Relationships Between Class Size and Teaching:

A Multimethod Analysis of English Infant Schools

Peter Blatchford, Viv Moriarty, and Clare Martin

Institute of Education, University of London

Suzanne Edmonds

National Foundation for Educational Research, Slough, U.K.

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Research and debate on class size differences has focused on relations with achievement, and there is little relevant research on what mediating classroom processes might be involved. In this article we investigate connections between class size and teaching interactions. We adopt a multimethod approach, integrating qualitative information from teachers' end-of-year accounts and data from case studies with quantitative information from time-allocation estimates and systematic observations. Our data come from a longitudinal study of two cohorts of more than 10,000 children ***[AQ: "each"? no overall]*** *for 3 years after enrollment in English infant schools (aged 4–7 years). Our results show, overall, that in smaller classes there is more individualized teacher support for learning. We interpret the results in the context of teacher time allocation, research on effective teaching, and post-Vygotskian*

approaches to teaching. It is suggested that direct models of teacher influences on pupils need to be adapted to allow for class size as a contextual factor that influences both teachers and pupils.

We start this article with a brief summary of an observer's report after a visit made to a small reception (4–5 years) class of just 15 pupils in a village school in East Sussex, England.

General classroom environment. There was lightness about the activities and a good deal of humor. The teacher joked with the children (for example, comments were made at her daughter's expense concerning her propensity to hoard and store things in the loft), chatted to the observer, and discussed social things with the children. Work was not neglected; rather it was supported by a personal style of interaction. The teacher was able to maintain a running and public commentary on children's work.

Classroom management. The teacher spent little time on control, and there was little need to keep children on task. There was a very noticeable contrast with the situation in another school visited at about the same time by the same observer, involving a teacher in a large class of more than 30. Interactions with the children were a continuous battle to keep their attention on task. As a consequence the teacher was severe; the children, subdued.

Teaching interactions. The teacher was able to stay with one small group of children (who she felt needed her help) for the whole session, more or less. They received sustained attention and she was able to offer immediate feedback. Task allocation and preparation were deliberate, responsive, and individualized; she dealt with each of the children in turn, asked what they wanted to do from a list of activities, and then helped them to start.

Teacher's knowledge of children. The teacher felt the main advantage of having a small class was that she knew children individually and that this informed her teaching. For example, on the basis of questions posed to children, she was aware of who knew and who did not know something.

Hearing children read. The teacher felt very strongly that hearing children of this age read individually in school was important. The small class allowed almost daily sessions in which children were heard to read individually, and there was a stress on individualized support at this crucial time in children's reading development. This would not be possible in a larger class.

Obviously, there are questions about the generalizability of individual case descriptions. The characteristics of the children in the school, the composition of the class, and the qualities of the teacher and the school are all important. But the foregoing shows the obvious potential in smaller classes for more teaching support and focused teaching. In visits to schools it was clear that the overwhelming professional judgment of teachers of young children was that smaller classes allow more effective and flexible teaching and the potential for more effective learning. This is also probably the commonsense view. It is often cited as one reason parents pay to send their children to private schools.

However, there is vigorous debate over the educational consequences of class size differences. In the United States, the debate has centered on the efficacy and cost effectiveness of initiatives to reduce class size. A major worry in the United Kingdom has been that classes at the primary stage are too large and that teaching, learning, and children's educational progress can suffer (see Blatchford, Goldstein, & Mortimore, 1998). Many in education are puzzled by the claims of past U.K. government spokespersons and academics (Rivkin, Hanushek, & Kain,

2000) that class size is unimportant. Current U.K. policy is for a maximum class size of 30 at KS1 (4–7 years) in England; but this allows a good deal of variability in class sizes, and concerns over the effects of larger classes remain. The most widely quoted research is the experimental Tennessee STAR project. Although findings are still contentious (see Goldstein & Blatchford, 1998; Grissmer, 1999; Hanushek, 1999; Prais, 1996), there is agreement that the STAR project **[AQ: OK?yes]** is an impressive large-scale study, that it provides evidence that smaller classes (below 20) have positive effects on pupil academic performance, and that the effects are most pronounced immediately after school entry, that is, if the youngest children in school are placed in small classes **[AQ: OK?yes]** (e.g., Finn & Achilles, 1999; Nye, Hedges, & Konstantopoulos, 2000).

But even if it can be shown that class size differences have an impact on pupils' academic progress, this still leaves unanswered important questions about what mediates the effect. Unfortunately, we have little systematic information on what processes, that is, which mediating factors, might be involved (Blatchford & Martin, 1998; Nye et al., 2000). Research has concentrated almost exclusively on the effects of class size reductions on academic outcomes. The STAR project, like many others, was predominantly focused on the relationships between class size and academic attainment and has little to say about classroom processes that might explain the effects found. Finn & Achilles (1999), members of the STAR research team, acknowledge this when they argue, "Despite dozens of earlier studies, the classroom processes that distinguish small from large classes have proven elusive" (1999, p. 102). In a similar vein, Grissmer (1999) has concluded that there is a lack of coherent theories by which to guide and interpret empirical work on class size effects and with which to make new predictions. The situation in the United Kingdom is much worse, in the sense

that there is little research on classroom processes connected to class size differences. We need, therefore, accounts of classroom processes that might explain why small and large classes differ.

It might be expected that one set of classroom processes affected by class size would be aspects of teaching, and that is the focus of our article. A major starting point for the work described in this article is the gap between professional experience, as described above, and the research evidence; the gap is perhaps most marked with respect to effects of class size on teaching. The judgment and experience of many practicing teachers is that, other things being equal, teaching and learning are likely to be improved in smaller classes. But the evidence from research is not clear-cut, and some of it even suggests that although teachers may feel their teaching has benefited in small classes, their feeling is not supported by observational data (Shapson, Wright, Eason, & Fitzgerald, 1980). A major motivation for the research reported here was to gain insights that might help inform this gap between professional experience and the research evidence. **[AQ: OK?yes]** Arends (1994) lists three functions of teaching: executive, interactive, and organizational. The concern in this article is with interactive functions of teaching.

Class Size and Research on Teaching

This article is informed by three perspectives that have been used to characterize or assess teaching. These are allocation of teacher's time to various activities, conceptions of the effectiveness of teaching, and cognitive components of teaching.

Teaching Time Allocation

Research on teaching has a long and varied history, and studies are far too numerous to be reviewed here. Reviews of this research show that there are various and often conflicting paradigms of research (Shulman, 1986), but a central tenet of many is the importance of maximizing teaching time and instructional support for children's learning. This is expressed most obviously in the process-product tradition, which stresses the importance of maximizing students' academically engaged time in classrooms and the strong influence of teacher instructional time and active teaching (Brophy & Good, 1986; Creemers, 1994; Pellegrini & Blatchford, 2000). Although there has been a reaction to the process-product style of research (see Pellegrini & Blatchford, 2000), there is empirical support for the importance of maximizing active teaching (Creemers, 1994).

On logical and commonsense grounds it seems likely that the greater the number of children in a class, the more time teachers will spend on procedural and domestic matters such as taking the registers, lining children up and putting on coats, and dealing with domestic duties such as toileting, accidents, and so forth (e.g., see Bassey, 1996), and conversely, the less time teachers will spend on instruction and dealing with individual children. It might be expected to be particularly important to maximize the amount of teaching and individual support for the youngest children in school.

This expectation is consistent with teachers' views. In the United Kingdom, Bennett's (1996) account of a survey of teachers' and head teachers' views shows that practitioners believe that large class sizes affect teaching and learning and are particularly aware that larger classes could have an adverse effect on the amount of teacher attention. Pate-Bain, Achilles, Boyd-Zaharias, and McKenna (1992) report as follows, on the basis of teacher interviews

conducted at the end of each school year in the STAR research:

> A common benefit cited by teachers in small and regular plus aide classes was that they were better able to individualize instruction. These teachers reported increased monitoring of student behavior and learning, opportunities for more immediate and more individualized re-teaching, more enrichment, more frequent interactions with each child, a better match between each child's ability and the instructional opportunities provided, a more detailed knowledge of each child's needs as a learner, and more time to meet individual learners' needs using a variety of instructional approaches. (p. 254)

Teachers' reports are supported by the meta-analysis conducted by Glass, Cahen, Smith and Filby (1982), who found that smaller classes resulted in greater teacher knowledge of pupils, frequency of one-to-one contacts between teachers and pupils, variety of activities, adaptation of teaching to individual pupils, and opportunities to talk to parents (cf. Cooper, 1989). Other studies report more individual teaching and attention (Harder, 1990; Pate-Bain et al., 1992; Turner, 1990) and more feedback (Pate-Bain et al., 1992; Cooper, 1989). However, in direct contrast to teacher views, Shapson et al. (1980), in a widely cited study, found no statistically significant differences between class sizes for most teacher activities.

