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AUTHOR	Achilles, C. M.
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ABSTRACT

Class size in elementary grades has taken on added importance recently. Research on the topic is finally getting some attention. Legislative and administrative actions to reduce deficits are pushing for larger class sizes, in addition to eliminating nonessential curricular activities, such as music, drama, and art. In Florida, various institutions are acting in opposition to small class sizes in ways that suggest willful political and administrative ignorance and incompetence. Research on class size reduction (CSR), such as the Student Teacher Achievement Ratio (STAR) program, have demonstrated that smaller class sizes improve students' academic achievement, improve their behavior and discipline both in the classroom and outside of school, improve their citizenship and participation/engagement in and outside of school, and enhance their development into productive, humane, and responsible persons who can contribute to society. Small classes are also an incentive to attract and keep teachers in teaching. Research-based recommendations are included the can guide educators' decision-making as they implement class-size changes. Appendix A briefly explains the differences between pupil-teacher ratio (PTR) and class size. (Contains 65 references and 8 tables.) (RT)

How Class Size Makes A Difference: What the Research Says

The Impact of Class-Size Reduction (CSR)

The 2003 SERVE Research and Policy Symposium on Class-Size Reduction and Beyond

Raleigh, North Carolina

2/25/2003

C. M. Achilles EdD[1]

C. M. Achilles, currently a Professor Education Administration at Eastern Michigan University and Seton Hall University (both part-time) was one of four Principal Investigators (PIs) of STAR and a consultant on numerous class-size studies (1984-present), including PI of Success Starts Small (SSS), funded by the Small Grants, School-Based Research Program of the Board of Governors of the University of North Carolina System (1994), (K. Kiser-Kling, J. Owen, A. Aust, co-authors).

Comments and opinions expressed in this paper are those of the author; they do not necessarily reflect the positions and policies of SERVE, SERVE supporting agencies, or of any other person.

THE IMPACT OF CLASS-SIZE REDUCTION (CSR)
A Sense of Urgency

The topic of class size in elementary grades has taken on added importance recently. There are several reasons for the urgency. First, the compelling and long-standing research on class size is finally getting some attention. This attention may (should) escalate if educators hope to try to contend with the requirements of the federal No Child Left Behind (NCLB) Act, and especially the call for adequate yearly progress (AYP). Interestingly, a group of respected researchers pointed out the extreme problems with the AYP goals and the high improbability that the goals can even be approximated (Linn, Baker & Betebenner, 2002)

Second, fiscal conditions (2001-2003, at least) throughout the nation are requiring legislative and administrative actions to reduce deficits. An early option to balance budgets is often to increase class sizes and in other ways reduce education spending [e.g., delay capital outlay; cut "non-essentials" like art, music, drama (aren't these the basics? They surely came before reading, math, science!); reduced extra-curricular" activities and athletics, curtail summer school]. In my opinion, this approach seeks to balance the budget on the backs of little kids, and to blame non-voting age youth for adult ineptitude.

However, by putting meaning into a former motto, "Less is more," it may be possible that fiscal hardships could benefit the class-size issue by urging educators both to be creative and to attend closely to the research on class size. Would people consider small classes, K-3, seriously if they knew that implementing them correctly would cost very little (if any) more once the space issue is not a problem?

In Florida, voters passed Amendment #9 that directly addresses class sizes, especially in grades K-3. The victory margin of more than 200,000 votes was in the face of Governor Bush's re-election and intense lobbing against class sizes. He was caught on tape saying he had "a couple of devious plans" if the amendment passed. (N. Y. Times, 11/1/02, p. A28 and Wall Street Journal 10/10/02, p. A4). In August (2002) the Florida Association of District School Superintendents (FADSS-great acronym!) distributed a "White Paper" on "Class Size Reduction

Constitutional Amendment" that generally opposed small classes for young students. The CEO of the James Madison Institute published a "Point of View" (8/8/02) harshly criticizing the class-size amendment (Moore, 2002). The James Madison Institute lists itself as a "nonpartisan, nonprofit research and educational organization" whose published works are not "to be construed as an attempt to aid or hinder the passage of any specific legislation." Given its boast of being a "research and educational organization," one must question why its report carries clearly inaccurate information on costs, and even the text itself errs by calling the amendment an issue of "classroom size" rather than class size.

Any solid research must rest on a modicum of precision, clarity, and accuracy. Without accuracy, mandates for small classes may be translated into "devious" plans to employ some arithmetic substitution such as pupil-teacher ratio (PTR) or "average" class size for actual class size. Class size is a precise concept requiring the adding of the actual number of students in each teacher's class. Use of PTR (a ratio implies division) as a proxy for class size will produce PTR results—essentially minimal—instead of class-size outcomes. Thus, the proposed plan in Florida to compute the "average class size for each grade level by figuring averages for entire districts" (Editorial: Orlando Sentinel, 1/06/03) will assure at least a) continuation of non-class size education outcomes in Florida and b) another set of "results" to show that small classes don't matter, but once again using PTR processes rather than class size as the improvement mechanism. A recent study has shown that in the USA the difference between class size and PTR in elementary grades is about 10. (Sharp, 2002; Achilles & Sharp, 1998). So, if the PTR in a school building is 16:1, the average teacher will be facing 26 or more students each day.

