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## Class Size

Class size has been studied in the United States since about 1900, yet it was still in limbo by 2008. An early econometric study tied small classes to improved student outcomes. Fredrick Mosteller, Richard J. Light, and Jason A. Sachs's study discussed only two topics as sustained inquiry in education: skill grouping and class size. They sought empirical evidence about education outcomes from heterogeneous or skill-grouped classes and about the impact of class size on student learning.

The authors found a few well-designed studies on benefits of skill grouping, and results were equivocal. They then described the Student Teacher Achievement Ratio (STAR) randomized, largescale class-size experiment (1984-1990) that demonstrates convincingly that student achievement is better supported in smaller classes in Grades K-3, and that this enhanced achievement continues
when the students move to regular-size classes in the fourth grade and beyond.

Mosteller and colleagues' finding is mysterious juxtaposed with a Gene Glass comment in 1992 of which he asserted that of all the areas omitted from deliberation in previous encyclopedia publications, none is more unusual than that of school class size. According to Charles M. Achilles, between the 1971 edition and second, 2003 edition of the Encyclopedia of Education, any understanding of class size and its actual uses have arguably seen both the greatest and least change among the fundamentals of education. Achilles has made that claim for the past 5 years. Even with huge increases in knowledge based upon robust research about what small classes achieve, how and why gains occur, about policy and implementation strategies, the ideologies that Glass described still hinder using small classes to improve education processes and outcomes.

With full data on 11,601 of approximately 15,000 students involved, the STAR database has been used in secondary analyses to demonstrate small-class, K-3 benefits on student long-term improvements, including large social and economic benefits such as high school graduation, college admissions, improved health, decreased grade retentions, and closing achievement gaps.

STAR, in its Lasting Benefits Study (LBS), followed students in Grades 4-8 combined with the large $\mathrm{K}-3$ small-class implementation in 16 of Tennessee's poorest counties (1990-1995); this study provided a base for burgeoning U.S. and international class-size studies. Small classes were court-mandated remedies in the New Jersey Supreme Court case Abbott v. Burke (1990, 1994, 1997) and in the Campaign for Fiscal Equity in New York. After noting that Title I had failed in its mission to address equity issues, Isabel Sawhill commented on education's role for opportunity in America and identified good teaching and small classes as two measures that have been shown to improve educational outcomes. Small classes should be the cornerstone of education improvement, not ubiquitous Title I-type approaches such as projects, pull-outs, and teacher assistants. International class-size interest is shown by substantial work in Australia, Canada, the Far East (especially Hong Kong, Singapore, South Korea, and China), the Netherlands, New Zealand, Sweden, and the United Kingdom.

The profound and durable effects of small class size on students' opportunity to learn and achieve in Grades K-3 are well documented. The STAR experiment and follow-up studies such as Challenge, Enduring Effects, and other initiatives such as Wisconsin's Student Achievement Guarantee in Education, consistently demonstrated positive short- and long-term small-class effects. No negative effects on student behaviors, attitudes, or achievement were found. Less is known about how small classes influence achievement in the middle grades.

A search of the education database Academic Search Premier and the social sciences section of the economics database PAIS International and Archives produced 874 peer-reviewed articles that contained the key words class size. Most articles presented or discussed research on class size in the United States, Western Europe, and Asia at the elementary level. A few dozen articles explained the influence of class sizes on student attitudes, perceptions, and achievement at high school and university levels. A Boolean search of both databases using class size and middle school produced 24 results. We found no experimental, quasi-experimental, or well-developed nonexperimental studies in the United States on outcomes of classsize reduction on middle school student achievement. An obvious dearth of empirical research exists in the knowledge dynamic.

An occasional study and some practice suggested that small classes are important in later years of schooling and can influence learning without extra costs. When one considers that apprenticeships, internships, and seminars in high school are typically small groups, as are Advanced Placement and International Baccalaureate, and Title I remediation courses, reducing class sizes in middle school to produce increases in the cognitive and affective outcomes seems reasonable. An investigation of class size on student achievement in middle school might be moot if education leaders and policymakers implemented class-size reforms appropriately in elementary grades; unfortunately that is currently not the case.

Middle school principals seek ways to address student achievement and behavior in their schools. Ideas like additional professional development, homogeneous grouping, and pull-out programs
are widely used, with limited or no positive largescale results. Daniel Tanner and Laurel Tanner declared the principle is clear: Class-size controls the nature of instruction and form of assessment. William Ouchi wrote, structure must change before culture can change. W. Edwards Deming demonstrated through his work in Japan and America that administratively mutable structural changes account for $85 \%$ to $94 \%$ of an organization's effectiveness. While class size in middle schools should not be a targeted intervention, it holds promise as a middle school reform while policy and education leaders demonstrate the leadership to support appropriate implementation in the primary school years.

Helen Pate-Bain renewed national interest in class size while president of the National Education Association. As professor of education administration and director of the Center of Excellence for Research in Basic Skills at Tennessee State University, she initiated the STAR experiment and served as one of the four STAR principal investigators. As a co-chair of HEROS, Inc., she has advanced classsize research by housing STAR follow-up studies and developing the Reduce Class Size Now Web site, which makes structured abstracts related to class size available to the public. Her work has contributed to the STAR and Beyond database and the National Class Size database.

