

Does Small Really Make A Difference? An update

**A review of the literature on
the effects of class size on
teaching practice and pupils'
behaviour and attainment**

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Executive Summary

The Scottish Executive Education Department (SEED) commissioned the Scottish Council for Research in Education (SCRE) to review the literature on the effects of class size on teaching practices and pupils' attainment, attitudes and behaviour. The original review was conducted between September and November 2001. It included UK and international literature, mainly from the USA, published between 1980 and 2000. In 2006, the review was updated to include research published between 2001 and 2006. Evidence from reviews, correlational studies, meta-analyses, experimental and multi-method studies is presented here. A significant study of the effect of class size in primary schools in England is included, but no relevant Scottish studies emerged.

Aims and findings

A summary of the questions addressed during both reviews and the main findings are presented below. A far from straightforward picture emerged in 2001 as much of the existing evidence was at best confusing, sometimes even contradictory. By 2006, although the class size debate had tended to polarise researchers, more of a consensus was emerging. Many researchers think that the evidence shows that a significant reduction in class size will improve pupil attainment, especially for children in the early years of schooling. Others suggest that such gains are prohibitively expensive and that alternative methods of raising attainment would be more cost-effective. In summary:

How good is the evidence?

- The evidence is extensive and some of it is very good. The Student Teacher Achievement Ratio (STAR) project in Tennessee is often regarded as the 'gold standard' of class size research. However, it has to be accepted that no research is perfect and questions remain about the research designs and the statistical analyses employed, and also the generalisability of the findings.
- Benefits in most studies were measured by a narrow range of outcome measures, ie progress in reading and mathematics. In addition, some scores from different tests across different classes and year groups were 'pooled'. Few had baseline assessments for the participating children and attrition rates for follow-up studies were often high.
- A large-scale study of the effects of class size in England – the Class Size and Pupil Adult Ratio (CSPAR) project – has been undertaken by the London University Institute of Education. It aimed to overcome the difficulties encountered by other researchers by employing multiple methods and multi-level modelling. Members of the same team also completed an Economic and Social Science funded project – The Primary School Grouping Project – with the University of Brighton.

- It should also be noted that there were no relevant studies relating to the effects of class size reduction on attainment in Scottish schools.

Does class size impact on pupil attainment?

- The evidence from studies conducted in the USA, in particular the large state-funded experiments, claim to have demonstrated an association between class size and pupil achievement, ie as class sizes reduce, pupil attainment rises.
- There is some disagreement amongst researchers about how much classes must be reduced in size to achieve significant improvements in pupil performance: some argue that benefits are most marked in classes of fewer than 15 pupils (Achilles *et al*, 1993); while others (Glass & Smith, 1978) suggest that the major benefits from reduced class size are obtained as size is reduced below 20 pupils.
- Evidence from the CSPAR study of primary schools in England broadly confirms American results, reporting a decreasing score in pupils' literacy with increasing class size, and little apparent change in performance between class sizes of about 18 and 25, with low achievers benefiting the most.
- In both the USA and England the evidence of lasting benefits seems to be weaker than for initial effects. Evidence from the STAR project in Tennessee claims that the benefits gained from being in smaller classes are still evident in later grades. This is not confirmed by English evidence, which found no evidence of an effect when pupils (aged 10–11 years) were assessed at Key Stage 2 (KS2).
- Some evidence from secondary schools in England shows that pupil attainment is higher in larger classes, but this is probably due to teachers assigning more able pupils to larger 'sets'. Other English evidence claims that smaller classes are associated with higher GCSE results, especially in GCSE Science.

Which stages of education benefit most from class size reduction?

- Evidence from the STAR project in Tennessee showed that the benefits of class size reduction are most marked in the early stages of a child's schooling, ie kindergarten through Grade 3 (5–8 years), and with children from minority ethnic backgrounds. The impact on younger and less able children is confirmed by English evidence.
- English evidence also shows that there is a possible 'disruption effect', in which benefits are lost, when children who have experienced small classes in Reception class move to larger classes in Year 1.
- At the secondary stage evidence is inconclusive because of the tendency for schools in Britain to teach less able children in smaller sets. However, a study of General Certificate of Secondary Education (GCSE) examination

results in England reported higher results from larger sets, composed mainly of more able pupils.

How does class size manipulation impact on teaching practices?

- Teachers in various studies in the USA and England believe that class size affects their teaching practices, in particular the way they organise within-class groups and the amount of time they can devote to individual children.
- Project STAR in Tennessee was not set up in a way that collected observational information about teaching practices.
- Better evidence about teachers' actual behaviour emerged from the various stages of the CSPAR project and The Primary School Grouping project in England. These projects report that:
 - a) The number of within-class groups increased with the increasing size of the class: small classes (under 20 pupils) had an average of just 3 groups; in larger classes it approached 6 groups.
 - b) Overall, the most common group size experienced by pupils was of 4–6 pupils. However, in classes of over 25, pupils were more likely to be in larger groups of 7–10, while in class sizes under 25 there was more likelihood of a pupil being in very large groups of 11 or over, including being taught as a whole class. There is also a tendency for the youngest children (ie the Reception class) to be taught in fewer, larger groups.
 - c) More whole class teaching took place in small classes.
 - d) Teachers believed that being in groups of 7–10 pupils had a negative educational effect in terms of the quality of teaching, pupils' concentration and their contribution to group work.
- Researchers in both the USA and the UK suggest that there is a difference between the way teachers indicate they would organise their classes if class sizes were reduced and their actual classroom practices. Researchers in both countries suggest that teachers need to modify their classroom practices, particularly the number and size of within-class groupings, to take account of different sized classes. Further training may be required.
- Teachers in numerous studies in the USA and England report that smaller classes are easier to manage and that they are less concerned about discipline than in larger classes.
- There was no evidence to show that Teaching Assistants in England had had an impact on pupils' attainment. It is suggested that they have an indirect effect by allowing teachers to focus more on teaching. This is broadly supported by Scottish evidence (Wilson & Davidson, 2006) which notes that the majority of local authority and headteacher respondents reported that additional support staff funded by the Teachers' Agreement had made an impression on teachers' administrative workload.

What effect does class size reduction have on pupils' learning?

- Teachers in USA and England claim that smaller classes afford them more opportunities to get to know children and devote more time to pupils' individual learning needs.
- Evidence from the USA suggests that small classes increase students' engagement with learning and reduce anti-social behaviour. The findings on prosocial behaviour (ie students assisting, supporting and caring for each other) are less complete.
- Evidence from the CSPAR project in England found that pupils in small Reception classes were more likely to be on-task than those in larger classes, but against expectations they found that class size did not affect pupils' on-task behaviour or peer interactions in Year 6 (10–11 year olds).
- Observational studies of within-class groupings show little evidence of collaborative learning taking place amongst pupils: most appear to learn individually while sitting within groups.
- Pupils usually have more physical space within which to learn in classes composed of fewer pupils. However, little attention has been devoted to the impact of the classroom environment, space and furniture on pupils' learning in the research literature.

What is the impact of class size reduction on pupils' behaviour, attendance and motivation?

- Teachers in a number of studies of smaller classes in the USA report that small classes are quieter and more easily managed than larger ones. Therefore, potential discipline problems are prevented from arising.
- In the STAR project, direct evidence of pupils' behaviour from their disciplinary records was absent. Most studies resort to proxy measures of behaviour, such as exclusion, 'drop out' and attendance.
- Researchers in the STAR project, however, claim that fewer pupils who experienced smaller classes in the early years of schooling subsequently 'dropped out' of school at Grade 10 (16 years). In addition fewer are excluded and their average number of days absence was less than for those who have not experienced smaller classes.
- Evidence from England shows that pupils in small primary classes have a more interactive relationship with their teacher, are more often the focus of the teachers' attention, but have fewer classmates from whom they can learn.
- There is some European evidence to show that the number of incidents of pupil pushing, crowding and other aggressive behaviour increases in larger classes within larger schools.
- Overall, research suggests a complex inter-relationship between pupil behaviour and their attitudes towards learning and their attainment. Class size may be one influential factor but the evidence is inconclusive.

How much does it cost to reduce classes?

- There is a continuing interest amongst policy-makers, practitioners and parents in many countries in class size reduction.
- In 2006, the maximum class size in Scotland is 30 for a single stage class P1–P3; 33 for a single stage class P4–7; and 25 for a composite stage class (Scottish Executive, 2006).
- Over the past decade average class sizes in Scottish primary schools have been falling, as has the number of primary schools and pupils.
- The Scottish School Census 2005 shows that the average primary school class size was 23.6 pupils (compared to 23.9 in 2004). Composite classes had an average of 19.9 pupils (compared to 20.2 in 2004).
- The average primary school class in the UK was 26.0 pupils, compared to an average of 21.9 in the countries in the Organisation for Economic Co-operation and Development (OECD, 2004): class size ranged across the OECD from 15.6 in Luxembourg to 41.5 in Egypt.
- Although researchers disagree about the outcomes of class size reduction, there appears to be a consensus that reducing class size is expensive. Some suggest that it is the most expensive educational policy option that can be chosen.
- Some other countries, particularly the USA, have allocated billions of dollars to class size reduction.
- Economists seem to be divided in their opinions as to whether a policy of class size reduction is a sensible use of resources and continue to debate whether the marginal benefits of class size reduction outweigh the marginal costs. In practice this is difficult to determine.
- Some economists, such as Hanushek (1996, 1998, 2003, 2004) argue that increasing resource inputs (including reducing class size) has not led to improved attainment in the USA. Others (eg Dustmann *et al*, 2003; Krueger, 2003) point out that smaller classes affect staying-on rates and lifetime earnings.

Finally in conclusion, although most researchers agree that there is a relationship between small classes, especially in the early years, and pupil attainment, many accept that this is only part of a complex picture. Classroom processes, the quality of teaching, the prior attainment of the child and parental background, are all likely to contribute. Other researchers, while accepting that class sizes should be reduced, claim that there are more cost-effective ways of providing young children with individualised attention when they most need it. Class size reduction is attractive because it maintains the existing structure of schools while simply adding more resources. This may be a necessary step, but there is no evidence that in the long-term it will be sufficient to raise the attainment of all pupils.

1: Introduction

1.1 Background to the Review

The impact of class size on pupils' attainment, attitudes and motivation, and its concurrent relationship to teaching practices and teachers' workload and motivation, is probably the most written about, but least researched, topic in educational research. The continuing debate on the topic is a reflection not only of the perceived centrality of the issue to raising pupil attainment but also to the lack of a consensus to emerge from the research findings. What exactly does the research evidence tell us? How extensive and reliable is that evidence? And can the findings be applied to Scottish education? These were the themes that ran throughout the short review of published literature which the Scottish Executive Education Department (SEED) asked the Scottish Council for Research in Education to undertake as part of its service level agreement in 2001. It is a sign that interest amongst policy makers and practitioners regarding the effects of class size on both pupils and teachers has not diminished in the intervening years that this update to the original review was commissioned by the Scottish Executive in 2006. The updated review has been prepared by the SCRE Centre in the University of Glasgow, and is intended as a resource primarily for use by the Class Sizes, Staffing and Resources Working Group. The Working Group, which is composed of representatives from SEED, CoSLA, GTCS, teachers' associations, the SPTC and HMIe, was established in June 2005 and has been considering the impact of class size and the use of resources to maximise attainment.

1.2 Aims and scope

The overall aim of the original review was to report on literature published during the past 20 years (ie 1981–2001) in the UK and abroad, particularly that emanating from the USA, related to class size and its impact on a range of pedagogical and related factors. The review provided an overview of findings from disparate studies which had focused on pupil attainment, teaching styles, behaviour management, pupil attendance and motivation, with a view to identifying the optimum class size for various purposes and the stages at which class size manipulation can provide the greatest benefits for pupils and teachers.

Seven research questions were applied to the literature. These are:

1. Which class sizes provide the greatest benefits and what are the problems presented by other class sizes?
2. Which stages of education benefit most from different class sizes?
3. What is the impact of class size on the teaching process?
4. What is the impact of class size on pupils' learning?
5. What is the impact of class size on pupils' attainment?
6. What is the impact of class size on pupils' behaviour?

7. What is the impact of class size on characteristics such as attendance and pupil motivation?

In addition, where it was available, data relating to the financial consequences of reducing class sizes was explored.

The updating process replicated the same research aims and questions as were addressed in 2001. It focuses on key texts published in English during the past five years (ie 2001–2006). Research-based literature from the UK, Europe, USA, Canada, New Zealand and Australia was sought to ensure that the Working Group was apprised of significant additions to the body of evidence on class size effects, which may be relevant to its deliberations. In particular, the Working Group was interested in information about any additional follow-up research with young people who had been involved in the original class size experiment in the Tennessee Student Teacher Achievement Ratio (STAR) programme (Finn & Achilles, 1990; Nye *et al*, 1992), and also in more recent research on pupil adult ratios undertaken by the London Institute of Education (Blatchford *et al*, 2004).

1.3 Definitions

Much of the research into class size reported in the original review had been conducted by researchers in schools in the USA, and though this remains broadly true of the totality of articles on this topic, changes have occurred in the literature published during the past five years. There are still numerous references to the STAR project (STAR itself is mentioned nine times in the search and Finn, one of the main researchers, eight times) but the published output from the Institute of Education Class Size and Pupil Adult Ratios (CSPAR) project is now very impressive (12 papers published by Blatchford between 2001 and 2005). There is, however, still a need to define terms carefully when considering evidence from different education systems where terms may be defined in different ways from those commonly used in the United Kingdom. In addition the organisational format may have no exact British equivalent. While nursery, primary and secondary schools are standard stages within all Scottish education authorities, this review attempts to incorporate findings from kindergarten (USA) and reception classes (England and Wales) and also infant, first, junior, middle and secondary schools in both the state and the independent sectors (England and Wales) and elementary, junior and senior high schools (USA) without conflating the evidence. These differences may be more than semantic and reflect age and curricular distinctions unique to particular educational systems.

To aid interpretation, the following definitions of class size have been adopted throughout this report. These have been adapted from the report prepared by researchers at Nottingham University for the National Association of Headteachers (Day *et al*, 1996), and should help the reader judge the strength of the evidence against various meanings of the term ‘class size’.

Pupil-teacher ratio (PTR) is a ratio which is determined by dividing the full-time equivalent number of pupils on a school roll by the full-time equivalent number of qualified teaching staff, including the headteacher, but excluding short-term cover. These ratios must be used with caution because they include teacher non-contact time which may greatly reduce the ratio while not giving an accurate reflection of the teaching unit experienced by pupils and teachers.

Pupil-adult ratio (PAR) is the ratio of full-time equivalent number of pupils on a school roll to the full-time equivalent number of adults in the school. These ratios may be extremely misleading as they include not only teacher non-contact time but also non-teaching staff such as classroom assistants/teachers' aides. (It is important here to note that the number of classroom assistants in Scottish schools has increased dramatically in the intervening years as a consequence of the Classroom Assistants Initiative (Wilson *et al*, 2002) and with funding from the Teachers' Agreement (SEED, 2001; Wilson & Davidson, 2006)

Class size (CS) is the total number of pupils allocated to a teacher for all or some of his/her teaching timetable. The average class size in a school is the total number of children in the school divided by the number of classes.

Pupil experienced teaching unit (PETU) is the size of unit in which pupils experience learning during their timetabled day. This will rarely equal the average class size for the school or the pupil-teacher ratio and may also vary as the day/week progresses with use of streaming, setting and within class groupings and the presence of other adults in the classroom. (Some researchers suggest that this is the most important ratio as it reflects learning and teaching as experienced by pupils and teachers.)

1.4 Search methods

Many policy-makers now seek to ground their decisions on an evidential-base but what constitutes high quality evidence is far from obvious. As in previous SCRE reviews (Harlen & Malcolm, 1997), we aim here to utilise the concept of 'best evidence synthesis' which Slavin (1987 and 1990) borrowed from the law profession and applied to reviewing educational research. It requires the reviewer to identify criteria for determining good quality research and to place more emphasis on those studies which match the criteria than those which have identifiable shortcomings.

It should be noted that other researchers have developed different approaches to identifying high quality evidence. For example, the Campbell Collaboration (Boruch *et al*, 1999) sets a premium on evidence generated from randomised field trials (RFTs). As will become apparent below, few of the studies published on the impact of class size can meet this strict criterion. We have, therefore, not excluded a number of small-scale studies, such as those undertaken by Galton *et al* (1996) on the effect of class size on teachers' practices which, while not meeting the quality criterion, do offer insights into an under-researched aspect

of the topic. In these cases, we indicate the scale of the study and the dangers inherent in generalising from such small samples.

Of greater relevance to educational policy, the Department for Education and Skills has encouraged the development of systematic literature reviews in education by funding the Evidence for Policy and Practice Information and Coordinating Centre (EPPI Centre) within the London University Institute of Education. The Centre has developed a set of '*Review Guidelines*' (EPPI, 2001) to help reviewers identify good evidence by working in review groups which systematically identify, map and assess key documents. Significantly, the Centre recommends that the process will take one researcher-year and should include users of the research as members of the review group.

It is against this background that the original and updated reviews should be placed and their limitations made explicit. First, both reviews were undertaken within very short timescales which can hardly do justice to the large volume of published work. In 2001 over a thousand items were identified using a combination of 'class size' and 'teacher-pupil/student ratio' key words, and an additional 191 articles in 2006. Second, although criteria were established (the search strategy is described in greater detail in Appendix A1 and A2), adherence to strict criteria for best evidence was not always possible. For example, in 2001 there was a paucity of well-planned experimental studies of class size in the UK, and the application of strict criteria by the reviewer would have left the review heavily dependent upon evidence from the USA. Since then although there has been an increase in the publication of UK evidence on the effects of class size (eg Blatchford *et al*, 2004), it has not tried to replicate the large-scale experimental manipulation of class size undertaken by Project STAR in Tennessee (Finn & Achilles, 1990). In addition, some studies simply do not provide sufficient information upon which to judge the quality of evidence. Many claim to have re-analysed data from other sources, without necessarily describing how the original data was generated. Other researchers report that they have 'pooled' achievement data across a number of different school years and analysed it as one data set. The standardisation process may have suppressed variations present in the original findings.