Two points here seem important. Following the research results closely should provide class-size outcomes similar to those found in STAR, Wisconsin's Student Achievement Guarantee in Education or SAGE, Burke County, NC and in other places where class size has been implemented carefully in elementary grades. A set of Recommendations for implementing appropriate-sized classes in elementary grades is on the next page.

HAND OUT: RECOMMENDATIONS

As the move to implement appropriate-sized classes in America's public schools escalates, educators need to use the available research to guide the changes. From years of studying and observing small classes, researchers and scholar practitioners have developed a research base theories, and consensually validated exemplary practices of outstanding teachers to guide effective class-size implementations of small classes. Informed Professional Judgement or IPJ is at the heart of class-size changes. **SMALL CLASSES ARE NOT SIMPLY HIRING TEACHERS AND DOING BUSINESS AS USUAL.**

A true class-size initiative will incorporate what the long-term class-size research has determined are important steps for successful class-size initiatives.

1. Early Intervention. Start when the pupil enters "schooling" in K or even pre-K.
2. Intense Treatment. The pupil spends all day, every day in the small class. Avoid Pupil-Teacher Ratio (PTR) events, such as "pull-out" projects or team teaching. Develop a sense of "community" and close student-teacher relations.
3. Sufficient Duration. Maintain the small class for at least 3, preferably 4, years for enduring effects.
4. Use Random Assignment in early grades to facilitate peer tutoring, problem-solving groups and student-to-student cooperation. (STAR).
5. Employ a Cohort Model for several years so students develop a sense of family or community. STAR results show the power of both random assignment and a cohort model. "Looping" adds teacher continuity to the cohort, and may be a useful strategy for added benefits. (Research is needed here).
6. Appropriate-sized classes in elementary grades will take policy and perhaps even legislation change. Evaluate process and outcomes carefully.

Adding ever endless "projects" ala Title I and continually disrupting the teacher's and students' day and continuity (e.g., coherence and stability) are not what the class-size research is about. To avoid needless costs and confusion, start in K and 1, add a grade per year through third grade. Reduce "specials' as small-class benefits will allow and re-allocate personnel to teach small classes. The difference between the PTR and actual class size provides some guidelines for planning. If the site has a PTR of 12:1, that suggests enough personnel to work toward class sizes of 15:1 or so and still keep some teachers for special assignments.

Equally worrisome with those types of politics and errors are errors evident in critiques of class size and class-size reduction (CSR) which show that many persons—both detractors and advocates—who discuss CSR and class size:

I. Have not read the research—especially the primary sources (e.g., the actual studies) such as STAR (Student Teacher Achievement Ratio, Word et al., 1990).

II. Confuse two extremely different terms, often substituting computations and outcomes of Pupil-Teacher Ratio (PTR) for class size (See Appendix A for examples).

III. Seem to believe that small classes (about 14-17 students/teacher) are simply adding teachers and doing "business as usual."

IV. Have not studied successful and unsuccessful approaches to doing CSR and getting small classes into place: There now are examples of both.

V. Speak of STAR (Student-Teacher Achievement Ratio) but do not really know much about the study. (Translate: They have NOT read it).

VI. Expect immediate grade-3 positive outcomes. (No).

VII. Believe that CSR requires considerable additional expense. (Probably not, if done in accordance with the research and with a modicum of creativity.)

At this point, some definitions are appropriate. First, in this paper a "small" class (S) is about 14-17 students per teacher. A really small class would be tutoring. The definitions here appear in several articles and papers by Achilles and others.

Class Size – "The number of students for whom a teacher is primarily responsible during a school year (Lewit & Baker, 1997, p. 113)." This is an addition problem. Class size is an organization for instruction important to teachers, parents, students.

Pupil-Teacher Ratio (PTR) – "The number of students in a school or district compared to the number of teaching professionals" (McRobbie et al., 1998, p. 4). In some venues all educators are part of the computation, including counselors, administrators, etc. In this division problem, the divisor is very important. PTR is a way to assure equitable distribution of funds and is important to administrators, policy persons, etc.

Hanushek (1998) reported that PTR reflects "the total number of teachers and the total number of students at anytime . . ." (p. 12). Some uses of PTR, however, include not just teachers, but other educators or adults serving the site. The PTR computations and definitions vary to reflect local and state rules, and public relations (i.e., favorable PTR).

Data available in large databases are PTR data. Surveys provide PTR data, or at best aggregated data (especially in secondary schools) of several classes resulting in an estimated or average class size. Valid ways to get class-size data are 1) to count the students in a class and/or 2) to establish class sizes and then monitor them as in STAR. It is impossible to do class-size "research" by avoiding class size and substituting PTR numbers or outcomes and calling those numbers class size. Research on class size requires hard work and visits to schools to check actual class sizes!

Class-Size Reduction (CSR) would include the processes involved in achieving class sizes smaller than the ones presently in place. Often this means changing the class size from 25 to 16 or so. One needs accurate pre and post data.

