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# Reforming School Education

## Class Size and Teacher Quality

Jennifer Buckingham

Research shows that effective teaching is far more important than the number of children in the classroom.

In the area of school reform, class size reduction seems to hold all the aces. It is popular with academics, teachers, students and parents alike. It seems intuitive that to have fewer children in a class is better.

It is often claimed that research unequivocally confirms this. Closer examination of the research on class size and student achievement, however, reveals that such claims are specious. Much of the research is flawed in ways that make it unreasonable to expect the same results in a real-world situation. Many studies have introduced other reforms at the same time as class size reduction, making the effect of class size alone impossible to determine. In most cases those participating in the experiment were motivated to produce positive results. Only a small minority of studies found any positive effect of smaller classes on student achievement, usually in classes of less than 20, and few of these effects were large.

One of the main recommendations of the recent report of the 'Independent Inquiry into Public Education in NSW'—initiated and funded by the NSW Teachers Federation and chaired by Professor Tony Vinson—is that large scale class size reduction takes place in state schools, bringing class sizes in Kindergarten through to Grade 2 (K-2) to a maximum of 20. The report said it had been guided 'not only by the consistency of the findings, but also the quality of the research yielding particular results.'<sup>1</sup> But the findings on class size suggest that there is little if any reason to believe that class reduction in the order of 25 students to 20 students would have an effect large

enough to warrant the cost. Research tells us that effective teaching is much more important than the number of children in the classroom. It is therefore much wiser to invest in the quality of teachers, rather than quantity.

The lack of good evidence about the efficacy of smaller classes is one reason why governments should not commit billions of taxpayer dollars to class size reduction. The other is that setting maximum class sizes at an arbitrary amount is yet another encroachment on the ability and freedom of schools to distribute their resources in the way they see fit. School systems should be moving away from centralised decisionmaking, not increasing it.

### Class size and achievement

Hundreds of studies can be cited on the relationship between class size and student achievement. Education researcher Ronald Ehrenberg and colleagues claim that

Most have found some evidence that smaller classes benefit students, particularly in the early grades, and especially kids at risk of being underachievers. Unfortunately, most of these studies were poorly designed. Teacher and student assignments were rarely sufficiently random; a number of studies were simply too brief or too small, and too few had independent evaluation.<sup>2</sup>

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Other researchers such as Stanford University’s Eric Hanushek go further, arguing that most of these studies are not only flawed but also fail to produce convincing evidence that class size has any significant effect on student achievement.<sup>3</sup> Hanushek is not without his critics and their points of contention with his research should be considered.

In a meta-analysis of 59 studies yielding 277 estimates of the effect of class size on student achievement, Hanushek found that 14.8% of these estimates were positive and significant. That is, students in smaller classes showed significantly higher achievement than their counterparts in larger classes. The remaining estimates were either insignificant (no difference in achievement—71.9%) or negative and significant (smaller classes had lower achievement—13.4%).<sup>4</sup>

Princeton University’s Alan Krueger argues that Hanushek’s method of selecting studies, extracting and counting the estimates is irrational and has produced a biased result. Krueger claims that multiple estimates from one sample are biased towards insignificance and that these results have a greater margin of error. For this reason, they should have less weight in a meta-analysis and therefore less influence on the results.

Whether one is persuaded more by the case presented by Hanushek or by Krueger, the strongest evidence is in the statistics produced by their various methods of analysis.

Table 1 below shows that even when estimates are weighted and manipulated so as to avoid perceived bias toward studies showing no effect of class size—arguably creating bias in the opposite direction—the statistics do not show the ‘systematic evidence of a relationship

between class size and achievement’ claimed by Krueger.<sup>5</sup> If we accept Krueger’s point that multiple estimates from a single study should not carry as much weight as a single estimate (which is debatable even so), only one in four studies found that students in smaller classes had achievement rates significantly higher than students in larger classes.

**STAR, SAGE and Prime-Time**

The following studies are frequently quoted to prove that class size reduction increases student achievement, yet such conclusions are misleading for the reasons outlined below.

*Project STAR (Student Teacher Achievement Ratio) in Tennessee:*

One of the largest and most influential studies of class size reduction, its researchers recently reported that the gains made by small class students on their regular class peers declined when they returned to regular classes, and that significant enduring effects of class size occurred only for students who had been in a small class for three or four years. There was only weak and mixed evidence of a larger effect for minorities.<sup>6</sup> Further, classroom practices differed between the small classes that achieved the largest and smallest gains.<sup>7</sup> That is, small class benefits were mediated by the quality and method of teaching.

