



The Class Size Issue Rides Again

Starring Gene Glass and Mary Lee Smith, with a cast of thousands — the researchers and the researched.

Our Story Opens to Reveal that:

Teachers are almost universally agreed that large classes "are exhausting, a cause of frustration, and a reason for failure in basic subjects". Their views about what constitutes a "large" class have changed considerably in recent years, however. The same author quotes figures for England to show that the optimum size of class that teachers thought most desirable was regularly about 3 to 5 pupils less than the current average! Parents tend to support the teachers' views about the desirability of small classes and frequently send their children to private schools for just this reason. Both teachers and

parents argue that with smaller classes there is less strain on the teacher, and he can give more attention to individual pupils, and so improve achievement levels. Unfortunately, the research shows that the situation is not nearly as simple as this.

The Plot Thickens: A Brief Review of Some Research Studies

The first experimental investigation was carried out by the American, J.M. Rice, in 1902. He studied the arithmetic achievement of 6,000 children in grades 4–8 in relation to size of class, amount of instruction time, and several other factors, and found that class size had no bearing on the results. He repeated the experiment with a test of language in the following year, with the same outcome. Rice concluded that there was no relation between size of class and the results, that some of the best work was done in the largest classes, and some of the poorest in the smallest classes.

Countless similar investigations have been conducted since Rice's day, but many have been poorly designed and executed. Writing in 1954, Blake reviewed 267 published studies on the subject, and found only 22 that met the criteria of "scientific adequacy". Eleven of these had been evaluated for achievement test scores, and of these, 5 favoured small

classes, 3 favoured large classes, and 3 showed no differences. The other 11 studies were evaluated by an analysis of desirable class activities and teacher practices, and all found small classes superior in these respects.

Several large-scale surveys in the U.K. have not resolved the issue. The Scottish Mental Survey of 70,000 eleven-year-olds (Maxwell, 1958) found no differences in test scores in relation to pupil/teacher ratio. A longitudinal study of a national sample of 5,000 U.K. children found that children in smaller classes performed slightly better, but nearly all these children were in private schools, so the results were not conclusive. Morris studied the reading progress of English children aged 7–11 years in 51 schools, and found that “schools with an unfavourable pupil/teacher ratio returned higher scores on the whole than those with smaller classes!” She added that the large classes usually had other favourable circumstances, however. Peaker in 1967 found the same pattern in his national survey for the Plowden Report, and made the same qualifying comments.

More recently the problem has been tackled internationally by the surveys of the International Association for the Evaluation of Educational Achievement (IEA). In the mathematics survey, students in countries with larger classes scored higher at the 13-year-old level, but the reverse was true at the 17–18 year level. It was suggested in explanation that, at the lower level, backward classes were reduced in size to assist their progress, and good teachers were given larger classes because they were able to cope with them. At the higher level, there would seem to be a tendency for the more advanced students to have smaller classes.

The IEA surveys in reading, science and literature, published in 1973, showed some relationships between class size and achievement but these were reduced to zero once the effects of home background and type of school/programme were taken into account. It is clear, then, that the problem of class size and achievement is far more complex than appears at first sight. Many other factors must be taken into account, and only sound experimental research will allow these to be fully tested.

The vast majority of research studies have used achievement of pupils on tests as the main criterion. An American study by Olson in 1971, however, looked at other “indicators of quality”. Teachers in 18,500 primary and secondary classrooms were rated on four criteria of quality: individualization, interpersonal regard, group activity, and creativity. On these factors, smaller classes did produce significantly better results, and the relationship was consistent with classes ranging from 5 to 50 pupils.

However, as no measure of pupil achievement was used, no conclusion can be drawn about the importance of these 4 factors in promoting better learning amongst pupils.

. . . And Thickens: Factors Which Intervene in the Relationship Between Class Size and Pupil Performance

Several factors are believed to complicate the research studies and explain why children in small classes do not show up to better advantage. Some argue that when classes are homogeneous in ability they can be taught more efficiently in large groups, although there is no actual research which supports this view.

