teacher deal with negative behaviour	Low/Medium MORE	Low MORE (p=.07); medium LESS

Discussion

Teacher-pupil interactions

Perhaps the clearest result to emerge from this study is the way that class size was related to the amount of individual contact with pupils. This was evidenced through two particular types of behaviour: 1. times when the pupil was the focus of a teacher's attention and 2. times when they were engaged in active interactions with their teachers, i.e., beginning, responding to, and sustaining interactions with them. The converse also applies – as class sizes became smaller there were more times when pupils were the focus of a teacher's attention, and more times when they were engaged in active interaction with teachers. This effect was found for all groups at both primary and secondary levels and there was little evidence that the relationship between class size and teacher pupil interaction varied by attainment groups. Though these behaviours were not frequent, when seen as a percentage of all observations, there was between two and three times more of these behaviours in smaller classes of 15 compared to larger classes of 30.

This appears to offer confirmation of the claim, often made by teachers (Blatchford, 2003a), that smaller classes allow more individual attention. It supports predictions and previous research but extends the finding beyond primary school into secondary school.

Amount of teaching

The other main result to emerge from the analysis of teacher pupil interaction in relation to size of class was the finding that the amount of teaching, i.e., talk dealing with the substantive nature of a task, through explaining or questioning etc, increased as the size of class increased. This may seem slightly contradictory as it seems that pupils get less individual attention in larger classes but they also receive more of a teacher's input overall relating to educational matters, and on the face of it this might seem to mean that larger classes advantage pupils. However, the finding probably means that pupils as a whole are actually receiving more of a teacher's delivery of a lesson in whole class contexts. This is confirmed by other results from the same study, not reported here, which showed that for primary and secondary schools together there was more whole class teaching in larger classes. So putting these two main results together suggests that in smaller classes pupils get more individual attention, while in larger classes they spend more time listening to the teacher talk to the whole class. They are perhaps getting more educational input, but this is at the expense of it being largely passive and as part of a large group.

Classroom engagement

The other main result from this study concerned classroom engagement. Here we found that there was a tendency for there to be more on task and less off task behaviour as class sizes decreased, and conversely less on task and more off task behaviour as class sizes increased, but unlike results for teacher pupil interaction this was affected by the pupil's attainment group. While there was more on task in smaller classes in primary schools for all attainment groups, at secondary level it was only the low attainers who showed more on task behaviour. Comparing class sizes of 30 and 15 showed a difference of about 10% in on task behaviour for low attaining pupils. In the case of off task behaviour, at primary level it was the middle and low pupils who showed most off task behaviour in larger classes, and at secondary level it was again the low attainers who tended to be most affected. We found that for the low attainers at secondary level there was more than twice as much off task behaviour in large classes of 30 compared to smaller classes of 15.

These findings on classroom engagement and class size confirm predictions but they are new in that they extend previous research into secondary and are clear that it is the low attaining pupils whose attention is most affected by larger classes.

These findings on classroom engagement are probably connected to findings on the effect of class size on teachers dealing with negative behaviour. This category was coded when teachers had to correct the target child or a group within which the target child was situated, when the teacher perceived them to be off task and misbehaving. In line with results on off task behaviour, we found the amount of dealing with negative behaviour was affected by pupil attainment group. The clearest trend is for the low attaining group to receive more of this kind of corrective behaviour, at both primary and secondary level. It therefore looks as if teachers in larger classes are responding to the increased off task behaviour of low attaining pupils by seeking to control their behaviour.

We feel that these results on on and off task behaviour are significant because they show that the problem of large classes, especially in older pupils, is particularly marked for the pupils who are already attaining at lower levels, and that it, in turn, leads to teachers seeking to control this kind of behaviour. It is easy to see how these two kinds of behaviours can become self reinforcing, exacerbating each other and making the situation worse. In contrast, smaller classes seem to allow an environment in which low attainers are not only less off task but are less likely to receive corrective talk from their teachers. This appears to be a more productive educational environment.