Project STAR suffers from the methodological problem of the ‘Hawthorne Effect’. This is where the participants in an experiment are aware of their role and are motivated to ensure it succeeds. The non-random self-selection of schools into the project creates another problem, because such schools might have a greater interest and enthusiasm for such reforms, perhaps inflating the results.

**The methodological problems of Project STAR cannot be dismissed as ‘criticisms’.**

**Table 1. Krueger’s (2002) Re-analysis of Hanushek’s (1997) Meta-analysis**

	<i>Hanushek: Estimates weighted equally</i>	<i>Krueger (1): Estimates weighted by inverse of number of estimates in study</i>	<i>Krueger (2): Estimates weighted by citation frequency</i>	<i>Krueger (3): Estimates derived from regression analyses of original estimates</i>
<i>Result</i>				
Positive and significant	14.8%	25.5%	30.6%	33.5%
Insignificant	71.9%	61.2%	62.3%	58.4%
Negative and significant	13.4%	10.3%	7.1%	8.0%

*Source:* Lawrence Mishel and Richard Rothstein, *The Class Size Debate* (Washington D.C.: Economic Policy Institute, 2002).

The methodological problems of Project STAR cannot be dismissed as ‘criticisms’. They create serious doubt over whether the results achieved by Project STAR would be replicated under different conditions.

*The SAGE (Student Achievement Guarantee in Education) in Wisconsin:*

Schools involved in the SAGE programme implemented a variety of reforms at the same time as class size reduction, including a longer school day and increased collaboration with community organisations; a more rigorous academic curriculum; and staff development and accountability mechanisms. Therefore any increases in achievement *cannot* be confidently attributed to reductions in class size.

In addition, the same team of researchers discovered important differences in teaching styles between SAGE and comparison schools. Instruction in SAGE schools was predominantly teacher-centred as opposed to student-centred.<sup>8</sup> Differences were also identified between classrooms within SAGE schools. So, as in Project STAR, the aptitude of the classroom teacher is the key, not the number of children.

*Prime-Time project in Indiana:*

This study was not random, other changes in school policy occurred at the same time and it is possible that teachers were motivated to ensure that small classes worked.

The extension of class size reduction from the original 24 experimental schools to all schools occurred after only one year. Even reviewers who favour class size reduction have admitted it was therefore ‘not possible to compare results for small classes with a comparable group of larger classes’.<sup>9</sup>

**Other studies**

The following studies are less well-known. Only one, based on New Zealand data, finds consistent effects of class size on achievement, but whether the gains are large enough to justify the expense is debatable.

*California Class Size Reduction Initiative:*

The Class-Size Reduction (CSR) Research Consortium concluded on the basis of four years of data analysis that ‘no strong relationship can be inferred between achievement and CSR’.<sup>10</sup> Furthermore, the large

number of extra teachers demanded by CSR led to ‘a deterioration in teacher quality which in some cases fully offset any benefits of smaller classes.’<sup>11</sup>

*Hoxby’s (2000) Population Variation Study in Connecticut:*

In this observational study, Caroline Hoxby,<sup>12</sup> a Harvard economist, looked at the relationship between achievement and changes in class size due to natural variation in age cohorts in the population.

The effect of reducing class size was estimated to be close to zero. Further, the results do not suggest that class size reductions are more effective in schools that serve low-income or African American students (in fact, the only significant result was an improvement in fourth grade reading scores of high-income students).

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*UK National Child Development Study*

In another observational study of existing data from the 1960s, Maria Iacovou<sup>13</sup> looked at average class size at age 7 and found that class size was related to student attainment in reading but not maths. A small effect persisted to age 11 for girls only and for children from large families. There was no evidence of greater benefit to disadvantaged students.

*Third International Maths and Science Survey (TIMSS)*

Class size effects for 18 countries were estimated using maths and science performance in TIMSS and average class size data. Class size effects varied greatly between countries, with large effects in only two countries: Greece and Iceland.<sup>14</sup>

It was concluded that class size is more important when teachers are less effective. Investment in fewer, more highly educated and better paid teachers seems to result in higher student achievement.

*Christchurch Health and Development Survey:*

Found significant effects only for children in persistently smaller average classes between the ages of 8 and 13, on both childhood test score improvements as well as on early adult outcomes such as completed education and unemployment.<sup>5</sup>

**Australian research**

Australian research on class sizes is scarce. A study by Sid Bourke in Melbourne in the 1980s found that smaller classes were related to higher achievement in

maths,<sup>16</sup> but John Keeves has noted that analysis of these results at the class level revealed that class size was also related to student ability (sorting) and that controlling for this changed the relationship between class size and achievement. Keeves concludes that 'there is little clear evidence to support the costly reductions in class size'.<sup>17</sup>

The analysis of TIMSS results described above did not lead to any meaningful findings for Australia. The researchers found that average Australian class sizes in maths and science were not good proxies for actual class sizes.