Again, small classes are more commonly found in rural areas and in older urban districts with bad social conditions. The children in such classes are less likely to perform as well as those from urban middle-class schools which frequently have large classes. Of course the opposite would be true of the small classes found in elite private schools. Slow learning students placed in small classes would also complicate the research picture.

Size of class also varies according to level of education. Smaller teacher/pupil ratios are found in the upper secondary school and universities, although the research has rarely supported this trend. Justification is found rather in the need for more space and more specialised facilities for the older, more advanced students.

Another complicating factor is the use of ancillary assistance in the classroom. English studies have shown that only about 43 per cent of the teacher’s time is spent on lesson instruction. Therefore, if teacher aids were used, the teacher’s efficiency would be increased, and the class size maintained at a higher level without loss of pupil achievement.

More important still is the behaviour and method of the teacher. Most would agree that different methods of teaching are best suited to different sized groups, and the more modern methods which focus on the way pupils learn rather than on the way teachers teach necessarily require smaller classes. Thus the lecture method can be used with equal efficiency for 200 students or for 10, but when used with large groups there can be little individual interaction between teacher and student. Even at primary and secondary levels, large groups of 100 or more are quite satisfactory where pupils are watching films or listening to illustrated talks. As soon as pupil participation is required, however, smaller classes become necessary, and with methods demanding close and continual interaction between individual pupils and their teacher, the smaller must the classes become to remain efficient. As one teacher put it, it is impossible to take an oral approach to French with classes of 40 pupils.

However, there is research in both England and America which shows that teachers do not automatically change from traditional lecture procedures when their class sizes are reduced. This fact would help explain why smaller classes do not show better in research studies. Improvement in pupil achievement will only follow from a reduction of class size if the teachers change their methods to take advantage of smaller groups, and if these changes are accompanied by genuine changes in the attitudes and beliefs of the teachers concerned.

Thus, the main reasons why smaller classes have not shown better achievement in research to date are:

- (i) The continued use of traditional teaching methods in small classes.
- (ii) The placing of low ability students in small classes, and vice versa.
- (iii) The failure to take socio-economic and urban/rural background into account.
- (iv) The concentration of research workers on a narrow range of curricular objectives.
- (v) The use of class size rather than pupil/adult ratio, thus ignoring the flexible use of staff for varying size groups.

Our Heroes Arrive and Start Unravelling the Plot . . .

Gene Glass and Mary Lee Smith of the Laboratory of Educational Research, University of Colorado, wrote *Meta-Analysis of Research on the Relationship of Class Size and Achievement* in 1978. It reports on a new technique of integrating the results of previous research. Their conclusion: that average pupil achievement increases as class size decreases.

Their research began with a four month literature search which turned up 300 reports, articles, theses, etc. They found the Australian Education Department report of 1974 and the Ontario Ministry of Education report of 1975 particularly helpful. Only 77 of the documents could be used. These yielded 725 comparisons of achievement in different class sizes. The data came from studies of 900,000 pupils back to 1900. Included were studies of the effects of tutoring in very small groups of one, two, or a few pupils. Class size was defined as the number of pupils being taught by a single teacher, giving a Pupil:Teacher ratio (P/I) for a class of thirty taught by one teacher as 30, for a supplementary maths class of four with a teacher as 4.

The results of the 77 studies were all expressed in different scales. These had to be reduced to show what Glass and Smith call achievement advantages, and expressed in a common way. This score (called a "delta") was the mean achievement score for the smaller class in a study minus the mean for the larger class, the difference being divided by the within-group standard deviation. To illustrate, Class A has 10 pupils, Class B in the same study 20. The students have been given a test with 50 items. The mean for Class A is 35, the mean for B is 30. The standard deviation for Class A and Class B is 10. The delta for this hypothetical case is $(35-30) \div 10 = 0.5$.

Such calculations are easy when means and standard deviations, etc., are given. But many were not and Glass worked out ways of estimating them from other data given.

