

Review of Empirical Evidence about School Size Effects

A Policy Perspective

Prepared for the Board of Education of the
Regina School Division No. 4 of Saskatchewan

by

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Summary And Recommendations

This review of research about the effects of school size on an array of important student and organizational outcomes was undertaken as background to decisions facing the *Board of Education of the Regina School Division No. 4*. These are decisions about the educational and economic virtues of retaining or amalgamating smaller schools in the face of changing student populations. While school districts across North America have struggled with these decisions for many decades, the outcome has almost always resulted in larger schools. This outcome has been justified as the least expensive and, at the secondary level, one which provides students with a more comprehensive education.

Results of this review of 59 post-1990 empirical studies suggests that the longstanding trend toward larger schools is not in the best interests of students. More specifically:

1. The weight of evidence provided by these studies clearly favors smaller schools. But “smaller” is a relative term. In districts with secondary school sizes exceeding 2500 students, for example, smaller can mean as many as 1500 students, a size which would be considered very large in other districts.
2. While smaller schools are an advantage for most types of student outcomes, there is some evidence recommending larger schools for advancing the subject matter achievement of academically successful senior high school students. One plausible explanation for this evidence is that students in larger schools have greater access to the specialized instruction needed to master complex subject matter. Students in smaller schools with access to comparable instructional resources could be expected to achieve as well or better than students in large schools. A second explanation for this evidence is the failure of this body of research to consider the larger drop out rates associated with larger schools. Secondary schools with higher retention rates are likely to have lower mean levels of achievement than secondary schools with high drop out rates.
3. Students who traditionally struggle at school, students from disadvantaged social and economic backgrounds, for example, are the major benefactors of smaller schools. But smaller schools do not seem to be an impediment to the learning of more advantaged and/or high achieving students, providing that those students have access to appropriate instructional resources.
4. The breadth of the curriculum, often cited as a major advantage of large comprehensive secondary schools, seems achievable in schools as small as 500 to 600 students. Compelling evidence now suggests, furthermore, that such breadth is a serious threat to the academic progress of most students.
5. Most contemporary studies have concluded, unlike an earlier generation of studies, that small schools are more efficient or cost effective. For high schools, this reversal of opinion is the results of taking student graduation rates into account. Small

secondary schools manage to graduate a significantly larger proportion of their students than do large secondary schools.

The most practical and obvious policy question that school size research should help to answer concerns the optimal size of schools. While the results of this review help to explain why this is not a simple question to answer, there is ample justification for the following recommendations :

- Elementary schools serving student populations exclusively or largely from diverse and/or disadvantaged backgrounds should be limited in size to not more than about 300 students.
- Elementary schools serving economically and socially heterogeneous or relatively advantaged students should be limited in size to about 500 students.
- Secondary schools serving student populations exclusively or largely from diverse and/or disadvantaged backgrounds should be limited in size to about 600 students or fewer.
- Secondary schools serving economically and socially heterogeneous, or relatively advantaged, students should be limited in size to about 1000 students.

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A Review of Empirical Evidence about School Size Effects

A Policy Perspective

Introduction

Purposes for the Review

This review of research was commissioned by the *Board Of Education Of The Regina School Division No. 4 Of Saskatchewan* to help determine the impact of school size on an array of different outcomes including, but not limited to, academic achievement, social impacts, psychological impacts, community integration, “at risk” children, “at risk” neighborhoods, extra-curricular programming, teacher effectiveness, and teacher satisfaction.

Review Methods

Search procedures. We began the search for relevant evidence by mining the ERIC electronic data base, narrowing the search from the outset to published articles. Using 1990 as the starting point, the abstracts of all studies located using the search terms school size and school organization, in combination with the outcomes of interest as specified in the contract (e.g., achievement, attendance, dropping out), were read. This amounted to more than 280 papers, in total. From the abstracts, we further narrowed our selection of papers to those which:

- appeared in refereed journals;
- reported original evidence; and
- included explicit descriptions of their research methods.

Relevant studies cited in papers selected using this procedure were also included if they met our criteria.

Studies selected for review. The Appendix summarizes key features of the 59 empirical studies which provided the core of the evidence included in the review. In addition to bibliographic information (the first three columns on the left), the table summarizes key features of each study’s research methods (samples and data collection procedures, columns 4 and 5) and design (variables included in the studies conceptual framework, column 6). The final two columns indicate the outcome variable (s) of interest in each study (column 7) and the direction of the effect of school size on the selected outcome (s). Eighteen of these studies were published between 1990 and 1999, the remaining 40 studies between 2000 and 2007.

While studies summarized in the Appendix form the core of our data base, we also located and read frequently cited pre-1990 studies, along with a small number of particularly well-done reviewsⁱ. Though not described in the Appendix, these studies and reviews appear in the reference list and are cited throughout the report as a means of filling gaps in our post-1990 evidence base. There is a significant amount of pre-1990

school size research beginning, as far as we could discern, with a still-frequently cited study by Barker and Gump published in 1964. Two other features of the evidence base should be noted:

- *School level:* 40 studies provided information about secondary (including middle) school size effects. Thirteen studies were conducted in elementary schools and the remaining six included data about both levels of schooling;
- *Research context:* the vast majority of studies (40) were conducted in the United States while only 4 were conducted in Canada. Other countries serving as contexts for the research included England with 3 studies and New Zealand, Australia and Norway with 2 studies each. Single studies were conducted in Wales, Iceland, Northern Ireland, Israel, Scotland and The Netherlands.

Quality of the Data Base Selected for Review

How much confidence is warranted in the results of the review? This question is a critical one to answer for policy makers intending to inform their decisions with the results of the review. The answer requires a judgement about at least three features of the evidence included in the review—its comprehensiveness, quality and “ecological validity” (explained below).

Comprehensiveness. We do not claim that the 59 original studies forming the core of this review exhausts the post-1990 evidence base concerning school size. Nevertheless, we do believe that it captures quite well both the central tendencies in the evidence base, as well as most of the important nuances. Comparing the number of original studies included in the review with similar information about other related reviews provides one yardstick for judging the review’s comprehensiveness. Three examples will suffice.

One of the most frequently cited reviews of literature on school size was published by Cotton in 1996. For this review Cotton was able to locate 49 original empirical studies. Two other reviews that we found especially useful were concerned specifically with economies of scale in relation to schools. One of these reviews (Fox, 1981) analyzed 29 studies published up to about 1980. The second review (Andrews, Duncombe & Yinger, 2002), addressing concerns Fox raised in his paper, included a total of 44 post-1981 studies.

Judged by most social science standards, as these three comparisons illustrate, the evidence base for this review would be considered relatively large, and with the inclusion of results from earlier reviews, quite comprehensive.

Quality. A significant proportion of the 59 are based on evidence collected from very large samples, frequent uses of longitudinal designs and applications of advanced statistical data analysis procedures. This is a methodologically more sophisticated data base than one typically finds in the accumulated body of research about most educational policy issues. A significant, although minor, proportion of the studies are also theoretically well-informed.

Ecological validity. Both the comprehensiveness and the quality of the evidence included in the review argue for reasonably high levels of confidence in its results. But there are two features that might be considered limitations on such confidence. These are limitations on the extent to which the evidence makes sense in the context of Regina schools, its “ecological validity”.

Perhaps the most striking limitation of this sort is the dominance of U.S. research (40 of 59 studies). Readers will draw their own conclusions about what this means for policy in Regina schools. And while we do not entirely dismiss this limitation ourselves, we are persuaded that it is likely not serious. Studies outside of the U.S., for example, typically report results very similar to those found in the U.S.

A more significant limitation for Regina policy makers, we believe, is the absence of evidence about school size effects on either Native Canadian or American students. There is, however, considerable evidence about the moderating effects of poverty and both linguistic and cultural diversity on school size/student outcome relations which may moderate this limitation.

In sum, reasonably high levels of confidence in the results of the review are warranted.