The criteria for inclusion of studies in the 2001 review were as follows:

- Studies concerned primarily with primary and secondary school-aged pupils.
- Studies concerned with class size (using various definitions), but not school size.
- Reports of well-designed experimental interventions into class size.
- Reports of analysis and reanalysis of statistical evidence relating to class size.
- Wherever possible preference was given to reports which had been published in peer-reviewed journals. Exceptions were made for conference papers which were relevant but where evidence of peer reviewing was

absent. Preference was given to first hand accounts rather than reporting the numerous reviews of existing literature.

- All studies reported were conducted during the twenty years from 1980 to 2000, with the exception of earlier work (eg by Glass & Smith (1978)) which is of enduring significance.

The same inclusion criteria were applied to the updated review in 2006, with the exception of the date of publication. This was limited to research published between 2001 and 2006. It was also made explicit that the research should be reported in English and refer to experiences in schools in the UK, Europe, USA, Canada, Australia and New Zealand.

In an attempt to limit the number of articles considered and focus on primary sources in both reviews, all reports in newspapers, the *Times Educational Supplement*, the *Times Higher Educational Supplement*, teachers' professional journals and newsletters have been excluded; so too have Government policy documents. Both reviews come, then, with a 'health warning'. Although they were conducted systematically, it is impossible within the time frame to be confident that errors have not crept in, either by including studies which failed to meet the strict criteria or excluding ones which other researchers may have considered worthy of inclusion.

1.5 Organisation of the review

This review updates the one published in 2001 by adding to it research reported between 2001 and 2006, to produce a report that covers approximately 25 years. It adopts the same structure and presents the evidence according to the research questions agreed with the SEED. It is organised into seven sections of which this introduction is the first and in which we present the aims, research questions, definitions and scope of the search strategy. In Chapter 2 the nature of the evidence arising from previous research reviews, correlational studies, meta-analyses and experimental designs is presented. Chapter 3 discusses the relationship between class size and pupil attainment and considers under which conditions, and with which groups of pupils, these results were achieved. The impact of class size on both teaching practices and pupil behaviour and motivation are themes which have more recently begun to emerge from the class size literature. These are explored respectively in Chapters 4 and 5. Some attempt is made to consider the attitudes of the key stakeholders – teachers, headteachers, parents and school governors – to the class size debate and how, if at all, this affects behaviour within the classroom. Within each of these chapters, the original evidence reported in 2001 is presented, newer evidence is incorporated at the end of each section and the chapter summary is amended to reflect both. In addition, a new chapter on costs has been added as Chapter 6 in responses to increased interest in the cost of educational innovation. The final chapter offers some conclusions which arise from a consideration of the totality of the evidence reported in both reviews, and indicates the possible implications, including costs and benefits for Scottish education.

2: Nature of the Evidence

2.1 Introduction

This section provides an overview of the research evidence on the effects of class size. In 2001 approximately 1000 references were identified in the seven databases searched. (See Appendix A1.) By 2006, an additional 280 articles on the topic of class size were found in the five electronic databases searched. Following the removal of duplicate articles, the number of new items on class size published between 2001 and 2006 was reduced to 191. (The inclusion criteria used are explained in more detail in Appendix A2.) The evidence from these, plus four articles suggested by the Working Group and one published after the initial search, were incorporated into this review to cast further light on the topic, and amendments were made, where necessary, to the original conclusions. The results of both searches were categorised into four main types: reviews, correlation studies, meta-analyses and experimental studies. A new category, multiple methods, was added in 2006. In subsequent sections the nature and limitations of each are examined in order to establish the credibility of the source before the outcomes are explored in more detail.

2.2 Reviews

Previous reviewers of class size data have tended to adopt a three-fold categorisation of the evidence. For example, the internal briefing paper produced for the Scottish Office Education Department by Semple (Semple, undated) divides the research into correlational studies, meta-analyses and experimental studies. These remain useful categories. However, given the number of reviews of research identified in this current search, some of which use the ‘best evidence’ approach described in Section 1 above, we suggest that reviews be considered as an additional and discrete category of evidence. Burstall (1979), for example, points out that the lack of a consensus about what the evidence means stands in ‘sharp contrast with the deeply held conviction of teachers and parents that smaller classes must inevitably bring about an improvement in the quality of life in the classroom, with consequent beneficial effects on children’s social, emotional and intellectual development’.

Much of the research identified by reviewers was conducted in the USA, with the state of Tennessee’s Student Teacher Achievement Ratio (STAR) Programme being held up by many as the ‘gold standard’ for class size research. There is, however, often a note of exasperation implicit in some of the reviewers’ choice of title. A policy paper (US Department of Education, 1998) asks: ‘Reducing Class Size: What do we know? – a title also chosen by Pritchard (1999). Krueger and Hanushek (2000) allude to the ‘Class Size Policy Debate’; while Finn (1998 and undated) asks ‘What does research tell us?’ and ‘What is known? What is next?’ All of the above were written in an American policy context of a decentralised education system in which much of the responsibility and authority for the organisation and delivery of public (ie state) education lies with locally elected school boards.

In a British context, but still largely dependent upon American evidence, four reviews are of interest. First, the National Association of Headteachers in England commissioned the University of Nottingham School of Education (Day *et al*, 1996) to survey the literature related to class size and the quality of teaching and learning. A team led by Professor Christopher Day (Day *et al*, 1996) presents the evidence against a background which included rising class sizes in England and Wales (from an average of 26.8 to 27.3 in English primary schools between 1991 and 1995) and a high number of teacher vacancies, especially in London and the South East of England (DfES, 2004). This compared with an average class size of 24.7 and 24.7 respectively in Scotland over the equivalent period. In addition, a report from OFSTED (1995) suggests that the class size debate can be uncoupled from attempts to improve the quality of compulsory age schooling.

OFSTED's findings, based upon the large number of inspection reports carried out in English schools, suggests that:

- Class size should not be a significant factor in the debate on the quality of pupils' learning because government is not in a position to increase funding to the point at which the reduction in the number of pupils in a class will generate significant gains.
- Class size is only one factor in the government's discussion of how schools need to improve the efficiency with which they manage present levels of funding. The key to school improvement is not through reducing class sizes, but through better teaching methods and the quality of leadership in schools.
- Assessments of the quality of education are to be based on pupils' development in the 'basics' and are to be measured via simple testing and assessment schemes and school inspections which will allow for comparisons to be made between schools and local education authorities (Day *et al*, 1996, p.8).

This stands in contrast to the Scottish Executive's promise in *Making it work together* [1999] to reduce class size in P1, P2 and P3 to 30 or less by August 2001, a promise that was repeated in 2001 in *A Programme for Government* (Scottish Executive, 2001). Reducing class size and employing more teachers and other staff to support learning in Scottish schools were identified as priorities in *Ambitious, Excellent Schools: Our Agenda for Action* (Scottish Executive, 2004a) and most of the additional resources were to be deployed in line with the promises made in the Partnership Agreement to reduce class size to a maximum of 20 in S1 and S2 for Maths and English and 25 in P1, and increasing the number of specialists working across the boundary between secondary and primary (Scottish Labour Party and Scottish Liberal Democrats, 2003; Scottish Executive, 2004b).

The second significant review of published literature, compiled by the same team and which should be read in conjunction with the NAHT review, is an annotated bibliography (Watling, 1996). This is accessible from the University

of Nottingham School of Education website. The researchers identified over 1500 references to papers, articles and books on class size research, of which almost 200 have been annotated. It should however, be noted that the criteria for inclusion are not specified.

Perhaps of greater significance than the first two reviews because it is cited by so many other researchers is the review prepared by Blatchford and Mortimer (1994) from London University Institute of Education. Like other reviewers, Blatchford and Mortimer summarise the evidence from correlational, meta-analysis and experimental studies. They reflect on the apparent inability of research to verify the common sense assumption of enormous consequence that smaller class sizes in schools will lead to educational benefits for pupils. We shall return to commonly held perceptions in Section 4. The researchers note the long-running disagreement about the possible impact of class size; the paucity of longitudinal studies (with rare exceptions such as STAR in Tennessee and Prime Time in Indiana), the different ways in which available evidence is interpreted and the enormous resource implications for policy-makers and school administrators of manipulating class size.

‘Probably all of us would take the view that – other things being equal – children are more likely to receive a better quality of education in small classes’ (Blatchford & Mortimer, 1994, p. 412) is how they put it. Yet they have to conclude that at best the evidence is inconclusive, at worst contradictory.

By 2006, further reviews of the research evidence had been published (eg Finn *et al*, 2003; Armstrong & Bitter, 2002; Blatchford *et al* 2002a; McCollow, 2002; O’Halloran, 2002; Rutter & Maughan, 2002). Of these Finn *et al* and Blatchford are extremely important because they were prepared by two teams of researchers who, as we shall see in later sections of this report, have moved on the debate about the effects of class size. In general, reviews provide a convenient précis of an extensive and often confusing body of research literature. Unfortunately, some reviewers have inadvertently contributed to the confusion which surrounds the topic by uncritically presenting findings which do not conform to ‘best evidence’ practices and/or by using the evidence to lobby for one case or the other.

2.3 Correlational studies

Although the most frequently quoted correlational studies fall outwith the past twenty-five years (the timescale for this review), it is worth considering what they have contributed to the debate. Correlational studies seek a relationship or association between naturally occurring events, for example between class sizes as they exist without any manipulation and various measures of pupil attainment. Often data from existing large-scale monitoring programmes, such as that generated from the Assessment of Performance Unit (APU) is analysed. Some, such as the ORACLE study (Galton & Simon, 1980) were based upon classroom observations.

In Scotland, it might be assumed that results from the Assessment of Achievement Programme (AAP) could have provided information of a possible correlation between class size and attainment. Unfortunately, as Thorpe (1997) explains it is not possible to draw firm conclusions on the impact of class size on AAP tests. Although the sample size for English (1995) and Science (1996) was sufficiently large (1,950 and 1,200 respectively) only 120 pupils were drawn from classes of between 21 and 25. Confidence was further reduced by the ways in which class size information was collected from schools: some headteachers provided information; while in other cases information was extracted from class lists or schools were telephoned to confirm class sizes. Cluster sampling further reduced confidence, and it was impossible to differentiate between pupils who were in different forms of composite classes.

Thorpe suggests three ways in which these difficulties inherent in AAP could be addressed: by increasing the size of the sample, increasing the confidence of data provided by headteachers or matching schools so that differences due to class size in Scottish primary schools which are very similar in other ways might be detected. This clearly has resource implications for the Scottish Executive which has now revised the way in which the successor to AAP is administered since the original review was published.

Correlational studies identify associations, but rarely are these sufficient to explain events. Unfortunately, they have also produced findings which are counter-intuitive and researchers suggest that a gap has emerged between professional judgement, on the one hand, and research evidence, on the other (Rutter & Maughan, 2002; Blatchford, 2003). Earlier studies (Morris, 1959; Wiseman, 1967) found that children in larger classes tended to do better than those in smaller ones even when some attempt was made to control for other variables such as parental occupation, school size and length of schooling. And Galton and Simon (1980) were forced to conclude that larger classes did not necessarily result in lower rates of progress in basic skills. Other factors, such as teachers, their style of teaching and the distribution of pupils, may very well come into play in explaining the findings. In later sections we shall see that there is a tendency in many secondary schools to teach more able children, whom one would expect to achieve higher results, in larger classes.

2.4 Meta-analyses

What they believed to be the confusing and inconclusive nature of the published literature on class size led researchers to the develop meta-analyses. Glass and Smith (1978, 1982) were particularly forthright in their criticism, arguing that previous research seemed haphazard, narrative and discursive, lacking quantitative rigor and afraid to generalise. Where quantitative methods had been applied, they lacked statistical significance, used crude classifications of class size and failed to integrate results to provide an answer to the question: 'What is the ideal class size?' To overcome these difficulties, meta-analysis was developed.

In the most famous, but now dated, study to utilise this method, Glass and Smith collected information from 77 previous studies of class size, coded information using 25 specific items and analysed it using a regression analysis. This yielded 725 comparisons based upon 900,000 pupils spanning 70 years of research in a dozen countries. The results are unequivocal. The researchers claim that:

The curve revealed a definite inverse relationship between class-size and pupil learning ... only one factor substantially affected the curve – control for smaller and larger classes. (Glass & Smith, 1978, p.v)

In short, as class size increases, achievement decreases. This relationship remained stable over different subjects, ie reading, mathematics, language and social sciences, and different age ranges from 5 to 19 years. However, significantly, the researchers note that reductions in class size have more beneficial effects at the lower end, ie below 20 pupils per class, whereas differences at the higher end over 25 pupils, have little effect. If correct, this conclusion has serious implications for the current Scottish Executive aim to reduce classes to 25 in P1 by 2007.

Meta-analyses are still undertaken. Lou *et al* (2001) analysed findings from 122 studies involving over 11,000 pupils/students to discover the effect of small group versus individual learning when students learn using computer technology. They conclude that on average small group learning had more positive effects, but admit that the findings on both individual achievement and group task performance was significantly varied.

Despite the apparent certainty offered by meta-analysis, some doubts have been raised about the validity and reliability of the method. Clearly any defects in the original studies would also be reflected in the meta-analysis. Of more serious concern, differences in educational contexts, curricula and values, will have been conflated in the process of analysis. The studies utilised by Glass and Smith were undertaken between 1900 and 1979; over a quarter date from 1910–1919, and many were undertaken in educational systems which cannot be compared with our own. It is, therefore, questionable whether the generalisations derived from this particular meta-analysis can be applied to our own system.

2.5 Experimental studies

The research methods outlined above rely mostly on naturally occurring events, ie they utilise situations as they exist within schools and classes in different countries without manipulating class size or other variables. Under these conditions (it is difficult, some would maintain impossible) to attribute pupil achievement solely to class size isolated from the impact of school, community or wider socio-economic factors. In addition, many of these studies have relied upon a narrow range of standardised tests of reading and mathematics as outcome measures of pupil achievement (Burstall, 1979) and have been

conducted over very short time spans. Experimental class size research attempts to overcome these problems.

The classic experimental model is based upon a controlled intervention accompanied by pre- and post- testing to ascertain pupil performance. The best-known studies of this type are the Indiana Prime Time project (Pate-Bain & Achilles, 1986) and the Tennessee Student Teacher Achievement Ratio (STAR) project (Finn & Achilles, 1990; Nye *et al*, 1992). Both build upon earlier studies (Glass & Smith, 1978) which claimed little gain in achievement could be expected from reducing class size from 40 to 35 or 30 but that substantial reductions, down to 15:1, would be required to yield higher results.

Both projects were extensively funded by state legislatures. In the STAR study, pupils and their teachers were randomly assigned to three types of class size:

- small (13-17 pupils)
- regular (22-25 pupils)
- regular (22-25) plus a full-time teaching aide.

The STAR experiment was unique in terms of the number of pupils involved and the timescale over which it ran. Seven thousand pupils were drawn from 79 schools within 42 school districts in inner city, suburban and rural locations. Researchers charted the progress of this cohort of pupils from when they entered Kindergarten (aged 5) in 1985 through to Grade 3 (aged 8) in 1989. A later study followed them as they progressed to high school (Grade 10) to assess the lasting benefits of being in small classes. The results from these experiments are claimed to be conclusive: small classes of approximately 15 pupils can lead to enhanced performance in reading and mathematics tests in the early years of schooling, especially for disadvantaged pupils.

Since the publication of these earlier findings from the STAR programme, researchers have reanalysed data from the programme to reconsider whether the effects were particularly evident among minorities and low-achieving students (Nye *et al*, 2004; Nye *et al* 2002); whether the benefits were cumulative (Nye *et al*, 2001); and whether the experience of being in a small class affected later high school graduation rates (Finn *et al* 2005). In particular, research published by Finn, either alone or with others (eight references in our search), aims to add to our understanding of the lasting effects of being in small classes, and also addresses the important question: ‘Why do small classes have a positive effect?’

However, many researchers remain unconvinced. Some suggest that the recommended reduction of 15:1 is unrealistic and unachievable in most education systems (Hanushek, 1998, 2004). Most damagingly, Hanushek (1998) points out that there are conditions in the original experiment which contaminate the analysis. Specifically:

- Not all students joined the STAR experiment at same time, as Kindergarten was not mandatory or universal in Tennessee.
- There was a sizable attrition from the experiment and it is likely not to be random (ie higher amongst pupils from lower socio-economic groups).

- Parents, teachers and schools knew they were in an experiment and some parents put pressure on authorities to re-assign their children.
- No baseline assessment measures were used for pupils entering Kindergarten.
- Approximately 6% of students were transferred across treatment groups at the end of the first year of the experiment.
- There was a drift in class sizes from the targets of 15 and 22.

Although the initial researchers (Finn & Achilles, 1990) were aware of these issues, they have not explained how the effects of such problems were taken into account, nor a decade later had they made data generally available to other researchers.

Others, particularly Slavin (1987 and 1990) criticise STAR for its failure to explore within-class grouping and alternative ways of providing individualised attention through collaborative learning and peer tutoring. Even those who accept that the STAR experiment showed that achievement was higher in small classes, do not believe that a ratio of 15:1 by itself causes pupil gains: it is perceived to be a facilitating factor which allows or encourages teachers to change their teaching practices. This issue will be explored in greater detail in Chapter 4 below.

These criticisms of the STAR experiment are serious and, as we shall see in Chapter 6, have influenced the conclusions that economists, such as Hanushek was able to draw.