Different types of on and off task behaviour

Separate analyses of different forms of on and off task behaviour indicated that pupil to teacher on and off task behaviour was most consistent with the results for total on and off task behaviour. For the most part this involved listening to the teacher talk (active forms of interaction were relatively uncommon). So overall it looks as if in larger classes low attaining pupils in particular are less likely to be on task and this is predominantly because they are less likely to be attending (or responding appropriately) to the teacher. It was interesting to see that pupil to pupil on and off task behaviour tended to increase with size of class, at both primary and secondary level. It seems likely that with more pupils in the classroom there is less of the teacher's individual attention available and this presumably means that pupils come to interact more with each other instead, in both acceptable and unacceptable ways..

Primary vs secondary

As was said in the introduction, relatively little is known about the effects of class size on classroom processes in older school pupils. A main theme of the study was therefore to see whether effects of class size continued into secondary stage. In line with results on class size effects on attainment outcomes, it was predicted that effects on the two main sets of behaviour - teacher pupil interaction and classroom engagement - would be most prevalent at primary level. But against expectation we found that effects actually extended into secondary schools and did not weaken, though in the case of classroom engagement effects were most marked for low attaining pupils. This therefore extends previous research findings which have reported only on primary aged pupils. The effect on individualised attention in particular, appears to be a robust finding that extends right through the school years.

Thresholds

As we saw in the introduction, it is often assumed that class sizes need to fall below a certain number (the number of 20 in a class is often cited) before they can have an impact on educational outcomes. In the present study an alternative approach was used and we were able to examine the effects of class size across the full range of class sizes, rather than presuppose class sizes likely to be important. There was not a clear and consistent picture

regarding size of classes below or above which effects were most evident. Whilst it is recognised that the threshold debate has been mostly addressed at academic outcomes, the present findings suggest that it is probably over simplistic to talk about thresholds below and above which effects across all outcomes knock in, or identify optimal class sizes in an exact way. The situation is likely to be affected by pedagogical beliefs and practices, teachers' views about preferred class sizes, their experiences of class sizes, and what they perceive as realistically achievable. Judgements are also likely to be affected by culturally bound views about teaching and about learning (see Blatchford and Lai, in press).

Class size, classroom processes and academic outcomes

The results on classroom processes contrast with those on class size in relation to academic attainment, which tend to find effects only for the youngest pupils in school. Effects on classroom processes seem to extend beyond the early years, and indeed, on current evidence, are maintained right through the school years.

There are two connected issues here. The first is the important issue of the connection between class size, classroom processes and academic attainment. To date researchers have not been successful in establishing clear links between these three factors, e.g., to show that certain kinds of classroom behaviour are affected by class size and, in turn, then lead to better or worse academic outcomes. Despite the efforts of an early pioneering study by Bourke (1986), and despite the development of conceptual models in which links between processes and outcomes are suggested (e.g., Anderson, 2000, Finn et al, 2003), researchers have not done enough to systematically test the causal connections involved. Given the importance of the class size issue for policy this is surprising. In the earlier CSPAR study, we did try this kind of analysis but did not find that the observation variables explained relationships between class size and academic outcomes. Elsewhere we have examined factors that might account for this, e.g., in terms of the types of measures used to assess academic outcomes (Blatchford, 2003a). In the present study the situation is made easier in one sense because in separate analyses we have not found that class size is related to academic outcomes, once other potentially confounding factors, like pupil prior attainment, are taken into account; there is therefore no causal relationship with academic outcomes to explain.

This connects with the second issue cited above, which is the degree of importance attached to academic and non-academic effects of class size differences. In one sense the result just cited is disappointing but we also argue that it is important not to downplay the importance of classroom processes. There has been a tendency to assume that links between class size and academic attainment are primary, and that links with classroom interactions are secondary. But it is important that pupils engage in work in classrooms and important that interactions with teachers are work focussed and where possible individualised, irrespective of whether we can show that these obviously cause changes in measured test scores. The quantity and type of interactions with teachers, and the degree of attention in class, are therefore important 'outcomes' in their own right. We return to this point below.