Several more recent U.S. studies have examined the effects of class size on teaching. Molnar, Smith, Zahorik, Palmer, Halbach, and Earle **[AQ: Spelled "Ehrle" in reference list.it should be Ehrle]** (1999) report results from the Wisconsin Student Achievement Guarantee in Education (SAGE) project, a 5-year K–3 project begun in the 1996–1997 school year, in which participating schools were required to reduce ratios to 15 students per teacher. Molnar et al. (1999) report results from interviews and questionnaires in which teachers were

asked to rank items according to the extent to which they were affected by reduced class size. The teacher behaviors that received the highest rankings were more individualized instruction; more teaching time; more discussion, sharing, and answering; more hands-on activities; and more content coverage. The most important classroom process affected by reduced class size, according to Molnar et al. (1999), is therefore individualization. Interviews conducted with 28 SAGE teachers suggested that small classes reduced problems with classroom discipline and allowed more knowledge of students, more time for instruction, and more individualization, for example, involving more one-to-one help. The 28 teachers put forward a tentative model of teaching in small classes that included three elements: better knowledge of students, more instructional time, and teacher satisfaction, saying that **[AQ: OK?no it wasn't the teachers that put forward the model but Molnar et al. So why not say 'Molnar et al put forward…'.etc]** these in turn lead to more individualized instruction.

In another recent study, Betts and Shkolnik (1999) modeled relationships between class size and teacher time allocation based on a secondary analysis of a national survey of students in middle and high schools in the United States (the survey covered the period 1987–1992, so is rather dated now). Teachers were asked to estimate retrospectively the minutes spent per week in group instruction, individual instruction per student, and percentage time in instructional activities. The results show some evidence that teachers substitute group instruction for individual instruction as class size increases and devote less time to group instruction and more to individual instruction in smaller classes. There was a small effect on percentage of overall instructional time.

Rice (1999) also conducted a secondary analysis of survey data from high school math

and science teachers, based on teachers' estimates of percentage time devoted to activities such as instruction of small groups and individuals, innovative instruction, and whole group discussion. Findings showed that in math, as class size increased less time was spent on small groups and individuals, innovative instructional practices, and whole group discussions, though increases in class sizes beyond 20 had little effect. There were no relationships between class size and instructional time allocation measures in science.

The aforementioned study by Betts and Shkolnik and that by Rice raise interesting questions about the effect of class size differences on teaching time and nonteaching (e.g., procedural or managerial) time overall and also about how time is shared among individuals, groups, and the whole class. But the studies are limited in that they rely on a secondary analysis of rather general teacher retrospective estimates of time spent; basic distinctions, for example, between individual, group, and class contexts, which might be expected to be differently affected by class size, are not always clear. Another problem with the studies is the age of the students involved. We have seen that greatest effects are reported with younger children, especially immediately after entry into school; thus the results involving much older children may underestimate effects of class size differences or involve different processes, or both.

Research on Effective Teaching

There is, of course, more to research on teaching than time allocation. For decades, researchers have sought to identify the aspects of effective teaching, and the search has gained new impetus from recent writings on the subject **[AQ: OK?yes]** (as reviewed by Brophy & Good, 1986; Creemers, 1994; Galton, Hargreaves, & Pell, 1999, **[AQ: 1996? See reference**

list.Sorry the ref here should be Galton, Hargreaves, Comber, Wall and Pell 1999, so the date is right the ref wrong] and many others). For the most part, the underlying model is of direct effects on pupil achievement. There has been relatively little interest in classroom contextual influences such as class size. Dunkin and Biddle's (1974) work is an exception: Their model, which has been influential in research on teaching in the process-product tradition, includes class size as one of several context variables. Bennett (1996) uses that model in his report of a Teacher Association survey of the views of teachers, parents, and school governors on class size effects. The model served to position class size in the context of overall influences on children's progress, but there has been little study of connections between class size and the processes within classrooms, which include teacher and pupil behavior.

There is very little U.K. research on the effects of class size differences on teaching. In a recent small-scale study (Galton, Hargreaves, & Pell, 1996), data came from 28 lessons and nine teachers, based on an adapted version of the observation systems used in the earlier ORACLE study. The authors claim that smaller classes allow more sustained interactions between teacher and child, more time spent on task than on routine management, and more feedback on work. The results are difficult to interpret because they involve only a handful of teachers working under unusual circumstances and for brief periods; moreover, none of the results reported appear to have reached statistical significance.

Cognitive Approaches to Teaching

A quite different approach to teaching, with roots in cognitive psychology, has drawn on Vygotskian thought, for example, on the Zone of Proximal Development (ZPD), and

"scaffolding" to inform effective teaching and tutoring (see Meadows, 1996; Tharp & Gallimore, 1991; Wood, 1998; Wood & Wood, 1996). This line of thought suggests that effective learning takes place when contingency, feedback, and assisted learning are provided; a number of authors show that those features are best provided not in school contexts but rather in more informal contacts in the home. The underlying learning context in this tradition of thought is the one-to-one tutoring relationship. From this point of view the school classroom seems inherently disadvantaged as a site able to provide a contingent learning environment, and a classroom with a large number of young children is particularly problematic. Some studies have examined the reality of teacher scaffolding and contingent teaching in the context of everyday life in classrooms (Bliss, Askew, & Macrae, 1996), but connections with numbers of children in the class have not been worked through conceptually or empirically.

Motivation for This Study

Two general limitations arising from this brief review of research on teaching inform the present study. First, the main traditions of research have in common a lack of interest in classroom contextual influences on teaching. There is an underlying assumption in many studies of a direct model, with teaching affecting pupils' achievements and learning in a causal way. But teachers do not meet pupils out of context, and class size can be seen as one contextual influence on classroom life, which plays a part in the nature of the interactions between teachers and pupils. The conceptual roots of this view can be found in Bronfenbrenner (1979) and in the ecological psychology approach of Barker (1968) and Gump. **[AQ: Gump not in reference list. Iit is more the name associated with this approach than a particular ref. Leave out if a problem]** The basic idea is that one classroom context has distinctive forces or 'signals'

different from those of other contexts, which pull events and participants along with them (Kounin & Gump, 1974). In an early article, Evertson, Sanford, and Emmer (1981) showed how one classroom contextual factor—heterogeneity of students' entering achievement levels—placed extraordinary demands on teachers' time, attention, and management skills. In the present article, it is argued that different class sizes may well involve different forces or signals that influence both teachers and pupils.

Drawing on previous research and theory two general questions informed the research described in this article:

1. Do teachers in large and small classes differ in time spent on teaching or instructional activities overall; time in individual, group, and class contexts; and amount of teacher-child contact and individual attention from teachers?

2. Apart from these more obviously quantitative dimensions, do teachers in large and small classes differ in more qualitative dimensions of teaching, seen in interactions between teachers and children?

A second general limitation of previous research concerns the methods used in such research as has been done on relations between class size and teaching. One problem is the diversity of research methods. Studies have used various research techniques, including teacher report **[AQ: Plural "reports"? Or is singular standard usage in the field?singular is fine]** and interviews (Pate-Bain et al., 1992), questionnaires completed by teachers (Molnar et al., 1999), teacher accounts of time spent (Betts & Shkolnik, 1999; Rice, 1999), and observation studies (Shapson et al., 1980); and it is not always clear that these studies cover the same phenomena. Integration of findings across studies is therefore difficult. Another problem concerns the quality of research methods used in particular studies (Goldstein &

Blatchford, 1998). Methods used are not always clearly described or adequate. Much is anecdotal and based on teacher report and the reported experience of individual teachers. **[AQ: Are the last two things different?agreed they are pretty much the same. Why not 'Much is anecdotal and based on the reported experience of individual teachers.']** Although valuable, these methods raise questions about validity and generalizability, especially given the finding by Shapson et al. (1980) of discrepancies between teacher reports and classroom observation data. Large-scale secondary analyses, such as those in Betts and Shkolnik (1999) and Rice (1999), are more reliable but have involved relatively crude, easily quantified, retrospective judgments of time allocation.

It seemed to us that a multimethod approach would advance understanding of the connections between class size and teaching, in particular by integrating teachers' judgments and experiences with case studies and by using carefully designed time allocation estimates as well as systematic observation data. **[AQ: Changes in preceding sentence OK?yes]** As a general strategy it seemed to us important to consider different approaches not in opposition to each other but as complementary. In studying class size effects, there is much to be said for seeking to integrate various approaches to teaching within a common frame of reference that will enable them to inform each other.

In this article, therefore, we have adopted a multiple-method approach. We collected quantitative information that would enable us to address basic questions on teacher time allocation and teacher and pupil behavior in class. But we also wanted a more qualitative assessment of relationships between teaching and class size, through the use of methods that captured teacher experiences and through detailed case studies. We have, therefore, deliberately sought to combine quantitative and qualitative approaches.