2.6 Multi-method approach

It was very evident in the 2001 review that much of the research evidence on the effects of class size, from reviews, correlation studies, meta-analyses or experimental approaches, emanated from the USA. By 2006, a major contribution to that body of evidence had been made by a team led by Professor Peter Blatchford at the London Institute of Education: twelve of the new references included in this review were published by that team. Firstly, Blatchford pointed out the limitations inherent in the design of the STAR programme, namely the lack of a zero blind which is usually considered necessary in randomised control trials. All the experimental schools, teachers, pupils and parents knew that they were participating in an experiment, which could affect their behaviour and alter the findings. In addition, no entry level assessments were made of the children when they joined the programme; therefore, it was impossible to measure their progress over time. Blatchford also believes that as the experimental classes tend to be smaller than the common class size experienced in the UK, the applicability of the findings to British schools is necessarily limited (Blatchford *et al*, 1998; Goldstein & Blatchford, 1998). In order to find more relevant evidence, Blatchford designed the Class Size and Pupil Adult Ratio (CSPAR) project with funding from the Department for Education and Skills and a number of LEAs in England. The research design

integrated both quantitative (in this case correlational evidence from a seven-year longitudinal study using standardized assessment tools to measure pupils' progress) and qualitative (classroom observation) methods in the hope of reconciling the inconsistencies and limitations in previous research on this topic. The study, which began in 1996, is an example of a naturalist approach, as opposed to the class size manipulation employed by the STAR programme. Over 10,000 children in already existing classes throughout 15 education authorities were included. Two cohorts of children were followed through their first three years of school, that is Reception class, and Years 1 and 2. As Blatchford *et al* (2002a, b) point out, the study differed from others in:

- Being longitudinal with baseline measures and follow-up of the same pupils over three years of Key Stage 1.
- Using reliable measures of class size, extra staff and adults, and educational outcomes.
- Employing a multi-method approach to data collection of classroom processes, such as teaching interactions and children's behaviour.
- Using sophisticated statistical techniques, including multi-level modeling to capture the complex structure of educational data.
- Building on measures and theory developed in previous research.

A number of forms of data collection were employed by the research team. These included:

- Teacher estimates of their allocation of teaching time using a termly questionnaire, completed by a class teacher in 279 Reception classes, 207 Year 1 and 118 Year 2 classes.
- Systematic observation by researchers of a sub-sample of 18 small classes (20 pupils or under, average 19) and 21 larger (30 pupils and over, average 33).
- Teachers' experience of the effect of class size, from annual end of year questionnaires completed by 151 Reception teachers (Cohort 1), 208 Year 1 (Cohort 1), 130 Year 1 (Cohort 2), 153 Year 2 (Cohort 1); and
- Information from case studies of 24 classes in selected schools, including examples of large (ie 30 pupils and over) large medium (ie 26-19 pupils) small medium (ie 20-25 pupils), and small (ie under 20 pupils) classes.

The size of this study of the effects of class size on Key Stage 1 pupils, and of the follow-up into Key Stage 2 (pupils aged 10–11 years), the comprehensive methods of data collection and analysis employed, and the number of publications from the team to appear in refereed journals are all very impressive. Although there are differences between the education systems in Scotland and England, we think it would be fair to conclude that, collectively, the findings from Blatchford's team are probably more relevant to Scottish schools than any previously published research on class size. As we shall see in later sections, this research has much to contribute not only to our

understanding of the impact of class size on pupils' achievement but also on classroom processes, such as teachers' use of within-class groups, whole class and individualised teaching and pupils' on- and off-task behaviours. Significantly, some of the findings, particularly on pupil behaviour, are not consistent with those reported in the STAR programme (Finn *et al*, 2003) – a point we shall return to later.

2.7 Summary

In this section the nature and extent of the existing published research on the effects of class size was discussed. The main conclusions are that:

- The evidence of the effects of class size is extensive and some of it is very good.
- Approximately 1,000 articles on the effect of class size were found in a search conducted in 2001: an additional 191 in electronic databases plus 5 others were identified in 2006. Findings from both searches have been included in this revised review.
- Studies on the effects of class size on pupil achievement fall mainly within one of four categories: literature reviews, correlational studies, meta-analysis or experimental designs.
- Each type has its strengths and weaknesses in terms of providing a valid and reliable answer to the question: 'What is the impact of class size on pupils' attainment?'
- Evidence from well-designed, longitudinal experimental studies, such as the Student Teacher Achievement Ratio (STAR) programme in Tennessee – often regarded as the 'gold standard' of class size research – are accorded higher credibility than findings from the other three types.
- In 2001 there was a paucity of British evidence, although one major project funded by the Department for Education and Skills (Blatchford *et al*, 2001) was about to report, and none refers specifically to the impact of class size on pupil achievement in Scottish schools.
- Most class size studies have relied on a narrow range of outcome measures, eg attainment on standardised tests of reading and mathematics, to judge pupils' progress.
- Some studies 'pooled' data from different tests across different classes, year groups and schools. Few started with baseline assessments and attrition rates were often high.
- The class size debate has polarised researchers, with some believing that the evidence produced over the past twenty-five years is conclusive (Glass & Smith, 1978; Nye *et al*, 1992; Finn & Achilles, 1990; Goldstein & Blatchford, 1997); others (Slavin, 1990; Galton & Simon, 1980; Galton *et al*, 1996; Bennett, 1996; Hargreaves *et al*, 1998) argue that part of the answer to the conundrum lies in within-class teaching practices.

- The findings from the Institute of London Class Size and Pupil Adult Ratio study, which have been published between 2002 and 2006, were obtained using multiple methods and sophisticated statistical techniques to model the effects of naturally occurring differences in class size and pupil teacher ratios. These are probably the most relevant to our own education system.

3: Class Size and Pupil Attainment

3.1 Introduction

In this section evidence of the impact of class size on pupil attainment is presented. In the 2001 review, most of the research on class size, eg the STAR project, had been undertaken in the USA and funded by state legislatures. Few relevant British studies were identified, and none compared with the American ones in terms of scale and duration of the experiment. By 2006, a significant contribution to the debate had been made by a team led by Professor Peter Blatchford from the London University Institute of Education. Here, the evidence is examined, first, to assess whether it establishes a relationship between class size and pupil achievement and, second, to determine which groups appear to benefit most, if at all, from reductions in class size. Finally, evidence of lasting benefits from experiencing small classes is discussed.

3.2 Does achievement improve in smaller classes?

Identifying the impact of class size on pupil attainment has preoccupied educational researchers in many countries since the early twentieth century. Despite this widespread interest, most studies have been undertaken in the USA, often with state aid. The reasons are not hard to detect: class size research is both difficult and costly to initiate and to sustain. Some also suggest that for reasons of equity, it is unethical and politically unwise to conduct experimental and control studies on children.

Early evidence (Glass & Smith, 1978) concluded that smaller classes can increase pupil performance. Yet as we saw in Chapter 2 above, these findings were not universally accepted. Glass and Smith were accused of comparing uncontrolled with controlled experiments and criticised for combining results from kindergarten to college levels. To overcome these problems, Robinson (1990) reanalysed the studies and confirmed that there are benefits from being taught in smaller classes, especially during children's formative years.

Experimental evidence to corroborate this general conclusion comes primarily from two projects: the Indiana Prime Time project and the Tennessee Student-Teacher Achievement Ratio (STAR) study. Both were state-funded. In 1981 the Indiana General Assembly approved an initial \$300,000 to reduce student-teacher ratios to 14:1 in 24 kindergarten, first and second grade classes around the state. Robert Orr, the State Governor explained the underlying rationale as: 'Children spend their first few school years learning to read, and the rest of their lives reading to learn'. (Pate-Bain & Achilles, 1986, p. 663). The two-year project yielded three important outcomes:

- Students in classes with pupil/teacher ratios of 14:1 scored higher on standardised tests than those in larger classes (ie over 22 students).
- Students in smaller classes had fewer behavioural problems.

- Teachers of smaller classes felt that they themselves were more productive and efficient than they had been when they taught larger groups.

This evidence was accepted as conclusive by the state legislature which in 1984 assigned an additional \$19 million for the reduction of all first-grade classes in the state. Unfortunately insufficient funds were available to achieve the desired ratio of 14:1 but nevertheless, classes were reduced to 18:1.

The Tennessee STAR project is probably the most significant experimental study in terms of its size, scope and the number of citations to it in the research literature. Following a small-scale study of class size manipulation in one Nashville school, Pate-Bain (Nye *et al*, 1992) persuaded the Tennessee state legislature to commit more than \$12 million to a major study of class size in Kindergarten to Grade 3. This project was implemented in 1985 and involved approximately 7,000 children in 79 schools throughout the State in city, suburban and rural areas. Children and teachers were randomly assigned to three types of class:

- small, ie 13 to 17 pupils
- regular, ie one teacher for 22 to 25 students; and
- regular with aide, ie one teacher for 22 to 25 students with a full-time teacher aide.

The results were impressive (Nye *et al*, 1992). In both reading and mathematics pupils in small classes performed significantly better than pupils in regular or regular-with-teaching-aide classes and the benefits of having been taught in smaller classes were still evident at high school level (Pate-Bain *et al*, 1999). On the basis of this evidence, Blatchford and Mortimer (1994) believe that it is incorrect to say that there is no proven connection between class size and attainment. Certainly it was sufficient for other states, such as California, to follow the examples set by Indiana and Tennessee.

By the 1990s similar class manipulation projects were underway in California (Stecher & Bohrnstedt (undated); Wisconsin (Molnar *et al*, 1999), and Florida (Florida Department of Education, 1998). In Canada, the University of Alberta co-operated with the city of Edmonton (Edmonton Public School, 2001) to monitor the impact of small classes in the city's schools.

Although the above projects were of varying sizes, all seem to have been initiated with significant amounts of public funding in an attempt to raise pupils' achievement. For example, the state of California made \$1.5 billion available annually to the Class Size Reduction programme. The overall aim was to reduce class sizes in Kindergarten to Grade 3 from 30 to 20 pupils or less. In 1996 Californian school districts were offered a flat rate of \$650 dollars for each student in a reduced class; an extra \$400 million was spent on additional educational facilities and the teaching workforce for K–Grade 3 was increased by 38%. By 1998 approximately 1.6 million students were being taught in smaller classes and small benefits were beginning to be reported. By Grade 3 the percentage of students whose standard achievement tests scores were above

the 50th national percentile had increased by 2–4 percentage points in reduced classes. The evaluators consider this to be a small but significant gain.

Wisconsin introduced a similar class reduction project – Student Achievement Guarantee in Education (SAGE) in 1996. Thirty schools within 21 school districts joined the programme. These schools were required not only to reduce class sizes in Kindergarten to Grade 3 classes to 15:1, but also to extend their school opening hours, introduce a rigorous curriculum, and demand teacher professional accountability. Post-test results for those in small classes improved by 3 to 7 percentage points. However, in this intervention it is impossible to ascribe the achievement gains solely to reductions in class size as the three other factors may have influenced pupil performance.

Edmonton Public School system spent \$0.5 million on a class reduction programme in 1999. Class sizes in Grade 1 were reduced to 15:1 in ten schools and pupils' reading comprehension and writing abilities were tested. Of the 161 pupils, 22% increased their percentile ranking in the four-month pre- and post-test period. Only 16% had demonstrated word accuracy at the mid-Grade 1 level in January compared to 71% four months later. Similar gains, from 38% to 75% respectively, were recorded for writing and composition.

Closer to home, Dobbelsteen *et al* (2002) report that the 1997 policy of the Dutch government to reduce average class size in primary schools was not well-supported by evidence. The researchers reanalysed a subset of the original survey - PRIMA dataset – that was used to justify the decision. They compare the performances of pupils in Grades 4, 6, and 8 in arithmetic and language in 400 schools. They found that:

- In Grades 4 and 6, class size has an insignificant positive effect on pupil's arithmetic, but an insignificant negative effect on language percentile scores.
- In Grade 8, attainment in arithmetic and language benefits from being in larger classes.

However, if IQ is added as a variable in the analysis, then the number of pupils with similar IQs has a significant positive impact on performance and in most cases the class size effect is negative. As they explain, reducing class size not only reduces the number of pupils per teacher, thus allowing teachers to spend more time with individual pupils, it also reduces the number of classmates from whom pupils can learn. As the Dutch policy encourages higher allocation of resources for those with lower socio-economic status, it is compensating them by providing better teacher–pupil ratios, but inadvertently restricting the number and range of classmates with whom they can interact. As they put it:

Should the parents of this child [who reports a reduction in class size by three children] be happy with the message? According to our results, this depends on which children are taken out of the class. If these are children who stimulate the child's learning behaviour, the parents should not favour this class size reduction. (p.37)

Overall, there seems little doubt that consistent results have been achieved from experimental class reduction projects in North America. However, as the Dutch evidence highlights, questions remain: Who benefits most? Can the results be translated to a British context? Is it the most cost-effective way of addressing under-achievement?

3.3 Which groups benefit most?

Although researchers from the STAR project report raised achievement for all pupils taught in small classes from Kindergarten to Grade 3, an examination of evidence shows that some groups benefited more than others. As we can see from Table 3.3 below, the percentage increase for children from minority ethnic backgrounds in small classes was far greater than for non-minority ethnic children – an average percentage of 17% compared to 7%.

Table 3.3: Average percentage of pupils passing Basic Skills First Test (BSF) Reading: Grade 1, STAR

Pupil status	Grade	Class Size		Difference
		Small %	Regular %	
Minority*	1	65.4	48	17.4
Non-minority	1	69.5	62.3	7.2
Difference		4.1	14.3	—

Source: Nye *et al*, 1992, p. 20.

* The researchers' definition is: 'minority group students (Blacks and Hispanics) and majority group (White) students'. Although in certain schools in Tennessee, minority ethnic groups may actually form the majority of the school roll.

Nye *et al* (1992) seem to show unequivocally that the class size effect on children from minority ethnic backgrounds who participated in the experiment was far greater than for majority white pupils. However, later publications from the same team based upon their reanalysis of output data from the STAR project present a much less persuasive picture and seem to contradict their earlier claims (For example, compare Nye *et al*, 1992 with Nye *et al*, 2002 or 2004). By comparing the achievement data from low achievement pupils (ie those who fall below the average for their class and are in the lowest 25%) the team found that although smaller classes in the early years lead to higher academic achievement (for all), small classes had had a differential advantage for low achievers in *reading* but *not in maths*. In reading the small class effect for lower achieving students is larger than for higher achieving students at every grade level, but in maths the small-class effect for lower achieving students is smaller than for higher achieving students at every grade. They conclude that: 'while there is strong evidence that small classes benefit all students, the evidence of differential benefits for lower achieving students is both weak and contradictory' (p. 215).

Part of the explanation may lie with the method of analysis used. The researchers explain that they had been 'pooling' data on different tests over

different grades over the four-year period of the original STAR experiment. Standardising test scores within grades before combining data across grades does not entirely solve the problem of making data from different grades comparable, even though the researchers point out that all the resultant differential effects were found to be statistically insignificant when the statistical analyses were conducted at each grade separately.

It is interesting to note that when the same team analysed 5-year follow-up data from the STAR project (ie pupils who had progressed from Kindergarten–Grade 3 to Grades 4–8), their findings were far more positive (Nye *et al*, 2004). Although they found that four years' exposure to small classes in K–3 were associated with higher achievement *for all* over the subsequent five years, compared to the achievement of those who had been in regular classes and regular classes with a teachers' aide, they report that the long-term effects in Grades 4–8 were larger for minorities. They also claim that four years in small classes produces lasting differential benefits for minority students *in reading* in all grades and *in maths* in all grades with the exception of Grade 5. The small class effect for both reading and maths was *higher for boys* in all grades. Thus it appears that boys had greater lasting benefits from small classes in maths and reading than did their female counterparts. It should, however, be noted that, although the class size effect was greater for minorities and boys, girls had a significantly higher achievement levels than boys overall, and minority and low socio-economic status students achieved significantly lower achievement in reading and maths than white children overall.

Although Nye *et al* (2001) were claiming lasting benefits for pupils who experienced small classes in K–3, (ie a lasting effect on maths scores at the end of Grade 9 of 97% – as large as the effects on maths achievement at the end of Grade 3), they also admit that there may have been weaknesses in their earlier analysis and that even in the Grade 9 follow-up they could only identify high school scores for half the original group. Attrition rates from the study had been high, including 60% of those in small classes who were tested in K–3. In addition, by 2004 the research team had expanded to include Hedges and Konstantopoulos from Chicago University, who brought their statistical expertise to the Tennessee State University team. Again, pooling of achievement data across grades may contribute to the disparities.

These discrepancies need explaining. In addition, the researchers (Nye *et al*, 2004) also point out what they perceive to be the most disappointing aspect of the STAR data set – that it sheds little light on the mechanism by which class-size reduction affects achievement. Because little data were collected about classroom processes or instruction, the experiment cannot indicate how instruction might have changed in small classes to increase achievement or why there were differential effects for minority students. They speculate that in smaller classes teachers may have more time to address the problems of minorities or that smaller classes are generally less disruptive and minority students may be more affected by disruption.

In contrast to this wealth of experimental data on class size manipulation, there is little experimental evidence from British studies to show which groups of children benefit most from class reduction. Earlier examination of Inner London Education Authority (ILEA) data by Mortimer *et al* (1988) discovered a somewhat confusing picture: pupil attainment seemed to increase up to a class size of around 25 pupils; decreased between 25 and 30 and then increased again in the 30–40 range, but pupil progress in maths was greater in junior schools of below average class size. The results were statistically significant for younger year groups. Similar results were reported by OFSTED (1995). The decline in Key Stage 1 results was so persistent in classes of up to 30 that it recommended class reduction in the early years.

Two studies report an impact of class size on attainment in secondary schools in England. Massey (1997) found, in an analysis of results for 9,000 candidates who were entered for GCSE mathematics with the Midland Examining Group in 1994, a positive correlation between achievement and class size. However in the highest tier, results continued to rise for both independent and state pupils as class sizes rose to 28 and 35 respectively. This is probably a result of teachers viewing able pupils as able to learn without much individual attention and assigning them to larger classes accordingly. Jenkins *et al* (2006) analysed GCSE results from a large data set including 450,000 pupils in 3,000 schools. They found that lower pupil teacher ratios were associated with significantly better GCSE capped scores (ie a method of determining the value of awards of varying sizes) and better performance specifically in Science GCSE. There was, however, no significant relationship between the pupil teacher ratio and attainment in GCSE maths or English.