School Size Effects on Student Outcomesⁱⁱ

Table 1 tallies the number of studies, of the 59 included in the Appendix, that provide evidence about school size effects on each of seven sets of student outcomes listed in the left column of the table. For each of these sets of student outcomes, the table (a) indicates whether the evidence concerns elementary or secondary school students (columns 2 and 3) and (b) the number of studies reporting significant positive (+) or negative (-) results. This column also indicates the number of studies finding a non-linear (U or inverted U) relationship between school size and each of the student outcomes, as well as the number of studies that tested for, but did not find a significant school size effect (ns).

Academic Achievement

In this section, evidence about the effects of school size on elementary and secondary student achievement is examined separately. Much more evidence is available about secondary as compared with elementary schools and student, a reversal of the emphasis evident in the pre-1990 research on school size.

Elementary schools. Table 1 indicates that nine studies selected for the review provide evidence about the relationship between school size and the academic achievement of elementary school students. Three of these studies found non-significant relationships while six reported a negative relationship between size and achievement (the smaller the school the better the achievement). We illustrate more fully the research giving rise to this central finding by describing two of these 6 studies.

The oldest of the studies reporting an inverse relationship between school size and student achievement is Eberts, Schwartz & Stone (1990). Indeed, this study actually used evidence collected by a U.S. government agency in 1978. This was evidence about one-year gains in math achievement on the part of 14,000 grade 4 students, along with information about the teachers, administrators and other features of the 281 schools attended by these students. The study also included measures of four student background variables—sex, race, parental involvement and economic status. Schools in the study were classified as small (less than 200 students), medium (400-600 students) or large (more than 800 students). Schools in the 200-400 and 600-800 ranges were not included to simplify the analysis. The main results of this study indicated students in small schools (less than 200) had significantly greater gains in achievement over a one year period than students in either medium or large schools. Students in medium-sized schools had significantly greater gains in achievement than students in large schools. Student background variables did not contribute to these differences.

A second study reporting an inverse relationship between school size and academic achievement was conducted in Indiana (Kuzienko, 2006). This study provides a methodologically sophisticated example of current research about the effects of elementary school size on both achievement in math and language, as well as average daily attendance. The study “exploit(ed) shocks to enrollment provided by school openings, closings, and mergers...” (p. 63) to control for the interactive effects of school size and achievement; student performance was compared before and after the shocks. Using schools experiencing shocks to enrolment is an important control since successful schools, over time, may attract additional students because of their reputation, while less successful school enrolments may decline.

The sample for this study included 59 schools that had experienced a shock leading to fewer students and 39 schools experiencing shocks producing increased student enrolment. Measured both two and three years later, increases in enrolment produced by the shocks resulted in statistically significant, negative effects on math scores, as well as a negative, though not significant, effect on language scores. These results suggest that the longer students attend larger (or smaller) schools, the more their achievement would decrease (or increase). Kuziemko also claimed that his estimates of school size effects “compare favorably with even the most generous estimates of the effect of reducing class size” (p. 71).

In sum, the weight of evidence in our review is tilted decidedly in favor of smaller elementary schools producing greater academic achievement on the part of their students. These findings are very much in line with research conducted prior to 1990. For example, Fowler and Walberg (1991) reviewed eight such studies (all but one of which included controls for student background or SES), each of which found negative relationships between school size and one or more student outcomes; in their words:

Thus, a number of studies conducted during the past 20 years, particularly at the elementary school level, have found an independent, positive effect upon student achievement, extracurricular participation, student satisfaction and attendance. (p. 191)

In a subsequent review and report of their own original evidence, Walberg and Walberg (1994) once again pointed to substantial evidence that academic achievement is consistently better in small elementary schools. From their perspective, this evidence was quite conclusive. Anticipating the focus of some subsequent research, they also noted the possibility of greater benefits to lower SES students, as well as a non-linear relationship between elementary school size and student achievement.

Secondary schools. As Table 1 indicates, substantially more evidence was available about school size effects on secondary school student achievement than on any of the other student outcomes addressed by the review. Of the 19 studies in total:

- 5 found that as school size increased so did achievement;
- 6 found an “inverted U” relationship between size and achievement. Achievement rises with school size up to some optimum school size then begins to decline as school size exceeds this optimum; and
- 8 found that as school size increased, achievement declined.

Positive relations. Three of the five studies finding positive relationships between school size and achievement were conducted in the U.K. context and were explicitly related to one another by their authorsⁱⁱⁱ. The initial study in this series was carried out in England by Bradley and Taylor in 1998. Two national datasets provided evidence for variables examined in this study. The dependent variable was the proportion of 15-16 year old pupils achieving five or more GCSEs at A* - C (the most common measure of secondary school achievement in studies carried out in the U.K.); the annual Secondary School Performance Tables were the source of this information for years 1992 through 1996. Independent variables included a variety of school characteristics including school size. Information about these variables was provided by the annual School's Census. This study found a strong positive relationship between secondary school size and student achievement. A similarly significant relationship was found between changes in achievement and changes in school size over time (1992-1996). These relationships were best described as an inverted U, however. Pupil performance peaked in schools serving years 11 to 16 pupils above 900 but under 1500, whereas in schools serving years 11 to 18 pupils the peak in performance was in schools between about 1200 to 1800 pupils.

A second U.K. study reported in 2002 referenced Bradley and Taylor (1998) directly. Barnett and his colleagues (2002) examined the relationship between school size and achievement in 152 Northern Ireland secondary schools using evidence from two years of achievement data (1994/95 and 1995/96). Schools were classified into seven size groupings with 19% of schools in the largest two groupings (800-999 students and over 1000 students). Consistent with Bradley & Taylor's (1998) results, this study found a significant positive relationship between size and achievement. The explanation suggested by the authors for their findings concerned the greater opportunities for both instructional and curriculum specialization in larger schools, opportunities that could only be provided in smaller schools through an infusion of additional funds to permit comparable specialization.

Some studies carried out in the U.S. have reported results similar to those reported in the U.K. For example, Schreiber (2002) assessed the factors influencing students' advanced mathematics achievement with evidence from 162 schools and 1839 senior high school students who participated in the *Third International Mathematics and Science Study* (TIMSS) (Population 3 Final Cohort). In addition to factors associated with students, three school-level factors significantly influenced advanced math achievement including resources, average parent education and school size. The larger the school the greater the achievement. Scribner argued that larger secondary schools are likely to have more teachers with specialized skills in teaching advanced mathematics.

The line of evidence illustrated by these three studies has two important limitations. First, as the authors of several of these studies point out themselves, school size itself is not likely what contributes to students' achieving more specialized and complex subject matter. Rather, it is more likely the availability of teaching staff capable of providing effective instruction in that complex subject matter. So attributing greater achievement to larger-sized schools misses the causal connection.

The second limitation is one of research design. Rumberger and Palardy (2005), for example, suggest that studies finding a positive, linear relationship between high school size and student achievement may not be adequately taking into account the higher dropout rates typically associated with large secondary schools. Improved average school performance in large high schools may simply be a function of the increased dropout rates found in such schools. Few of the studies reporting positive school size-achievement relations took this variable into account.

Non-linear relations. Six of the 19 studies about secondary school size effects on academic achievement reported non-linear relationships. Two U.K. studies illustrate this evidence. One of these studies (Sawkins, 2002) used Scottish data about student performance reported in 1993/94 and in 1998/99 for 398 secondary school. This study found that as school size increased, student performance first declined and then improved. More specifically, Sawkins reports that:

examination performance declines at a decreasing rate as the number of pupils in a school increases, reaching a minimum turning point of around 1190 pupils for the 1993-1994 data and 1230 pupils for the 1998-1999 data. (p. 2038)

The most recent U.K. study in our review (Foreman-Peck & Foreman-Peck, 2006) reported similar results. Evidence from this study suggested a non-linear relationship between achievement and school size best described as an "inverted U", although pupil performance peaked in much smaller schools than was the case in Bradley and Taylor's (1998) study. More specifically:

Schools of more than at most 600 pupils tend to achieve poorer public examination results in the long run and a higher proportion of pupils fail to gain any qualification at all. (p. 157).

Negative relations. Eight of the 19 studies of secondary school size effects on academic achievement reported negative, linear relationships. The smaller the school the greater the academic achievement. Rather than describing individual examples of these studies here, we demonstrate the consistency of the findings from these studies with findings from earlier research. Three reviews of literature are used for this purpose.