Class-size research has a long history, and over the years the designs and methods of class-size research have improved. Thus, any discussion of "The Impact of Class-Size Research" builds upon a foundation that includes small studies; meta-analyses; statewide pilot tests; a large and longitudinal, randomized experiment; evaluations; case studies, etc. As stated in Slavin (2002), the 2001 No Child Left Behind (NCLB) Act actually has attempted to define "scientifically based research" or SBR as "rigorous, systematic and objective procedures to obtain valid knowledge." This includes research that "is evaluated using experimental and quasi-experimental design" preferably with random assignment (p. 15). Some class-size work (e.g., STAR, SAGE, evaluations of the Burke County, NC initiative) meets these tests.

The primary research base for class-size "impact" is Tennessee's Project STAR (Word et al., 1990). As Mosteller (1995, p. 116) correctly noted, the Tennessee class-size effort really was

three studies: the experiment in K-3 (STAR), checking on the continuation of benefits achieved in STAR (Lasting Benefits Study), and Project Challenge, a four-year study of class-size implementation. STAR subsidiary studies and studies using the STAR database likely meet the new criteria for SBR.

The NCLB points have been discussed in the Educational Researcher (Feuer, Towne, & Shavelson, 2002) where the authors summarized six criteria or principles of scientific endeavors (p. 7). Prior to discussing the "Impact" of class-size research, I have provided some evidence of the substantial research base, showing how STAR matches with the "Principles" of scientific endeavors in Table 1 (Feuer et al., 2002, p. 7). Table 2 compares STAR to Crane's (1998) criteria for social program research. An important point is that STAR and other class-size studies usually are independent research: There is no monetary gain or connection (nothing for sale). Probably because of STAR's simplicity and because no salesperson knocks on the door with a program to "save education," folks don't really pay attention to the research. Besides, STAR results call into question much of current education practice.

NOTE: The several tables and the appendix have appeared in prior papers which I authored or co-authored. The tables are quite comprehensive. The interested reader should take time to peruse them for details. This paper's References incorporate added bibliographic material, not just text references.

Tables 3 and 4 offer views of the extensive research base behind the "Impact" statements in Tables 5, 6, and 7. These provide a level of "confidence" in class-size outcomes. Table 5 describes (briefly) the STAR experiment and how it was conducted. Tables 6 and 7 summarize

outcomes (impacts) of small classes. Table 8 shows research and theories behind the class-size "impact," including observed processes and class-size outcomes.

The Conclusion,

Changing the size of the class, the usual organization for delivery of instruction in U. S. schools, causes increased student outcomes (as shown in STAR). Unlike in a targeted project (e.g., Reading, where one would expect an increase in student reading scores), students in small classes improve in all subject areas tested (social studies, science, math, reading spelling, etc.). But, not just test scores improve. Students improve in major ways that for ease in remembering, I have labeled: The ABECEDARIAN (ABCD) Concept. The ABCD form presented here is similar to Dr. James Comer's four areas of schooling improvement,[2] as well as results from the Perry Preschool experiment. (E.g., Schweinhart & Weikert, 1997; Weikert, 1998; Xiang & Schweinhart, 2002)

A Academics (e.g., test-score performance).

B Behavior and discipline in classes and in school, including safety.

C Citizenship and participation/engagement in and outside of school.

D Development into productive humane persons who contribute to society and are responsible for their actions.

Table 8 provides an outline for discussion of the impacts of small classes in five general areas: 1) learning, 2) teaching, 3) classroom, 4) "other," and 5) student behavior. These points serve as guides for discussion. Rather than a panoply of "projects" to get each one of these desirable education interventions, contexts, or outcomes, reducing class sizes to fit the important task at hand causes, or paves the way, for each of the elements to "impact" the education

enterprise. What other intervention is so comprehensive? Small classes really are "whole school reform.," clearly meeting the new federal idea of "scientifically based research" (Slavin, 2002).

Appendix A briefly explains some differences between Pupil-Teacher Ratio (PTR) and class size showing why the two terms cannot be substituted for each other. The numerical difference between PTR and class size is about n=10 in U. S. elementary schools, (Achilles & Sharp, 1998)

Because appropriate-size classes impact both students and teachers (and parents, too, in some cases), small classes are also an incentive to attract and keep teachers in teaching. To most people, this large constellation of class-size impacts would be a STARtling occurrence.

TABLE 1. COMPARISON OF STAR DESIGN, PROCESSES, AND FACTS WITH ONE SET OF "PRINCIPLES OF INQUIRY".*

"ALTHOUGH NO UNIVERSALLY ACCEPTED DESCRIPTION OF THE PRINCIPLES OF INQUIRY EXISTS, WE ARGUE NONETHELESS THAT ALL SCIENTIFIC ENDEAVORS: ...