Of the 725 deltas calculated 60 per cent were positive, indicating that achievement was higher in smaller classes. The average was 0.9. Further analysis revealed two important interactions. The size of the difference depended on the size of the classes being compared. It also depended on the quality of the research design. Effects were stronger in studies having good design characteristics. Further mathematical analysis produced the now famous graph.

Imagine a typical pupil in a typical class of 40. He can be described as being better than 50 per cent of all the pupils of his class-level in a country-wide achievement test. The same pupil in a class of 20 would be better than

55 per cent of this group. In a class of 15 he would be better than 58 per cent. In a class of 10 he would be better than 65 percent. And being taught in a group of five he would improve his achievement to exceed that of 74 per cent of his class peers.

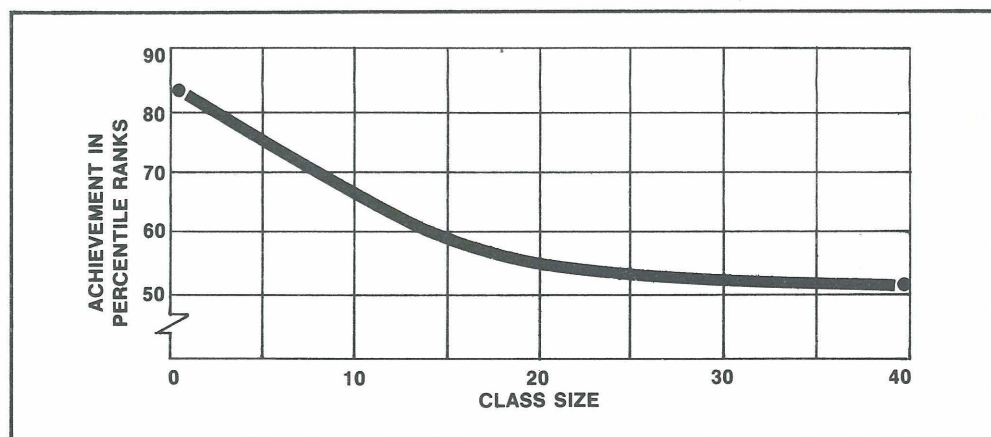
Another example: the average pupil in a class of 40 might be expected to gain one year's school knowledge in a year. In a class of 20 he could be expected to gain approximately 1½ year's knowledge. In a class of five he could be expected to gain 1.7 year's knowledge in a year.

In the figure, as in the examples, the curve starts to rise most dramatically when class size is reduced to below 20 pupils. Such improvement is not of course automatic and relies on the better use the teacher makes of the opportunities smaller classes give. Instances of substantially larger classes out-performing smaller classes have been recorded. Glass and Smith point out that "researchers must take account of what actually takes place in smaller classes: the instructional procedures used, the beliefs and capabilities of the teachers, the demonstrated abilities and backgrounds of the pupils, the subject matter, and the like. These ultimately determine whether the potential for increased learning that smaller classes create will be realised".

Glass and Smith found further that the relationship between class size and achievement was slightly stronger in secondary school than in primary school, but not strong enough to lead to the conclusion that primary pupils would profit less than secondary pupils if class sizes were reduced. There also appeared to be no difference in the results for reading, mathematics, and language.

The overall difference in results between the well controlled and the poorly controlled studies was dramatic. The curve for the poorly designed studies was almost flat, indicating, at best, a very small advantage to smaller classes. There was no correlation between class size and achievement in studies done before 1940.

How does one judge the importance of the differences shown in the figure? With such a small decrease in achievement between class sizes of 30 and 40 could it be argued that in these straightened times a return to 40 pupils per teacher would do little harm? Glass and Smith are continuing with their work and are now relating class size to classroom practice, and field studies are being conducted to see what changes take place in classrooms when they are reduced in size. In two schools four infant classes, each with a single teacher will be observed for half a year and then extra teachers will join the staff, the classes will be made smaller and the classes observed for the second half of the year. Such research as this will perhaps show why the increases are so dramatic as class size decreases below 20. However, in the meantime, it is



clear that increasing class size to save money will cause pupils to learn less. The effects such moves would have on teacher morale can be best spelled out by teachers' unions.