Another feature of the research approach used in this study is a response to some limitations of experimental designs. For example, randomized controlled designs may be limited theoretically, in terms of the validity and generalizability of results, and pragmatically, in terms of policy recommendations. One limitation of studies that compare selected class sizes (in the STAR project, class sizes of 13–17 were compared with class sizes of 22–26) concerns generalizing to class sizes that fall outside the ranges studied. There are also immense practical and financial difficulties in setting up large-scale experimental studies of class size differences.

The overall strategy in the University of London Class Size Project **[AQ: Is this your study?yes]** has been to employ a longitudinal research design, random selection of participating schools, and a systematic approach to capturing information on classroom processes affected by class size, using measures carefully drawn up on the basis of previous research and pilot work. A naturalistic design is more useful in addressing policy issues because it is more authentic and reflects adjustments and processes as they occur under normal circumstances.

Our principal aim was to **[AQ: OK?yes]** examine two types of connections: (a) those between size of class and pupils' progress, and (b) those between size of class and classroom processes, such as teacher and pupil behavior, within-class grouping practices, teacher self-perceptions, assessments, **[AQ: "of pupils' progress"?not really – too avoid confusion and to actually make this more in keeping with what we have published elsewhere I suggest this sentence ends '…such as teacher and pupil behaviour, and within class grouping practices.' Ie drop record keeping]** and record keeping. In this article the focus is on connections between class size and one classroom process: teaching. Results on class size

and attainment are reported in Blatchford, Goldstein, Martin, and Browne (in press); results on class size and within-class groupings are reported in Blatchford, Baines, Kutnick, and Martin (2001).

Method

Sample: Schools, Classes, and Children

The overall Class Size Project followed for three years a large cohort of pupils who entered reception classes (4–5 years) in English schools during 1996–1997, and a second, separate cohort of pupils who entered reception classes during 1997–1998. At the start of the project there were, in the first cohort, 7,142 pupils in 330 classes (199 schools under 9 local education authorities [LEAs]). The second cohort comprised 4,244 pupils in 212 classes (134 schools under 6 LEAs). We followed the children for the whole of Key Stage One (KS1) (4–7 years), that is, through the reception year (4–5 years), Year 1 (5–6 years), and Year 2 (6–7 years). The research design involved random selection of schools within the participating LEAs. All children entering reception in a selected school during the year were included in the study. The schools in the study drew from a wide range of social backgrounds and were situated in urban, suburban, and rural areas. At the start of the study, 49% of the sample were female and 51% male, 17% were eligible for free school meals (a measure of low family income), the vast majority (97%) spoke English as a first language, and most (91%) were classified as from White U.K. ethnic backgrounds. Schools were either all-through primary schools (i.e., children aged 4–11 years), constituting 74%, or infant schools (i.e., children aged 4–7 years), constituting 26%.

Data Collection

We collected a number of forms of data, including start-of-school and end-of-year assessments, termly teacher-completed questionnaires, teacher- and head-teacher-completed end-of-year questionnaires, pupil behavior ratings on each child in the study, and systematic observations and case studies conducted on subsamples of the main sample. For this article we have made use of four types of data: teacher end-of-year reports, case studies of individual classes, teacher estimates of time allocation, and systematic classroom observations. As described above, the aim was to use the strengths of various approaches in a complementary way and to check for consistencies across different forms of data, thereby strengthening the validity of conclusions. We describe below the four forms of data collection.

Teachers' experiences of the effect of class size on teaching and learning: Data from end-of-year questionnaires

We collected information from class teachers about their experiences and views on a range of issues, including one question about the effect of class size on teaching and learning. In this article, data come from questionnaires completed in the summer term of 1998 by 151 reception teachers (cohort 2) and 208 Year 1 teachers (cohort 1), and questionnaires completed in the summer term of 1999 by 130 Year 1 teachers (cohort 2) and 153 Year 2 teachers (cohort 1). The aim was to describe thoroughly the teachers' views and experiences by collecting information from a substantial number each year during Key Stage 1 and by a careful analysis of the range and types of answers given. The analysis combined quantitative analysis of the prevalence of various categories of answers with illustrative and verbatim quotations from teachers' written answers.

For this article we used answers to one question from the questionnaire (concerning whether and in what ways teachers felt that class size differences had affected teaching and learning over the year). The question was open-ended, with space provided for answers. We developed a coding frame on the basis of an initial analysis of 50 of the 1998 questionnaires and 20 of the 1999 questionnaires (within each teaching age group). Answers were read through, and categories were devised that captured the most frequent themes. Different members of the research team worked on the same corpus of teachers' responses, and categories were checked for reliability and validity. The remainder of the questionnaires were then read through, and all teachers' answers to the teaching and learning question were categorized in terms of the system developed earlier. There were 19 categories in all. Categories coded for each teacher were then entered into SPSS. More than one category could be entered for each teacher. The questionnaires were completed by all teachers in the study, whatever the number of children in a class. Some comments were therefore based on experience of large classes; some made the same point (e.g., regarding individual attention) based on experience of small classes. These are discussed together under the appropriate category.

Case Studies of Selected Small and Large Classes, Conducted by Field Workers

Case studies were conducted to provide information complementary to that in the main quantitative study. The aim was to provide a more detailed portrayal of individual classes, which would serve as the basis for a more interpretive and grounded analysis of factors relating to staff and adult deployment **[AQ: I don't understand "deployment" here.**

How about "deportment"? this may be an American vs English English difference! 'Deployment is commonly used in the UK to refer to how people in classes are used. Some of the analyses have been directed at teaching assistants in class. Hence this term. But agreed this is a bit unclear and it may be best to change to '…..grounded analysis of teachers' interactions with children.' Deportment is not right, I think] in class. Schools were selected with differing class size categories; that is, large (30 and over), large medium (26–29), small medium (20–25), and small (under 20). The aim was to study two classes in each class size band in each year (reception, Year 1, and Year 2), totaling 24 classes in all. Procedures differed for the reception year because classes are more likely to see changes over the year (e.g., because of new entries each term). Visits to the eight classes took place each term. For Years 1 and 2, there were three visits in the spring term. So that the fieldwork could be conducted during the same school year, the reception classes were from schools in cohort 1, the Year 1 classes from cohort 2, and the Year 2 classes from cohort 1. In this article we concentrate on three case studies drawn from the large- and small-class categories, supplemented by additional material from other case studies.

The methodology was developed on the basis of field visits to schools. Selected aspects of classroom learning and experience, expected to be connected to class size differences, were defined in advance and then, on the basis of field visits, were refined into the following main headings: (a) physical space, (b) grouping practices, (c) establishment of routines, (d) classroom discipline, (e) tasks and curriculum, (f) teacher-pupil interactions and knowledge of children, (g) teacher stress and enthusiasm, (h) atmosphere or ethos, (i) assessments and record keeping, (j) pupil adjustment and peer relations, (k) relationships with parents, and (l) special educational needs. In this article we concentrate on teaching factors

connected to class size.

The method used in case studies comprised four components. The first was *event sampling of significant events,* which included whole-class and child-focus observations. For whole-class observations, continuous notes were taken on the activities of the whole class and of groups working at the time. Observers' notes were grouped under the aforementioned main headings. Observers noted the time on the sheets every five minutes, and the times of changes in activities were also noted, for example, when a group of children moved to another task. Observation notes described the nature of the task and curriculum area and the nature of the interactions among teachers, other adults, and children. For child-focus observations, three children in each class were observed (one high, one medium, and one low achiever, chosen from among six children identified by the teacher; that is, two high, two medium, and two low achievers). Again the main headings were used, as in the main observations above, to organize observation notes. As before, times were noted. The aim was to obtain more insight into children's adjustment to school in terms of the aspects represented by the headings. The second component of the case studies was *semistructured interviews* with teachers and the head teacher, classified by the main headings. The third component was *end of session/day comments* and judgments by field workers in terms of the main headings, related to class size differences. The fourth component was *summative judgments by field workers* in terms of the main headings and end-of-year discussions **[AQ: Plural OK?yes]** between the research team and field workers. The fourth component made use of experienced teachers as field workers, who were experienced in teacher training and school inspection. Quite deliberately, the

aim in this component was to marry aspects of systematic observation and interviewing (with an emphasis on the objectivity of data) with professional and interpretative judgments by experienced teachers and teacher trainers and a more inquiring or questioning **[AQ: Could "inquiring" or "questioning" be deleted? Or do they differ in meaning?could delete questioning]** role during field visits.