SCIENTIFIC ENDEAVORS*	STAR DESIGN, PROCESSES and FACTS
1. **Pose Significant Questions That Can Be Investigated Empirically.** The initiating law required questions and processes. Researchers added others	1. STAR was driven by two significant, major questions: What is the EFFECT of small classes in primary grades on the 1) Achievement and 2) Development of students? Researchers addressed secondary questions required or implied in the legislation: Effects of a) full-time teacher aide, b) training, c) duration, d) cohort, e) random assignment. (See Table 5). Researchers studied other questions: teacher quality (by credentials), comparisons of sample with state averages, checks on "randomness," time use, teaching processes, incentive value . . .
2. **Link Research to Relevant Theory.** (STAR began in 1984, so some design and theory issues we now know (2003) were not yet refined. Table 8 is a summary of some theories supporting STAR.	2. STAR was deeply rooted in prior research and theory. Theories are evident in the design, data forms, analysis steps. Additional theory and refinements were "teased out" during the study (1984-1990), as data were analyzed (some data still await analysis), as STAR played into Project Challenge, and while students progressed throughout their schooling for longitudinal results (they would graduate from High School in 1998, if on schedule).
3. **Use Methods That Permit Direct Investigation of the Questions.** The variable of focus was class size so only class size was manipulated; the Aide was a Pupil- Teacher Ratio (PTR) element. STAR represented school as it is normally operated.	3. "Effect" required an EXPERIMENT (Campbell & Stanley, Design #6), of sufficient Duration (4-years), Magnitude (at least 80 classes of each type – eventually 11,600 students). The experimental plan was small class (S) at 13-17; regular (R) at 22-25; and full-time Aide (RA) at 22-25. Within-school design was parsimonious, reduced school-level effects, eliminated control group mortality, moderated the "Hawthorne Effect" if it might be a factor (Table 5 summarizes the experiment).

* Feuer, M.S., Towne, L. & Shavelson, R. J. (2002, November). Scientific culture and educational research. Educational Researcher, 31 (8), 4-14. p. 7.

TABLE 1. COMPARISON OF STAR DESIGN, PROCESSES, AND FACTS WITH ONE SET OF "PRINCIPLES OF INQUIRY"** (con't)

"ALTHOUGH NO UNIVERSALLY ACCEPTED DESCRIPTION OF THE PRINCIPLES OF INQUIRY EXISTS, WE ARGUE NONETHELESS THAT ALL SCIENTIFIC ENDEAVORS: ...

4. **Provide a Coherent and Explicit Chain of Reasoning.** Longitudinal class-size studies were needed to test duration. Without an experiment, effects of SES, teacher, principal leadership (etc.) clouded the class-size issue/effects.	4. Much of the reasoning appears in the STAR Report literature review, data instruments, observation data, research questions, sample, and design. Prior to STAR there was disagreement on the effects of group (class) size on student outcomes. Before establishing statewide class-size limits, Tennessee lawmakers and policy persons sought evidence about class size and paraprofessionals. They commissioned STAR
5. **Yield Findings That Replicate and Generalize Across Studies, and:** Work continues here as more states, and local districts move into class-size changes. Note International work in Australia, England, Netherlands, Sweden. (see also Tables 3 and 4)	5. STAR results have been replicated and generalized in state studies (e.g. SAGE in WI); by state law (e.g. HB 72 in TX); in observations (SSS); in cases studies (e.g. Rockingham Co, NC); in large (n=15,000) and small (n=1200) districts (Burke, Co. NC; Litchfield, MI); in Title I schools (n=16) in a large district; in single schools (SC, NC, LA). "Micro" comparisons contrast with "macro" or statewide events (e.g., NC, TN, TX, IA, UT) and even in NV that did some PTR and in CA, a "near text-book case of doing it wrong" Biddle & (Berliner, 2002). Results are always positive.
6. **Disclose Research Data and Methods To Enable and Encourage Professional Scrutiny and Critique.***** STAR data, methods and outcomes are in the Final Report, papers and articles by the PIs, dissertations, and other print sources.	6. The Spencer Foundation assisted PI's to organize, clean, and post STAR data on "The Web." After the final report was accepted, data were provided to researchers in London and later to persons in the USA. Critique is evident in some journal articles. "Scrutiny" is in the hands of the secondary analyzers, and has seldom been rigorous, absent pre-conceived ideology.

** Feuer, M.S., Towne, L. & Shavelson, R. J. (2002, November). Scientific culture and educational research. Educational Researcher, 31 (8), 4-14. P. 7.

*** The narrowness of most STAR critiques suggests that the STAR Report and Papers (The Primary Sources) were read by few (e.g., Mosteller, 1995; Burke, Co. administrators; SAGE staffers; SERVE personnel, Doctoral Students); Few persons engaged the four Principal Investigators (PI's) in discussions or asked important questions so they could understand STAR outcomes. Professor Mosteller (1995) actually explained that in reality STAR was THREE studies. (STAR, LBS, CHALLENGE)

Table 2. Critique of STAR Results Using Crane's (1998) Criteria. STAR is a Class-size Reduction (CSR) Experiment, Not a Pupil-teacher Ratio (PTR) Effort.*