One of these reviews (Fox, 1981) examined 29 studies of economies of size dating back to 1959. Taking the Fox review as their point of departure, Andrews, Duncombe and Yinger (2002) examined a further 22 studies. Both reviews included studies concerned with district as well as school size, sometimes together in one study and sometimes separately. These reviews included careful attention to both conceptual and methodological features of the studies selected for review, eliminating studies believed to be weak on either grounds. With respect to the impact of school size on the quality of education (usually academic achievement), Fox approvingly quotes James and Levin (1970):

all the studies that have tried to relate school or district size to education outcomes have found either no relationship or a negative one between student enrolments and the level of education outcome. (in Fox, 1981, p.287)

While there are limitations on all of the studies Fox reviewed, he considered the direction of the results to be clear.

Andrews, Duncombe and Yinger's conclusions were quite similar. Noting a fair degree of consistency in the results, they concluded that:

Generally, larger schools are associated with lower student performance holding school and non school inputs constant Based on average enrollments in school ... decreasing returns to size may begin to emerge for high schools above 1000 students.... (2002, p. 255)

The third review was by Walberg and Walberg (1994). They considered results about secondary school size effects to be less conclusive than results about elementary schools, but still clearly favoring smaller schools. Citing an especially well designed national study by Marian and McIntire (1992), the authors also associated smaller high schools with many of the other outcomes we consider in later sections of the review.

In sum, while evidence about secondary school size effects on academic achievement is mixed, the most defensible conclusion favors smaller to mid-sized schools. This conclusion is most accurately portrayed in studies reporting non-linear relationships between school size and achievement.. Lack of attention to drop out rates in studies favoring large schools seriously undermines the confidence we can have in their results.

Equitable Distribution of Learning

Evidence about the effects of school size on more or less disadvantaged students in schools was derived from six of the studies summarized in the Appendix, one

conducted in elementary schools, the remainder in secondary schools. These studies look beyond the effects of school size on average school achievement and ask about the extent to which such achievement is comparable among students who vary in their previous achievement levels and such other “background” factors as socioeconomic status (SES), family educational culture, first language and the like. All of these studies associated better outcomes for disadvantaged/low SES students with smaller schools and most found no negative effects for advantaged/high SES students.

A series of similarly designed studies carried out in five U.S. states are examples of research which have produced very similar results (reviewed by Howley & Bickel, 1999). By way of illustration, the Georgia study carried out as part of this series (Bickel & Howley, 2000) examined the combined and separate effects of district and school size on student achievement with student SES included as a moderating variable. A total of 367 elementary and 298 secondary schools were included in the sample for this study. The achievement measure for elementary students was the grade 8 Iowa Test of Basic Skills in language and mathematics. For secondary students, the achievement measure was the State’s graduation tests in English, mathematics, social studies and science. Results confirmed the expected conclusion that (among other things) small school size is good for the performance of disadvantaged students and does no harm to the achievement of advantaged students.

Bickel et al.’s (2001) replication of the Georgia study in 1001 Texas schools produced very similar results. Using performance on the Texas Assessment of Academic Skills (reading, math and writing), this study reported a statistically significant, negative size-by-SES interaction effect. The authors explain, “As school size increases, the cost to school performance of schools serving economically less-advantaged students increases, as well” (p. 10). These results replicated the results of all of their earlier studies.

A second series of well-designed U.S. studies also has been carried out by Valerie Lee and her colleagues (Lee & Smith, 1993; 1995; 1997; Lee et al., 2000; Lee & Loeb, 2000). As with the Bickel and Howley studies, Lee and her colleagues set out to uncover the size of schools that allow low SES students, or those who typically struggle at school, to be successful academically without disadvantaging high SES students or those who typically do well. This series of studies, including both middle and high schools, used data from one or more of three rounds of the *National Educational Longitudinal Studies* beginning in 1988-99 (NELS:88). These studies found more equitable distribution of achievement in very small schools.

As an example, their 1995 study sampled 11,794 grade 10 students in 820 high schools from the NELS:88 data base. Student outcome measures included changes in student achievement from grade 8 to grade 10 (math, reading, history and science), student engagement in school and equitable distribution of achievement gains across students with different SES levels. While the main focus of the study concerned the impact of various initiatives aimed at restructuring schools, its clearest results were about the superior impact of smaller secondary schools. For example:

- "...students in smaller schools learn more in these [math, reading, science, social studies] important areas of the curriculum/ These results are net of differences in the schools' academic and social character, as well as the academic and social characteristics of their students" (p. 8);
- "Achievement gains in the four subjects we considered are more equitably distributed in smaller schools" (p. 8);
- "Students in smaller schools are more engaged in their courses" (p. 9).

These results support the tenor of earlier studies which, Bickel and Howley summed up as follows:

nearly a decade of research on school size (in particular) has developed a preponderance of evidence to suggest that smaller school size would improve schooling in impoverished communities. (2000, p. 3)

In sum, these studies as a whole tell us that school size has a larger impact on the learning of disadvantaged and/or low SES students than on the learning of advantaged or high SES students. But smaller schools do not seem to harm the learning of more advantaged students, at least at the elementary level. The explanation for these effects may be found in the communal environments more likely to develop in smaller schools; less complex subject matter is typically learned well in these smaller, more communal environments. Disadvantaged or struggling students benefit most from the care and attention they receive in such environments.

Results such as these are not new. Studies examining the interactions among school size, student SES and achievement began, according to Bickel and Howley (2000), with a study by Friedkin and Necochea in 1988. Most evidence that has inquired about these interactions since that time has confirmed the value of relatively small schools for more impoverished or low SES students and communities.

Attendance or Truancy and Retention or Dropping Out

Evidence about attendance or truancy and retention or dropping out are considered together since the causes of each are approximately the same and most studies measuring one also measure the other, with very similar results. As Table 1 indicates:

- 1 study reported a positive relationship between retention and/or attendance and larger schools;
- 7 studies reported this relationship to be negative (favoring small schools);
- 2 studies reported evidence favoring mid-size schools or evidence of a non-linear relationship between school size and student dropout or attendance; and
- 4 reported non-significant relationships.

Positive relationships. Rumberger and Thomas (2000) authored the only study in our review reporting a positive linear relationship between high school size and dropout rates. Evidence for this study was provided by 7642 grade 10 students in 247 schools who participated in the NELS *High School Effectiveness Study*. The authors found that "larger schools actually had lower adjusted dropout rates than did smaller schools..." (p. 56).

Negative relationships. Of the six studies reporting higher attendance and/or dropout rates in larger schools, five were methodologically quite robust^{iv}. We describe three of these, all conducted in U.S. schools to illustrate the range of evidence available about this matter.

Rumberger (1995) examined the relationship between a handful of student-level (e.g., SES) and school-level variables (including school size) on dropout rates. Data for this study were provided by the 1988 and 1990 responses of 17,424 students in 981 schools to surveys included as part of the NELS:88 survey of students, teachers, schools and families. Other factors equal, this study found students in larger middle schools were at increased risk of dropping out as compared with their peers in smaller schools.

Using data from both U.S. national and state (California) sources, Gardner, Ritblatt and Beatty (2000) compared the dropout rates of 67 randomly selected large California high schools (+2000 students) to the dropout rates of 60 randomly selected small high schools (200 to 600 students). Dropout rates were significantly higher in the large schools.

Providing evidence about school size effects on both attendance and graduation rates, Darling-Hammond and her colleagues (2002) report the results of a seven-year study of New York City's Coalition Campus Schools project. This project aimed to replace a number of large, failing comprehensive secondary schools with much smaller organizations, typically about 200 students. In particular, this study focused on the six small schools which replaced Julia Richman High. Collected in three waves over seven years, evidence for this study was provided by the City's school record data on student characteristics, attendance, achievement and graduation. A wide array of other data were also collected from other sources. Even though the student populations in the six new small schools ended up being more "at risk" than those attending the former large high school, both attendance and graduation rates in the six small schools were much better.

Non-linear relationships. Three studies reported evidence either favoring mid-size schools or evidence of a non-linear relationship between school size and dropping out.