3.4 Do the findings apply to a British context?

As we have seen above, compared with the scale and volume of research generated from the USA by 2001, very little work has been undertaken by British researchers (Day *et al*, 1996). To what extent then are the findings from the USA applicable to schools and pupils in Britain? This is the question which researchers at the London University Institute of Education explored first by reanalysing STAR data (Blatchford & Mortimer, 1994; Goldstein & Blatchford, 1997); and second, by undertaking the largest class size project in Britain to date (Blatchford *et al*, 2005). We shall consider each in turn.

Goldstein & Blatchford (1997) agree that STAR's researchers have demonstrated differences between the achievement levels of pupils in small and larger classes. Their reanalysis confirms that:

- Those pupils in small Kindergarten and Grade 1 classes have higher scores in mathematics and reading than those children who were taught in regular or regular-plus-full-time-teaching-aide classes; and
- Although both black and white children in small classes score higher than those in larger classes, the biggest effect is for black children in small classes.

Despite accepting these general findings from the STAR project, Goldstein and Blatchford raise a note of caution. They believe that even randomised control trials, such as STAR, that are generally viewed as the 'gold standard' of class size research, do not necessarily guarantee valid or generalisable findings. A 'compositional effect' in which more low or high ability children may have been assigned to some classes will influence outcomes. In addition, children, their parents and teachers will all know the group compositions and 'anticipated expectations' of each may affect their progress. They also point out the narrowness of the outcome measures used by STAR and affirm their belief that education should be judged by more than children's performance on a series of cognitive tests. But by far the most serious criticism is reserved for the assumption embedded in STAR that children and classes can function, and their progress be assessed, independently of the complex education systems of which they are part. Therefore, while accepting the overall findings from the STAR project, Goldstein and Blatchford (1997) argue that the predictive value of the findings for British schools is limited. A valid British-based experiment would require:

- Good initial pupil achievement data (such as a baseline assessment test).
- Ways of measuring processes within the classroom, including teachers' expectations.
- Multi-level modelling to show the effects of different variables on pupils' achievements.
- More detailed qualitative and case study research to attempt to generate specific theories about how changes in class size actually produce changes in children's cognitive and affective attributes; and
- A cost-benefit analysis of various ways of distributing resources, for example by reducing class size, increasing the size of school buildings or purchasing more text books. They cite one study (Jamison, 1987) that found that greater gains accrued from introducing textbooks in a poorly resourced country than from reducing class sizes and suggest more studies are required.

Some of these conditions have been met in the London University Institute of Education's own class size study (Blatchford *et al*, 2005), in which they adopted a multi-method longitudinal naturalistic approach, including classroom observations, in which they study actual classrooms without any class size manipulation rather than take an interventionist approach. This should avoid most of the problems inherent in an experiment/control design. The study was sufficiently large to match some of the state-funded American projects. Approximately 9,330 children in 368 classes within 220 primary schools were involved. Initially, eight different local education authorities in England agreed to participate. The first cohort of children joined the study in 1996 upon their entry to Reception class at age four. A second cohort and an additional five LEAs were recruited in 1997 and ultimately a total of 15 LEAs and over 11,000 children in over 300 schools were included. On joining the project, children

were assessed by their teachers using the Avon Reception Entry Assessment for literacy and mathematics, and again at the end of the first year using the Reading Progress Test. Teachers from participating classes were offered training and they provided information each term on the registered and 'experienced' class sizes which the children experienced. Pupils' entitlement to free schools meals and further information, which could affect their performance, was collected for all pupils, and all the information was analysed using a sophisticated multi-level model.

In general, the findings accord with American evidence regarding raised attainment in smaller classes, but it also provides further insight into classroom processes. In 2001, the team reported that there is a significant effect of class size differences on children's educational progress in Reception class. Further details are provided in Blatchford *et al* (2002 and 2003), in which the researchers report that for Reception class literacy they found a strong and statistically significant increase in attainment in all three groups of pupils, ie low middle and high attainers on baseline tests. (Specifically, a reduction in class size from 30 to 20 pupils resulted in an increase in attainment of approximately 0.35 standard deviations for low attainers; 0.2 SD for middle attainers, and 0.15 SD for high attainers.) In contrast for Reception class maths, they found no evidence that the effects of class size varied between different baseline attainment groups. It was a roughly linear (straight line) relationship between the two variables, ie class size and attainment in maths, such that a reduction in class size from 30–20 resulted in an increase in attainment of approximately 0.25 SD.

These results show that for literacy there is a decreasing test score with increasing class size, with little apparent change between class sizes of about 18 and 25. What is also evident is that for the highest and middle achievers on the baseline tests, there is a continuing decrease in expected achievement with increasing class size up to a class size of 28. Below about 28, the gain from a reduction in class size of 10 is about 0.5 standardised score points for the lowest achieving group, but only 0.2 for the other pupils – thus demonstrating that low achieving pupils (ie those below the year group average) have the most to gain from a class size reduction. As with literacy, there is only a small amount of change for maths for class sizes from 20 to 25, with a clearer relationship emerging after adjusting for baseline achievement. (Most researchers accept that the best predictor of future performance is past performance; hence the need to adjust for baseline scores.) Like literacy, it is the low achievers at the baseline, who appear to gain the most from being in small classes. For middle and high baseline pupils there is little change above a class size of about 22. The researchers concluded that:

The effect of class size on children's educational progress over the first year of school is impressive, even after adjusting for possible confounding factors. The effect is comparable to that reported by the experimental STAR project and this trend is therefore confirmed by both experimental and non-experimental research designs. (p. 724)

However, the question remains: are these benefits lasting? The researchers report that there was no clear statistical evidence of an effect of class size upon progress in literacy and maths at Year 1 or Year 2. Class size in each year was not found to be related to progress in either. However, the researchers detect what they call a ‘disruption effect’. Although pupils, who move to smaller or similar sized classes in Year 1 maintain the progress they made in Reception class, moving to a larger class between the two years results in a loss of the benefit of experiencing small Reception classes. There was, however, less change between Year 1 and Year 2 and no effect of moving to a different size class on attainment in Year 2. (Presumably by the third year of schooling, most children were used to school and, therefore, any change was likely to be less disruptive.) Specifically, the gains in literacy attainment in Reception that had been maintained by pupils who had not moved to larger classes between Reception and Year 1 were lost in Year 2, but the gains had been lost in maths by the end of Year 1.

Further evidence regarding the possible long-term effects of small classes was provided from an extension to the Class Size study (Blatchford *et al*, 2004). The researchers investigated the progress of a large cohort of pupils who entered Year 4 during 2000–01, including 75 schools that had participated in the KS1 study, 17 not previously in the research but attended by pupils who had been part of KS1 study, and 110 schools new to the study. They found:

Regarding attainment:

- No evidence that children in smaller classes made more progress in maths, English or science, even after allowing for the characteristics of pupils in small and large classes (ie pupil attainment at the end of previous school year).
- No effect on progress in maths or literacy in Year 4 and Year 5.
- No effect of class size upon progress in maths in Year 6.
- Pupils in larger classes made more progress in literacy in Year 6.
- Pupils eligible for free school meals made less progress in literacy and maths during KS2 than those not eligible (This group was behind at KS1 and fell further behind at KS2.)
- No evidence that teacher characteristics (eg age, length of experience) influenced pupil attainment.

Regarding classroom processes:

- Class size effects and classroom processes had multiple effects, ie as the size of class increases, the size and number of groups increases.
- Pupils in smaller classes were more likely to be the focus of a teacher’s attention and experience more teaching overall in maths.
- Pupils in larger classes at KS2 were more passive in their contact with the teacher.

- Pupils in smaller classes were more active, responding to their teacher and sustaining interactions.
- No differences were found between mixed ability classes and sets in terms of academic attainment, and few differences in teacher and pupil behaviour

The researchers conclude that the effects of class size are more obvious in the first year of school. This is consistent with other research. Small classes work best for literacy for children who are most in need academically, and have the most ground to make up. Blatchford suggests that there is support for using small classes immediately after entry to school, but little evidence of longer-term effects of class size differences on maths achievement. The biggest change, ie a 'disruption' effect, occurred between Reception and Year 1, especially when that move involved going to a larger class.

The message is very clear: class size does affect children's academic attainment during their first year in school. Those most affected are the ones who enter school with the lowest levels of skill and knowledge. However, for those low achieving children, class size must be reduced to below 20 if they are to benefit from the reduction. The researchers also suggest that it would be advisable not only to offer smaller classes in reception, but also ensure stability of class sizes across years

3.5 Is there any Scottish evidence?

In 2001 only one reference to class size in Scottish schools was identified in the search of published literature (see Appendix A1). Referring to her research with disadvantaged pre-school children, Watt (1996) argues that if children from disadvantaged backgrounds are to succeed in school their teachers need to know them and that requires knowledge which comes in a large part from the educational process of interaction between teacher and child in the classroom. As she puts it:

It needs professional knowledge and commitment. It also needs time...What seems to be needed is one teacher and a relatively small number of children. Class size is not, of course, an end-in-itself: it is what happens within the class that matters and what is made possible by smaller numbers. (p.145)

She believes that this should come as no surprise because all young children are dependent upon adults, and disadvantaged pupils more than most.

A second source of Scottish evidence arose from the AAP surveys referred to in Chapter 2 above. Thorpe (1997) reports that the highest performing pupils in the 1995 English and 1996 Science surveys were to be found in very small composite classes of under 20 pupils. Unfortunately this particular result is unreliable because it conflates information about small classes with small composite classes and small schools. All 97 pupils in the smallest composite Primary 4 classes taking part in the survey were from 24 schools which lay outside the survey's confidence level, thus making it unsafe to generalise. Since the first review was published, the Scottish Executive has made major changes

not only to AAP but also in assessment of learning for 3–14 year olds, and promises to ‘report annually to parents on the results of a new sample-based survey of achievement, from 2005, to replace the current blanket annual 5–14 test survey’ (Scottish Executive, 2004: 14). It may, therefore, be more possible now to identify pupil performance at class level than it was in 2001, but this would require further investigation.

What is certain is that in the intervening years since the publication of the first edition of this literature review on class size, little new evidence on the impact of class size on pupils in Scottish schools has emerged. Only two new studies on the topic were identified in refereed journals, (Ostberg, 2003, and Buston & Wight, 2004), and neither is particularly relevant to the organisation of mainstream classes. In the first Ostberg reanalyses data from ‘The Aberdeen Child Development Survey’ – a longitudinal study of 14,000 children in 500 school classes in the city of Aberdeen, initiated in 1962 when the children (aged between 7–11) were in P3–7. The researcher reports a clear association between a child’s social status within the classroom and feelings of malaise (ie the higher the status position the more uncommon the malaise). It exists regardless of class size. Unfortunately, although the research was published within the timescale of this current update, the educational conditions present when the information was collected bear little resemblance to the modern teaching and learning environment.

The findings from the second article (Buston & Wight, 2004) are more helpful, especially with reference to the teaching of Personal, Social and Health Education. Buston and Wight report the results from a randomized controlled trial of a teacher-led sex education programme (SHARE) in 25 non-denominational, co-educational state schools in Tayside and Lothian. Drawing on evidence from both classroom observation and in-depth interviews with teachers and members of the senior management teams, the study found that class size was one of the factors identified as affecting pupil participation in sex education lessons. (Others included class composition, pupils’ interest, teacher’s relationship with class, materials used, school catchment). In what many would accept as a difficult area of the school curriculum, teachers generally felt that participation was, or would be, greater in smaller classes.

There are other potential sources of information about class size in Scottish schools but these have not been analysed here. The School Census (Scottish Executive, 2006) provides average pupil–teacher ratios by educational sector, but these may give a misleading picture of the teaching units which children experience within schools. Although the definition of ‘a class’ adopted by the School Census is ‘a group of pupils normally supervised by one teacher’ (Note 6.3, p.7) it is not clear whether teachers without a class teaching commitment have been included in the school returns.

Further information on class size and pupil achievements may be available from an analysis of HMIE reports. Much will depend on the extent to which HMIE has computerised its records, the choice of outcome measures (ie HMIE performance indicators, results from national tests or 5–14 assessment levels),

and whether information gathered from different sources will provide a reliable picture.

Additional data on class size is probably embedded within a number of research projects which have been commissioned by the Scottish Executive Education Department. These include evaluations of Early Intervention (Fraser *et al*, 2001); Pupils and Teachers' Days in the Classroom (McPake *et al* 1999a) and Setting and Streaming (McPake *et al*, 1999b). Further analysis might be worthwhile.

3.6 Summary

Despite the controversy which for over twenty-five years has surrounded the class size debate, a number of areas of general agreement emerge. We conclude that:

- The literature presents a confusing and sometimes contradictory picture of whether and how the reduction of class size impacts on pupil achievement.
- As of 2001, most of the studies of class size had been conducted in the USA, with few reports of specifically British or Scottish research projects. More recently, a significant contribution has been made by a team from the University of London Institute of Education.
- The evidence from North American studies, in particular the large state-funded experiments, claim to have demonstrated an association between class size and pupil achievement, ie as class sizes reduce pupil attainment rises.
- There is some disagreement about how much classes must be reduced in size to achieve significant improvements in pupil performance: some argue that benefits are most marked in classes of fewer than 15 pupils (Achilles *et al*, 1993); while others (Glass & Smith, 1978) suggest that the major benefits from reduced class size are obtained as size is reduced below 20 pupils.
- Most researchers agree that effects are most marked with younger children, (Kindergarten to Grade 3 in the USA), and that subsequent experience of small classes in their later schooling will not compensate for lack of exposure to small classes in the formative years.
- In American projects the benefits of class size reduction were most marked with young children from minority ethnic groups.
- Benefits in most studies were measured by a narrow range of outcome measures, ie progress in reading and mathematics. A more comprehensive assessment of pupils' progress using both cognitive and affective indices would be desirable.
- Evidence from a large-scale study in primary schools in England broadly confirms American results and reports a decreasing score in literacy with increasing class size, little apparent change in performance between class

sizes of about 18 and 25, and low achievers benefiting the most. They also report a possible ‘disruption effect’ that is associated especially with children moving to larger classes after experiencing smaller classes in the Reception class.

- Evidence from project STAR in the USA claims that the benefits gained from being in smaller classes are still evident in later grades. This is not confirmed by English evidence, which found no evidence of an effect at KS2.
- Some evidence from secondary schools in England shows that pupil attainment is higher in larger classes, but this is probably due to assigning more able pupils to larger ‘sets’. Other English evidence claims that smaller classes are associated with increased GCSE capped scores, especially in GCSE Science.

The above represents an impressive amount of evidence of an association between class size and pupil achievement. However, a statistical association does not constitute an explanation and we are still left with the unresolved issue: why and how does pupils’ attainment rise as class sizes fall? For an answer to these questions we turn in the next section to the teaching practices which occur within classrooms.

4: Class Size and Teaching Practices

4.1 Introduction

We have seen so far that there is a wealth of data on the implications of having small size classes. However, different approaches have provided contradictory conclusions to questions, which seem to teachers and parents to have obvious answers. On logical and common sense grounds it seems likely that as the number of children in a class increases, so too will the amount of time that teachers spend in procedural and domestic matters, and that as a consequence teaching time will decrease. Blatchford *et al* (2003) note this gap between professional judgement and research findings. Clearly, policy-makers operating in a value-for-money context have to be convinced that the benefits of class size reduction would be sufficient to justify the huge extra expense. (Costs are discussed in more detail in Chapter 6.) Some studies have pointed out that relating class size to outcomes in terms of pupil achievement, which we reported in Chapter 3, omits mediating factors that can impact on teaching and learning processes. In this section the focus will turn to what happens in classrooms (what researchers refer to as ‘classroom processes’), in particular the opportunities for teaching when class size is reduced and how teachers respond to those opportunities. The answers to these questions may be helpful in two ways.

- First, it may help to settle whether class size is an important factor in raising the quality of education and improving pupil performance, and more importantly how and why this may be so; and
- Second, it may explain why previous studies have not always found a link between class size differences and outcomes, if teachers involved in previous investigations did not alter their teaching styles and classroom organisation.

This section reviews data which already exists on comparative classroom practices within the context of the class size debate. Often this occupies a section within large research reports but in a minor role. Attention here will be given to teacher approaches in general, followed by comment on features of classroom interaction which research suggests are important factors in effective teaching – individual attention given to pupils, the provision of feedback, within-class grouping of pupils, classroom organisation and the utilisation of classroom assistants. Finally, mention will be made of the need for teacher in-service education associated with teaching in small classes, a theme that researchers have pointed to frequently in recent years.

4.2 Characteristics of effective teaching

In 2001, we reported that researchers involved in the influential STAR initiative in Tennessee, Pate-Bain *et al* (1992) had suggested a number of classroom activities which they believed were associated with effective teaching in small class teaching. These included:

- Basic instruction completed more quickly allowing time for additional material to be taught.
- More in-depth teaching.
- More opportunities used to engage in first-hand learning.
- Increased use of learning centres.
- More use of individualised attention to pupils.

Further, using the class unit as a measure rather than individual students, the researchers identified the qualities possessed by those teachers whose classes achieved the top 15 per cent average gains in reading and mathematics during the project. A number of similar characteristics, strongly associated with effective teaching were observed in those teachers. These were:

- Similar affective behaviour, including enthusiasm for teaching.
- Positive attitudes towards children.
- Recognising pupil success with praise.
- Using humour in promoting learning and motivating pupils.
- Engaging children through use of a variety of creative activities.
- Using assertive discipline.
- Having high expectations.
- Maintaining good communication with parents.

It should, however, be noted that, as Nye *et al* (2004) point out, the STAR study was not set up in such a way that the data collected answers questions about classroom interactions: it lacked the strong classroom observational element of later studies (eg Blatchford *et al*, 2003). How these characteristics and approaches to classroom teaching have been investigated will be looked at next.

4.3 The impact of class size on classroom procedures

Teachers' choices

Teachers have a number of choices to make when planning for teaching and learning in their classrooms. It is generally accepted that, whatever the size of the class, teachers should as far as possible:

- Match the individual learner's needs to the pupil's age, abilities and rate of progress.
- Plan the use of material resources, especially how time will be allocated to teacher exposition, question and answer sessions, individualised learning and group work.
- Remain sufficiently flexible to take account of opportunities for teaching as they arise.