	CRANE CRITERIA and QUESTIONS		STAR'S FACTS
1.	Do the benefits outweigh the costs? *YES.*	1.	In the short term (K-3), there were no definitive data. In the "follow-up studies;" yes; in the STAR reanalysis, yes; in alternative implementations, yes. See Krueger (1999; Finn & Achilles, 1999; Finn et al., 2001).
2.	Does the program have a statistically significant effect on the treatment group? *YES.*	2.	Yes. This statistically significant difference was found each year, all years, and in many combinations of analyses done by STAR persons and by others (as far away as London).
3.	What is the magnitude of the program's effect? *(Shown in Effect Size or ES).*	3.	Effect-size (ES) results were .17-.40 in the early analyses. Effects were about twice as high for minority children as for Anglo children, grades K-3 (each year, all years). Grade-equivalent analyses show continuing growth even after students leave small classes (see #4). (Finn & Achilles, 1999; Finn et al., 2001).
4.	How long do the effects of the program last? *(At least into high school and beyond.)*	4.	Positive academic and social effects of K-3 small classes are highly visible in H.S. and beyond including in college-entrance tests. (Boyd-Zaharias & Pate-Bain, 2000; Krueger, 1999; Krueger & Whitmore, 2000).
5.	What is the relationship of the evaluator to the program.? *(Independent)*	5.	The STAR evaluator was a contracted independent expert. STAR personnel did secondary analyses. The external expert's work is (and was) the primary analysis accepted and published. Others have re-analyzed STAR data with similar results.
6.	Can the program and its results be replicated? *(Yes)*	6. & 7.	They have been consistently replicated in well designed class-size analyses. Replications of STAR have been achieved in single districts, and in general policy implementations. Reported gains and ES for well conducted studies are similar. Evaluations of state-wide small-class efforts in CA, and the results in Texas (HB 72, 1984) suggest large-scale benefits, but these results are less definitive than STAR or SAGE in Wisconsin, probably because of less controlled implementations.
7.	Can the program maintain its effectiveness on a larger scale? *(Still being assessed. Yes if well implemented).*		

* Social Programs That Work edited by Jonathan Crane (1998). Russell Sage Foundation. 324 pages.

Table 3. Summary Listing of Some Class-Size Studies and Research Summaries, 1970-2002: Thirty (+) years of The "Present Generation."

Author, Study	Source/Date *
Lindbloom	1970
Olson	1971 (From Cavenaugh, 1994)
Glass & Smith	1978, 1979
Smith & Glass	1979
Filby et al.	1980
Glass et al.	1982
Shapson et al.	1980
Evertson & Folger	1989
Evertson & Randolph	1989
STAR (Generally)	Word et al. (1990); Johnston (1990)
Teacher Interviews (1000+)	Bain et al. (1992)
Robinson	1990 Research Review
STAR Good Teacher Study	Bain & Lintz
Project Success (NC)	1994 (In Achilles et al., 1994)
Success Starts Small	Kiser-Kling (1995), Achilles et al.
Wenglinsky	1997 (ETS)
Participation & Engagement	Finn (1998, 1993), Voelkl
SAGE (Wisconsin)	Molnar et al. (1998, 1999, 2000)
California CSR	CSR Consortium (1999), Bohrnstedt, etc.
(STAR-Related)	1999 →
Long-Term Effects (STAR)	Krueger, Bain et al.
	Finn et al., Nye et al.
Teacher Aides	Finn, Gerber et al.
	Bain, Boyd-Zaharias, Achilles
College Entrance Tests	Krueger & Whitmore (2000)

* Many of these studies have been reviewed briefly in Achilles (1999) Let's Put Kids First. The work of B. Bloom on tutoring and the "2-Sigma Problem" is foundational.

Table 4. Samples of the STAR Legacy of Class-size Studies, Categorized as "Subsidiary" (directly from STAR), "Ancillary" (building on the STAR database) and "Related" (usually involving STAR researchers and using STAR information and earlier findings).

CATEGORY, TITLE & PURPOSE *	DATE(S)	AUTHOR(S), SOURCE, DATE
STAR Pilot (DuPont)	1984-1986	Bain et al.
STAR (Class-size experiment)	1985-1989	Word et al., 1990 Finn & Achilles, 1990
Subsidiary Studies		
• Lasting Benefits Study (LBS)	1989-1996	Nye et al., 1991-1999
• Project Challenge (TN)	1989-1996	Nye et al., 1991-1995
• Participation, Grades 4, 8	1990, 1996	Finn, 1989, 1993; Voelkl, 1995; Finn et al., 1989; Finn & Cox, 1992
• STAR Follow-up Studies	1996-2000	HEROS, 1997-2000
Ancillary Studies		
• Retention in Grade	1990-1995	Word et al, 1990; Harvey, 1994, 1995
• Achievement Gap	1993-2001	Bingham, 1993, 1994; Achilles et al., 1997-98, 2000, 2001, 2002
• Value of K in Classes of Varying Sizes (test scores)	1985-1989	Achilles, Bain, Nye, 1994
• School Size and Class-Size Issues	1985-1989	Nye, K., 1995
• Random v. Non-Random Pupil Assignment and Achievement	1985-1989	Zaharias et al., 1995
• Re-analysis, Sample "drift" (out-of-range classes)	1985-1989	Boyd-Zaharias et al., 1995 Finn et al., 1999
• Class Size and Discipline Grades 3,5,7	1989, 1991, 1994, 1996	Several studies. SSS, 1995; Hibbs (1997).
• Outstanding Teacher Analysis	1985-1989	Bain, 1992; Boyd-Zaharias, 2001
• Teacher Aides	1990-2001	Achilles et al., 1994; Finn et al., 2001; Boyd-Zaharias & Pate-Bain, 1998 Gerber et al., 2001
• Continuing student growth	1985-2001	Finn, Achilles et al.; Bain et al.
• College entrance exams	1999-2001	Krueger & Whitmore (2000, 2001)
• Enduring Effects	1999-2001	Finn et al., 1999,2000, 2001, etc.
Related Studies		
• Success Starts Small (SSS): A Study in 1:14 and 1:23 Schools	1993-1995	Achilles et al., 1994 Kiser-Kling, 1995
• Burke Co., NC Study	1992-2001	Achilles et al., 1995
• SERVE Studies in NC		SERVE, 1996, 2002; Harman et al., 1998
• Education Production Functions	1996-2001	Krueger, 1997, 1998, 1999, 2000, 2001