Conclusions

In this paper our purpose has been to take a focussed perspective on several relatively common and low inference behaviours, amenable to systematic observation techniques, and to address these in terms of the impact of pupil attainment level and age. This is not meant to imply that the present study has addressed all the classroom processes involved. It is highly likely, as argued previously (Blatchford 2003a), that class size effects are multiple

rather than singular. There are likely to be other kinds of classroom processes which are affected by class size, though many of these dimensions are likely to be far harder to measure. Anderson (2000) identified a number of these factors, for example, greater knowledge of students and more ‘in depth’ treatment of content in smaller classes.

Perhaps the main implication of this study is that smaller classes can benefit all pupils in terms of individual, active attention from teachers, but that the lower attaining pupils in particular can benefit from small classes at secondary level. This suggests that small classes can be a valuable educational initiative right through school, but could be particularly targeted, at secondary level, at lower attaining pupils. If not, the evidence is that they will be more prone to go off task and teacher’s will have to use up more time bringing them back on task.

Small classes can therefore allow teachers to engage in more individualised teaching, and can be used as part of more differentiation of the curriculum. It is recognised that there are cultural, school sector and subject differences that will affect the adoption and method of enacting such a strategy. But it is also well known from research (Evertson & Randolph, 1989; Graue, Rauscher and Sherfinski, 2008), that teachers do not always adapt their teaching to take advantage of small classes. In the CSPAR case studies we found that some teachers in small classes still relied a good deal on whole class teaching with very brief interactions with individuals, and did not take advantage of the possibilities of increased individualisation. Other researchers have commented on the curriculum and cultural constraints on small class teaching. Teachers do not always seem to adapt the physical layout of the classroom to make the best use of the number of pupils relative to teaching methods and classroom size (Blatchford, Kutnick, Baines and Galton, 2003). It is also recognised, as Galton (1998) has pointed out, that we do not have a lot of knowledge about effects of class size on teaching on which to base practical advice and build coherent pedagogies. If we are serious about implementing a more individualized pedagogy then we need to think through ways in which we can maximize opportunities for individual attention, in the context of changing classroom contexts.

Another implication of this study is the need to be aware of how pupils in large classes can drift off task through too much teacher to whole class talk, and how it is the low attainers who seem most affected. In the UK at least there is at present in schools a large diet of passive listening to the teacher talk – a diet made worse by large classes. This suggests the value in more varied pedagogical approaches. We need to be careful not to overlook the benefits that can stem from other contexts for learning, for example, pupils learning together with a deliberate attempt to minimize the teacher’s input. Indeed, there is no guarantee that smaller classes will automatically lead to more productive work in groups. In earlier research we found if anything *less* collaborative group work in smaller classes (Blatchford, Baines, Kutnick and Martin, 2001). This finding was also replicated in other results from the current study, not reported in this paper, in which we found a tendency for there to be less group work in smaller classes. A lot of research from many countries has shown the case for collaborative group work, though this needs careful development, and training for both teachers and pupils (Blatchford, Baines, Rubie-Davies, Bassett and Chowne, 2006). It therefore seems that teachers should be encouraged to take up opportunities for varied pedagogical approaches in smaller classes, including collaborative learning, rather than simply increase the amount of individualised attention.

References

Achilles, C.A. (1999) *Let's Put Kids First, Finally: Getting Class Size Right*. Thousand Oaks, California: Corwin Press

Anderson, L. W. (2000). Why should reduced class size lead to increased student achievement? In M. C. Wang and J. D. Finn (Eds.) *How Small Classes Help Teachers Do Their Best*. Philadelphia: Temple University Center for Research in Human Development.

Bennett, N. (1996). Class size in primary schools: Perceptions of head teachers, chairs of governors, teachers and parents. *British Educational Research Journal*, 22(1), 33-55.

Betts, J.R. & Shkolnik, J.L. (1999). The behavioral effects of variations in class size: The case of math teachers. *Educational Evaluation and Policy Analysis*, 21(2), 193-213.