It is also assumed that it would be easier for teachers in smaller classes to meet this ideal. However, a number of the earlier research reports had indicated that many teachers engaged in teaching small classes do not meet this ideal because they have not changed their methods from those they use in larger classes (Sharpson *et al*, 1980; Galton & Simon, 1980). This may in part explain why some research has found little association between class size reduction and pupils' progress. For example, a state-wide statistical survey in Florida suggested that teacher practices may potentially be more important than class size reduction *per se*.

Research supports alternative measures to reduction in class size that do improve student achievement. These measures are related more to improving teaching practices than to the number of students in a classroom.

(Florida Department of Education, 1998, p.11)

Other reports, which specifically took classroom observations into account, noted a relationship between the nature of teaching practices and the quality of education. Stecher and Bohrnstedt (undated) found in Californian schools that teaching practices were very similar in reduced and non-reduced size classes, except that more time was spent on working one-to-one, for example with 'problem readers'. Similarly, the SAGE project in Wisconsin (Molnar *et al*, 1999) which looked at classrooms in some detail, found that:

Reduced class size permits some movement towards more student-centred teaching but the main effect appears to be a focus on students as individuals. Many, if not most, of the techniques and methods that teachers use may be the techniques and methods that they have used in normal-sized classrooms. The difference is that now techniques and methods are directed at individuals and frequently...this attention to individuals is implemented in one-to-one situations, in small groups formed on the basis of need, and in total class situations through response and critique and it is a continual, pervasive feature of classroom life. (p 176)

The thrust of this view is that teaching in small classes allows teachers to do more effectively what they know is the right thing to do (Achilles, 1999). However, the SAGE project hints that despite the greater opportunities for individualized learning, it remains largely 'teacher-centred, teacher controlled' and that 'student choice, independence and interest are of less concern than individual content coverage' (p. 173). This seems to imply that a different and radical approach to teaching in small classes may be possible but that teachers either cannot make the change or think that minor readjustments (or none) are needed in classrooms with fewer children.

Two studies report research on teachers' practices in classes of varying sizes in schools in England. Hargreaves *et al* (1998) observed in a very small-scale project that there was little variation in the teaching style of teachers when they worked with large or small classes. Seven pairs of teachers were matched and, as 'buddies' taught each others' classes. This provides some illumination on teacher behaviour despite the short amount of time which teachers were allowed to have with their 'new' classes, thus making knowledge and familiarity between teacher and pupils so slight as to hamper the opportunity for 'effective'

teaching. Some confirmation is provided by Pedder (2006), who concluded from a very small-scale study of 20 teachers that there is no simple one-way relationship between class size and the optimum conditions for learning and teaching. The teachers in his study in Cambridge found opportunities for learning and teaching in both small and large history classes in Year 8 and Year 9 (13–15 year olds).

Teaching styles

A number of earlier studies had pointed to styles of teaching or listed characteristics of effective teaching which had emerged as a result of their observations. The ORACLE study in England (Galton *et al*, 1980) identified six different styles of teaching, two of which they considered to be especially effective when matched to pupil progress. Both involved high levels of attention given to individual pupils, and the most successful involved posing challenging questions and giving direct feedback. Later work in PRISMS (Galton & Patrick, 1990) which looked at classes in a total of 62 small schools, found similar interactions between teacher and pupils in both small and large classes, but differences were noted in pupil behaviour. Pupils in large infant classes engaged in more ‘off-task’ talk whilst in small (junior) classes pupils spent more time working alone. Limited findings here suggest that in smaller classes, there is:

- More sustained interaction between teachers and pupils.
- More high order questioning.
- More feedback on work.
- Less time spent on routine supervision.
- Less time spent exercising classroom control.
- Less time given to ‘housekeeping’.
- Less time spent on managing the classroom and more on direct teaching which allowed teachers to ‘engage in more enquiring questioning, ask more task-related questions, make more statements’ and to be ‘more involved with the task when interacting with pupils’. (Hargreaves *et al*, 1998, p. 789).

A project in Alberta (Edmonton Public Schools, 2001) has provided a detailed description of those teacher practices in small classes which were considered to be effective. These teachers:

- Individualised learning for pupils.
- Developed productive learning environments.
- Achieved a richer, more creative and complete curriculum.
- Used active learning.
- Integrated reading, writing and speaking.
- Supported students’ personal skill development.
- Employed a repertoire of literacy processes.
- Grew themselves through teacher support.

What emerges here is a picture of quality teaching practices. In earlier research, Glass *et al* (1982) suggested that effective small class teaching was associated with the better use of teaching materials, good planning and a variety of activities used with imagination. Cooper (1989) added improved quality of assessment to the list so that teachers were able to monitor pupils' progress and needs more immediately and accurately.

Findings from a variety of sources all point out that the major advantage of small classes is that they allow teachers to give more attention to the individual pupil. Pate-Bain (1992) and Bennett (1996) placed individual attention high on their list of opportunities for teaching in small classes, as also did a survey of headteacher and teacher opinions outlined in a report by NAHT (Day *et al*, 2001). The SAGE research asserted: 'Individualisation, the practice that seems to be the main effect of having reduced-size class, needs to be examined in greater depth' (p.176).

However, what is meant by 'individualisation of learning' varies considerably across the reports. The SAGE study pointed to teachers helping individual students rather than students following their own objectives. It suggested that the type of teaching observed in small-sized classes was still 'teacher-centred, teacher-controlled teaching' and that 'student choice, independence and interest are of less concern than individual contact coverage' (p. 173). In interviews in the same project, however, teachers pointed to their greater knowledge of individual pupils, especially their personalities and task progress.

The Alberta project saw individualised learning as a complex combination of monitoring assessment and giving attention and feedback, together with direct provision of encouragement, support correction, challenge and practice. Individualised attention was seen to be of particular value for some groups. Slavin (1989) argued that providing low attainers with one-to-one tutoring for a portion of their day is probably the most effective educational strategy for them. The SAGE project indicated that individual attention helped shy and, struggling students, and in Scotland, Watt (1996) noted that individual attention was of especial value for young disadvantaged pupils 'in order to [help them] come to terms with what school is all about' (p. 145). All point out how small classes facilitate such individual attention, but more research would identify ways in which teachers could use the opportunities provided by small-sized classes more effectively.

A second key feature of individualisation mentioned in research is immediate feedback on work done (Edmonton Public Schools, 2001). Galton *et al* (1980) point out that the effectiveness of the 'challenging question' style often relies upon immediate feedback to an individual pupil. A report by NFER (Jamison *et al*, 1998) looked at feedback practices in assessment and listening to reading at Key Stage 1 as effective ways of progressing learning, but found that these were so time consuming that teachers resorted to using breaks and lunchtimes to continue teaching. Even so, small classes were seen to allow more time to give praise and recognition to individuals. More detailed knowledge of individual

learners allowed teachers to pick up on language skills in, for instance, a science lesson, and monitoring targets for individual pupils was easier to manage.

Within-class groupings

Within-class grouping is a third factor which features in class size research. It is a complex and contentious area and one which a previous SCRE review addressed (Harlen & Malcolm, 1997). Blatchford *et al* (2001) defined grouping conceptually in terms of proximity of member seating and working on the same task. A review of pupil grouping conducted by members of the same team (Kutnick *et al*, 2004) suggests that the size of classes, size of within-class groups, composition of within class groups, nature of the assigned learning task, intended social interaction used in task completion, and teacher intervention appear to be interrelated. Specifically, they argue that the literature does not suggest that teachers must choose between setting and mixed ability groupings: schools show a much wider range of practices and pupils can be grouped for social and academic purposes. They found no published evidence to show that one form of grouping benefits all pupils. However, the reviewers think that:

- Pupils in lower groups are vulnerable to less progress, becoming demotivated and developing anti-social attitudes.
- Gifted pupils benefit from specialist programmes and separate groups within mixed ability classes.
- Boys are over-represented in lower sets.

For their own ‘mapping’ study of within-class groupings, Kutnick *et al* (2002) analysed over 1,000 groups in Years 2 and 5 reported by 187 teachers in 111 schools in five LEAs. They found that:

- The most common group size was the small group of 4–6 pupils.
- Other groups, including whole class, individuals, dyads, and triads were less frequently employed by teachers.
- There was a predominant use of same-ability level within groups. (The researchers suspect that this grouping may work to the disadvantage of low-ability children, especially boys.)
- Groups were of mixed sex and consisted of equal numbers of boys and girls.
- Most groupings were within core areas of English and maths (71% of groupings).

Clearly class size and within-class groupings are connected and have implications for children’s learning experiences. In the Class Size and Pupil Adult Ratio study, Blatchford *et al* (2001) found that the number of groups varied with the size of the class and age of child. Overall, pupils are more likely to experience a group size of 4–6 children, followed by 7–10 and 11+ (mostly whole classes). The number of groups increased with the increasing size of the class: small classes (under 20 pupils) had an average of just 3 groups, larger classes approached 6. In addition, in classes of over 25, pupils were more likely

to be in a large group of 7–10, while in class sizes under 25 there was more likelihood of a pupil being in a large group of 11 or over, which included whole class grouping. Children in Reception classes were usually in the smallest classes with the largest groups but the least number of groups. More whole class teaching took place when classes were small. Teachers believed that groups of 7–10 pupils had a negative educational effect in terms of the quality of teaching, pupil concentration and their contribution to group work. However, it was found that at all ages studied, pairs and triads of pupils were least likely to have an adult present. The number of adults in classes increased with the number of groups. This study's conclusions suggest that the effects of class size can best be seen through the number and size of groupings within the classroom which have strong implications for learning experiences.

Earlier, Lou *et al* (1996) had show how whole class contact and small group work are likely to have different pedagogical consequences: in the former there is more teacher explanation, encouragement and uniformity of instruction. In small groups there is likely to be more peer influence and diversity of learning activities. Overall, results suggested that the most common type of activity in groups was individualised work, which did not require interaction between pupils. Co-operative and collaborative work in groups was rare (a finding confirmed by McPake *et al* (1999 and 1996) in a study of Scottish primary schools), although working together was more likely in smaller groups.

A main result from the study, therefore, is that in large classes, especially with the youngest reception aged children, teachers seem forced to teach them in larger groups of 7–10, larger according to their own preferences, than they would like. (Blatchford *et al*, 2001, p. 298)

Occasionally a comment in a report refers not just to teaching styles but also to what is taught. Reference was made to a concentration on basic subjects in larger classes. Also, Carter (reported in Cooper, 1989) identified a more varied curriculum with greater breadth, depth and richness in smaller classes. More recently, Jamison *et al* (1998) made a similar observation:

The important thing was that the range of teaching methods was not as restricted as with a larger class and they were more able to explore ideas further and occasionally extend the curriculum beyond what was prescribed. (p. 52)

More specifically, they added:

Evidence from teachers strongly suggested that it was in practical activities such as those in science, technology and art that pupils in larger classes tended to have more limited experiences. (p. 50)

Reference should be made briefly here to the use of 'peer tutors' in which older or more able children engage in helping pupils to learn. Slavin (1987) claimed that greater gains could result from cross-age tutoring than from small class influence. Similarly, Florida's analysis of all its schools and cost data from 1993–94 (Florida Department of Education, 1998) pointed to peer tutoring and co-operative learning having greater impact at less cost. Teachers who have used this technique claim that its effectiveness depends on careful preparation

and matching of pairs, but also on the management of behaviour. (For more details, see Topping (2001) an exponent of peer tutoring in Scotland.) Several studies have reported a better management of pupil behaviour in small classes, an issue that will be considered in more detail in the next chapter.

Much of the research on learning and teaching in small classes included in the 2001 review looked at the considerable body of evidence on teachers' approaches to teaching in small classes. These approaches appear to offer greater opportunities to use concrete materials and encourage pupils to attend, keep on task, and follow enriched curriculum content. What appears to be lacking is detailed comment on 'how' and 'why' pupils learn in small and large classes rather than the ways in which they are organised and taught.

Why attainment improves

By 2006, Finn *et al* (2003) had begun to publish research which addressed the important 'why' question: how if at all do teacher-student interactions change in small classes in ways that can explain the improved student achievements reported in the previous chapter? The researchers reviewed the empirical evidence from nine studies that they believe begin to demonstrate relationships between class size and teachers' interactive styles. They conclude that the studies confirm that teachers get to know each student more intimately in small classes and their tolerance of a broader range of student behaviours increases. The results were consistent over the nine studies cited. However, none considered the possibility that as class size falls, teachers might actually enjoy teaching more and students' enjoyment of learning might as a consequence increase – both of which could impact on both teachers' and pupils' behaviour.

Stronger empirical evidence of what is actually happening within classrooms of different sizes emerged from the Class Size and Pupil Adult Ratio project (Blatchford, 2003). The team found that children in small classes were more often observed interacting with their teachers than were children in large classes, eg an average of 213 times with teacher in small classes, compared to 144 times in large classes. There was no difference in the amount of whole-class teaching in small and large classes. The child was more likely to be the 'focus' of teachers' attention (173 vs 117 observations). Children in small classes experienced more teaching overall and more child-to-teacher talk about procedural matters. With specific reference to the subjects being taught, the most noticeable difference between small and large classes was that children in small classes experienced more basic language and maths; while in large classes children engaged in more 'other activities', such as topic work, history, geography. There were also more teacher-led activities in small classes, but more play activities in large ones. As class size decreased teaching overall increased, as did teaching in both individual and group contexts. As Blatchford concludes:

...a small class, while not making a poor teacher good, can allow teachers to provide opportunities for more extensive and task related individualization of instruction. Conversely, larger classes can present almost inevitable difficulties and hard choices for teachers, at least in terms of their interactions with children. (2003: 593)

4.4 The use of classroom assistants (teachers' aides)

In 2001 we found growing evidence of the use of classroom assistants in the UK and teachers' aides in the USA. What tasks should they undertake and what were the effects of deploying additional adults in classrooms? These, are questions which need addressing. (See Wilson *et al*, 2002) for an evaluation of the use of classroom assistants in Scotland.) The STAR project (Achilles *et al*, 1993) provides some illumination. In almost all cases, pupils in small classes had the highest scores, followed by pupils in regular classes with full-time aides. However the researchers noted that pupils identified as having been retained a grade before entering STAR benefited most in their test scores from the 'teacher plus aide' situation in regular classes and often least from being in small classes. Jamison *et al* (1998) show how teachers were divided about the comparative value of having small classes without an assistant or a larger class with one. Additional adult support is an important and influential feature of classrooms now: the responses to the NFER study in England (Jamison *et al*, 1998) showed that 86% of the teachers had some paid classroom assistant support whilst 79% had unpaid assistance. Many teachers at Key Stage 1 said their pupils benefited from a good assistant. However, pressure of time was identified by others (Moyle & Suschitzky, 1997a and b; Wilson *et al*, 2002) as a hindrance to quality contact between teachers and their classroom assistants.

The debate about classroom assistants appears to centre upon what they should actually do in the classroom. Slavin (1987) suggested that a classroom assistant should contribute to a strategy in which both teachers and assistants gave one-to-one instruction to each child for perhaps twenty minutes each day. Hargreaves *et al* (1998) thought that greater general flexibility of organisation could be achieved, thus allowing the teacher to work interactively with some pupils whilst the classroom assistant worked with the rest of the class. However, they gave a warning that flexibility would be prevented in situations where assistants were used to offset the difficulties posed by large classes.

Jamison *et al* (1998) provide a great deal of data about headteacher and teacher views about the use of classroom assistants. Most headteachers did not see classroom assistants as simply a means to help teachers of large classes. Both teachers and headteachers thought that all but the smallest of classes at Key Stage 1 needed an assistant working alongside the teacher. The relationship which can develop between a good classroom assistant and pupils was felt to be valuable for pupils' social development, though headteachers believed that at Key Stage 1 young children also needed the stability of the teacher-pupil relationship. Discussion centres on boundaries and skills as well as the personalities required of assistants. Teachers in this survey observed that

classroom assistants were often more concerned with outcomes than a learning strategy, and that frequently they gave an answer to a pupil too quickly.

In 2006, support staff are very much part of the classroom in Scotland (Scottish Executive, 2001). In a study of additional support staff funded under the Teachers' Agreement, Wilson and Davidson (2006) found that the majority of local authorities and headteachers reported that additional staff had made an impression on teachers' administrative workload, but views about the impact on teachers' motivation and teaching and learning varied: forty per cent of headteachers reported an impact on teachers' motivation, compared to 59% of local authority representatives; and 43% of headteachers thought that teaching and learning had been affected, compared to 59% of local authorities. The researchers conclude that schools, especially secondary schools, are still trying to define a role for additional support staff.

More details of how the presence of other adults alters classroom practices is provided by Blatchford *et al* (2002a, b). The team found that there was no statistical evidence that the number of Teaching Assistants (TAs) or other adults in addition to teachers in the classroom influence children's progress. However, from case studies they found variations in the way Teaching Assistants were used, which may explain why quantitative analysis did not show any clear evidence of benefits of classroom support on pupils' progress. Importantly they argue that the presence of other adults does not have a consistent or clear effect on teaching and curriculum time and no effect on the time a teacher has to hear children read individually. There was some evidence that as the number of children increases so does the teachers' sense of stress:

These comments [from teachers] indicated that teachers could suffer with large classes; moreover, they believed that having extra support in class could help. (p. 3)

(This confirms views expressed by teachers in an earlier evaluation of the Classroom Assistants Initiative in Scotland, Wilson *et al*, 2002.) They suggest that the benefit of classroom assistants might be indirect in that they allowed pupils to have a more active form of interaction with teachers, initiating more contact, and responding or being involved in sustained interaction. Pupils were also more likely to be the focus of the teacher's attention, ie there was more individual teacher attention in small classes.

Of concern, Kutnick *et al* (2002) found that many low ability pupils (mainly boys) who were assigned individual tasks had an adult present, but for nearly half of the observed time this was not the teacher. In contrast, when an adult worked with high-ability pupils (mainly girls) there was a much greater likelihood that the adult was a teacher. The researchers argue that this calls into question the use of classroom assistants and, by implication, whether the teacher's time is being distributed equitably amongst all pupils.