* This is a sample of STAR-related class-size studies. Not all authors appear exactly as listed here. A similar table appears in several STAR reports and articles. Others have reported on STAR (e.g., Mosteller, 1995; Finn, 1998; McRobbie et al., 1998); several non-STAR persons have conducted secondary re-analyses of STAR data (e.g., Goldstein & Blatchford, 1998; Krueger, 1997-2001, Nye et al., 1999-2001).

Table 5. A Longitudinal Class-Size Experiment.

Project STAR (1985-1989) and the many studies that build upon STAR benefit from the experiment's tightly controlled, in-school longitudinal design. STAR was conducted by a four-university consortium with considerable external support from consultants, advisory groups, and the Tennessee State Department of Education. Basic design issues are:

(1) Project STAR built on principles recognized in prior research. The intervention began in the primary grades. Small classes had fewer than 20 students. STAR's design enabled researchers to look at the effects on minority as well as majority students. Moreover, the design produced a "real" difference in the class sizes, from an average of 24 pupils to an average of 15.

(2) STAR was a controlled experiment that permitted, to the extent possible with empirical data, causal conclusions about outcomes. Pupils entering K were randomly assigned to a small class (S; 13-17), a regular class (R; 22-27), or a regular class with a full-time teacher aide (RA). Pupils entering in later years were also assigned at random to classes. Teachers were assigned to classrooms at random. Randomization and testing were monitored carefully.

(3) With minor exceptions, students were kept in their class grouping in grades K, 1, 2, and 3 (cohorts). A new grade-appropriate teacher was assigned to the class each year. STAR was a four-year longitudinal experiment.

(4) Norm-referenced tests (NRT), and criterion-referenced tests (CRT) and measures of self concept and motivation were administered each spring. Researchers used a post-test only design. (Campbell & Stanley, 1963). Students were aggregated to classes and classes nested into schools for analyses. Teachers and teaching were studied.

(5) The samples were large and diverse. The K year involved over 6300 students in 329 classrooms in 79 schools in 46 districts. The first-grade sample was larger still. The large samples were maintained throughout the four years, producing an excellent longitudinal database. Total sample = 11,601.

(6) The class arrangement was maintained throughout the day, all year long. There was no intervention other than class size and teacher aides. No special training was provided to the teachers except for a small sample in second grade; no special curricula or materials were introduced. (Training didn't increase outcomes).

(7) Students were followed and evaluated after STAR ended in grade 3. Most students graduated in 1998. Their college-entrance test results were monitored. (Krueger & Whitmore, 2000).

Table 6. Synopsis of Class-Size Findings, from STAR and Various Other Sources.*

Findings, Idea, Issue		Selected Sources of Support
I.	Class-size effect was found in all sites, for all participants, at all times and grades K-3, This includes tutoring and "special" projects.	STAR, Challenge, Reading Recovery (RR); Success for All (SFA)
II.	Small classes work best when students start (K, 1) school in them; they are preventive, not remedial. Formal and small-class education MUST start no later than K, be intense (all day, every day) and last at least 3 years (Duration).	STAR, SSS, Challenge SAGE, Burke Co. Abecedarian (NC), Finn & Achilles (1999) Perry Pre-School
III.	Crowding, not just small classes, is an issue. School safety and environment are improved. (Prout, 2000). School size is important.	STAR, SSS, Nye, Fowler & Walberg, Behavioral Research, Cotton, others.
IV.	Although all pupils benefit from small (S) classes in K-3, some students benefit more than others.	STAR, SFA, RR, LBS, Other class-size work. Robinson (1990).
V.	The teacher is important. Each pupil's learning depends upon the teacher and others in the class. (Thus the class is the unit of analysis).	STAR, LBS, SSS, Challenge, Burke County, CSR in California.
VI.	A teacher aide does not improve student outcomes. This adds to crowdedness and causes new dynamics (Issues: Training, inclusion, ESL, role description).	STAR, Other Studies. Finn, Gerber et al., (2001); Bain & Boyd-Zaharias (1998); Gerber et al. (2001).
VII.	Teachers should use known educational-improvement processes: (Parent and home involvement, portfolios, alternative assessments, etc.). Small classes may not change what teachers do—just how much they do good things well.	STAR, LBS, SSS, Filby et al., Burke County, NC; Downtown School, NC STAR Teacher Studies. Achilles, 1999
VIII.	Reduce retention in grade especially when student will be moving into another small class. (Retention should not be used, unless in extreme cases).	STAR, Many studies of Retention (Holmes and Matthews).
IX.	Study costs and benefits; Use PTR and class size differences to get to small classes.	STAR, SSS, PTR studies, Sharp, Darling-Hammond; Miles
X.	Small classes and small schools encourage increased student participation in schooling. (Engagement)	Finn, Voelkl, STAR, LBS, Lindsay's work, etc., Finn et al., (2002)
XI.	Small classes in early grades provide long-term multiple benefits (achievement and development).	Krueger; STAR Follow-up. Finn & Achilles, (1999), Finn et al., (2001), Krueger & Whitmore (2002).