Funk and Bailey (1999) used evidence from both U.S. national and state (Nebraska) sources. This study, including evidence from almost all districts in the state, assessed differences in student dropout rates of districts with varying numbers of high school students. Results of this analysis indicated that "High school completion rates are lowest for school districts with 600 to 999 high school students" (p. 4).

Two studies, one by Lee and Burkam (2003) and one by Rumberger and Palardy (2005) reported non-linear relationship between high school size and student dropout rates. Both studies used samples of data collected as part of the U.S. *NELS High School Effectiveness Study*. As well, both studies included a wide array of both independent and dependent measures and analyzed their data using multilevel methods. Rumberger and Palardy's (2005) data were from a sample of 14,199 students attending 912 high schools who provided valid data from the 1988, 1990 and 1992 survey years. Estimates of dropout rates were based on the number of students who left school between 1990 and 1992.

Results of this study provide a complex account of the factors associated with student success and suggest that, with respect to the alternative outcomes measured in the study, one size does not fit all. Dropout rates tended to be lower in mid-sized (600-1200 students) rather than smaller or very large high schools. This result, the authors suggest, may help explain the findings of other studies reporting higher levels of achievement in large high schools. Students struggling to succeed in such schools drop out at significantly higher rates, thereby eliminating the depressing effect their scores would have on their schools' average performance.

Lee and Burkam's (2003) data were provided by a sample of 3840 students in 190 urban and suburban schools indicated that large schools (1500-2500). Dropout rates were from estimated from the numbers of students who left school between grades 10 and 12. Results indicated that large schools (1500-2500) had higher dropout rates than either very large (+2500) or medium sized (600-1500) schools. However, small schools had the lowest dropout rates.

Non-significant relations. Of the four studies reporting non-significant relationships between school size and rates of dropping out, one was conducted in a small sample of low SES urban schools (36) in The Netherlands (Bos, Ruijters & Visscher, 1990), one was conducted in 38 urban and suburban secondary schools in the Milwaukee area of the U.S. (Witte & Walsh), one was conducted in 23 middle schools in a predominantly African-American suburban U.S. county (Phillips, 1997), and one used data from the U.S. national *High School and Beyond* study (McNeal, 1997). While there was considerable variation in samples, all of the studies were methodologically of very good quality. Other factors explored in these studies overwhelmed school size as explanations for variations in dropping out across schools. Some of these other factors, however, might be related to size in some school contexts. For example, McNeal's (1997) study found significant effects of pupil-teacher ratio on student dropout. Larger schools in some contexts also have higher pupil-teacher ratios. If larger schools have higher pupil-teacher ratios they are likely to have higher dropout rates. But the cause of these higher rates would not be the larger school size per se.

In sum. Evidence from the 14 studies is mixed and only two of the studies (concerned with attendance rates) are relevant to elementary schools. There is a clear indication in the weight of this evidence, however, that smaller secondary schools have superior "sticking" power; student attendance and retention rates are significantly better in smaller than larger secondary schools.

This conclusion is very similar to the conclusions drawn from reviews of earlier evidence. For example, from her review of 10 drop out studies (only 6 of which were original) Cotton (1996) concluded the results to be "greatly favoring small schools" (p. 7). Citing a total of 16 "documents" located for her review of evidence about school size effects on attendance (5 would have met our criteria to be included in this review), Cotton also concluded that:

The pattern of findings favoring small schools continues with the research on student attendance. Not only do students in smaller schools have higher

attendance rates than those in large schools ..., but students who change from large schools to small alternative secondary schools generally exhibit improvements in attendance. (p. 7)

The most defensible conclusion from our review would likely argue for medium sized secondary schools, with dropping out increasing at the more extreme ends of the size continuum. What is medium sized, however, varies considerably from district to district. Medium in these studies exceeds 600 students and rises as high as 1500.

In an effort to explain evidence linking lower dropout rates to small or medium sized high schools, Lee and Burkham argue that “School size, per se, is unlikely to directly influence the probability that students will dropout of high school. Rather there are likely to be other organizational features that accrue to students and staff in smaller high schools”. These include how teachers and students relate to one another and may also include “organizational trust, members commitment to a common purpose and more frequent contact with people with whom members share their difficulties, uncertainties and ambitions” (p. 385).

Participation, Identification and Connection with School

Six studies included in the review provided evidence about the relationship between school size and some form of engagement by students in their schools beyond simply attendance and retention. One study included evidence from both elementary and secondary schools, the remainder were concerned only with secondary schools. Five studies were conducted in the U.S. and one in Australia. And five of the six (those summarized below) are based on large samples of schools and students. The results of all studies indicate significantly stronger student engagement in smaller as compared with larger schools.

The earliest of these studies was conducted by Lee and Smith (1995). Based on the U.S. *High School and Beyond* data base, this study examined the effects of school size on a host of outcomes including student engagement in school. An 18-item survey scale was used as the measure of engagement. These items asked students about the extent to which they looked forward to various subjects (e.g. math, social studies), the extent to which they believed study of these subjects would be useful to them in the future and issues related to their behavior in school. The study reported a significant negative relationship between student engagement and school size.

McNeely, Nonnemaker and Blum (2002) used the concept of “connectedness” in their U.S. study drawing on data collected in 1994/95 from school administrators and students in grades 7-12 as part of the *National Longitudinal Study of Adolescent Health* (Add Health). These data were from 83,074 students in 127 schools. Among the structural variables explored in the study—public/private, school location (suburban, rural), class size and school size, only school size had a significant relationship with students’ connectedness to their school. As school size decreased, school connectedness increased.

Using survey data from 2503 teachers and 3500 students in 96 Australian secondary schools, Silins and Mulford (2004) examined the influence of a small handful of school context and internal school variables, including school size, on students' participation in school activities (four "levels" of participation) and the extent to which students identify with school as a good place to be. School size had direct, negative, effects on both student participation and engagement in school. Indeed, the effects of school size on both student participation and engagement were greater than the effects of SES and most other measured variables.

Crosnoe, Kilpatrick and Elder's (2004) study of student attachment to their school, (among other issues) was based on evidence from 14,966 students in 84 schools collected as part of the U.S. *National Longitudinal Study of Adolescent Health* (Add Health). This study found that student attachment "declined at a slowing rate as school size increased, with the lowest levels occurring at schools with between 1900 and 2000 students. These four studies offer unambiguous evidence to indicate that both elementary and secondary students are much more likely to feel connected and engaged in smaller rather than larger schools.

Finally, Kuziemko's (2006) study, using Indiana Department of Education data, found a negative relationship between elementary school size and student attendance rates. Furthermore this negative relationship increased the longer students were enrolled smaller schools.

In sum. Though a relatively small number of studies (6) were located for our review of school size effects on student engagement, they are of quite good quality and provide entirely consistent evidence in support of the claim that smaller schools are associated with greater student engagement conceived of in moderately different ways. Several frequently cited pre-1990 studies have reported similar results (Huling, 1980; Lindsay, 1982). This also is the conclusion Cotton (1996) arrived at from her review of 14 studies about what she termed students' sense of "belongingness" or "alienation" with school.

Course-taking Patterns

This student outcome is unique to the higher grades where students typically have some choice in the courses they take. Three studies were included in the review about the effects of school size on course-taking patterns. All three studies were carried out in the U.S. and all three used evidence from large populations of schools and students.

Drawing on evidence from 682 schools included in the U.S. *High School and Beyond* study, Monk and Haller (1993) concluded that larger school size is positively related to the number of senior course credits available to students but that "the effects of size are differentiated within high schools" (p. 3). The positive relationship between size and number of courses was stronger for non-urban than for urban schools, non-unionized vs. unionized schools^v and for vocational vs. academic offerings. Larger schools were also more likely to have greater numbers of specialized courses within subject areas.

Whether or not these results favoring larger schools should be viewed as educationally positive or not is less clear. Monk and Haller (1993) offer a possible equity argument favoring large schools—equitable access to the same breadth of courses. On the other hand, a growing body of literature now argues that a narrower academic curriculum is in the best interests of all students and the so-called “shopping mall”, comprehensive high school was an old reform initiative badly conceived from the outset.