4.5 Teachers' training for small-sized classes

This section so far has explored what research has to say about teaching in small size classes. Most has concentrated upon statistical evidence of pupil attainment in small classes, and where observational research has commented upon teaching practices, an implicit challenge has often been issued to teachers: that they either are unwilling or unable to change their planning, organisation and delivery to take full advantage of the perceived opportunities of having fewer pupils in a classroom. But how can teachers be encouraged to change their teaching styles? Small-scale experimental studies (eg Hargreaves *et al*, 1998) do not provide the best opportunities for teachers to think new approaches through. Jamison *et al* (1998) comment on this:

...teachers who were assigned to smaller classes after being assigned to larger classes for a number of years tended to continue for some time at least to teach in the same way, before discovering what could be achieved with a smaller class. Although this appears to indicate a need for in-service training, there was little evidence of such training being available (p. 46).

This 'weak link' in the system was also seen in the USA. Pate-Bain *et al* (1992) recommended that those teachers who had never experienced small classes should observe and consult with effective small-class teachers. What should be the basis of such instruction? Stecher and Bohrnstedt (undated) found little help in California where they reported that the designers of professional development programmes were largely unable to provide guidance.

The Alberta Project (Edmonton Public Schools, 2001) is noteworthy for its description of peer group support by teachers. The report cites McRobbie (1996) who suggested that staff development should be on-going, school-based and designed to develop a professional community in which teachers shared what works for particular students. The teachers in the Alberta Project participated in training workshops, which allowed teachers to adapt the strategies of their peers to their own programmes and students.

Galton *et al* (1996) agreed that training was needed and Jamison (1998) reported that teachers reported that 'teaching approaches with classes of varying sizes had not featured in their initial teaching or in-service courses' (p.48). In addition, Tomlinson (1990) was sceptical of the effects of minimal (two-day) training courses in the STAR project. Teachers who had been part of the SAGE project expressed a wish for more small class in-service in future.

Further, Kutnick *et al* (2002) argue that there is a need for teachers to think strategically about the size and composition of within-class groupings in relation to the tasks assigned. They believe that adult presence in within-class groups is associated with control of knowledge and behaviour and that more account needs to be taken of the 'social pedagogy of pupil grouping', ie the way in which pupils learn from each other. They conclude that 'teachers provide little training for children to develop group work skills, and offer little opportunity for these skills to be practised in the promotion of learning' (p187). This does, of course, beg the question: Is the training that teachers themselves

receive sufficient to enable them to teach classes of varying sizes effectively? In the case of England, Kutnick *et al* (2002) think that the emphasis has focused on students' development of curriculum knowledge at the expense of classroom pedagogy.

4.6 Summary

In 2001, few large-scale research projects had focused on the teaching practices required for effective teaching in small classes. Yet clearly teachers' practices are a mediating factor. Unfortunately, the STAR project was not set up to collect information about classroom processes. By 2006, there was better evidence about what actually happened in small classes, especially in term of within-class grouping, teachers' use of time and the role played by teaching assistants (Blatchford *et al*, 2001; Blatchford, 2003; Kutnick *et al* 2002). This shows that:

- Teachers in various studies in the USA and England believe that class size affects their teaching practices, in particular the way they organise within-class groups and the amount of time they can devote to individual children.
- Project STAR in Tennessee was not set up in a way that collected observational information about teaching practices.
- Better evidence about teachers' actual behaviour emerged from the various stages of the CSPAR project and The Primary School Grouping project in England. These projects report that:
 - a) The number of within-class groups increased with the increasing size of the class: small classes (under 20 pupils) had an average of just 3 groups; in larger classes it approached 6 groups.
 - b) Overall, the most common group size experienced by pupils was of 4–6 pupils. However, in classes of over 25, pupils were more likely to be in larger groups of 7–10, while in class sizes under 25 there was more likelihood of a pupil being in very large groups of 11 or over, including being taught as a whole class. There is also a tendency for the youngest children (ie the Reception class) to be taught in fewer, larger groups.
 - c) More whole class teaching took place in small classes.
 - d) Teachers believed that being in groups of 7–10 pupils had a negative educational effect in terms of the quality of teaching, pupils' concentration and their contribution to group work.
- Researchers in both the USA and the UK suggest that there is a difference between the way teachers indicate they would organise their classes if class sizes were reduced and their actual classroom practices. Researchers in both countries suggest that teachers need to modify their classroom practices, particularly the number and size of within-class groupings, to take account of different sized classes. Further training may be required.

- Teachers in numerous studies in the USA and England report that smaller classes are easier to manage and that they are less concerned about discipline than in larger classes.
- There was no evidence to show that Teaching Assistants in England had had an impact on pupils' attainment. It is suggested that they have an indirect effect by allowing teachers to focus more on teaching. This is broadly supported by Scottish evidence (Wilson & Davidson, 2006) which notes that the majority of local authority and headteacher respondents reported that additional support staff funded by the Teachers' Agreement had made an impression on teachers' administrative workload.

In the next chapter we move on to consider pupils' behaviour and attitudes in small classes.

5: Class Size and Pupil Behaviour and Motivation

5.1 Introduction

In this section, the possible impact of class size on pupils' attitudes, motivation and behaviour is explored. In 2001 it was immediately obvious that although there has been considerable research on the effects of class size on pupil attainment, few researchers had focused their attention on how, if at all, pupils' behaviour and attitudes vary in different sized classes. In addition, not only was the evidence on this topic sparse, but also much of it relied on stakeholders' perceptions, which lack the reliability of experimental and observational data. By 2006, new evidence had emerged from the STAR programme and from the Institute of Education Class Size and Pupil Adult Ratio project, although these findings were not entirely consistent with each other.

5.2 Pupil behaviour

As we saw in the previous chapter, many teachers have formed definite views about the impact class size has on their teaching practices. Many also believe that variations in class size influence the way in which pupils behave within their classes (Bennett, 1996; Pate-Bain & Achilles, 1986; Pate-Bain *et al*, 1992; Boyd-Zaharias *et al*, 1997; Cannon, 1966). Day *et al* (1996) point out what they think are the inescapable consequences of increasing class size without a concomitant increase in teaching resources and classroom space. There will be:

- A reduction in the amount of time that a teacher can devote to an individual pupil; and
- Additional pressure placed upon the physical space and resources within the classroom.

Both of these may be connected to the increase in pupil misbehaviour detected in larger classes.

Cannon (1966) (cited in Day *et al*, 1996) reports findings from an early small scale study undertaken by the University of Utah in which the same teacher taught two kindergarten classes, one smaller with 23–28 pupils, and the other larger with 34–39 pupils. Both were taught in the same room, using the same teaching programme and equipment. The teachers observed that:

- The larger group was more aggressive than the smaller group with more incidents of pushing, crowding and striking and was generally noisier, more chaotic and harder to teach; whereas;
- The atmosphere in the smaller class was described as 'more relaxed and permissive' in which children appeared to make several friends, be more well-adjusted, more patient and helpful to each other, less dependent upon one friend and exhibiting more variety and creativity in their play.

It should be noted that the above study was a small-scale experiment, and other factors, such as the socio-economic, gender or ethnic composition of the group or even inclement weather which limits opportunities for outdoor play during the session, could all have influenced the children's behaviour.

Despite the limitations of the above study, its findings do accord with those which emerged from the well-designed longitudinal STAR project (Pate-Bain & Achilles, 1986). An analysis of teachers' logbooks suggests that a class of 15 has a positive effect not only on teaching practices but also on pupil behaviour. Teachers agreed that:

- Small classes were quieter with fewer student interruptions; and
- Students in smaller classes showed more appreciation for one another, more desire to participate in activities and interacted more with each other.

The teachers attributed these differences to the factors which we discussed in some detail in Chapter 4 above. With reduced numbers of students, they were able to offer greater individualisation of learning activities, monitor student progress and provide quicker feedback, thus keeping pupils on-task and preventing potential disciplinary problems from arising.

However, as Pate-Bain and Achilles (1986) admit, a comparison of the disciplinary records of pupils in the early years of the Nashville County project, the forerunner of STAR, while favouring those in smaller classes, were inconclusive because of the rarity of corporal punishment in the First Grade classrooms in Nashville. It is from the follow-up years of the STAR project that better evidence on discipline emerges but this is related to school attendance and 'drop out', which Boyd-Zaharias *et al* (1997) regard as surrogate measures of indiscipline. These findings will be considered in more detail in Section 5.2 below.

Although these findings from the original STAR project were becoming increasingly dated by 2001, there was little other up-to-date evidence of a connection between class-size and discipline to draw upon. By 2006, more recent evidence from Finn *et al* (2003), Blatchford (2003), and Blatchford *et al* (2003 and 2005) had been published that related specifically to pupils' engagement with learning. This will be discussed in Section 5.4 below. In 2001, three studies provided some evidence more generally on pupils' behaviour (Bennett (1996); Funk (1998); Bevington and Wishart (1999), and we shall consider each in turn.

In one of the few examples of a British-based study of class size, Bennett (1996) reports the results of a survey of teachers, headteachers, chairs of governors and parents of children in 325 primary schools in England and Wales. These were stratified by size and type of school and regional location. All four sets of stakeholders believed that class size had an effect on the quality of learning and teaching, especially in the amount of individual attention teachers were able to offer to pupils, the assessment of pupils' work and the impact on pupil behaviour. This finding accords with Jamison *et al* (1998) who

found that headteachers believed that ‘discipline is at the forefront with large classes’ due to the constraints of time and space. Interestingly, parents also were concerned about the lack of space in larger classes and increasing noise levels, both of which they believed adversely affected their children’s confidence. Some felt compelled to move children, especially to the private sector, specifically because class sizes are usually smaller than those in state schools.

But it is unlikely that the cause of indiscipline can be attributed exclusively to class size. As one teacher in Bennett’s study points out, there are wider contemporary cultural influences at work:

As a teacher who began with classes of nearly fifty children...it is increasingly difficult to discipline children...motivating children gets more and more difficult. We [teachers] cannot compete with TV programmes and other ‘experience’ mediums which supply short sound bite type well-presented multi-sensory chunks of interesting information. (Bennett, 1996: p. 47)

Working in a German context, Funk (1998) presented findings from his analysis of pupils in Grades 7, 8 and 9 in junior secondary, general secondary and grammar schools who participated in the Nuremberg Pupil Survey. After controlling for gender, social factors, and ethnicity, only patchy evidence emerges regarding the relationship of disciplinary incidents, such as name calling, fighting and carrying weapons in schools, with class-related or school-related factors. He concludes that in general as the percentage of boys in a class increases so does the prevalence of name-calling and violence. Increases in the size of the school also tended to foster vandalism, whereas favourable teacher-pupil ratios reduced the levels.

Finally, Bevington and Wishart (1999) provide a helpful summary of the problem that faces researchers who attempt to explain pupils’ problem behaviour. It is difficult, some would argue impossible, to decide whether under-achievement leads to problem behaviour, behavioural problems result from under-achievement, or behavioural problems and under-achievement stem from a common underlying cause, or causes, such as poor social environment. They suggest that the classroom should be viewed as a particular environment which requires the child to attend to learning materials presented by the teacher, while most of the time sitting in a designated seat alongside other pupils.

The nature of this environment rewards the child who is able independently to sustain attention both mentally and physically to learning materials and who will persist even when the tasks are difficult or unstimulating – [it] puts at risk those less able to focus and sustain attention and more active children. (Bevington & Wishart, 1999, p.21)

In order to identify the classroom conditions under which children can best perform cognitive tasks, the researchers studied 24 children attending two special schools in Scotland. Pupils were observed working alone, alongside a peer and within a group of six. In all cases, performance scores were highest in solitary conditions, decreasing with increasing number of peers. Times taken to complete the various activities also varied:

Children studied here worked faster and were less disruptive when working in a group than when working in pairs, but made fewer errors when working on their own. (p. 30)

As the researchers point out, the study has implications for class size and teachers' management of all classrooms. Teachers must decide on what appears to be a trade-off between, on the one hand, achieving more accuracy by encouraging pupils to work alone, or setting them to work within groups (which supports their self-esteem by modelling task-oriented behaviour) on the other.

5.3 Attendance, exclusions and 'dropout'

As was reported in Chapter 2 above, the significant finding from the STAR project (Finn & Achilles, 1990) 'is that small classes have an advantage over larger classes in reading and mathematics in the early primary grades' (p. 576). This finding reached across grade levels, school locations and student ethnicity, gender and socio-economic status. All students benefited from participation in small classes but the greatest advantages were found amongst minority, inner-city students from low socio-economic backgrounds (Word *et al*, 1990). It is worth noting here that the unit of analysis was the class not the individual student, and clearly those who had 'dropped out' or were absent or otherwise excluded from school, could neither benefit nor be included in class norms. It was, therefore, critical to the credibility of STAR that individual students were traced in order to determine the long-term effects of participating in the class size manipulation project.

In follow-up studies (Nye *et al*, 1999) students who had been in small classes during Kindergarten to Grade 3 continued to score significantly higher on standardised tests than their peers who had attended regular or regular with a full-time teaching aide. The researchers also found that by Grade 10, more students who had been in larger classes had been retained a grade prior to entering Grade 10, (12% and 19% respectively from regular and regular plus aide classes compared with only 8% from small classes). Over the period 1993–95, these differences grew with time, until eventually 30% and 44% of regular and regular students plus aide, had been retained, compared with 17% of those in small classes. The researchers conclude that being in a small class may prevent students failing later grades and, therefore, helps to keep students in school. From a British point of view, the practice of failing and/or repeating grades until students reach the minimum school leaving age is a rare occurrence, and even by American standards, the percentage of pupils repeating grades seems high, which perhaps indicates a low baseline for schools entering the experiment in Tennessee.

Perhaps of greater significance in this section is the data on 'drop-out', juvenile detention and expulsion rates. In one predominantly rural county in Tennessee 'drop out' by Grade 10 from small classes was down to 1.8%, compared with 8.5% and 5.9% for those who had been in regular and regular plus aide classes.

Further, when suspension records were examined as a surrogate for discipline, the researchers found that the mean number of days Grade 10 students were suspended was lowest for those who had been in small classes (.32 for small classes, compared with .62 and .77 for regular and regular plus aide classes respectively). A similar trend emerged for the average number of days absence at Grade 10, with those pupils who had been in small classes registering 15.88 days per annum, compared with 22.55 and 24 for regular and regular plus aide students.

By 2006, more evidence of the effect of small classes on student 'drop out' had emerged (Finn *et al*, 2005). Although the STAR project ended when students reached Grade 4, researchers continued to follow up as many students as possible through high school and Finn *et al* (2004) report the findings from a sub-sample of almost 5,000 of the original 11,600 pupils who had participated in the experiment. The analysis revealed a strong relationship between students' achievement in maths and reading in K-3 and graduation from high school. This is hardly surprising as most researchers accept the connection between early and later academic performance, and conversely a history of poor academic performance and risk of drop out (eg National Research Council, 2001). Seventy-seven per cent of the sub-sample for whom high school records were available graduated from high school compared with a graduation rate of 87.8% for those who had experienced the full four years in small classes from Kindergarten to Grade 3. In addition, the impact was especially noteworthy for students from low-income homes. After spending four years in small classes in the early years of schooling, the graduation rate for those entitled to a free school meal was greater than those for non-free school meal students (88.2% and 87% respectively). The researchers point out that this impact on dropout rates cannot be entirely explained by improvements in academic performance carried through to later grades, and suggest that other dynamics, such as the effects on students' attitudes, motivation, pro- and antisocial behaviour and students' engagement with learning, were probably operating – a point we shall return to in the following section.

5.4 Attitudes to learning and teaching

In 2001 there was little direct evidence of the impact of small classes on pupils' attitudes to learning. We saw in Section 5.3 that surrogate measures such as attendance, exclusions and dropout rates were employed by researchers in the absence of observational evidence about classroom processes. Teachers claimed that it is easier for them to manage small classes in ways which enhance pupils' self-esteem (Turner, 1990), and Glass and Smith (1978) found an association between more positive attitudes to school and being in taught in smaller classes. In addition, Rogeness *et al* (1974) detected a trend in Chicago for students' attitudes towards school to decline as class numbers increased.

Smith *et al* (1989) found improved pupil relationships in small classes, less negative aggression, annoying and teasing, and evaluations of Wisconsin's Student Achievement Guarantee in Education (SAGE) programme pointed to

the family atmosphere achieved in smaller classes as a favourable environment in which to deal with discipline problems. These favourable conditions have been recognised as directly beneficial to pupils and teachers (Hargreaves *et al*, 1998). As they put it:

If smaller classes increase teacher morale and satisfaction with the job, this must surely contribute to improved educational outcomes for children. (p793)

Teachers also commented on pupils' attitudes in an NFER study of primary schools in England and Wales (Jamison *et al*, 1998). They observed that in smaller classes individual children were less likely to get 'lost in the crowd', and shy or less motivated children found it more difficult to hide or 'coast'. Teachers were more able to 'draw out' children and enhance their self-esteem. One teacher of a class of 22 pupils pointed out that:

The children took it [the learning task] over and discussion took off, everybody taking part, asking and answering questions. There was a strong and growing confidence to express views, suggest and predict. (p. 61)

Other teachers in the same study thought that relationships between pupils were likely to be better in smaller classes. Teaching strategies to develop tolerance of each other, co-operation and to encourage pupils to listen to each other's views were thought to be easier to employ with fewer children in the class. Some mentioned that Circle Time worked better with smaller classes than with larger ones in which restrictions imposed by lack of physical space and class numbers limited pupil participation and interest. However, it must be remembered that pupils, themselves, have had little opportunity to voice their views on the issue of class size.

By 2006, two research teams (Finn *et al* in the USA and Blatchford *et al* in London) had made a major contribution to our understanding of the impact of class size on students' engagement with learning. We will consider each in turn.

Finn *et al* (2003) takes as its starting point the major conclusion from the STAR programme that small classes in elementary school boost students' academic performance. They seek to prove from empirical and theoretical evidence that class size reduction results in major changes in students' engagement in the classroom; that engagement is composed of 'learning behaviour' and pro- and antisocial behaviour and that both are highly related to academic performance.