Teacher Estimates of Time Allocation: Overall Teaching Time, Teaching to Individuals, Groups, or the Whole Class

Data came from questionnaires completed by class teachers that produced information on classroom activities during a half-day period each term. In addition to information on registered and "experienced" class size (i.e., the number of children in class at the time of the survey) and adults present, teachers were asked for a given morning session to estimate the amount of time in minutes they spent in (a) *nonteaching activities*, such as collecting dinner money; talking with other adults in the classroom; dealing with domestic and personal problems, for example, toileting or accidents; responding to outside interruptions, for example, receiving visitors; lining the class up, putting on coats, and so forth; spending time out of class; taking the register; settling the class and allocating the children to groups; dealing with discipline and behavior problems; and (b) *teaching activities,* such as teaching or working with the whole class; working with an individual child; and working with a group of children. These activities were selected on the basis of pilot work. The three teaching activity categories—teaching of individuals, of groups, and of the whole class—were measures in minutes and also added to give an estimate of the total time in minutes spent on teaching activities. The totals were then converted to percentages of the session time (because in some

classes the session may have been reduced by times out of class and unexpected events). There were then four measures for each teacher: (a) percentage time teaching individuals, (b) percentage time teaching groups, (c) percentage time teaching the whole class, and (d) total percentage time in teaching (i.e., the sum of the first three categories). In this article, only data from cohort 1 were used for the questionnaires. Data came from teachers of 279 reception classes, 207 Year 1 classes, and 118 Year 2 classes.

Systematic Classroom Observations

Because of the labor-intensive nature of systematic observation data and because the first year of school was of particular interest, the observation component reported in this article involved a subsample of reception classes from cohort 1 (children aged 4–5 years). Three of the participating LEAs were approached and agreed to take part in the observation component. Schools were selected on the basis of information already provided on class sizes. Schools with small (20 or under) and large (30 and over) reception classes were identified and a random selection were approached to see if they were willing to take part. The aim was to get 40 classes, divided between large and small classes. Thirty-nine classes in 27 schools with the required characteristics agreed to take part. There were 18 large and 21 small classes. Those identified as small classes had on average 19.4 children, and those identified as large classes had 32.5 children on the register, according to the observer notes at the time of the observations. For the systematic observation study, observers were provided with the names of six children from each class randomly chosen by the researchers, along with two reserves to be observed in cases where the sample children were absent. There were observations on 235 children (one class had observations on 7 children).

We used a systematic observation schedule that had been developed in previous research (Blatchford, Burke, Farquhar, Plewis, & Tizard, 1987; Blatchford, Burke, Farquhar, Plewis, & Tizard, 1988). **[AQ: This 1998 source not in reference list. Sorry, the second ref should be Tizard, Blatchford, Burke, Farquhar and Plewis, 1988, which is in refs]** It involved direct, that is, on-the-spot, observations of selected children in terms of previously developed categories and in terms of 5-minute observation sheets divided into continuous 10-second time samples. The schedule was child-based in the sense that one child at a time was observed, the "target" child. The aim was to provide a description of the child's behavior; teachers and other children were observed only when they came into contact with the target when he or she was being observed. The schedule had categories that provided a description of time spent in various settings (e.g., teacher-directed activities) and various school subject areas (e.g., language and mathematics) and a description of how children behaved in three "social modes"—when with their teachers, when with other children, and when not interacting. Subcategories within each of these three modes covered work, procedural, social, and off-task activities. For full definitions and conventions of categories, see Blatchford et al. (1987) and Tizard, Blatchford, Burke, Farquhar, and Plewis (1988). In this article we concentrate on the categories from the teacher-to-child social mode. This included two major categories, *teacher-child contact* and *child-teacher contact,* with the subcategories described here.

Subcategories of teacher-child contact

Social setting: one-to-one, group or whole class.

Child role: whether the child is the focus of teacher's attention or audience, that is, another child is focus in group or class involving target child, or teacher interacts to same extent with all children).

Teacher content:

Task-teach, which concerned the substantive content of children's task activities, such as communicating concepts, facts or ideas by explaining, informing, demonstrating, questioning, suggesting;

Task-preparation, concerning the organization and preparation of children's task activities and not their substantive content;

Task-silent, in which a teacher's contact is passive, for example, hearing child read, looking over work;

Procedure, which is concerned with classroom management and organization of classroom routine, often at transition times, for example, milk, changing, organizing materials;

Social, concerning personal or social comments, for example, about life outside the classroom, children's appearance, health, and so forth;

Unclear: not possible to code reliably.

Subcategories of child-teacher contact

Child contribution: whether the child responded to teacher, initiated contact with teacher, attended to teacher, continued interaction from previous time intervals, or contribution was unclear.

Child content: child behaviors in contact with teacher, as defined for aforementioned "teacher content"; that is, *task, procedure,* and *social,* plus *inappropriate* (child behavior obviously unrelated to teacher request or situation—for example, rather than answering a question on math, making a comment about a television program the previous evening).

Off-task: inattention to the teacher; and **[AQ: Am I to treat this & next item as numbered items? No they are sub categories of 'child content' ie the categories are task, procedure, social, inappropriate, off task and unclear – so suggest this: '… previous evening), *off-task* (inattention to the teacher) and *unclear*.']**

Unclear.

For each 10-second interval the predominant category within each of these subcategories was coded ("predominant activity sampling"). The basic principle was to observe during classroom-based work activities (e.g., language, math, crafts, and painting) and free play. The aim was to observe the 6 children in each class 5 times per day for 3 days. The average number of completed observation sheets per child was 14, and there were 3,238 sheets overall. This amounted to 97,140 ten-second observations (30 per sheet), and there were on average 413 of these observations per child. There were 69 minutes of observation per child, which amounted to 270 hours for the whole sample.

Observers were recently retired senior teachers and head teachers contacted through participating LEAs, who then received initial training, made practice observations in a

reception class not involved in the study, and received a follow-up training session. Reliability checks were carried out through the training sessions. A reliability study carried out in earlier work showed that observer agreement for the main sets of mutually exclusive categories was high. Setting, subject, teacher-child "social setting," "child role," "teacher content," child-to-teacher "child contribution," "child content," and "not interacting" all had reliability coefficients (kappa) greater than 0.80. Kappa for child-child content was 0.77 (Blatchford et al., 1987).

Results

Each of the four forms of data—that is, end-of-year questionnaires, case studies, termly "time" variables, and systematic observations—were analyzed and separate reports compiled. Here we summarize the results from each of these forms of data in turn, with the aim of identifying and integrating the most common and consistent themes across different forms of data collection.

Teachers' Experiences of the Effect of Class Size on Teaching and Learning: Data From End-of-Year Questionnaires

The end-of-year questionnaire responses to the question concerning ways in which teaching and learning were affected by the number of children in a class were analyzed and entered into SPSS. The frequencies for each of the 19 categories were calculated, as well as the percentage of teachers who gave each category. A full breakdown of these results is not provided here, but the most frequent three responses given by more than 10% of teachers during any year were the following:

1. Less individual attention/contact/feedback (58% of reception teachers, 47% of

Year 1 C1 teachers, 35% of Year 1 C2 teachers, and 40% of Year 2 teachers)

2. Less group attention/larger group sizes (29% of reception teachers, 22% of Year 1 C1 teachers, 14% of Year 1 C2 teachers, and 12% of Year 2 teachers) **[AQ: My changes OK?very good!]**

3. Fewer individual reading opportunities (19% of reception teachers, 8% of Year 1 C1 teachers, 1% of reception C2 teachers, and 4% of Year 2 teachers) **[AQ: My changes OK?yes]**

The 19 categories were also grouped into five collective categories. The three individual response categories just described were added together on conceptual grounds to form one of these collective categories, which was called "reduced teacher-child interaction" and covered expressions of the view that class size influenced the quality of teaching and learning through reduced time for educational interactions. This included less individual attention, contact, and feedback. This was by far the most prevalent of the five collective categories, taking up more than 50% of all responses at each age level.

It can also be seen that the single most prevalent of the 19 categories used to code teachers' answers was that in larger classes they were able to give less attention and feedback to individual children in the class. This category is of particular relevance to this article. In this section we describe the most prevalent types of teachers' responses that were classified in this category. Each type is described and illustrated with quotations, representative of many similar quotations drawn from the reports. The quotations detail a compelling account of the ways that teachers felt that attention to pupils was affected by the number of children in their classes.

Amount, duration, and extended nature of interactions

Teachers were concerned that large classes affected the quantity of educational interaction each child received. That is, the more children in the class, the less individual teaching was seen to be possible. This was seen as an almost mathematically necessary consequence: "More children = less time for each child. Simple division really!*"* and "Bigger class = smaller proportion of my time!" One teacher of a large class used a different kind of image: She described her professional self as "like Marmite, spread very thinly." Another teacher said that in her large class there was "less opportunity for one-to-one teaching, which is essential"; conversely, a teacher of a smaller class was clear that "a smaller class has enabled me to spend longer with each child."