Evidence provided by Lee and Smith (1995) significantly advanced this position, offering a strong, opposing, view of what would constitute equity with respect to course taking patterns. Using the 1995 U.S. NELS data base, they inquired not about course availability in relation to school size, but the relationships among school size, different course-taking patterns and student achievement. This study found that more within-school variability in course taking was negatively related to all of their measures of student outcomes. Smaller secondary schools were found to offer a more constrained variety of courses with greater academic emphasis (or higher standards) and higher academic achievement for all students was the consequence. Lee and Smith concluded from their study that:

High schools with constrained curricula, in which all students take a similar set of academic offerings, appear to increase the learning of all of their students. (p. 8)

Alexander’s study (2002) tests the possibility of changing the typical pattern of course taking reflected in the studies by Monk and Haller (1993) and Lee and Smith (1995). Alexander examined the course-taking patterns of students in different-sized secondary schools within the context of a New York State policy which called for “greater prescription of courses and the expanded use of curriculum exit examinations” (p. 677). Students’ course-taking patterns were examined four years before and six years after the policy was enacted. The expected changes were threefold: an increase in the proportion of class periods devoted to core courses; a greater proportion of time within the core devoted to advanced courses; and reduced relationships between course taking trends and student background variables. The outcomes of this study most relevant to our review were twofold. First, in New York City schools, the likelihood of the expected results of the policy increased with increases in secondary school size; for example, a 10% increase in the size of a school was associated with a .3% increase in the share of the curriculum allotted to the core. Outside the City, however, in other large districts, smaller schools were more likely to have more class time focused on the core parts of the curriculum.

In sum. These studies suggest that course taking patterns in larger secondary schools are typically more varied. That said, Monk concluded from his comparison of curricular offerings in secondary schools in New York State that:

an expanded, more specialized, more diversified curriculum is not guaranteed by large enrolment levels alone it is possible to offer at the 400 pupil level a curriculum that compares quite favorably in terms of breadth and depth with curriculum offered in much larger settings. (cited in Fowler & Walberg, 1991, p. 199)

Evidence also suggests that curricular breadth is not in the interests of students' academic success in any event. Patterns of course taking most likely to emerge in smaller secondary schools—fewer courses and, within those courses, a clear emphasis on core academic outcomes—seems to promote greater academic achievement for all students. An admittedly small body of research suggest that the more varied course taking patterns associated with larger secondary schools can be changed with focused intervention and without reducing school sizes.

Extra-curricular Participation (EP)

Four studies of school size effects on extracurricular participation were located for the review (see Table 1), all published between 1996 and 2007 and all summarized below. Based on the reviews of literature included in these studies and other earlier reviews, it is likely that the total body of empirical English-language research bearing on this relationship is in the range of approximately two dozen studies.

While four studies seems a small proportion of the total available, these are the most recent. More importantly, these are the most methodologically robust studies to be published to date at least in terms of their external validity or generalizability. All of these studies used evidence from one of three large, national U.S. longitudinal data sets. One might argue that restricting the review to U.S. evidence is a serious limitation, but we have encountered no reasons to believe that the EP-school size relationships would vary significantly across North American contexts. A more serious limitation is the complete lack of evidence about elementary school EP, an historical limitation of EP studies.

Coladarci and Cobb (1996), the earliest of the four studies to be published, examined the relationship between school size and secondary school students' EP using evidence provided by a U.S. national data base, the *National Educational Longitudinal Study*^{vi} (NELS:88). To be included in this study, students had to have participated in all three waves of NELS data collection when they were in the 8th, 10th and 12th grades. Furthermore, students were included only if they attended either a "small" high school (fewer than 800 students) or a "large" high school (1600 or more students). NELS data provided information about student participation in a range of activities (29 in total) classified as academic (14), sport (11) and performing arts (4) extracurricular activities, along with the number of hours per week they devoted to these activities. Coladarci and Cobb (1996) sum up the main results of their studies as follows:

EP is significantly greater among smaller-school students for 21 of the 29 activities: 8 of the 11 sports activities, all 4 performing-arts activities, and 9 of the 14 club [academic] activities...Across all activities and both grades, participation was roughly four tenths of a standard deviation higher for smaller school students than for students attending larger schools. (p. 96)

Results for this study also indicated that, as a determinant of EP, school size outweighed other variables for which data were available including student SES, academic achievement and student self esteem.

McNeal's (1999) analysis of the 1983 data provided by the (U.S.) National Center for Educational Statistics' *High School and Beyond Study* (HSB) was based on evidence from 5,772 students in 281 public schools, McNeal found significant effects of school size on the extent of extracurricular participation by students. He also found much greater joint effects of school climate and school size on such participation. McNeal concluded that "students attending schools that are larger or have problematic climates are generally less likely to participate in extracurricular activities" (p. 8). Together participation and climate explained 66% of the between-school variation in athletic participation, in particular.

Using evidence from 14,966 students in 84 schools collected as part of the U.S. *National Longitudinal Study of Adolescent Health* (Add Health), Crosnoe, Kilpatrick and Elder (2004) examined the effects of school size on students' participation and several other measures of interpersonal climate^{vii} in a total of 33 different activities (athletic, academic, performing arts, leadership and other). School size was treated as a continuous rather than categorical variable in this study. Results indicated that increases in school size were associated with decreases in EP, as well as other measures of interpersonal climate. In the case of EP specifically, the relationship was entirely linear, that is "each increase in school size was associated with an equal decrease in the predicted extracurricular participation of a student..." (p. 1270).

The fourth and most recently published studies of EP included in the review was by Feldman & Matjasko (2007). This study used data provided by wave 1 of the *National Longitudinal Study of Adolescent Health*, including responses to surveys by students, parents and school administrators (a total sample of 14,411). School sizes, based on the estimates of school administrators, were categorized as small (1-400 students), medium (401-1000 students) and large (1001-4000 students). Suggesting limits on the opportunities for engagement as the reason (after Barker and Gump, 1964), the authors reported that non-participating students were more likely to attend schools classified as large.

In sum. Results of the four studies of school size-EP relationships are very similar. All four indicate that extracurricular participation decreases as secondary school size increases. Furthermore, this seems to be a simple linear relationship, one for which a plausible explanation has been available since Barker and Gump (1964) proposed their "overmanning" hypothesis to explain increased participation with decreased school size. According to this hypothesis, most schools offer a fixed number of activities (for example, athletic activities) each of which has a fixed number of possible positions to be filled. Smaller schools offer a greater proportion of students opportunities to fill those positions. There also is more pressure for students in smaller schools to fill the available positions. All four studies included in this section offer support for this hypothesis.

From her review of a substantial amount of earlier evidence, Cotton (1996) also concluded that:

The greater and more varied participation in extracurricular activities by students in small schools is the single best-supported finding in the school size research. (p. 7)

Other Student Outcomes

Only small amounts of evidence (five studies in total) were located about school size relationships and several other student outcomes—self-esteem, physical safety and social behavior.

Student attitudes about self and others. Two studies provided evidence about school size relationships with student self-esteem or self-concept. The first of these studies inquired about the relationship between school size and student self-esteem defined as “the value or sense of worth one perceives about one’s self” (Holland & Andre, 1994, p. 345). This study was based on evidence from 648 students attending either small or large high schools. Schools were classified as small if they had fewer than 100 students per grade and large if they had more than 250 students per grade. School size had no effect on student self esteem.

The second study also failed to find a significant relationship between student self esteem and school size using evidence from the *NELS:88* data base, described more fully earlier (Coladarci & Cobb, 1996). This study tested for an indirect effect of schools size on student self-esteem through school size effects on extracurricular participation.

Although neither of these two studies reported significant relationships between school size and student self esteem or self concept, Cotton’s (1996) review of several earlier studies led her to conclude that “both personal and academic self-regard are more positive in smaller schools” (p. 8). Evidence on this matter, in sum, is meager and the results inconclusive.

Physical safety. Rubie-Davies and Townsend (2007) was the only study located for the review which examined the relationship between school size and student safety, in this case the incidence of bone fractures among elementary school students in New Zealand. Based on evidence from a representative sample of 76 grades 1 to 6 schools, results indicated that fractures were more common in larger schools (and among boys). Reduced ability of staff to monitor the activities of students was the primary explanation for these results.