Biddle, B.J., and Berliner, D.C. (2002) What research says about small classes and their effects. Part of series In Pursuit of Better Schools: What research says. Downloadable from www.WestEd.org/policyperspectives or <http://edpolicyreports.org>

Blatchford, P. (2003a) *The Class Size Debate: Is Small Better?* Open University Press: Maidenhead, U.K. and Philadelphia, U.S.A.

Blatchford, P. (2003b) A systematic observational study of teachers' and pupils' behaviour in large and small classes. *Learning and Instruction*, 13(6), 569-595.

Blatchford, P., Baines, E., Kutnick, P., & Martin, C. (2001) Classroom contexts: connections between class size and within class grouping. *British Journal of Educational Psychology*, 71, 2, 283-302.

Blatchford, P., Baines, E., Rubie-Davies, C., Bassett, P., and Chowne, A. (2006) The effect of a new approach to group-work on pupil-pupil and teacher-pupil interaction. *Journal of Educational Psychology*, 98, 750-765

Blatchford, P., Bassett, P., and Brown, P. (2005) Teachers' and pupils' behaviour in large and small classes: a systematic observation study of pupils aged 10/11 years. *Journal of Educational Psychology*, 97,3, 454-467

Blatchford, P., Bassett, P., Brown, P., Martin, C., Russell, A., and Webster, R. (2007) The Deployment and Impact of Support Staff in Schools: Report on findings from the second national questionnaire survey of schools, support staff and teachers (Strand 1, Wave 2, 2006). Department for Children, Schools and Families (DCSF) Research Brief 005 <http://www.dfes.gov.uk/research/data/uploadfiles/DCSF-RB005.pdf>

Blatchford, P., Bassett, P., Goldstein, H., and Martin, C. (2003) Are class size differences related to pupils' educational progress and classroom processes? Findings from the Institute of Education Class Size Study of children aged 5-7 Years. *British Educational Research Journal*, 29, 5, 709-730. *Special Issue 'In Praise of Educational Research'*, Guest Editors: S. Gorrard, C. Taylor and K. Roberts.

Blatchford, P., Goldstein, H., & Mortimore, P. (1998) Research on class size effects: a critique of methods and a way forward. *International Journal of Educational Research*.

22,691-710.

Blatchford, P., Kutnick, P., Baines, E., and Galton, M. (2003) Toward a social pedagogy of classroom group work. In Blatchford, P., and Kutnick, P. (Eds.) Special Edition of *International Journal of Educational Research*, 39, 153-172

Blatchford, P. and Lai, K.C. (in press) Class size: arguments and evidence. In Barry McGraw, Eva Baker and Penelope P Peterson (Eds.) *International Encyclopedia of Education*. 3rd Edition. Elsevier

Blatchford, P., Moriarty, V., Edmonds, S., & Martin, C. (2002). Relationships between class size and teaching: a multi-method analysis of English infant schools. *American Educational Research Journal*. . 39, 1, 101-132.

Blatchford, P. and Mortimore, P. (1994) The issue of class size in schools: what can we learn from research? *Oxford Review of Education*, 20,4,411-428

Blatchford, P., Russell, A., and Brown, P. (in press) Teaching in large and small classes. In L.J. Saha and A.G. Dworkin (Eds) *The New International Handbook of Teachers and Teaching*. Springer

Bourke, S. (1986) How smaller is better: some relationships between class size, teaching practices, and student achievement. *American Educational Research Journal*, 23,4,558-571

Bronfenbrenner, U. (1979). *The Ecology of Human Development*. Cambridge, MA: Harvard University Press.

Cooper, H.M. (1989). Does reducing student-to-teacher ratios affect achievement? *Educational Psychologist*, 24(1), 79-98.

Creemers, B. (1994). *The Effective Classroom*. London: Cassell.

Croll, P. (1986). *Systematic Classroom Observation*. London: Falmer.