First, they reviewed previous studies on the impact of class size and pupils' learning behaviours. The studies used (as a single indicator) a wide range of definitions for describing 'learning behaviour, ie on-task (paying attention in class, engaged in academic behaviour, off-task but not disruptive), or behaviours thought to be related to learning (ie effort, initiative, active learning). The 11 studies reviewed showed a positive impact of smaller classes on students' learning behaviour regardless of methods or measurements used. Earlier work by Finn *et al* (1989) found that this effect ranged from small to moderate; it persisted into Grade 4 (Finn *et al*, 1989) but not into Grade 8 (Voelkl, 1995). The team explains this diminishing effect by suggesting that the

norms of later larger classes may affect students, or that learning may take different forms as children progress through school.

Second, Finn *et al* (2003) considered the impact of class size on students' social behaviour. Here again researchers rely on a wide range of definitions of social behaviour and use a mixture of methods to investigate it (frequently conceptualizing it as negative or antisocial behaviour, eg disruptive (needs a reprimand, annoys or interferes with peers' work) or discipline issues (corporal punishment records or referrals to the principal); while prosocial behaviour is defined by the classroom atmosphere, ie it is quiet and peaceful, students engaged in exclusionary behaviour, students assisted other students. Overall, the ten empirical studies showed a positive impact of smaller classes on students' social behaviour. Three studies reported results that were completely statistically significant (Dennis, 1986; Finn, Forden, Verdinelli & Pannozzo, 2001; Finn, Fulton, Zaharias & Nye, 1989). The pattern of results for antisocial behaviour was highly consistent, despite using a range of definitions, and demonstrated that reducing class size reduces antisocial behaviour. Pupils are less likely to 'fool around', engage in inappropriate behaviours, or disrupt others, and there are fewer referrals for discipline offences. The evidence of a positive impact of class size on students' prosocial behaviour is less complete. Smaller classes appear to promote an atmosphere in which pupils are more supportive and caring, but few studies have addressed this aspect. Overall, Finn *et al* (2003) conclude that there is 'consistent data showing that when class sizes are reduced, students become better behaved and more intensely involved in learning activities' (p. 351).

Unlike the findings reported by Finn *et al* (2003) which were based upon an analysis of secondary data mainly from the STAR programme and high school records, the Blatchford team employed a multi-method approach to investigate the impact of class size over a seven year period in a large sample of primary schools in England (Blatchford, 2005). Therefore, the researchers were in a much better position to observe classroom processes, including pupil behaviour in small and large classes. The first paper on pupil behaviour (Blatchford, 2003) reports the results for the systematic observation of a sub-sample of 39 reception classes, 18 large (over 30 pupils) and 21 small (under 20 pupils). In addition to timed observations by researchers, teachers administered a Rating Pupil Behaviour Scale assessment, the main features of which were: hyperactive/distractible, aggressive, anxious/fearful, prosocial, asocial, and excluded. In small classes there was more task related talk with the teacher (166 vs 107 observations) and more social talk to the teacher. Conversely, in larger classes there was more off-task behaviour (usually not attending to the teacher). Five per cent of all child-to-child contacts in both small and large classes involved 'mucking about' (p. 585), but the overall number of off-task interactions in large classes was twice that of small classes. Children in larger classes were less likely to attend to the teacher and to be off-task in contacts with her, and more likely to be off-task when on their own, especially in the

passive sense of being disengaged from allocated work. There can, however, be more on-task behaviour with other children in larger classes.

Further work on the same sub-sample was reported in Blatchford *et al* (2003). Observations showed that children in large classes were more likely to show off-task behaviour of all kinds, and more likely to interact with their peers in terms of off-task behaviour, social and also on-task behaviour. Connections between class size and Pupil Behaviour Rating factors were not strong and the researchers found no support for the popular view that peer relations are better in smaller classes. They suggest that there might be a slight tendency for worse peer relations, in terms of aggression, asocial and excluded behaviour, in smaller classes. The researchers suggest two possible explanations for this unexpected finding: either teachers have a clearer and more visible picture of children in small classes, ie they get to know children better and the difficulties they face; or there is something real about the relations in small and large classes, ie children in larger classes spend more time interacting about work and socially, as well as ‘mucking about’. Some teachers felt there could be too few children in a class and if pupils fell out their social relations could suffer. Over-dependence on the teacher could also develop.

By 2006, the team was able to report the findings from a follow-up of pupils in the first Class Size project which had looked at pupils in Reception classes, ie 4–5 year-olds (Blatchford *et al*, 2005). Their aim was to see whether the effects of small classes on teacher-pupil interaction was still evident when pupils were in Year 6, ie 10–11 years old. The article draws on information from a sub-sample of children in 42 Year 6 classes, 16 small (25 pupils or under) and 26 large (31 pupils and over). (It should be noted that the definition of small and large classes are different from those used in the STAR project and also from earlier reports by Blatchford in 2003.) Two clear differences between small and large classes emerged: in small classes, pupils had a more active role in contact with the teacher and were also more likely to be the focus of a teacher’s attention. Against expectations, and in contrast to the findings reported for the earlier CSPAR study of Reception classes (Blatchford, 2003; Blatchford *et al*, 2003) there was no difference between the individual or total on-task and off-task behaviour in large and small classes. The effect varied by subject, ie in small classes there was more interaction between pupils *in maths and other subjects* but no difference for English and science. It is also interesting to note that these conclusions are at variance with Finn *et al’s* (2003) conclusion that class size affects student engagement more than does teaching behaviour.

5.5 Summary

The research evidence presented in this section indicates that:

- Researchers have paid far more attention to the effects of class size manipulation on pupil achievements than they have to its possible impact on pupils’ behaviour, attendance and attitudes.

- Much of the evidence reported in 2001 on the effects of class size on pupils' behaviour and attitudes within school arises from teachers' perceptions. Overwhelmingly, these report that teachers in the USA and England believe it is easier to manage smaller classes and, hence, encourage the development of positive behaviours and attitudes in their pupils.
- In the 2001 review, evidence of a statistical association between class size and suspension and attendance records was reported from a follow-up study of Grade 10 students who had participated in the original STAR project in Tennessee. These demonstrate the lasting benefits for students of being taught in small classes in the early years of their primary education. Fewer students 'dropped out' of school, the average number of days absent from school was lower than for those who had been in regular or regular plus aides classes, and they continued to make better grades.
- By 2006, further follow-up of a sample of STAR programme participants in Tennessee indicates that pupils who had spent their first four years of schooling in small classes were more likely to graduate from high school than those in regular-sized classes. The benefit for those who were entitled to free school meals was greater than for non-free-school meal students.
- There is some evidence to show the detrimental effects of increasing class size (and also school size) on pupil behaviour which seems to be related to overcrowding. Teachers, headteachers, parents and school governors were all concerned about the lack of physical space as pupil numbers grew. They believed this affected not only teaching practices but also pupils' behaviour and confidence.
- More recent evidence from the USA suggests that small classes increase students' engagement with learning and reduce anti-social behaviour. The findings on prosocial behaviour (ie students helping and supporting each other) are less complete.
- Evidence from the Institute of Education Class Size and Pupil Adult Ratio project found that pupils in small Reception Classes were more likely to be on-task than those in larger classes, but against expectations they found that class size did not affect pupils' on-task behaviour or peer interactions in Year 6 (10–11 year olds).
- Statistical correlations do not, in themselves, provide an explanation of the relationship between achievement and behaviour and researchers have struggled to show the direction of the causation. Pupils may achieve more because they are better behaved in smaller class and thus pay more attention and spend more time on task than those who misbehave. It would seem reasonable to assume positive behaviour is enhanced in smaller classes in which teachers have more time to spend with individual pupils and cater for their disparate learning needs.

6: Structures and Costs

6.1 Introduction

In this chapter we consider the current size of classes in Scottish schools and compare this to class size in other countries. The published evidence on the potential costs of reducing class size is discussed, and reference is made to the on-going debate, largely amongst American economists (eg Krueger and Hanushek), about the most cost-effective way of raising pupil attainment. Finally, the ambiguity of the conclusions on the effect of class size drawn by economists is highlighted.

6.2 Class size in Scottish schools

Current regulations specify that maximum class sizes in primary schools in Scotland should be:

- 30 for a single stage class P1-P3
- 33 for a single stage class P4-7
- 25 for a composite stage class.

However, the latest results from the School Census (Scottish Executive, 2006) show that average class sizes in publicly funded primary schools in Scotland are falling. Over the period 1998–2005 (with the exception of 2004) the trend was downwards for all primary classes. The average fell from 23.9 in 2004 to 23.6 pupils in 2005. Composite classes had an average of 19.9 pupils, which was down from 20.2 in 2004. Primary 1 classes had the smallest average size of any single stage with 23.1 pupils, down from 23.2 in 2004. In addition, pupil numbers, particularly in primary schools, have been reducing since 1996 in line with the decline in the population. It is, therefore, clear that in many Scottish primary schools the number of pupils is already below the maximum allowed and the 25 in P1 promised for 2007 by *A Partnership for a Better Scotland*. However, the average class size hides variations across stages, size of school and education authorities. For example, while the average is 23.1 pupils in P1, P5 classes have an average of 26.3. As might be expected average class size was highest in larger schools, ie 28 for schools of 400–599 and 600 or more, and it also ranged from 13.7 in Eilean Siar to 26.1 in East Renfrewshire, a reflection of the distribution of population across Scotland. These are the existing conditions which any proposed policy changes should take into account.

There is also continuing interest in class size reduction amongst policy makers, teachers' associations and parents. The Scottish Parliament Information Centre (SPICe) has produced one briefing paper on the topic (SPICe, 2002;) and another (Kidner & Berry, 2006) includes information about class size. The Partnership Agreement (Scottish Labour Party and Scottish Liberal Democrats, 2003) has indicated that it aims to reduce class sizes to a maximum of 25 pupils in Primary 1, and a maximum of 20 pupils in Secondary 1 and 2 in English and

Maths by 2007. The Education Institute of Scotland would like to see further reductions and point out that this should be possible if the teaching force reaches 53,000 FTEs by 2007. It proposes that ultimately a class size maximum of 20 pupils in all primary and secondary school classes, with a maximum of 15 for composite classes (Smith, 2006) should be the aim. This ratio would be in line with the point at which the STAR project found that maximum effect of class size reduction occurs.

It is interesting to note that the Netherlands began class size reduction in 1997, following action reported by approximately 18 states in the USA. In 2001 the New South Wales Teachers Federation prepared a number of briefing papers for the incoming Education and Training Minister, John Watkins (O'Halloran, 2002; Leete, 2002; Edsall, 2002) recommending that class size reduction should be phased in, beginning with the youngest children.

6.3 Class sizes in other countries

How do class sizes in Scotland compare with our European neighbours? Figures for publicly funded institutions published by the Organisation for Economic Co-operation and Development (OECD, 2004) are not particularly helpful in that the class sizes in the four home countries of the UK are recorded as one average. This does, however, show that average class size in primary schools in the UK is 26.0 pupils against an OECD average of 21.9 (ranging from 15.6 in Luxembourg to 41.5 in Egypt). The position is slightly better for lower secondary school education where the UK has an average class size of 24.7 compared to an OECD average of 23.6. It is also worth remembering the continuing paradox of Asian Pacific countries with their much higher average class sizes that consistently out perform the UK on international tests of student achievement, such as the Programme for International Student Assessment (PISA).

A comparison of countries within the European Union is provided by Eurydice (2005). Regulations in Scotland requiring 1 adult to every 8 children for 4-year-old children in schools or other education-oriented pre-primary institutions are amongst the best in Europe, surpassed only by Finland which has a ratio of 1:7. Most countries in Europe have recommended or prescribed upper limits for the number of pupils per class in primary schools. At 30 Scotland is close to the average for Europe of 29.5 (ranging from 22 in Bulgaria to 34 in Latvia and Liechtenstein). There are, however, wide variations in the pupil teacher ratios in primary schools across different countries. The ratios vary from as little as 10 pupils for every teacher in Italy to over 20:1 in Slovakia. (The UK records 19.9.) Particularly large classes in the fourth year of primary education in the UK (ie 27–32) were reported by teachers who participated in the Progress in International Reading Literacy Study (PIRLS, 2001) survey, but this masks the lower range reported by Scottish teachers which was 24–29. These figures suggest that while class sizes in Scotland are amongst the highest in Europe, they are lower than in England.

6.4 Cost of reduction

What would it cost to reduce class sizes, and how robust is the evidence presented by economists? Most researchers seem to agree that it would be extremely expensive to implement a class reduction policy. Some idea of the scale of expenditure required is provided by the New South Wales briefing paper (O'Halloran, 2002) that points out that in 2001–02, the US Congress appropriated \$1.6 billion to expedite class size reduction in K–3 in all states. Presumably the initial implementation costs would have to be supported by higher annual expenditure to cover the extra teachers' salaries. Further evidence is provided by economists at the Southern Methodist University in Dallas who point out that:

The US federal government allocated \$12 billion (over a seven-year period) to reduce class size (Hoxby, 2000a), the state of California has spent over \$3.6 billion on class size reduction since 1996, 20 US states are currently undertaking or discussing policies to reduce class size, and the Dutch government decided to allocate approximately \$500 million (in US dollars) to reduce class size (Levin, 2001).

Maasoumi *et al.*, 2005: 364.

The same research team used complicated econometric measures to assess the impact of reduced class sizes on a nationally representative sample of public high school students drawn from the US National Educational Longitudinal Study of 1988 (NELS). The database contains several test score measures for each student, class size corresponding to the subject being tested, and a wide set of conditioning variables (eg student, family, and school variables, and experience, gender and ethnicity of teacher). They confirm earlier research from the STAR programme that a reduction in class size from above 20 students to below 20 students is associated with increased test scores for below average students, but they also make two new points which have cost implications. First they found that rarely does class size reduction have a uniform impact across test score distribution, which implies that simply reducing existing classes by one or two pupils will not have the desired impact on student achievement; and second that the most beneficial impact of class size reduction arises because of what the researchers call 'the productivity-enhancing effect' it has on other educational inputs, such as teacher quality and parental involvement. It is difficult to put a monetary value on these, so they have usually been excluded from costing models.

Unfortunately for policy makers, the debate on the effects of class size amongst economists continues (eg Dustmann *et al.*, 2003; Jenkins *et al.*, 2006; Krueger, 2003; Hanushek, 2003). Dustmann *et al.* (2003) claim that the inconclusive results arise from shortcomings in experimental evidence about the effects of class size, and also from the ambiguity in non-experimental data. It is important to note here that econometric analysis involves modeling relationships between different factors using computers to work in 10 to 12 dimensions at once. The resultant models will not necessarily be supported by experimental evidence from classroom practices. This lack of reliable measures to feed into economic

models and the complexity of the class size problem being modelled have resulted in ambiguity.

Some economists, such as Hanushek (1998, 2003 and 2004) at Stanford University, have used econometric analysis to warn against the policy of class size reduction. He points out that between 1960 and 2000 the resources invested in education in the US have risen dramatically against four key resource measures:

- Pupil-teacher ratio has improved from 25.8:1 to 16:1
- The proportion of teachers with master's degrees or more (an indicator of teacher quality) has increased from 23.5% to 56.2%.
- The average years of teacher experience has risen from 11 to 15 years.
- Real expenditure has risen from \$2,235 to \$7,591 per pupil.

And yet student performance has remained stubbornly flat for three decades on the National Assessment of Educational Progress (NAEP), which tests a random sample of 17 year-olds. He argues that programmes that appear to be efficacious in one setting do not generalise to other settings and that the debate about class size assumes that class size has a linear effect on achievement that is independent of other factors such as teacher quality. Despite using randomisation of students and teachers, the STAR project made no explicit consideration of teacher quality in the analysis of results. Yet in only 40 out of 79 schools did the kindergarten performance in small classes exceed that in regular classes (with or without aides). Hanushek thinks that the most straightforward interpretation for this variety is that teacher quality is an extraordinarily important input. If the effect of class size is dependent on teacher quality then researchers and policy makers need to know the distribution before they can replicate STAR.

As an alternative to a centrally determined policy of class size reduction, Hanushek suggests that local personnel, who are in the best position to assess teacher quality, should be allowed to make decisions that incorporate information about the relevant teachers and local circumstances, in order to implement educational policies aimed at improving student achievement. He suggests that the impact of resources is complicated – involving interactions with various inputs that are not observed or understood – and that the simplest notion is that teacher quality interacts with resources to determine outcomes. It therefore essentially determines the efficiency with which resources are converted into student achievement. As he explains:

Certain resources may be necessary but may not by themselves be sufficient...When effectiveness of the resources is a function of local managerial factors, including those of teachers, simply making the resources available does not solve the problems of improving student performance.
(p. 171)

The STAR experiment cost \$3 million per year and the cost of the implementation of a full programme, such as the 1996 California class size

initiative for K–3, was \$1 billion annually. Hanushek (1998) believes that fiscal realities put a natural limit on what it is feasible to spend on class size reduction which results in marginal reductions rather than full-scale implementation. For example, he asks us to consider that to reduce class sizes from 26 to 23 represents an increase in teacher costs alone of over 10%. Would teachers notice such changes and alter their approach? He believes that on current evidence the answer is ‘no’ and that marginal changes are less likely to lead to changes in the behaviour of teachers. To achieve the results reported by the STAR experiment, teacher numbers increased by one third.

In contrast, other economists argue that class size is closely related to school quality, and hence pupil attainment. For example, Krueger (2003) converts pupil test score outcome measures from small classes into dollar benefits by using the relationship between test scores and later earnings. He concludes that the internal rate of return in the STAR project from a 7-student reduction in class size in the first four years of primary school is about 6% (ie every dollar invested in smaller classes yields about \$2 in benefits discounted to current values).