Social behavior. Two studies, one in elementary and one in secondary schools found reduced incidence of misbehavior in smaller schools. Cross sectional data from the *New Brunswick School Climate Study* were used by Ma (2001) to examine, among other things, the effects of school size on the disciplinary climate in schools. Data for the study were provided by 6883 grade 6 students and 6868 grade 8 students. In particular, this study aimed to better understand the relationship between bullies and victims. Students in

small schools, the results indicated, were more likely to become bullies than victims. But bullying was reduced by greater parental involvement, such involvement being more likely in small schools.

The second study of social behavior was Darling-Hammond, Aneess & Wichterle Ort (2002) Described in some detail earlier, this study tracked the effects on students of disbanding a large comprehensive high school in New York City and creating five smaller secondary schools in its place. All student outcomes measured in this study, including the incidence of indiscipline, improved in the smaller schools. The study's design, however, makes it difficult to distinguish the effects of smaller structures from the effects of the many other improvement initiatives undertaken simultaneously in these schools.

Table 1
Evidence about School Size Effects on Students

Student Outcomes Influenced by School Size	Elementary/Middle Schools	Secondary Schools
Academic achievement	+ - 4, 5, 20, 23, 45, 42 u ns 9, 46, 59	+ 14, 31, 14, 17, 35 - 3, 20, 25, 26, 28, 30, 16, 45 u 11, 28, 25, 35, 48, 61 ns
Equitable distribution of achievement across students with varying SES	+ - 27 ns	+ - 16, 25, 26, 31, 32 ns
Attendance or truancy and retention or dropping out	+ - 4, 50 u ns 59	+ 49 - 16, 52, 55, 56 u 48, 51, 57 ns 53, 54, 58
Participation, Identification and Connection With School	+ - 27 ns	+ - 10, 18, 26, 27, 38, 43 ns
Course-taking patterns	+ - ns	+ 15, 39 - 26 ns
Extra-curricular participation	+ - ns	+ - 1, 34, 37, 43 ns
Other student outcome (attitudes about self; physical safety; social behavior)	+ - 2, 43, 44 ns	+ 38 - 16, 37 ns 38

The numbers in the cells correspond to the numbers assigned studies cited in the Appendix.

+ = studies reporting positive relationships between size and student outcomes

- = studies reporting negative relationships between size and student outcomes

u = studies reporting non-linear relationships between size and student outcomes

ns = studies reporting non-significant relationships between size and student outcomes

No firm conclusions can be drawn about school size-social behavior relationships from just two studies. Cotton's review (1996), however, provides a useful synopsis of evidence predating these two studies. She found that this earlier evidence encompassed many forms of social behavior including, for example, class disruption, vandalism, aggressive behavior, theft and substance abuse. "This research", she concluded, "shows that small school have lower incidences of negative social behavior, however measured, than do large schools...[furthermore}...The social behavior of ethnic minority and low-SES students is even more positively impacted by small schools than that of other students" (p. 6).

School Size Effects on Organizational Characteristics

Much less evidence was located about school size effects on school organizations than on student outcomes. The 17 studies located for the review which provide such evidence are identified in Table 2. Similar to Table 1, this table tallies the number of studies, of the 59 included in Table 1, that provide evidence about school size effects on each of three categories of organizational outcomes listed in the left column. For each of these organizational outcomes, the table indicates whether the evidence concerns elementary or secondary schools (columns 2 and 3) and the number of studies reporting significant positive (+) or negative (-) results, as well as those studies reporting both non-linear (u) and non-significant (ns) relationships.

Costs and Cost Efficiency

Evidence about the costs and cost efficiencies of schools varying in size was provided by five studies, four carried out in the U.S. and one in Northern Ireland. All were concerned with secondary schools. Bowles and Bosworth (2002) argue that there is a large school finance literature about economies of scale in education but empirical analysis in much of this work depends on expenditure data at the district level. As a consequence, there is little evidence about economies of scale at the school level. Studies included in this section of the review use school-level cost data. Two of these studies report results favoring large schools, two favoring small schools and one favoring mid-size schools.

Evidence favoring large schools. The single non-U.S. study included in the review was reported by Barnett and his colleagues (2002). They examined the relationships among secondary school size, student achievement and the costs of schooling in Northern Ireland. To assess the most cost-effective school size, these researchers used the typical U.K. measure of secondary school achievement (percentage of pupils achieving 5 A* - C grades on the GCSE exams) along with a measure of costs that included the number of full time equivalent teachers, the average annual salary for these teachers, annual expenditures on teaching staff, annual expenditures on support staff and annual expenditures on other non-labor "input" resources. The result of this analysis are described as a "cost-constrained best practice performance score" (p. 302). Maximum values on this score were achieved by the largest schools in the sample, suggesting that "larger schools perform relatively better than smaller schools when measured relative to

cost-constrained best-practice benchmarks” (p. 303). Barnett et al. go on to argue that the only realistic way that smaller schools can match the performance of larger schools is by adding the resources necessary to allow for the levels of specialization in teaching they believe explains the effects of larger schools.

Bowles and Bosworth (2002) used detailed expenditure data for each school in 17 Wyoming school districts to examine how per pupil costs vary by school size. They wanted to know the effect of changes in school size on per pupil costs with student test scores held constant. This study found greater costs to educate a student in a small as compared with a large school; for example, a 1% change in school size is associated with a 0.2 % change in costs per student.

Evidence favoring small schools. In addition to finding significant negative relations between school size and student achievement for students spanning the SES spectrum, Bickel et al.’s (2001) study, carried out in 1001 Texas schools, raised a provocative question about the number of grades included in a single school. The context for this study is important to acknowledge: many small rural schools spanning all elementary and secondary grades are often in districts with only one high school. Within this context Bickely and his colleagues report evidence clearly favoring schools with large grade spans with respect to costs. Specifically:

With expenditure per pupil as the outcome measure, multiple regression analysis shows that single unit schools, on average, correspond to a reduction of \$1,017 per pupil [italics in original] a substantial efficiency, when compared with conventionally grade-specialized high schools. (p. 3)

Bickel et al. explain that this significant per pupil savings can be accounted for by the fact that each single unit school in their study was the only school in the district and each had the full range of grades from K (or earlier) to 12. This evidence also indicated that the savings in these single unit schools declined as they became larger.

The context in which the Bickel et al. (2001) study was carried out is quite unlike the Regina school system context, of course. Nonetheless, moving toward the creation of small K-12 schools is an interesting policy option to consider even for a medium sized urban/suburban school district like Regina. It is an option that clearly flies in the face of historic trends toward larger size, greater specialization and the ingrained expectations of students, parents and other members of the community about what high schools should be. But the bulk of the evidence in this review also implies that these trends have not served to improve student learning or reduce educational costs particularly well, either.

Kuziemko’s (2006) Indiana elementary school study asked whether or not decreasing school size would be worth the cost. For this analysis, the author examined only the individual benefits to the future income of a representative student. Based on expected increases in achievement resulting from decreases in school size and the payoff of such increased achievement in employment earnings, a 2% increase in income would be predicted for a 50% reduction in school size.

Evidence of a non-linear relationship. Stiefel et al.'s (2000) cost-effectiveness study was carried out with a sample of 121 New York City high schools. This study used graduation rates as the measure of school effectiveness and estimated school-level costs using a 4-year budget per graduate for each school "in order to cover the entire career of a typical high school student and to combine budgets and graduates; this method for calculating costs means, of course, that dropouts greatly increase per pupil budgets for schools.

The 121 high schools sampled in this study were divided into three groups by size: small schools (0-600 students); medium (601-2000); and large (more than 2000 students). Evidence indicated that the small to medium-sized schools (600 to 1200) had the highest budget per students. Large high schools had the lowest budget per student followed closely by those small high schools with an academic mission (some New York high schools have specialized missions, not always academic). So large and small schools seem to be relatively efficient, mid-sized schools much less so.

In sum. The five studies included in this review alone offer no clear direction about the most cost-efficient size of secondary schools, a result consistent with much earlier research.^{viii} These mixed results are likely due to the quite different methods used to calculate results. Most studies finding an inverse relationship between size and cost-effectiveness also have a strong interest in equity as an outcome.