* Detailed references are available. They were omitted because of space. RR = Reading Recovery; SFA = Success for All; SSS = Success Starts Small.

Table 7. Summary of Small-Class Benefits: Source, Study, (x= Yes, as included in the source named)

STUDY or SOURCE *

Observed In-Class Changes	Lind-bloom 1970	Olson 1971	Glass & Smith 1978	Smith & Glass 1979	Burke Co. 92 - 02	SAGE 2000 +	SSS 1994 1995	FCPS 1997	Cooper 1989	STAR 1985+	Project Success 1994	Teacher "Stories" 2001+	Tot. of 12
A. Increases:												ALL	
• Time on Task		X	X	X	X	X	X	X	X	X	X		11
• Hands-on	X	X		X	X	X	X	X		X	X		10
• Indiv. Attn.	X	X	X	X	X	X	X	X	X	X	X		12
• Diagnosis	X			X	X	X	X	X		X	X		9
• Social Climate	X	X		X	X	X	X		X	X	X		10
• Management	X	X	X	X	X	X	X	X	X	X	X		12
• Participation	X	X	X	X	X	X	X	X		X	X		11
• Academics	X	X	X		X	X	X	X	X	X	X		11
• Parent Involv.					X	X				X	X		5
• Early ID of Spec. Ed.					X					X	X		4
• Morale	X	X		X	X	X	X		X	X	X		10
• Space					X		X			X	X		5
• Enrichment	X	X			X		X	X	X	X	X		9
• Text/Methods	X	X			X	X	X	X	X	X	X		10
• Group Work	X			X	X		X	X		X	X		8
B. Decreases:												ALL	
• Indiscipline	X	X		X	X	X	X		X	X	X		10
• Retention					X					X			3
• Spec. Ed.					X					X	X		4
• Stress		X		X	X	X	X		X	X	X		9

* SSS: Success Starts Small: Achilles et al. (1994); Kiser-Kling (1995). SAGE: Student Achievement Guarantee in Education, Molnar (1998). Project Success from Achilles et al. (1994). FCPS: Fairfax County (1997). STAR (Word et al., 1990). Teacher stories are from CA, NC, SC, TN, and WI. Other authors are listed in References. Adapted from Tables 6.12, p. 104 (Achilles, 1999).

Table 8. Small Class (K-3) Benefits Are Supported by Research and Established Theories About Groups, Teaching, Learning, and School Outcomes.

I. LEARNING

A. Task Induction: Learn About School (Student's Work).

B. Mastery of Basics

C. Time On Task Increases.

D. Appropriate Homework

E. Child Development/ Developmentally Appropriate.

F. Early Intervention, Duration

II. TEACHING

A. Individual Accommodation.

B. Early Diagnosis and Remediation of Learning Difficulty.

C. Teach to Mastery.

D. Immediate Reinforcement.

E. Assessment (In-Class)

F. Effective Teaching Methods.

G. Planned, Coherent Lessons. (Seamless Transitions)

H. Portfolios, Running Records.

III. CLASSROOM

A. Classroom Environment (E.g.: Air Quality, Materials, Space, Crowding, Noise).

B. Personal Attention/ Community.

C. Inclusion, Special Needs

D. Variable Room Arrangements (E.g., Learning Centers).

E. Classroom Management.

F. Many Volunteers.

IV. "OTHER"

A. Increased Parent Interest.

B. Reduced Grade Retention

C. Increased Teacher/Student Morale/Energy.

D. Teacher Accountability and Responsibility

E. Few Projects and "Pull Outs." (Coherence). Intensity

F. Assessment (Outcome)

V. STUDENT BEHAVIOR (Research in Progress).

A. Participation, Engagement, Identification.

B. Peer Interaction.

C. Cooperative Learning

D. Student-Led Activities

E. Group Dynamics.

F. Less Indiscipline

G. Cross-Age Events

Appendix A
Some Major Differences Between Class Size (CS) or Class-size Reduction (CSR) and Pupil-Teacher Ratio (PTR).