Quality and intensity of interactions

Not only does the quantity of interaction decrease when classes are large; teachers also feel that the quality of interactions is affected: "Children have less quality time with the teacher." A reception class teacher in a small class made the following comment: "The greatest difference . . . is in the time and quality of support that can be given to each child." Teachers often made comments concerning their affective response to class sizes and this highlighted the emotional work of teachers and the feelings they have toward children in their classes.

Monitoring, checking children's understandings, and offering appropriate feedback to individuals

Allied to comments from teachers working in large classes concerning the decline in

quality of interactions with children were the types of interaction that they felt to be valuable. Teachers wrote that monitoring, checking understanding, and offering appropriate feedback to individual children was more difficult in a larger class, implying that these were considered to be important aspects of teaching and that to neglect them would have a detrimental effect on learning. Teachers valued being able to offer immediate feedback on children's work and felt that this was more difficult with large classes: "Marking work alongside the child is not always possible," and "With a smaller class pupils get faster feedback on their achievements."

Supporting individual learning

Comments from teachers of both large and small classes suggested that they perceived a relationship between the number of children in their classes and the support for learning that could be achieved. A reception class teacher in a smaller class wrote: "I feel that I have been able to work through problems as and when they arise, far more successfully. This has given the children a secure and settled start to school, allowing them to become independent and confident in their abilities." This theme was continued by a Year 1 teacher with a small class, who valued the fact that she could spend more time with individual children and encourage children "to work independently and at their own level." Other teachers with small classes wrote about getting to know the children very well and being able to support their particular learning needs.

Teaching of "basic skills"

Teachers not only felt that larger classes were less conducive to individual learning

but also expressed concern that "basic skills" learning suffered in larger classes. Reception class teachers seemed especially concerned about this. "So many early skills, e.g., letter formation, require guidance which is very difficult to manage within a large class."

Extent and depth of knowledge of individual children

Teachers of larger classes were concerned that they could not develop a depth of knowledge and understanding of the children as individuals. Once again, this category reflects the view of primary school teachers that their work is about more than enabling children to achieve educationally, but also encompasses social and emotional development. We can contrast a quote from a teacher with a large class: "There is less time for individuals, to listen to their news, to get to know them" with that from a teacher with a small class: "Demands on time being lessened has meant better relationships with all the children—I feel I know more about their individual likes and dislikes, and personalities."

Perhaps the single theme that underlies these comments from teachers is that with fewer children in the class there is more time possible with children to support their educational progress.

Case Studies

On the basis of the fieldworkers' reports (organized under the main headings for observations already described) and interviews with teachers and head teachers, a composite report was written, which identified the main themes arising out of the analysis organized under each main heading. In this section we summarize the section concerned with teacher-pupil interactions and knowledge of children. Each report was read through and the following

sub-themes were identified in terms of their central role in organizing field notes and conclusions by field workers: (a) amount of individual attention, (b) immediacy and responsiveness of teacher response to children, (c) sustained and purposeful interactions, (d) dealing with interruptions, (e) depth of knowledge of children, (f) disruption and noise, (g) sensitivity to individuals' particular needs, (h) teaching in whole class situations, and (i) flexibility of teacher questioning techniques.

It can be seen immediately that there are overlaps between these themes and the teachers' comments from the questionnaires, despite the fact that the two forms of data had been **[AQ: OK?yes]** analyzed by different researchers. There is not sufficient space to go through each of the categories in turn. By way of illustration and to complement the material in the last section, we concentrate on three case studies but draw on others where appropriate. The themes that emerge are to a degree typical and occurred regularly in the case studies. But the purpose of the case studies and of this section is to bring out the particular experiences of teachers and children in individual classrooms. The first source is a teacher in a large class; the other two are teachers in small classes.

Large class (Year 1)

This was a one-form entry village school in rural Shropshire with a largely middle-class, white intake. There were 37 children enrolled in Year 1, although at the time the observations were conducted, this number had been reduced to 35. The teacher had taught for thirteen years, eight years at the current school, and was due to leave at the end of the term to take up a deputy headship. The teacher had taught the class in their reception year and knew them very well. The case study gives insight into the difficulties that teachers in large classes

face.

Despite this teacher's experience level and competence, she was under stress and admitted to being "worn out." She spent many hours outside her contact time marking, and she read with children individually during her lunch break. The observation notes indicated that effective teaching was evident in this large class but at great personal and emotional expense in terms of eroding the teacher's personal time. The observer noted that this particular teacher had interactions with about seventeen children every minute, which was exhausting for her. The observer noted that classroom interaction tended to involve the teacher's telling the children things rather than sustained or meaningful interaction about tasks or concepts. In one extract, involving writing activities, the observers' notes show the teacher attending to many different children for short lengths of time, often repeating instructions. The teacher-child interactions were also concerned with management activities, and quelling rising noise levels. As noise levels rose easily to unacceptable levels when everyone was talking, she had to keep them all quieter than she wanted to. There was a similar problem, seen in one instance, when children assembled on the carpet to talk about their work, and the teacher was irritated by the noise of all their papers rustling. This, along with other examples, did not seem to be an effective use of her considerable skills and time, and she admitted to becoming frustrated and tired. She talked almost all the time. It also took a long time for every child to have a turn on the computer.

Additionally, the researcher noted that the behavior of the children could be strained. This was related to the limited amount of space that the young children had to move in. Children in the classroom were often grouped by ability, but the groups were, inevitably, large and included a wide range of ability. This made differentiation of tasks difficult, and

there was evidence that the higher-ability children were not making the progress expected of them.

Other case studies of large classes showed similar difficulties and showed that individual feedback was limited. In one class of 32 children, the teacher was observed to interact well with the children, listening to their questions and encouraging them to join in with discussions, but with so many in the class it was difficult to involve many of them (for instance, in practical examples when doing number work). The teacher felt that with so many children she was not able to talk to each child every day and that children received less individual attention than they would in a smaller class.

Small classes

By contrast, in one very small class of fewer than 15 children (the number of children present varied slightly on fieldwork visits), a particular feature noted by the observer was the amount of interaction between the teacher and the children and the responsiveness of the teacher to the children's interests, which she fed effectively into her teaching. Significantly, the children asked many questions that the teacher was able to respond to and make part of the teaching session. The teacher believed that this was partly due to the size of the group, as she could listen to them all and respond to them. This increased their confidence and enabled them to feel secure enough to ask questions. During a history lesson the children were asked to recall their visit to a Victorian classroom. One child asked what the children did when it became dark, especially in the winter, as they had no electricity. The teacher made a teaching point of this, and a discussion ensued. More children asked questions and others modeled possible solutions, such as the use of candles. The activity that the teacher had planned was open-ended enough for this new aspect to be reflected by the children in their recording. This suggests that in smaller classes teaching can be more flexible.

The teacher was also able to give immediate feedback to the children about the quality of their work. Because the class was so small, the children never had to wait for support or feedback, and this ensured that they were consistently on task and not distracted. The children also showed high levels of persistence, which owed much to the teacher's being able to give them the appropriate help at the right time. The teacher demonstrated considerable sensitivity and was able to ascertain which children needed help very quickly.

Observations in another small class of fewer than 15 children showed that interactions between the teacher and the children were of high quality in both whole-class and small-group contexts. In the beginning part of the sessions with the children there was an efficient atmosphere that was at the same time warm and encouraging. The children were taken through the work to be done in a detailed and clear way. Many of the children received much attention. Perhaps the central feature was the sustained nature of interactions in whole-class sessions and their purposeful nature. There is no real test of this but it is the observer's view that the small class allowed this to happen without strain on the teacher. The sustained nature of teacher-pupil contact was also evident in small-group contexts. A distinctive feature was the way that the teacher stayed with the group for the whole session, even when they had started independent work, still encouraging and prompting, answering their questions, and seeing the work to its completion.

The sustained nature of teacher-child interactions in whole-class teaching sessions, with a carryover into subsequent individual and group work, was also a feature of another small class of just over 20 children. When introducing writing tasks during the "literacy hour" on the third observation day, the teacher modeled the process and the children were asked questions about what she was writing. When the groups were sent off to work, the teacher checked their understanding of the tasks to be completed. She also often checked with individual children (especially those in the support group) to ensure they had understood the concepts being presented and the task to be completed. If required, these interactions were of a reasonable duration (up to 4 or 5 minutes). The teacher recognized that some individuals claimed more of her time than others, but this was related to their academic needs, and not behavioral needs.