Among earlier reviews of cost-effects evidence, Walberg and Walberg's (1994) review is most inclined to favor small schools. Noting the longstanding trend across North America to reduce the number and increase the size of both districts and schools, the authors review research suggesting that theories about scale effects have been called into question by evidence in most sectors and certainly with respect to districts and schools. While results of scale-economy studies are still described as "mixed", there is a growing tendency among economists to write about the "diseconomies" of scale. The longstanding trend toward greater size, the authors conclude, is "in exactly the wrong direction" (p. 19).

Teacher Turnover

Two studies, both carried out in Northern Europe, examined the effects of school size on teachers' decisions to change schools. Undertaken in Norway using a national sample of schools, Falch & Strom (2005) inquired about the factors that give rise to teacher turnover (the authors use the term "quit behavior") which, in Norway averages about 9.5% annually. Because teacher salaries are determined nationally, the context for the study controlled for this variable. The authors justify the focus of their study as follows:

[As] teachers sort themselves between schools according to preferences for non-wage school characteristics, non-attractive schools from the teachers' point of view are likely to be left with lower quality teachers. (p. 612)

"Quit behavior" or turnover for this study included changing schools within the same jurisdiction, changing schools across jurisdictions and leaving the profession. Teacher turnover data in Norway between 1992-93 and 1999-2000 were used for the study.

Evidence from this study found that school size was a significant factor in teachers' turnover decisions. The highest quit rate was in the smallest and largest schools; evidence indicated that "The quit probability is equal in schools with about 70 and 670 pupils" (p. 624). This finding about very small schools is quite consistent with results of Dunathan's (1980) much earlier study (cited in Eberts, Schwartz & Stone, 1990) suggesting that small schools typically have difficulty attracting and retaining teachers.

Adalsteinsdotti's (2004) examined not only the tenure but the behaviors and practices of 20 teachers in 10 small ($m = 57$ students) and 10 large ($m = 309$ students) Icelandic primary schools. Longer tenure was associated with larger schools in this study. Given the small size of the "large" schools in this study, however, the results actually seem to be quite consistent with those reported in the Norwegian study. Mid-size elementary schools, those in the range of about 300 students, may be an optimum size for retaining teachers.

Teacher Attitudes

Ten of the 59 studies in the review (see Table 2) examined the relationship between school size and several different teacher work-related attitudes. Seven of these studies were conducted in elementary schools, three in secondary schools. Of the ten, one found a non-linear relationship between school size and teacher work-related attitudes, seven reported evidence favoring smaller schools and two found non-significant relationships

Non-linear relationships. The one study reporting a non-linear relationship was reported by Barty and her colleagues (2005). This study examined a wide range of Australian data to identify factors influencing attitudes and decisions related to applying for the principalship. Australian schools varied substantially in the number of applicants they attracted when a new principal is required. This study found schools size to be one of a small handful that influenced the decision to apply. The presence of an incumbent candidate and local educational politics also were found to influence such decisions. The most attractive size school for applicants was at neither of the extremes. Principal applicants appeared to favor schools larger than 200 students, worrying about such matters as inadequate funding, insufficient staff and difficulty in moving to another school later in one's career. These applicants also appeared to avoid schools larger than about 800 students because of their more complex budgets and organizational structures, substantial managerial demands and inadequate support for administrative tasks (even though Australia has devolved considerable decision making authority to school principals).

Evidence favoring small schools. Seven studies reported linear relationships between size and teachers' work-related attitudes. By way of example, Sturman's (2003) study, carried out in English primary schools, examined the test preparation attitudes and activities in which teachers engaged their year 6 students prior to the Key Stage 2 high stakes science tests. Evidence for the study was provided by the responses of 64 headteachers to a survey. Results indicated that teachers in smaller schools began preparing their students

for the test later than did teachers in larger schools. Sturman speculated “This may be because less preparation time is required with a small Y6 class or where liaison with other Y6 teachers is not required, or it may arise from the difficulties of revising with mixed-age classes which are common in small schools” (p. 269).

Eberts, Schwartz & Stone (1990) found that teachers in small schools were more satisfied with their schools’ programs, relations among staff in their schools, and the manner in which conflicts in their schools were addressed. But these teachers also perceived that their principals were less effective than did teachers in larger schools. By way of explanation, Eberts and his colleagues reasoned that in small schools, principals have to take on a wide variety of duties only some of which they may be skilled at, whereas large-school principals may be able to delegate tasks better carried out by other staff in the school.

A qualitative study by Lee et al. (2000) in nine high schools varying widely in size aimed to better understand the relationship between schools size and both social relations in schools and the nature of the school curricula. This study did find closer social relationships between students, as well as between staff and students (although not always to the advantage of some students). The study also found a narrower curriculum offered by smaller schools, as would be expected.

These results by Lee and her colleagues raised more complex questions about the viability of small secondary schools. For example, whether a school was small by choice or by default (declining enrolments over a substantial period of time) seemed to influence staff attitudes in the school and the likelihood of teachers taking advantage of the smallness of their organizations. Enrolment-driven funding formulae also provided serious constraints to the resource base of small secondary schools. In addition, while the small schools were in a good position to develop a more constrained academic curriculum for all students (a curriculum which considerable evidence now suggests offer all students significant achievement advantages) many small schools did not take advantage of this opportunity. Instead they wished to be able to offer the broad curriculum associated with large, comprehensive high schools.

Lee and her colleagues (2000) as well as Rosenblatt (2001) associated smaller schools with higher levels of teacher commitment and sense of responsibility for student learning.

Non-significant relationship. Two of the ten studies about teacher attitudes and school size found no relationship. One of these studies (Brown, 1994) examined teachers’ attitudes toward the purposes for assessment, the second (Duncan & Noonan, 2007) was concerned with secondary teachers attitudes and practices related to student grading and assessment.

In sum. While not a unanimous finding, the combined weight of these results seem to indicate that smaller school size enhances the chances that teachers will hold positive work-related attitudes.

Table 2
Evidence about School Size Effects on the School Organization

Organizational Outcomes	Elementary Schools	Secondary Schools
Costs, cost efficiency	+ - u ns	+ 14, 40 - 4, 20 u 21 ns
Teacher turnover/tenure	+ 12 - 36 u 6 ns	+ - 36 u ns
Teacher attitudes	+ - 12, 13, 23, 41, 42, u 7 ns 9	+ - 19, 24 u ns 47

The numbers in the cells correspond to the numbers assigned studies cited in the Appendix.

+ = studies reporting positive relationships between size and organizational outcomes

- = studies reporting negative relationships between size and organizational outcomes

u = studies reporting non-linear relationships between size and organizational outcomes

ns = studies reporting non-significant relationships between size and organizational outcomes

Conclusion

Limitations on the Scope of the Review

The terms of the contract for this review mentioned an array of different outcomes for which school size effects were of interest. These were outcomes including, but not limited to, academic achievement, social impacts, psychological impacts, community integration, “at risk” children, “at risk” neighborhoods, extra-curricular programming, teacher effectiveness, and teacher satisfaction. Although not all of these labels explicitly appear in the text of this paper, all of the outcomes they signify have been considered, with two exceptions.

One exception concerns “community integration”. Adopting a broad conception of what that term could mean, we were unable to locate evidence inquiring about the effects of school size on it. We did find, however, that many parents felt smaller schools to be more welcoming, less intimidating, places than larger schools and as a consequence, more likely to participate in school-related matters with their children.

The second exception is “teacher effectiveness”. We were able to locate very little evidence bearing on this outcome. None of the evidence that we did find linked school size to the quality of teachers’ classroom instruction. This evidence did suggest that

smaller (but not very small) schools are likely to be considered by the majority of teachers to be attractive workplaces. This, in turn, seems to result in a more stable teaching staff and a greater sense of responsibility for student learning on the part of teachers. But evidence about these responses by teachers is quite limited in the review.

With these limitations in mind, we turn to three matters in this final section of the paper. The results of the review are summarized first. Second, four recommendations are offered about optimum school sizes. Third, arguments that appear in the literature favoring both larger and smaller school sizes are briefly rehearsed and, finally, some important evidence is presented about the interactive effects of school and district size.