### Implications

The Vinson Report estimates that the reduction of class sizes to a maximum of 20 in Years K-2 would cost \$47 million dollars per annum in disadvantaged schools and \$225 million per annum in all schools. Even this figure underestimates the cost of class size reduction as it accounts only for extra staffing costs. Each additional teacher necessitates an additional classroom, must be educated and trained, will need extra classroom resources and require ongoing professional development.

Not only is the cost large, but the findings of the studies described earlier are mixed and weak at best on the issue of class size. The one major New Zealand study seems to be an exception, but it is not clear why. It is also not clear whether the gains found are analogous to the costs involved. Further research should be done to explore this.

Only one thing comes through loud and clear from all of the research: what goes on in the classroom is more important than how many children are involved. This is not to say that classroom activity is unaffected by the number of children, but that proven and appropriate teaching methods are paramount.

### Class size myth 1: individual instruction

The idea that a teacher can devote more time to each student in a smaller class, thereby increasing the amount students learn, is intuitively appealing. Yet simple calculations show this appeal to be misplaced.

In a six hour school day, approximately five hours are spent in the classroom. If half of this time is spent directly addressing the class, and the other half on individual attention, each child would hypothetically

receive six minutes of individual instruction in a class of 25, or 7.5 minutes of individual instruction in a class of 20. That is, a class size reduction of this magnitude buys an extra 1.5 minutes per day of teacher's time. If two-thirds of classroom time is spent on individual attention, students get two minutes more in a class of 20 than 25.

These calculations may be simplistic, but indicate the insubstantial change in individual attention that a 20% reduction in class size brings, at considerable cost.

Another counter to the individual instruction theory comes from Project STAR. Some of the regular size classes were assigned a teacher's aide. Even though children in these classes presumably had twice as much individual attention, there was no difference in achievement levels between regular size classes with and without teacher's aides.

### Class size myth 2: improved teaching

It is said that small classes provide the potential for more effective teaching strategies—suggesting that small classes alone do not produce gains in learning; that their benefits are mediated by teacher quality. The research discussed earlier demonstrates that there were notable differences in teaching and classroom management styles between high and low achieving small classes.

Teachers rarely change their teaching and classroom management styles. Even Project STAR data shows this, with few teachers modifying their classroom practices in different size classes after attending a professional development programme.<sup>18</sup> If this is the case, then reducing class size will have little or no effect without ensuring that teachers adopt instruction and management practices proven to be effective in small classes. This substantial investment in professional development once again adds to the cost of class size reduction, and would more than likely be equally effective without changing class sizes.

### Teacher quality

Commonsense says that it is better to have a great teacher in front of a large class than a mediocre teacher in front of a small one.

Writing in the Bulletin of the US National Association of Secondary School Principals, Leslie

**What goes on in the classroom is more important than how many children are involved.**

Kaplan and William Owings state that ‘Research affirms that teaching quality is the single most important factor influencing student achievement’,<sup>19</sup> and cite a wide variety of supporting studies. According to Ronald Ferguson, a Harvard University economist, research shows that teacher quality, not class size, is the most important factor in education.<sup>20</sup> Australian research has also shown that the largest differences in achievement between students is that between students in different classes.<sup>21</sup>

The ‘Ramsay Report’ on the Review of Teacher Education in NSW,<sup>22</sup> provides plenty of evidence to support the primacy of teacher quality, demonstrating the impact of teachers on student achievement and the benefits from investing in teacher education.

Although much has been said about the importance of teacher quality, what makes a good teacher is yet to be adequately defined. We know that some teachers bring about higher levels of achievement from their students than others, but consensus on how is still elusive. A certain proportion of good teaching comprises temperament, charisma, enthusiasm and other qualities that cannot be measured or taught. However, several criteria can be identified:

- mastery of subject matter and curriculum content;
- awareness of the individual abilities and capabilities of students;
- classroom management skills;
- use of teaching strategies that are proven effective;
- good verbal communication skills.

Each of these capacities is necessary but insufficient on its own. Strong content knowledge is crucial but not enough—teaching also requires a set of professional skills separate from but related to the subject being taught.<sup>23</sup> These skills are supposed to be gained from teacher education courses.

What constitutes effective pedagogy is beyond the scope of this article, but there seems to be agreement that teacher education in Australian universities is inadequate in imparting both pedagogical and behaviour management skills to teachers. There is too much emphasis on the theoretical over the practical. New teachers have usually spent only a few weeks in teaching practicum, and support for them in the extremely difficult first year in a school is patently inadequate.<sup>24</sup>

Another problem is the lack of evidence-based ongoing professional development for classroom teachers. The NSW Department of Education’s undervalues the need for teachers to be aware of new

developments in both curriculum and pedagogy, and teachers have too few incentives to seek out professional development opportunities for themselves.