VARIABLES of note in comparing PTR and CS	PUPIL-TEACHER RATIO (PTR)	CLASS SIZE (CS) or (CSR)
Definition	Students (n) at a site (building, district, class) divided by: teachers, educators, adults, (etc.) serving the site.	Students (n) in a teacher's room regularly, and for whom the teacher is accountable.
Computation	DIVISION, with various divisors available depending upon the EXACT definition.	ADDITION. This cannot be accurately determined from large databases.
Concept	The teacher needs help; the student needs special services the teacher cannot provide.	A competent teacher can handle most education issues if given a reasonable case load.
Operation and Context	A project and "pull-out"- driven model full of commotion and "Band Aid" treatments. Loss of time on task. Difficulty in determining responsibility and accountability.	Teacher is responsible and accountable for the student's growth and development: Academics, Behavior, Citizenship, Development, (A, B, C, D) Small focused learning groups.
Outcomes	CONSISTENTLY MARGINAL. Note, for example, education "production function" analyses; Title I evaluations, Boozer and Rouse (1995), Borman and D'Agostino (1996) Wong and Meyer (1998), etc.	CONSISTENTLY POSITIVE on many variables (A, B, C, D). See data in Tables 1 & 2 of this paper. Much consensual validation, anecdotal evidence, and "common-sense" support.

Recent examples of the PTR and class-size confusion (e.g., just add teachers) and mis-use of the terms in articles and policy pieces include:

- Ehrenberg, R. C., Brewer, D. J., Gamoran, A., & Willms, J. D. (2001, November). Does class size matter? Scientific American 285 (5). 79-85.
- Ehrenberg, R. C., Brewer, D. J., Gamoran, A., & Willms, J. D. (2001, May). Class size and student achievement. Psychological Science in the Public Interest, 2 (1). 1-30.
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- Hanushek, E. (2000, October). Evidence, politics, and the class-size debate. Washington, DC: Economics Policy Institute. Working Paper #121.
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- Shakeshaft, C., Mann, D., Becker, J. & Sweeney, K. (2002, January). Choosing the right technology. The School Administrator, 59 (1), 34-37. (Esp. p. 36.)
- Several policy papers from The Heritage Foundation, e.g.:

  Johnson, K. A. (6/9/00). Do Small Classes Influence Academic Achievement? What the National Assessment of Educational Progress Shows.

  Shokraii Rees, N. H. (9/24/99). How Congress Can Assure Title I Dollars Benefit Poor Students.

  Shokraii Rees, N. H. (5/28/99). Accountability 101: Why the President's Educational Proposals Won't Make the Grade.

  Shokraii Rees, N. H. (4/13/99). A Close Look at Title I, The Federal Program to Aid Poor Children.

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Author Notes

[1] C. M. Achilles, currently a Professor Education Administration at Eastern Michigan University and Seton Hall University (Both Part-Time) was one of Four principal Investigators (PIs) of STAR and a consultant on numerous class-size studies (1984-present), including PI of Success Starts Small (SSS), funded by the Small Grants, School-Based Research Program of the Board of Governors of the University of North Carolina system (1994), (K. Kiser-Kling, J. Owen, A. Aust, co-authors).

This paper accompanies remarks made at the symposium. It is not intended to contain the actual remarks, but provides detailed background information, history, references related to class-size issues.

Much material in this paper is a compendium of materials presented in other papers authored or co-authored by Achilles, especially the figures and tables. The author thanks those at SERVE for inviting him to share these ideas. He also thanks research-and-practice comrades who have been and who are working to achieve appropriate-sized classes for the difficult task of schools. A few of these persons are Helen Pate-Bain, Paula Egelson,. Pat Harman, Art Hood, Jeremy Finn, Jayne Boyd-Zaharias, Sheldon Etheridge, Gilda Howard-Outz, Mark Sharp, the persons in Burke County and Rockingham County, NC, the many local school administrators who strive to improve teaching conditions so teachers can teach well, legislators and policy persons who seek ways to improve class conditions so students can learn.

[2] The Comer School Development Program helps students improve in "(a) Academic Achievement, (b) Behavior and School Adjustment, (c) School and Classroom Climate, and (d) Self Concept." [Haynes, N. M. & Emmons, C. L. (1997, February). The Comer School Development Program Effects: A Ten Year Review, 1986-1996. New Haven, CT. Yale Child Study Center, School Development Program.]

The similarity of the Comer efforts and the four points in the "ABECEDARIAN Compact" for small-class outcomes helps emphasize that class size is a concept rather than a "program" and that by adjusting class size we can anticipate an array of important schooling outcomes, not just an increase in achievement.

The Perry Preschool Program, another randomized education experiment that has followed its subjects from preschool into adulthood, shows that early intervention and small classes provide short and long-term cognitive (academic) and non-cognitive (social) benefits.

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Organization/Address: E. Mich. Univ. > 50% Each, Seton Hall Univ.

4490 ACHILLES SENECA HARBOR GENEVA, NY 14456

Telephone: 315 789 3369

FAX:

E-Mail Address: plato936@rochester.rr.com

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