This connection between investment in smaller classes and pupils’ future earning capacity is supported by others. Dustmann *et al* (2003) use data from England and Wales to show that class size is related to pupils’ staying-on decisions, which in turn significantly affect future wages. Therefore, whereas the costs of class size reduction are immediate and continuing in terms of increased capital and revenue expenditure, the monetary benefits may only appear when students enter the labour market. Cost-benefit calculations should, therefore, include wages earned during their whole life-cycle. The economists do, however, caution against accepting the outcomes of some non-experimental studies, which may suffer from a paucity of experimental information about the effects in classes of different sizes.

Finally, in a study of resources and GCSE outcomes from 3,000 schools in England funded by the DfES, Jenkins *et al* (2006) argue that increased expenditure used to reduce pupil teacher ratios is more effective at increasing GCSE results than an increase in general spending on education. They calculate that an increase of £100 per pupil per annum on reducing pupil teacher ratios would raise GCSE capped scores and Science GCSE by between 2 and 4 times as much as increasing the general expenditure per pupil would. This correlation does not, however, provide confidence that the connection between resources and pupil attainment is causal: other factors, such as the quality of teaching, were not included in their analysis.

In conclusion, all the economists quoted above were trying to determine the point at which the marginal cost of reducing class size was balanced against the resultant marginal benefits, ie the ‘critical effect size’ (Krueger, 2003). However, in practice it is extremely difficult to quantify a stream of possible marginal benefits and/or compare these with the likely marginal costs and benefits, of alternative policy options, such as increasing the quality of teaching. In addition, none of these studies used Scottish data.

6.5 Summary

The evidence about the cost of implementing class size reduction is complicated and incomplete largely because some input measures, such as teacher quality and parental involvement, remain unspecified. Specifically this review found that:

- In 2006, the recommended class size in Scotland is 30 for a single stage class P1–P3; 33 for a single stage class P4–7; and 25 for a composite stage class (Scottish Executive, 2006).
- Over the past decade average class sizes in Scottish primary schools have been falling, as has the number of primary schools and pupils.
- The Scottish School Census 2005 shows that the average primary school class size was 23.6 pupils (compared to 23.9 in 2004). Composite classes had an average of 19.9 pupils (compared to 20.2 in 2004).
- Figures for the average class size in Scotland mask large variations across P1–7, small and large schools and education authorities. Primary schools with 400 pupils or more tend to have larger classes.
- It is much more difficult to determine meaningful average class sizes in secondary schools because of course options and sets.
- There is a continuing interest amongst policy-makers, practitioners and parents in class size reduction.
- The average primary school class in the UK was 26.0 pupils, compared to an OECD average of 21.9. Class size ranged from 15.6 in Luxembourg to 41.5 in Egypt.
- Although researchers disagree about the outcomes of class size reduction, there appears to be a consensus that reducing class size is expensive. Some suggest that it is the most expensive educational policy option that can be chosen.
- Some other countries, particularly the USA, have allocated billions of dollars to class size reduction.
- Economists seem to be divided in their opinions as to whether a policy of class size reduction is a sensible use of resources, and continue to debate whether the marginal benefits of class size reduction outweigh the marginal costs. In practice this is difficult to determine.
- Over the past decade, the most sustained criticism of a policy of class size reduction has been made by Hanushek (1996, 1998, 2003 and 2004). He argues that increasing resource inputs (including reducing teacher pupil ratios) over the past 30 years has not led to improved student performance in the USA and that teacher quality is an important variable which is missing from many resource models.
- Others economists (eg Dustmann *et al*, 2003; Krueger, 2003) calculate that pupils' staying-on school decisions and their future earnings are higher for those who have been in small classes.

7: Conclusions

7.1 Introduction

Evidence from previous reviews of published literature, correlational studies, meta-analyses and experimental interventions in class size manipulation were included in the original review. Despite the volume of research identified in 2001, few British studies emerged. By 2006, a significant contribution to the class size debate had been made by a team from the University of London Institute of Education. Evidence from both periods has been included in this updated review.

7.2 How good is the evidence?

Overall there has been an enormous amount of evidence published on the effects of class size on pupils' attainment. It has tended to polarise researchers into those who think that the available evidence is strong and others who see it as at best confusing, sometimes even contradictory. From this review it seems that:

- There is evidence to show a relationship between class size and pupil attainment, especially for younger children. However, it should be noted that associations are not explanations.
- Even though some of the evidence is very good, it has to be accepted that none is perfect and questions remain about the research designs and the statistical analyses employed, and also the generalisability of the findings. Experimental design and multilevel modelling are not accepted by all researchers.
- Benefits in most studies were measured by a narrow range of outcome measures, ie progress in reading and mathematics. In addition, some scores from different tests across different classes and year groups were 'pooled'. Few had baseline assessments for the participating children and attrition rates for follow-up studies was often high.
- It should also be noted that there were no relevant studies relating to the effects of class size reduction on attainment in Scottish schools. This presents a problem for policy-makers in Scottish education. Not only do they require valid and reliable evidence of the impact of small classes on pupil attainment, but also confidence in its transferability, applicability and value-for-money in Scottish schools and classes.

7.3 Does class size impact on pupil attainment?

Many researchers, teachers, headteachers and parents believe that a reduction in class size will improve pupil attainment. However, the evidence is more complicated. Specifically:

- The evidence from North American studies, in particular the large state-funded experiments, claim to have demonstrated an association between class size and pupil achievement, ie as class sizes reduce pupil attainment increases.
- There is some disagreement about how much classes must be reduced in size to achieve significant improvements in pupil performance: some argue that benefits are most marked in classes of fewer than 15 pupils (Achilles *et al*, 1993); while others (Glass & Smith, 1978) suggest that the major benefits from reduced class size are obtained as size is reduced below 20 pupils.
- Most researchers agree that where there are effects, they are most marked with children in the early years of schooling and that subsequent experience of small classes in their later years does not compensate for lack of exposure to small classes in the formative years.
- In American projects, the benefits of class size reduction were most marked with young children from minority ethnic groups.
- Evidence from a large-scale study in primary schools in England broadly confirms American results and reports a decreasing score in literacy with increasing class size, little apparent change in performance between class sizes of about 18 and 25 and with low achievers benefiting the most.
- The evidence of lasting benefits seems to be weaker than for initial effects. Evidence from Project STAR in Tennessee claims that the benefits gained from being in smaller classes are still evident in later grades. This is not confirmed by English evidence, which found no evidence of an effect at KS2.
- Some evidence from secondary schools in England shows that pupil attainment is higher in larger classes, but this is probably due to assigning more able pupils to larger 'sets'. Other English evidence suggests that smaller classes are associated with higher GCSE results, especially in GCSE Science.

7.4 Which stages of education benefit most from class size reduction?

Most research studies reported here agree that class size reductions do not affect all children equally. Both American and English evidence shows that children in the early years of schooling and those in the lowest ability groups (usually members of minority ethnic groups in the USA) appear to benefit the most.

- Evidence from the STAR project showed that the benefits of class size reduction are most marked in the early stages of a child's schooling, ie Kindergarten through Grade 3 (5–8 years), and with minority ethnic children. The impact on younger and less able children is confirmed by English evidence.

- The STAR Lasting Benefits study identified that the initial advantages gained from early exposure to small classes was still evident for pupils at Grade 10 (age 16 years). This is not confirmed by English evidence which found no evidence of small class effects at KS2 for pupils who had been in small classes at KS1.
- English evidence also shows that there is a possible ‘disruption effect’, in which benefits are lost, when children who have experienced small classes in Reception class move to larger classes in Year 1.
- At the secondary stage English evidence is inconclusive because of the tendency for schools to teach less able children in smaller sets. Therefore, some examination results are higher from larger sets, composed mainly of more able pupils.

7.5 How does class size manipulation impact on teaching practices?

Researchers attempting to understand ‘how’ and ‘why’ small classes affect pupils’ achievement have turned to classroom processes for an explanation. Unfortunately, Project STAR was not set up to collect this type of information, but better evidence has emerged from the Class Size study in England. Evidence show that:

- Teachers in various studies in the USA and England believe that class size affects their teaching practices, in particular the way they organise within-class groups and the amount of time they can devote to individual children.
- Project STAR in Tennessee was not set up in a way that collected observational information about teaching practices.
- Better evidence about teachers’ actual behaviour emerged from the various stages of the CSPAR project and The Primary School Grouping project in England. These projects report that:
 - a) The number of within-class groups increased with the increasing size of the class: small classes (under 20 pupils) had an average of just 3 groups; in larger classes it approached 6 groups.
 - b) Overall, the most common group size experienced by pupils was of 4–6 pupils. However, in classes of over 25, pupils were more likely to be in larger groups of 7–10, while in class sizes under 25 there was more likelihood of a pupil being in very large groups of 11 or over, including being taught as a whole class. There is also a tendency for the youngest children (ie the Reception class) to be taught in fewer, larger groups.
 - c) More whole class teaching took place in small classes.
 - d) Teachers believed that being in groups of 7–10 pupils had a negative educational effect in terms of the quality of teaching, pupils’ concentration and their contribution to group work.

- Researchers in both the USA and the UK suggest that there is a difference between the way teachers indicate they would organise their classes if class sizes were reduced and their actual classroom practices. Researchers in both countries suggest that teachers need to modify their classroom practices, particularly the number and size of within-class groupings, to take account of different sized classes. Further training may be required.
- Teachers in numerous studies in the USA and England report that smaller classes are easier to manage and that they are less concerned about discipline than in larger classes.
- There was no evidence to show that Teaching Assistants in England had had an impact on pupils' attainment. It is suggested that they have an indirect effect by allowing teachers to focus more on teaching. This is broadly supported by Scottish evidence (Wilson & Davidson, 2006) which notes that the majority of local authority and headteacher respondents reported that additional support staff funded by the Teachers' Agreement had made an impression on teachers' administrative workload.

7.6 What effect does class size reduction have on pupils' learning?

Despite the volume of literature on class size, there is an obvious paucity of evidence on the relationship between class size and pupils' learning. This is an area which requires further attention.

- Evidence from the USA suggests that small classes increase students' engagement with learning and reduce anti-social behaviour. The findings on prosocial behaviour (ie students helping and supporting each other) are less complete.
- Evidence from the Institute of Education Class Size and Pupil Adult Ratio project found that pupils in small Reception classes were more likely to be on-task than those in larger classes, but against expectations they found that class size did not affect pupils' on-task behaviour or peer interactions in Year 6 (10–11 year olds).
- Observational studies of within-class groupings show little evidence of collaborative learning taking place amongst pupils: most appear to learn individually while sitting within groups.
- Pupils usually have more physical space within which to learn in classes composed of fewer pupils. However, little attention has been devoted to the impact of the classroom environment, space and furniture on pupils' learning.

7.7 What is the impact of class size reduction on pupils' behaviour, attendance and motivation?

Research studies tend to report teachers' perceptions of the impact of small classes on pupils' attitudes and behaviour. To date, the pupils have had little opportunity to voice their opinions.

- Most studies show that teachers of smaller classes in the USA and England report that these are quieter and more easily managed than larger ones. Therefore, potential discipline problems are prevented from arising.
- In the STAR project in Tennessee, direct evidence of pupils' behaviour from their disciplinary records was absent. Most studies resort to proxy measures of behaviour, such as exclusion, 'drop out' and attendance.
- Researchers in the STAR project in Tennessee, however, claim that fewer pupils who experienced smaller classes in the early years of schooling subsequently 'dropped out' of school at Grade 10 (16 years). In addition fewer were excluded and their average number of days' absence was less than for those who had not experienced smaller classes.
- Evidence from England shows that pupils in small classes have a more interactive relationship with their teacher, are more often the focus of the teachers' attention, but have fewer classmates from whom they can learn.
- There is some European evidence to show that the number of incidents of pupil pushing, crowding and other aggressive behaviour increases in larger classes within larger schools.
- Overall, research suggests a complex interrelationship between pupil behaviour and their attitudes towards learning and their attainment. Class size may be one influential factor but the evidence is inconclusive.

7.8 How much does it cost to reduce class sizes?

The evidence about the cost of implementing class size reduction is complicated and incomplete largely because some input measures, such as teacher quality and parental involvement, remain unspecified. Specifically this review found that:

- There is a continuing interest amongst policy-makers and practitioners in class size reduction.
- In 2006, the recommended class size in Scotland is 30 for a single stage class P1–P3; 33 for a single stage class P4–7; and 25 for a composite stage class (Scottish Executive, 2006).
- Over the past decade average class sizes in Scottish primary schools have been falling, as has the number of primary schools and pupils.
- The Scottish School Census 2005 shows that the average primary school class size was 23.6 pupils (compared to 23.9 in 2004). Composite classes had an average of 19.9 pupils (compared to 20.2 in 2004).

- The average primary school class in the UK was 26.0 pupils compared to an OECD average of 21.9; class size ranged from 15.6 in Luxembourg to 41.5 in Egypt.
- Although researchers disagree about the outcomes of class size reduction, there appears to be a consensus that reducing class size is expensive. Some suggest that it is the most expensive educational policy option that can be chosen.
- Some other countries, particularly the USA, have allocated billions of dollars to class size reduction.
- Economists seem to be divided in their opinions as to whether a policy of class size reduction is a sensible use of resources, and continue to debate whether the marginal benefits of class size reduction outweigh the marginal costs. In practice it is extremely difficult to determine.
- Some economists, such as Hanushek (1996, 1998, 2003, 2004) argue that increasing resource inputs (including reducing class size) has not led to improved attainment in the USA. Others (eg Dustmann *et al*, 2003; Krueger, 2003) point out that smaller classes affect staying-on rates and lifetime earnings.

Finally, in conclusion, although most researchers agree that there is a relationship between small classes, especially in the early years, and pupil achievement, many accept that this is only part of a complex picture. Classroom processes, alternative approaches to organising within-class and across-year groupings, more one-to-one tuition from teachers and classroom assistants during the working day, peer tutoring, the quality and experience of teachers, the socio-economic background of the child and parental background, are all likely to contribute. Other researchers, while accepting that class sizes should be reduced, claim that there are more cost-effective ways of providing young children with individualised attention when they most need it.

As Hanushek (1998) points out:

None of this [evidence] says that smaller classes never matter. Indeed, the micro-evidence, which shows instances where differences in teacher: pupil ratios appear important suggests just the opposite. My own interpretation is there are likely to be situations defined in terms of specific teachers, specific groups of students, and specific subject matter, where small classes could be very beneficial for student achievement. At the same time, there are many other situations where reduced class size has no important effect on achievement, even if it always has very significant impacts on school costs. (1998:35)

Class size reduction is attractive because it maintains the existing structure of schools while simply adding more resources. This may be a necessary step, but there is no evidence that in the long-term it will be sufficient to raise the attainment of all pupils.

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Appendix 1: Search Strategy

A1 Databases

The following seven databases were systematically searched in the course of this review:

- The SCRE library catalogue
- ERSDAT (Educational Research in Scotland Database maintained by SCRE)
- British Education Index
- ERIC (US-based education index)
- Australian Education Index
- Psycinfo (a database of articles in psychology journals)
- IBSS (International database of Social Sciences)

A2 Keywords

The following keywords, and combinations of keywords, were employed in the search:

1. class size
2. teacher/pupil OR student ratio
3. 1 and 2 in combination
4. 3 plus attainment OR achievement
5. 3 plus behaviour OR discipline
6. 3 plus teaching OR learning OR pedagogy
7. 3 plus age OR stage
8. 3 plus attendance
9. 3 plus motivation

A3 Results

The number of references identified in each database is displayed in the table below:

Table A1: Number of references to class size by database search

		ERIC	BEI	PsychInfo	IBSS	AEI	ERSDAT	Library
1	Class size	528	91	32	10	71	1	22
2	Teacher (pupil or student) ratio	409	31	22	2	57	1	0
3	1 & 2	789	114	53	12	71	1	22
4	3 & (attainment or achievement)	313	29	29		16	1	12
5	3 & (behavio(u)r or discipline*)	103	4	2		8	1	—
6	3 & (teaching or learning or pedagog*)	327	25	25		23	1	4
7	3 & (age or stage*)	53	2	10		2	—	1
8	3 & attend*	80	—	4		1	—	—
9	3 & motivat*	24	—	1		2	—	—

Appendix 2: Search Strategy 2006

A1 Databases

The following five databases were systematically search in March 2006 in order to update the original review:

- ERIC (US-based education index)
- Professional Development Collection (EBSCO)
- BEI British Education Index
- AEI Australian Education Index
- Psycinfo (a database of articles in psychology journals)

A2 Keywords

- Class size
- Class size with pupil
- Class size with student (not college or higher education)
- Teacher with student and ratio
- Teacher with pupil and ratio
- Class size and year of publication (2001, 2002, 2003, 2004, 2005, 2006)
- Teacher student ratio
- Teacher pupil ratio

(The keywords were truncated to comply with each database.)

A 3 Results

The number of references in each database is displayed in the table below:

Table A2.1: Number of references to class size by database searched

Source	No. of articles	Limited to:
ERIC	67	2001–06
Professional Development Collection (EBSCo)	67	2001–06
BEI	22	2001–06
AEI	56	2001–06
PsychoInfo	68	2001–06
Total	280	2001–06

Five additional references, including three from an economics journal, were identified by hand searching and/or recommendations from the Class Size Working Group.

A4 Application of inclusion criteria

Inclusion criteria (ie class size, schools only, developed countries, refereed articles, published in English) were applied in a series of steps to the 280 articles identified in the search of electronic databases. This resulted in:

Step 1: Duplicate titles removed 280=191

Step 2: Removed articles published prior to 2001 191=182

Step 3: Scanned titles to remove ones not relevant to class size 182=119

Step 4: Read all abstracts and removed ones referring to developing countries 119=87

Step 5: Removed last remaining non-refereed articles 87=83

Step 6: Read and included 83=46

A2.2: Number of articles on class size by country

Country	No. of articles
USA	10
American	7
UK	5
British	5
Scotland	2
Scottish	3
England	10
Welsh	1
Dutch	1
Australia	3
Australian	3
New South Wales	5
Victoria	1
New Zealand	1
Canada	2
Canadian	1
Scandinavian	3
Swedish	1
Norway	4

Additional 5 references by country: 2 England; 1 England & Wales; 2 USA.