A connected theme was more effective and flexible use of questioning techniques found in whole-class sessions in small classes. In one class of 17 children, the whole-class sessions observed during the three observation days were in excess of 25 minutes long. The children's attention was maintained throughout by the teacher, who encouraged contributions from all of them. On the third day the teacher used two big books written by Judith Kerr to compare the stories. The teacher asked open questions, accepting all answers and reframing them as necessary; for example, one child talked about the wild animals in the story, and through questioning the child was able to realize that these were part of a dream of one of the characters. The teacher emphasized phrasing and sentence structure, not by correcting but by modeling and rephrasing the answers the children gave. When the teacher wanted to teach or revise particular vocabulary, she asked more specific and closed questions, for example, when she wanted to teach different fiction genres such as adventure stories and traditional tales. This situation contrasts markedly with the situation in large classes, where questioning more often seemed to have a controlling purpose.

But observations in another small class of 20 children also showed one possible drawback, stemming from the potential in smaller classes for more immediate feedback, which was identified in several of the case studies. These observations **[AS: OK?yes]** make the important point that size of class does not *necessarily* lead to positive effects. It was noticeable in this class, during whole-class carpet sessions, that the teacher had time for individual interactions and was able to correct small things such as pronunciation ("Tuesday" rather than "Chewsdy"). The teacher was able to give effective feedback to almost all children all the time, and they came to her even while she was working with a group. However, because this behavior occurred **[AQ: OK?yes]** during lesson time, it indicates one potential

cost, in the degree to which this teacher felt she had to respond immediately to children. The observer also noted that adults such as the secretary, helpers, and nurse were allowed to interrupt the teaching in a way that was clearly not beneficial to the children.

Termly Questionnaires: Teacher Time Estimates

We now turn to the two more obviously quantitative forms of data collection. Analysis of data from the termly questionnaire showed that there was a moderate but significant correlation between class size and percentage of time spent teaching overall (i.e., teaching whole classes, teaching groups, and individual teaching added together), at reception and Year 1 **[AQ: I have substituted "Year 1" for "Y1," "Year 2" for "Y2," etc., wherever they appear. Correct interpretation?yes, thanks]** (-.15, $p = .01$, $n = 279$, and -.187, $p < .01$, $n = 207$, respectively, for class size registered). **[AQ: Could you clarify "for class size registered"? 'for the number of children on the class register' (we also had a measure of the number of children actually present in the class at the time but don't use that here)]** The correlation was in the same direction for Year 2 but not significant (-.12, *n*s, $n = 118$). **[AQ: Should I have italicized the "s" after *n*?yes, stands for 'not significant']** These results mean that there was a consistent, albeit not strong, tendency over the first 3 years of schooling, for children in smaller classes to experience more teaching time overall. Because of the way the variables were defined, these results also mean that there was a (positive) correlation of the same order between size of class and nonteaching time. In other words, the larger the class the more nonteaching time.

The association between class size and teaching time can be looked at in a different way (see Mortimore & Blatchford, 1993) by expressing class size as a categorical variable, that is, as "small" (20 or fewer) or "large" (31 or more). The medium-sized group was split into two (21–

25 and 26–30). There were therefore four class-size categories. Associations between class size defined in this way and teaching time overall for Year 1 are shown in Table 1. It can be seen that there were significant differences among the four class-size categories in teaching time. Tukey **[AQ: Is "Tukey" a typo?no it's the statistical test]** post hoc comparisons indicated that children in classes with 20 or fewer children experienced more teaching time, followed by smaller classes of 21–25. Associations between percentage of teaching time and the four class-size bands for the reception year were not statistically significant ($F(3,274)$ 1.611, *ns*), **[AQ: Does "F" need to be italicized? How about "*ns*"? Italicize? And is its meaning known to your readers? This is a matter for the Journal convention? It probably should be italicised, also ns, and readers should know about ANOVA/F tests]** although the general trend was as expected; means for percentage teaching time for 20 or fewer, for 21–25, for 26–30, and for more than 30 were 68.1%, 67.3%, 64.6%, and 64.0%, respectively.

[Table 1 about here]

Separate analyses of associations between class size and percentage of time spent teaching individuals, groups, and whole classes did not show a consistent picture (correlation coefficients between class size and time spent teaching whole classes, groups, and individuals were -.11, *ns*, - .07, *ns*, and .10, *ns*, respectively, for the reception year; -.10, *ns*, -.05, *ns*, and .02, *ns*, respectively, for Year 1; and .12, *ns*, -.19, $p < 0.05$, and -.03, *ns*, respectively, for Year 2 (numbers of children were the same as for total teaching time, described earlier). The only (just) **[AQ: Could "barely" be substituted for "just" here?don't mind]** significant result, therefore, is for class size, which is related negatively to time spent teaching to groups at Year 2.

To summarize this section: The termly questionnaire provided consistent, albeit not strong, evidence that class size was related to the amount of teaching overall, though not to the

[AQ: "relative amounts"?ok] amount of teaching to individuals, groups, or the whole class.

Systematic Observations

First, we look at data concerning the three "social modes," that is, interactions with teachers, interactions with other children, and behavior when not interacting. Total scores for these three "mode" categories were calculated for each child by adding each of the teacher-to-child "content" categories (and the child-to-teacher "content" categories, which are almost but not exactly the same, as is explained later **[AQ: OK?yes]**), the child-child categories, and the not-interacting categories. Mean scores are the average number of observations per child. Mean differences between large and small classes in terms of these variables are shown in Table 2.

[Table 2 about here]

It can be seen in Table 2 that children in small classes were more often observed interacting with their teachers than were children in large classes. The teacher-to-child and child-to-teacher totals can differ slightly; for example, in a time interval a child might initiate a contact to which the teacher has not yet responded or does not respond. Just considering the teacher-to-child measures, **[AQ: OK?yes]** in a small class children were observed on average 213 times with their teacher, as compared with 144 times in a large class.

Looking more closely at the teacher-to-child categories, it can be seen in Table 3 that children in smaller classes were more likely to interact with their teachers on a one-to-one basis (on average 36 versus **[AQ: OK? I'm substituting throughout, hope I'm right. yes]** 18 observations), and in groups (77 versus 35 observations). There were no differences between large and small classes in the amount of whole-class teaching.

[Table 3 about here]

The child was more likely to be the focus of a teacher's attention in a small, as opposed to a large, class (on average 173 versus 117 observations); that is, the child was more likely to be the subject of a teacher's attention on a one-to-one basis (by definition the child was the focus), in a group, or in the whole class. Children in small classes also experienced more teaching overall (see Table 3). Consider the category "task teach," which may be the strictest definition of teaching, in the sense that it denotes contacts directly concerned with the substantive content of children's task activities (communicating concepts, facts, or ideas by explaining, informing, demonstrating, questioning, etc.) rather than setup (task preparation) or getting materials ready (procedure). We see that "task teach" **[AQ: OK?yes]** was coded on average 156 times per child in small classes and 101 times in large classes. There was also about twice as much teacher task preparation in small classes as in large classes. There was more teacher social talk with children in small classes—for example, talk about their clothes and home experiences—although this category was not frequent overall. The only category of teacher talk to children that was more numerous in larger classes was procedural talk, as predicted.

The categories used to describe children's contacts directed at their teachers are given in Table 4. The first set of categories covers the type of interaction with the teacher, such as attending, initiating, or responding. There was more attending to the teacher (144 versus 96), more responding (27 versus 22), and more initiating (8 versus 6, although this category was not common) in small classes. So children had a more active role in interaction with their teachers (respond plus initiate), and were more attentive to her (attend). There are also signs that interactions are more likely to be continued from one interval to the next.

[Table 4 about here]

Table 4 also shows results related to the content of the behavior. As with the teacher-to-

child categories, there is more task-related talk (166 versus 107) and more social talk to teachers in small classes. Conversely, in large classes there was more inappropriate or off-task behavior, which usually took the form of not attending to the teacher.

To summarize the systematic results on teacher-child interaction: In small classes there was more one-to-one teaching, more teaching in groups (but not more or less teaching in whole-class contexts), more times when children were the focus of a teacher's attention, more time spent interacting with teachers and more teaching overall, and more time actively involved in interactions with teachers.

Discussion

To date, research and debate on class-size differences has focused on relations with achievement. The position taken in this article is that too little is known about classroom processes affected by class-size differences that might mediate any relationship with outcomes. In this article, connections between class size and one type of classroom process—teaching—have been explored. The naturalistic, nonintervention nature of the research design means that connections between class size and teaching cannot be said to be proven, and they will not follow necessarily. However, naturalistic studies can be more authentic and can include the full range of class sizes as they naturally occur. One limitation of the STAR project (Finn & Achilles, 1999) is that it compared, by U.K. standards at least, small classes with very small classes and therefore offers little to help those seeking information on the range of class sizes actually experienced by the majority of teachers and children. Other class-size reduction experiments suffer from the same problem. The present study also made use of a multimethod approach, drawing and integrating data from teacher time estimates, systematic observations, end-of-year reports, and case studies. Although time consuming to collect and to analyse, when

put together they have provided a thorough examination, from several different perspectives, of the connections between size of class and teaching.