Summary of Results

Results of the 59 post-1990 studies which were the focus of the paper, along with evidence from reviews of earlier research, justify six claims about school size effects.

1. *Smaller schools are generally better for most purposes.* The weight of evidence provided by the review clearly favors smaller schools for a wide array of student outcomes and most organizational outcomes as well.
2. *"Smaller" does not usually mean "really small".* "Smaller" is a relative term. In districts with secondary school sizes exceeding 2500 students, for example, smaller can mean as many as 1500 students, a size which would be considered very large in other districts.
3. *One size may not fit all purposes.* Smaller schools are an advantage for most, although not all types of student outcomes. Some evidence, for example, recommends larger schools for nurturing the achievement of academically successful senior high school students, whereas many other student outcomes seem to develop best in smaller schools.
4. *Student background matters.* Students who traditionally struggle at school, students from disadvantaged social and economic backgrounds, for example, are the major benefactors of smaller schools. But smaller schools do not seem to be an impediment to the learning of more advantaged and/or high achieving students, at least if those students have access to the specialized instruction they need to master complex subject matter.
5. *Breadth of curriculum is no longer a justification for large schools.* The breadth of the curriculum, often cited as a major advantage of large comprehensive secondary schools, seems achievable in schools as small as 500 to 600 students. Such breadth, however, is now regarded as a serious threat to the academic progress of most students.
6. *Cost efficiency is no longer a justification for large schools.* Most contemporary studies have concluded, unlike an earlier generation of studies, that small schools are

more efficient or cost effective. This reversal of opinion is the results of taking student graduation rates into account. Small secondary schools manage to graduate a significantly larger proportion of their students than do large secondary schools. The higher drop out rates of large secondary schools is also one of the most plausible explanations for the results of studies associating higher achievement levels among senior students with larger school size.

Recommendations about Optimum School Sizes

The most practical and obvious policy question that school size research should help to answer concerns the optimal size of schools. While the results of this review help to explain why this is not a simple question to answer, there is ample justification for the following recommendations :

- Elementary schools serving student populations exclusively or largely from diverse and/or disadvantaged backgrounds should be limited in size to not more than about 300 students.
- Elementary schools serving economically and socially heterogeneous or relatively advantaged students should be limited in size to about 500 students.
- Secondary schools serving student populations exclusively or largely from diverse and/or disadvantaged backgrounds should be limited in size to about 600 students or fewer.
- Secondary schools serving economically and socially heterogeneous or relatively advantaged students should be limited in size to about 1000 students.

A Brief Explanation of School Size Effects

Most of the studies reviewed in this paper offer some explanation for school size effects and many of these explanations have been touched on in earlier sections of the paper. We briefly sum up these explanations here.

Historically, larger schools have been justified on the grounds that they:^{ix}

- provide increased variety of classes for students;
- allow for increased specialization of teachers through a finer division of labor;
- can be run at lower per pupil costs because the same equipment is used by more than one student;
- are more likely to draw a more diverse population, thus exposing students to greater diversity;
- include a greater variety of teachers and so are more stimulating for students.
- are less likely to “pigeonhole” students (e.g., teachers assuming that younger siblings have the same characteristics as older siblings they have already had in their classes);
- provide greater opportunity for students to develop social relationships

- provide students with greater access to secondary teachers with more specialized instructional skills
- have greater flexibility to offer specialized courses to small numbers of students.

A number of these justifications have been seriously challenged by empirical evidence, for example: Coladarelli & Cobb (1996) found significantly higher rates of extra-curricular participation in smaller schools; Monk (1987) and Elsworth (1998) found no change in the quality of courses offered in smaller and larger secondary schools; a number of the cost studies reviewed above found larger schools to be less efficient than smaller schools.

The advantages of smaller schools are often argued on the grounds that:

- it is easier to develop relationships with other students in smaller environments;
- smaller schools increase the chances of staff knowing students well;
- teachers are more likely to take more responsibility for student learning in smaller settings;
- smaller schools offer students a better chance to be known by someone
- smaller schools increase the connection between student and community
- better teaching strategies are associated with fewer students
- in a smaller organization, there is a diminished need for costly monitoring and supervision

Theoretical arguments underpinning the historical trend toward larger school units have not held up well to empirical scrutiny even though this seems not to have seriously slowed the move toward larger units. This ought to provide a lesson for those now offering arguments for smaller schools. The lesson is to let school size policies be driven by empirical evidence, not attractive theory or ideology.

A Final Caveat about District Size

While the review was restricted to an examination of school size effects, we encountered a reasonably compelling body of evidence to suggest that district and school size interact in their effects. Some of this evidence suggests, for example, that the main advantages of small schools are greatly diminished if those schools are located in large districts.

A few examples of this evidence will suffice at this point. Fowler and Walberg's (1991) study carried out in New Jersey secondary schools examined the effects of both school and district size on a range of important organizational and student outcomes. In addition to finding significant, negative, school size effects on students, evidence also pointed to significant effects of district size: "Smaller school districts and smaller schools, regardless of socioeconomic status and grade level, may be more efficient at enhancing educational outcomes" (p. 189). A U.S. national study by Walberg and Walberg (1994) several years later reported essentially the same results.

While neither of the Walberg studies directly examined the interaction of school and district size, more recent studies have picked up this issue. Bickel and Howley's (2000) study is one of these and seems quite relevant to the broader policy context in

Saskatchewan. While evidence from this study strongly suggested the value of reductions in either district or school size, "...the combined strategy of reducing both school and district size would be predicted to yield substantial equity and excellence effects." (p. 21). In the Bickel and Howley (2000) study "equity effects" refer to increases in the achievement of low SES students without harming the achievement of high SES students and "excellence effects" refer to increases in the mean levels of achievement across all students in a school.

Replicating, in Texas, studies completed in Georgia and several other states, Bickel et al. (2001) reported additional evidence confirming the important, combined, effects of district and school size on student achievement identified in their earlier efforts. "The expected achievement gains of less-advantaged students in small schools", they report, "were undercut in large districts" (p. 20).

At this point in time, decisions about district size in Saskatchewan are likely to be considered a "fait accompli". This evidence may be relevant, however, to decisions about the internal structure of the Regina school district. Smaller, more localized, sub-divisions within the district, each with considerable decision making power and community-like cultures, would seem to be worth the board's consideration.

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Endnotes

- i Fox (1981), Walberg & Walberg (1994), Cotton (1996) and Andrews, Duncombe & Yinger (2002),
- ii A large proportion of the studies providing evidence about the effects of school size on students are based on two distinct methodological approaches. One approach is described as the Hierarchical Linear Modelling (HLM) or “quantitative educational psychology approach” (Bradley and Taylor, 1998; Sawkins, 2002). The other approach is the “production functions” approach. The HLM approach is the method of choice among school effectiveness researchers, whereas the production functions approach is typically used by economists.
HLM acknowledges different educational processes associated with different levels of the system (the individual student level, the classroom level, the school level and sometimes the district level, as well). Using HLM, researchers attempt to discover what proportion of the variation in student outcomes is explained by processes associated with each of these levels. When schooling is viewed as a production process, the value added to student learning is considered to be a function of four sets of variables—initial levels of achievement, family background, peer group effects and school inputs. Production function researchers aim to determine how much of the variation in student attainment across schools is accounted for by each of these sets of variables.
- iii Curiously, these studies typically began by claiming little prior research on school size, a claim that would only be defensible by restricting one’s attention to research carried out in the U.K.
- iv The two studies by Jeffries and colleagues (2002, 2003) were conducted in individual schools. While both studies associated positive consequences with small school size, the design of the studies provides very weak justification for this claim.
- v These are schools in which teachers belong to an organized union which bargains salaries and some aspects of their working conditions on their behalf.
- vi This study also tested claims about the contributions of EP to student achievement and self esteem
- vii These other interpersonal climate variables included school attachment (or identification) and student-teacher bonding.
- viii For example, Chakraborty & Lewis (1968), Public Education Association (1992) and Monk (1990).
- ix These arguments are rehearsed, for example, by Ready, Lee & Welner (2004) and Kuziemko (2006)