Improving the quality and effectiveness of the teaching force as a body cannot be achieved through better pre-service and in-service training alone. Some teachers will be unaffected by any amount of professional development. Improving the teacher force involves both enhancing the skills of willing teachers and removing incompetent and unwilling teachers.

This is best achieved by allowing schools to hire and fire. The centralised staffing of public schools in NSW is one of their greatest impediments to success. Given that teachers are the most important influence on educational achievement, the inability of public schools, whether through principals or school boards, to ‘choose their team’, puts them at great disadvantage.

## Conclusion

Evidence shows that most research on the relationship between class size and student achievement is flawed, or shows a marginal effect of reducing class size, or both. Research is, however, unequivocal on the finding that good teaching practices are far more effective than any other external influence on learning.

Public funding has limits, even for imperatives such as education. It is, therefore, necessary to prioritise. When it comes to teachers, quality is far more important than quantity. The push for class size reduction serves only to weaken the case for more urgent and supportable concerns, such as improving teacher education and professional development, as well as making it easier for schools to remove ineffective teachers.

Whatever the conclusions of researchers and analysts, such priorities should be determined at the school level. Given the opportunity, some schools may well decide against all evidence that small classes are of highest importance, while others might opt for slightly larger classes but offer higher salaries to attract better teachers. Yet other schools might distribute their funding an entirely different way. It should be up to schools to decide how to spend their resources to best meet the needs of their students, and up to parents to evaluate whether this objective is being met.

## Endnotes

<sup>1</sup> Report 1, p.84.

<sup>2</sup> Ronald G. Ehrenberg, Dominic J. Brewer, Adam Gamoran and J. Douglas Willms, ‘Does Class Size Matter?’, *Scientific American* 285: 5 (2001), pp. 78-85.

- <sup>3</sup> Eric Hanushek, 'The Evidence on Class Size', *Occasional Paper* 98-1 (University of Rochester: W. Allen Wallis Institute of Political Economy, 1998).
- <sup>4</sup> Percentages do not add to 100 because of rounding.
- <sup>5</sup> Alan B. Krueger, 'Understanding the Magnitude and Effect of Class Size on Student Achievement' in *The Class Size Debate*, ed. Lawrence Mishel and Richard Rothstein (Washington, D.C.: Economic Policy Institute, 2002), p.31.
- <sup>6</sup> Jeremy Finn, Susan B. Gerber, Charles M. Achilles, Jayne Boyd-Zaharias, 'The Enduring Effects of Small Classes', *Teachers College Record* 103: 2 (2001), pp.145-183.
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- <sup>9</sup> Bruce J. Biddle and David C. Berliner, 'What Research Says About Small Classes and Their Effects', *Policy Perspectives* (San Francisco: WestEd, 2002), p.6.
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- <sup>13</sup> Maria Iacovou, 'Class Size in the Early Years: Is Smaller Really Better?' (Essex University: Institute for Social and Economic Research, 2001).
- <sup>14</sup> Ludger Woessmann and Martin R. West, *Class Size Effects in School Systems Around the World: Evidence from Between-Grade Variation in TIMSS* (Research Paper PEPG/02-02, Program on Educational Policy and Governance, 2002), <http://www.ksg.harvard.edu/pepg/pdf/PEPG02-02.pdf>
- <sup>15</sup> Michael A.Boozer and Tim Maloney 2001, 'The Effects of Class Size on the Long-Run Growth in Reading Abilities and Early Adult Outcomes in the Christchurch Health and Development Study' (Working Paper 01/14, New Zealand Treasury, 2001).
- <sup>16</sup> Sid F. Bourke, 'How Small is Better: Some Relationships Between Class-size, Teaching Practices, and Student Achievement', *American Educational Research Journal* 23:4 (1986), pp.558-571.
- <sup>17</sup> John P. Keeves, 'The Contribution of IEA Research to Australian Education', in *Reflections on Educational Achievement: Papers in Honour of T. Neville Postlethwaite*, ed. Wilfried Bos and Rainer H. Lehmann (New York: Waxmann, 1995), p.148
- <sup>18</sup> Ronald G. Ehrenberg, Dominic J. Brewer, Adam Gamoran and J. Douglas Willms, 'Class Size and Student Achievement', *Psychological Science in the Public Interest* 2: 1 (2001), 1-30.
- <sup>19</sup> Leslie S. Kaplan and William A. Owings, 'The Politics of Teacher Quality: Implications for Principals', *National Association of Secondary School Principals Bulletin* 86: 633 (2002), pp.22-41
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