The results from the two more obviously quantitative components, especially the systematic observations, seemed clear. There was consistent evidence that in small classes children were more likely to interact with their teachers, more one-to-one teaching took place, children were more often the focus of a teacher's attention, more teaching took place overall, and children more often attended to their teachers and became actively involved in interactions with them (i.e., responding or initiating rather than just attending). These results show that individual children in small classes receive more interactions with their teachers of a task-related nature.

We look at results in the context of the three general approaches to research on teaching described at the beginning of this article. First, there is support for an interpretation of class-size effects in terms of teacher time allocation. The termly questionnaires and the systematic observations show that in smaller classes more time is spent in teaching. This suggests a kind of "dilution" theory, as seen, for example, in research on family size. Meadows (1996) explains family size effects on children's cognitive development in terms of the parents' effect being diluted if they spread themselves among many children.

Children also receive more interactions from their teachers of a social nature in small classes, indicating that the interactions are more personalized. The fact that there are fewer teacher interactions about procedural matters adds to this picture. Overall, in smaller classes children seem to experience interactions that are more work **[AQ: "work-oriented"? yes better]** and more socially intense. Turning this on its head, in a large class an individual child will, by comparison, experience a less intense contact with teachers and receive fewer work and social contacts but more contacts in group and whole-class contexts about procedural matters.

The trend toward individualization in small classes in not indicative of a passive role for children; the opposite seems more likely, that is, that children in large classes spend less time actively interacting.

The present results are informative about the balance of individual, group, and whole-class contexts for teacher-pupil interactions. Although the results from the termly questionnaire, based on teacher estimates of time spent, were not clear cut, results from the systematic observation study for the reception year showed that teaching in both individual and group contexts increased as class size decreased. It might be argued that one solution to the teacher's difficulties in contacting children in large classes would be to alter her approach so that there is more teaching to larger groups or to the whole class. But there was no evidence that teaching to the whole class increased in larger classes, and this ran contrary to expectation. This might suggest that teachers in large classes strive to maintain the same balance of individual, group, and whole-class teaching as do their colleagues in small classes. Teachers of such young children are unlikely to feel comfortable about increasing the amount of whole-class teaching. This may be possible in some curriculum areas and for some activities but will inevitably be of limited relevance to primary-aged children, especially the youngest children.

We also looked at teaching interactions in a more rounded way, allowed by the end-of-year questionnaire and case study analyses. Results from the end-of-year questionnaires and case studies provided a broader and more qualitative version of connections between class size and teaching. These components suggested that class size affected the amount of individual attention, the immediacy and responsiveness of teachers to children, the sustained and purposeful nature of interaction between teachers and children, the depth of a teachers' knowledge of children in their classes, and sensitivity to individual children's particular needs.

Overall, we propose that there is support for the notion that in smaller classes there is more likelihood of what we can call *teacher support for learning.* One aspect of this is a greater likelihood of individualized teaching in small classes. In general, these results appear consistent with other studies reviewed earlier, for example, Molnar et al.'s (1999) evaluation of the SAGE initiative. We need, though, to be clear about the nature of individualization correlated with **[AQ: OK?yes]** small class size as opposed to large. Although there is more one-to-one teaching in small classes, the greater incidence of times when a child is the focus of attention indicates that children receive more attention in group and whole-class situations as well. We need to bear this in mind when we consider worries that smaller classes might encourage a reliance on individual teaching.

In this study we have made use of two main kinds of data. The first is the more narrow, quantitative kind (e.g., frequency of attention); the second is broader (e.g., responsiveness and knowledge of individuals). Distinguishing between the two may help explain the inconsistencies in the research literature, for example, differences between the systematic observation studies of Shapson et al. (1980) and teacher reports. These differences may be attributable not to questionable validity of teacher's accounts or inadequacies of systematic observation in capturing subtleties of teaching, but rather to the differences between narrow and broad perspectives on the same thing. The interesting point to arise out of the present study is that here the two perspectives are in agreement.

We found, particularly in the case studies and end-of-year questionnaires, that teachers' experiences of class sizes are connected to their emotional involvement in the job of teaching. It was very clear that some teachers with large classes felt they could not provide the quality of education important for young children, and this upset them. The gap between a vision of what is

appropriate for young children and the realities of teaching a large class may be particularly wide for teachers of the youngest children in school. This theme is taken up more fully in Moriarty, Edmonds, Blatchford, and Martin (2001).

The present results can be seen in terms of the second general approach to research on teaching, that is, research on effective teaching. As Galton et al. (1996) have pointed out, small classes can encourage aspects of teaching that are the same as those identified in research on effective teaching (e.g., immediate feedback, sustained purposeful interactions) linked **[AQ: Do you mean "as linked" (that is, "identified . . . as linked")? yes]** with the promotion of pupil achievement. The connection will not necessarily follow, and small classes will not make a bad teacher better; but small classes seem likely to make it easier for teachers to be effective.

With regard to the third approach to research on teaching—the cognitive approach—the end-of-year questionnaire and case study data indicated that many of the characteristics identified in small classes can be seen as aspects of effective "scaffolding," a term associated with Vygotsky but originally used by Wood and Bruner in the late 1970s **[AQ: Is this meant to be a citation of Wood, Bruner, & Ross in the reference list? If not, I'll delete that source from the list. Do you want to supply another source in the list, either for Bruner alone (not in list) or for Wood and Bruner together? The usual ref is Wood, Bruner and Ross, and to be clear it should be inserted here ie in brackets after '1970s'?]** in considering mother-child interactions (see Wood, 1998). Our data strongly suggest that in a small class a teacher will more easily be able to provide effective scaffolding for her pupils in the form of individual attention, immediacy of feedback, sustained interactions, and flexible and effective questioning techniques. A large class is likely to make the provision of a contingent learning environment very difficult, especially if control becomes an issue and dominates interactions. And as

Meadows points out, and consistent with research on class-size effects (see Blatchford & Mortimore, 1994), scaffolding is most important in the early years of schooling, when it needs to be at its most active and sustained.

Similarly, qualities that mark effective tutoring, according to Wood (1998), can be seen again and again in the case studies of small classes and experienced primary teachers. These qualities, which make up what Wood and Wood (1996) refer to as contingent teaching, include contingency, immediacy, reminders of learning goals, and transfer of responsibility.

Post-Vygotskian approaches are generally pessimistic about classroom learning. Underlying recent articles on scaffolding (e.g., Bliss et al., 1996; Tharp & Gallimore, 1991; and Wood & Wood, 1996) is the learning context of informal, usually one-to-one, interactions with an adult at home. **[AQ: OK? yes]** Tharp and Gallimore (1991) argue that adults assisting children in everyday interactions are more effective and that **[AQ: OK?yes]** schools have much to learn from informal teaching of parents. Bliss, Askew, and Macrae (1996) cite Wood as showing that school interactions are not effective as contingent learning environments because teachers cannot provide the individualization of scaffolding needed by all children. The problem is likely to be magnified with a large number of children. In these terms, small classes can help minimize the problem, though school classrooms are still not seen to be ideal for learning.

It may be, though, that there are limits to the applicability of post-Vygotskian approaches, at least as currently expressed, in considering classroom learning. A close reading of case studies of small classes in the present study suggests these studies **[AQ: OK? Or "such studies"? such studies is better]** risk looking at classrooms through the wrong, or at least an unrealistic, lens. Wood and Wood, in fact, acknowledge that "any theory designed to explain how and why individualized instruction works cannot be extended without further theoretical

development to a theory of scaffolding of collaborative or group learning" (1996, p. 12). The case studies reveal a picture of classroom teaching that has distinctive qualities, different from one-to-one tutoring, that will need to be conceptualized in different terms. This suggests that classroom learning involving a number of children does not have be at best a watered-down version of the ideal, that is, one-to-one tutoring. We need a *different* view of effective learning in school contexts and a social pedagogy of classrooms that takes account of the realities of classroom environments, including various numbers of children.

[AQ: Did you want a new paragraph to start here? I ask because there was a tab command embedded in the text. Or should I run in the following with the preceding paragraph?a new para please] The present results can be seen in the context of models of the influences of class size and **[AQ: Did you mean "on"? I don't think you are treating pupil achievement as an influence but more as a result. Yes 'on' is better]** pupil achievement. In this article we have looked at relationships between class size and one form of classroom process, that is, teaching. In future articles it may be possible to provide a fuller model, with linkages between class size, processes, and outcomes. But the purpose of this article was deliberately to explore just the first part of the model.