Would it be economic to increase achievement by reducing class size dramatically — to say, below 15? Already we reduce class sizes for some pupils, for example, backward readers, and reading recovery programmes report that the gains children make are worth the expense. The employment of less expensive paraprofessional or ancillary staff can free teachers for professional duties (that is, for teaching, which is often pushed aside by administrative chores). Grouping and individualised programmes are also methods of cutting down the instructional group size, if not the class. Staggered hours so that children "glide" in, some coming early for reading instruction and going early, others arriving later for school and reading, and going later, would also cut down the size of the instructional group.

In the end, however, weighing up outcomes against costs is a question of values. Glass shows a clear relationship between class size and achievement. What value does society, and therefore the school, put upon a particular magnitude of improved achievement, and upon those values the school can give that are not measurable?

After the Cheering Has Died Down: Our Heroes Methods Are Questioned

In essence Glass and Smith's techniques boil down to an attempt to quantify — to put into numbers — a review of all the available literature on the subject. The danger of this is that it lends the results an appearance of more accuracy and veracity than they may deserve. There are two important and related points which need to be made and which should influence any interpretation of the findings.

- (a) There are very few studies which contrast small classes (i.e., 1–10) with classes a little bigger than themselves (i.e., 2–16) thus the graph as drawn may reflect the influence of a very small number of results.
- (b) A substantial proportion of the effect produced by the analysis may result from the comparatively small number of studies which contrast individual instruction with larger classes. The inclusion of these studies may give the Glass Smith graph an unwarrantedly sharp bend and exaggerate the real gains to be made from reducing class size where, for us, it is most realistic, e.g., from 30 to 25. Nevertheless, the graph would be expected to follow the same shape, even if the one-to-one classes were omitted. However, the slope would be less steep at moderate class sizes and apparent gains from reducing class size much reduced. The slope at very small class sizes would be, however, much steeper.

Redrawing the graph to take these considerations into account could possibly reveal that Glass and Smith's results have tended to *overestimate* the gains in achievement resulting from a reduction in class size from 30 to 20, but have *underestimated* the gains resulting from individualised instruction.

To fill out (and perhaps to justify), the Glass and Smith predictions of large gains in very small classes many more pieces of research on the differences

between classes with few members are needed, for example, classes with three, four, or five members contrasted with classes of six, seven, and up to 16 members.

Overall the Glass and Smith finding of increased performance from smaller classes holds. But the effect is probably less than they show. Alas, the fate of our heroes is, in the meantime, to have their importance, like their graph, lowered.

Credits:

The first part of this article was written by Warwick Elley, now Reader in Education, University of the South Pacific, Fiji, for New Zealand *set* in 1975, summarising the work of Douglas Pigeon in 1973 for the OECD, published by them as "Class Size as a Factor of Pupil Performance: A Policy Analysis".

The second part, *Our Heroes Arrive . . .*, is a summary of two articles: the first by Gene Glass, Leonard Cahen, Mary Lee Smith, and Nikola Filby, "Class Size and Learning — new interpretation of the research literature" in *Today's Education*, April-May 1979; and "The Class Size/Achievement Issue: New Evidence and a Research Plan" in *Phi Delta Kappan*, March 1979, by Leonard Cahen and Nikola Filby.

The third part, *After the Cheering . . .*, is by Peter Jackson of the Test Development Unit of the New Zealand Council for Educational Research and is based on examination of Glass, G.V., and Smith, M.L., *Meta-Analysis of Research on the Relationship of Class Size and Achievement*, Boulder, Laboratory of Educational Research, University of Colorado, 1978.

A report drafted by Mudina Campbell of the New Zealand Department of Education Research and Statistics Division was of help to the editor.

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