## Project STAR and Beyond: A 13-Year Database

STAR data are available to researchers through the STAR and Beyond database. This public data set contains student- and school-level data. Although the experiment ended in 1989, researchers continued to collect student achievement data through high school and beyond. The primary student-level data file contains information on 11,601 students who participated in the experiment for at least 1 year. Information for each grade, $\mathrm{K}-3$, includes

- Demographic variables
- School and class identifiers
- School and teacher information
- Experimental condition ("class type")
- Norm-referenced and criterion-referenced test scores
- Motivation and self-concept scores

Additional data, for some or all students, include

- Achievement test scores for students, Grades 4-8
- Teachers' ratings of student behavior in Grades 4 and 8
- Students' self-reports of school engagement and peer effects in Grade 8
- Course taking in mathematics, science, and foreign language in high school
- SAT/ACT participation and scores
- Graduation and drop-out information

The sample-size ranges for each stage of data are shown below.

- Grade K-3 Achievement tests 5,907-6,684
- Grades K-3 Motivation, self-concept

5,038-6,129

- Grades 4-8 Achievement tests 2,593-6,441
- Grade 4 Participation ratings 2,217
- Grade 8 Participation ratings 2,978
- Grade 8 Identification self-reports 3,648
- High school courses and grades 3,922
- High school graduation status 4,992
- SAT/ACT College entrance scores 3,880
- SAT/ACT participation (yes/no) 11,601

The online User's Guide provides details about each file and the variables, such as stages of data collection, codebooks with frequencies for all variables in the files, recommendations about approaches for analyses, and a bibliography of studies from the STAR and Beyond data.

## National Class Size Database

Education researchers, policymakers, and practitioners commonly misuse the terms class size and pupil-teacher ratio (PTR) as synonyms. Class size and PTR are different concepts and cannot validly be used interchangeably. Class size is the number of students who regularly appear in a teacher's classroom and for whom that teacher is primarily responsible and accountable. PTR is a derived estimate commonly computed by dividing the number of students at a site by the number of professionals who work there, including counselors, special teachers, administrators, classroom teachers, and librarians. Typically, the difference between average
class size in a school and PTR in the same school for K-3 would be 9 or 10 students, and up to 15 in some sites.

Researchers, policymakers, and practitioners need to understand and carefully maintain the distinction between class size and PTR when studying class size and/or class-size reduction. Available public information on education often adds to the confusion, as federal, state, and local agencies typically report PTRs whereas class-size data are extremely difficult to obtain, if available at all.

Educators need to collect and report actual class-size data as well as PTR data. HEROS, Inc.,
a nonprofit independent research agency, has designed the National Class Size database so actual class sizes can be collected at the school level. Security has been set up so only individual schools and HEROS can access the actual data. School systems, state departments, and so forth cannot perform data entry or change data in any way. However, anyone (parent, legislator, teacher, state department staff, and others) with an Internet connection can access this database to run a report. The National Class Size database will help researchers to analyze class-size data with achievement data or other pertinent variables.

Table I Class-Size Studies and Initiatives, 1978-2009

| Dates | Study/Focus | Grades | $N$ |
| :--- | :--- | :--- | :--- |
| $1978-1980$ | Meta-analyses (Glass \& Smith; Smith \& Glass, et al.) | Multiple Studies |  |
| $1983-1986$ | Dupont (TN) (one school) Project STAR Pilot Test | K-3 | 300 |
| $1985-1989$ | Project STAR (TN) (42 districts, 79 schools) The Experiment | K-3 | 11,600 tested* |
| $1990-1995$ | Lasting Benefits Study (LBS; TN) to follow STAR Students | $4-8$ | $5,000-6,000 /$ year |
| $1990-1995$ | Project CHALLENGE (TN; 16 districts) | K-3 | 58,000 (est.) |
| $1993-1994$ | SSS, High Point (NC) | K-3 | 145 |
| $1994-2009$ | SAGE (WI; statewide) | K-3 | ? |
| $1995-2009$ | Enduring Benefits | $8-12$ | $4,000-6,000 / y e a r$ |
|  | $\bullet$ High school courses, ACT/SAT | and | (STAR data) |
|  | $\bullet$ College, etc. (TN) | $1-A d u l t$ | (STAR data) |
| $1981-1985$ | Prime Time (IN) | K-3 Adult |  |
| $1996-2002$ | CA Class-Size reduction (CSR) | K-3 | ? |
| $1988-2009$ | Burke Co., NC** | K-4 | ? |

*Students had to be in class by November of the year tested. Total ( N ) of students in STAR sometimes was $15,000^{+}$(est.).
** ( $\mathrm{N}=15,000$ in district $)$
Other Major Class-Size Work
UK: KS1, KS2, Ages 4-11 or so ( $\mathrm{N}=20,000$ est.)
Canada: British Columbia, Alberta, Ontario
New Zealand (RR), Sweden, Australia, Netherlands, Far East (e.g., Hong Kong)
Numerous states: e.g., CA, FL, IA, MI, MS, NC, NE, NY, OK, TX (1982.HB72)
Serve Work: NC, several districts
Head Start: USA, since 1965
Perry Preschool: MI, N = 123
Abecedarian: NC, $\mathrm{N}=109$
Court Cases With Class Size*** Abbott v. Burke (NJ), CFE v. State (NY), Hancock v. Driscoll (MA)
***In remedy: Often PTR (pupil-teacher ratio) is incorrectly "substituted" in implementation.

In looking ahead, educators may find the joining of studies by researchers in other disciplines helpful in advancing the acceptance of small classes, at least in early grades. Studies by economists, physicians, and organization theorists on indoor air quality (carbon dioxide) and space use, teaching and teaching processes, and the increasing diversity in classes may coalesce so that appropriate-sized classes become a common phenomenon.

## Charles Achilles, Jane Boyd-Zaharias, and Christopher Tienken

See also Age Grading; Assessment; Differentiated Instruction; Differentiated Staffing; School Size

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