These results raise questions about traditional ways of viewing teaching effects. As we have argued in this article, classroom processes are often viewed in terms of a direct model, where teachers' actions toward pupils are seen as having effects on pupils' learning or attainments. The present study, however, supports a contextual approach, within which class-size differences have effects on both teachers and pupils. Bearing this contextual approach in mind, it is instructive to look at studies that downplay the importance of class-size differences. Rivkin, Hanushek, and Kain (2000) have recently argued that teaching quality and training are

important but that class size is not. The rather convenient conclusion that follows from this argument is to blame the teacher. But the present study suggests that it is not entirely the teacher's responsibility; contextual factors cannot be ignored. Class size is one environmental contextual factor that will influence teachers and pupils in a number of ways. It is not, as Rivkin et al. imply, a case of either supporting teacher training to improve teacher quality or reducing class sizes. We need to consider both together and ways of making the most of the opportunities of smaller classes.

One way of maximizing potential advantages of smaller classes would be through initial teacher training and professional development. Galton et al. (1996) point out that currently there does not appear to be much preparation in initial teacher training concerning ways of adapting to class size. They recommend allowing student teachers opportunities with smaller classes, for example with half the class, while the teacher takes the other half in another location. This would enable the student teacher to gain experience of teaching the whole class and also to experience the kind of sustained and focused teaching that Galton and many others recommend. **[AQ: OK? yes]**

Although small classes seem to offer opportunities to be more effective, a teacher can deal with class size inappropriately. Evertson and Randolph (1989) have offered a fascinating account of observations in STAR small classes, in which teachers' adherence to established methods of reading and math instruction may have minimized differences between processes in small and regular classes. They describe a teacher in a small class—of fewer than 20—teaching to one group of 10 while the other children did **[AQ: OK?yes]** individual work, and then later switching to the other group to teach exactly the same material. They attribute this unnecessary repetition to an inflexible assumption that this size of group works best. Similarly, our case

studies indicated that some teachers varied in how successfully they adapted to the classroom contextual feature of class size. In particular, our case studies indicated that one feature of smaller classes—a tendency to allow immediate feedback—could lead to frequent interruptions and therefore needs to be watched carefully by teachers. It seems absurd to argue that small classes lead to more interruptions. Rather, there is a potential for interruptions when children expect to have their demands met instantly, a situation that can develop in a small class.

On the other hand, we have documented examples of teachers in small classes doing a marvellous job, with observers coming away inspired by the quality of teaching and children's educational experiences. In these classrooms teachers were taking full advantage of the extra opportunities for individual, focused, and sustained attention provided by small classes. The benefits of having fewer children will not flow in any natural **[AQ: How about "inevitable"?yes, better]** way—teachers have to work just as hard to manage learning effectively.

References

Arends, R. I. (1994). *Learning to teach* (3rd Ed.). New York: McGraw-Hill.

Barker, R. (1968). *Ecological psychology*. Stanford, CA: Stanford University Press.

Bassey, M. (1996). Inspection, unlike research, is disinterested! *Research Intelligence, 55,* 30–32.

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.

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.

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,* 283–302.

Blatchford, P., Burke, J., Farquhar, C., Plewis, I., & Tizard, B. (1987). An observational study of children's behaviour at infant school. *Research Papers in Education, 2*(1), 47–62.

Blatchford, P., Goldstein, H., Martin, C., & Browne, W. (in press). A study of class size effects in English school reception year classes. *British Educational Research Journal.*

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, 29,* 691–710.

Blatchford, P., & Martin, C. (1998). The effects of class size on classroom processes: "It's a bit like a treadmill—working hard and getting nowhere fast!" *British Journal of Educational Studies, 46*(2), 118–137.

Blatchford P., & Mortimore, P. (1994). The issue of class size for young children in schools: What can we learn from research? *Oxford Review of Education, 20*(4), 411–428.

Bliss, J., Askew, M., & Macrae, S. (1996). Effective teaching and learning: Scaffolding revisited. *Oxford Review of Education, 22*(1), 37–61.

Bronfenbrenner, U. (1979). *The ecology of human development.* Cambridge, MA: Harvard University Press.

Brophy, J., & Good, T. (1986). Teacher behavior and student achievement. In M. Wittrock, (Ed.), *Handbook of research on teaching* (pp. 328–375). New York: Macmillan.

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

Creemers, **[AQ: Author initials?]** (1994). *The effective classroom.* London: Cassell.

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

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.

Evertson, C. M., Sanford, J. P., & Emmer, E. T. (1981). Effects of class heterogeneity in junior high school. *American Educational Research Journal, 18*(2), 219–232.

Finn, J. D., & Achilles, C. M. (1999). Tennessee's class size study: Findings, implications, misconceptions. *Educational Evaluation and Policy Analysis, 21*(2), 97–109.

Galton, M., Hargreaves, L., Comber, C., Wall, D., with Pell, A. (1999). *Inside the primary classroom: 20 years on.* London and New York: Routledge. **[AQ: This source is not cited in the text, though "Galton, Harvgreaves & Pell" is cited with the year 1999—you will have seen my note about that earlier. Was that citation meant to refer to**

this source? If not, I'll delete this source. See text – this should be in]

Galton, M., Hargreaves, L., & Pell, A. (1996). *Class size, teaching, and pupil achievement*. Report for National Union of Teachers, Leicester University.

Glass, G., Cahen, L., Smith, M. L., & Filby, N. (1982). *School class size.* Beverley Hills, CA: Sage.

Goldstein, P., & Blatchford, P. (1998). Class size and educational achievement: A review of methodology with particular reference to study design. *British Educational Research Journal, 24*(3), 255–268.

Grissmer, D. (1999). Class size effects: Assessing the evidence, its policy implications, and future research agenda. *Educational Evaluation and Policy Analysis, 21*(2), 231–248.

Hanushek, E. A. (1999). Some findings from an independent investigation of the Tennessee STAR experiment and from other investigations of class size effects. *Educational Evaluation and Policy Analysis, 21*(2), 143–163.

Harder, H. (1990). A critical look at reduced class size. *Contemporary Education, 62*(1), 28–30.

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.

Meadows, S. (1996). *Parenting behaviour and children's cognitive development*. Hove, East Sussex, UK: Psychology 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. **[AQ: In text citation, the last author is spelled "Earle."see text, this should be 'Ehrle]**

Moriarty, V., Edmonds, S., Blatchford, P., and Martin, C. (2001). Teaching young children:

Perceived satisfaction and stress. *Educational Research, 43*(1), 33–46.

Mortimore, P., & Blatchford, P. (1993). The issue of class size. In *National Commission on Education Briefings* (pp. 167–182). London: Heinemann.

Nye, B., Hedges, L.V., & Konstantopoulos, S. (2000). The effects of small classes on academic achievement: The results of the Tennessee class size experiment. *American Educational Research Journal, 37*(1), 123–151.

Pate-Bain, H., Achilles, C. M., Boyd-Zaharias, J., & McKenna, B. (1992). Class size makes a difference. *Phi Delta Kappan, 74*(3), 253–256.

Pellegrini, A., & Blatchford, P. (2000). *Children's interactions at school: Peers and teachers.* London: Edward Arnold.

Prais, S. J. (1996). Class size and learning: The Tennessee experiment—what follows? *Oxford Review of Education, 22,* 399–414.

Rice, J. K. (1999). The impact of class size on instructional strategies and the use of time in high school mathematics and science courses. *Educational Evaluation and Policy Analysis, 21*(2), 215–229.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2000). *Teachers, schools, and achievement.* Paper presented at **[AQ: OK? At a particular meeting, conference, or other event?sorry this is all we have on the actual paper]** Amherst College, University of Rochester.

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,* 144–152. **[AQ: Please supply issue number. Have checked but there doesn't appear to be one]**

Shulman, L. S. (1986). Paradigms and research programs: The study of teaching: A contemporary perspective. In M. C. Wittrock (Ed.), *Handbook of Research on Teaching*

(3rd Ed., pp. 3–36). New York: Macmillan.

Tharp, R., & Gallimore, R. (1991). A theory of teaching as assisted performance. In Light, P., Sheldon, S., & Woodhead, M. (Eds.), *Learning to Think* (pp. 42–61). London: Routledge.

Tizard, B., Blatchford, P., Burke, J., Farquhar, C., & Plewis, I. (1988). *Young children at school in the inner city.* Hove: LEA.

Turner, C. M. (1990). Prime time: A reflection. *Contemporary Education, 62*(1), 24–27.

Wood, D. J., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17*(2), 89–100. **[AQ: This source not cited in text. See text. Should be here]**

Wood, D. (1998). *How children think and learn* (2nd Ed.). Oxford: Blackwell.

Wood, D., & Wood, H. (1996). Vygotsky, tutoring, and learning. *Oxford Review of Education, 22*(1), 5–16.