Delamont, S. & Hamilton, D. (1986). Revisiting classroom research: A continuing cautionary tale. In Hammersley, M. (Ed.). *Controversies in Classroom Research*. Milton Keynes, England: Open University Press.

Dunkin, M.J. & Biddle, B. (1974). *The Study of Teaching*. New York: Holt, Reinhart and Winston.

Ehrenberg, R.G., Brewer, D.J., Gamoran, A., and Willms, J.D. (2001) Class size and student achievement. *Psychological Science in the Public Interest*, 2,1, May

Evertson, C.M., & Randolph, C.H. (1989). Teaching practices and class size: A new look at an old issue. *Peabody Journal of Education*, 67(1), 85-105.

Finn, J.D. & Achilles, C.M. (1999). Tennessee's Class Size Study: Findings, implications, misconceptions. *Educational Evaluation and Policy Analysis*, 21, (2), 97-109.

- Finn, J.D., Pannozzo, G.M., & Achilles, C.M. (2003). The "why's" of class size: Student behavior in small classes. *Review of Educational Research*, 73(3), 321-368.
- Galton, M. (1998) Class size: a critical comment on the research. *International Journal of Educational Research*, 29, 809-818
- Glass, G., Cahen, L., Smith, M.L. & Filby, N. (1982). *School Class Size*. Beverley Hills, C.A.: Sage.
- Goldstein, H. (1995). *Multilevel statistical models*. London: Hodder Arnold.
- Goldstein, H., Rasbash, J., Plewis, I., Draper, D., Browne, W., Yang, M., Woodhouse, G. & Healy, M. (1998). A user's guide to MLwiN. London: Multilevel Models Project, Institute of Education, University of London.
- Graue, E., Rauscher, E., and Sherfinski, M. (2008) Using Multiple Data Sources to Understand the Synergy of Class Size Reduction & Classroom Practice in Wisconsin, Paper to American Educational Research Association Annual Meeting, New York
- Grissmer, D. (1999). Class size effects: Assessing the evidence, its policy implications, and future research agendas. *Educational Evaluation and Policy Analysis*, 21(2), 231-248.
- Hattie, J. (2005) The paradox of reducing class size and improving learning outcomes. *International Journal of Educational Research*, 43, 387-425
- Kounin, J.S. & Gump, P.V. (1974). Signal systems of lesson settings and the task-related behavior of pre-school children. *Journal of Educational Psychology*, 66(4), 554-562.
- McIntyre, D. & Macleod, G. (1986). The characteristics and uses of systematic observation. In Hammersley, M. (Ed.), *Controversies in classroom research*. Milton Keynes, England: Open University Press.
- Molnar, A., Smith, P., Zahorik, J., Palmer, A., Halbach, A., & Ehrle, K. (1999). Evaluating the SAGE program: A pilot program in targeted pupil-teacher reduction in Wisconsin. *Educational Evaluation and Policy Analysis*, 21(2), 165-177.
- NICHD Early Child Care Research Network (in press). Does class size in first grade relate to children's academic and social performance or observed classroom processes. *Developmental Psychology*.
- Pate-Bain, H., Achilles, C.M., Boyd-Zaharias, J. & McKenna, B. (1992). Class size makes a difference. *Phi Delta Kappan*, 74(3), 253-6.
- Paterson, L., & Goldstein, H. (1991). New statistical methods for analyzing social structures: An introduction to multilevel models. *British Educational Research Journal*, 17(4), 387-393.
- Rowe, K. J. (1995). Factors affecting students' progress in reading: Key findings from a longitudinal study. *Literacy, Teaching and Learning*, 1(2), 57-110.

Shapson, S.M., Wright, E.N., Eason, G. & Fitzgerald, J. (1980). An experimental study of the effects of class size. *American Educational Research Journal*, 17, 144-52.

Slavin, R. E. (1989). Class size and student achievement: small effects of small classes. *Educational Psychologist*, 24 (1), 99-110.

Wood, D. (1998) *How Children Think and Learn* . Second Edition. Oxford: Blackwell.