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School Size as a Factor in the Academic Achievement of Elementary School Students

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This study empirically assessed the relationship between school size and academic achievement of elementary school students in Ontario, Canada. Utilizing data from the Ontario provincial standardized test, the Educational Quality and Accountability Office (EQAO), the results of 541 schools from ten school boards, were studied. A One-way Analysis of Variance (ANOVA) indicated that overall, there was no statistically significant correlation between school size and student achievement. However, there were significant correlations with respect to levels of performance in both Grades three and six in some curricular areas. Also, further analysis at each independent achievement level revealed that the mean percentage of students achieving at stipulated provincial standards in Grade three writing and in Grade six reading, writing and mathematics were highest in large-sized schools (schools with more than 420 students). Results further indicated that the mean percentage of students performing above provincial standards in Grade six reading and writing was also highest in large schools. Students in medium-sized schools (between 246 and 420 students) also had the highest mean percentage of students performing above provincial standards in Grade three writing and in Grade six mathematics. The limitations and implications of the results are discussed, and relevant suggestions made.

Keywords: School, Size, Achievement, Elementary, Students

Introduction

Optimal school size has long been an issue of contention at both the elementary and secondary levels. Throughout the last century, the organizational tendency in education has fluctuated between a push for small or large schools. Advocates for each perspective have fought relentlessly for referendum in school boards across North America. Such debates are further exacerbated by emotional, financial and political investments. Clarification from the research literature does not provide an adequate resolution to the issue of optimal school size, as empirical validation exists for each side of the argument.

Over the last five years, the trend in educational reform has favoured smaller schools (Mulrine, 2002). For example, the Annenberg Foundation had pledged $500 million to reform urban schools in Chicago (Ready, 2004). The Bill and Melinda Gates Foundation had also contributed $51.2 million for the creation of 67 small theme-based schools in New York (Ready, 2004). In Ontario, Canada, the location of this study, the debate over the physical constitution of schools that effectively promote positive academic growth continues. This debate has been intensified with the specific physical makeup of Ontario schools and the deliberate composition of the public funding formula. According to *People for Education* (PFE) (2006) almost half of the elementary schools in Ontario would be considered small in size, having less than three hundred students. A similar situation exists in Ontario high schools, with thirty-three percent having an enrolment of less than six hundred students. The existing funding formula is based on larger school enrolments, with sixty percent of elementary schools and fifty-five percent of high schools below the formula limitations that would permit for a full-time principal (People For Education, 2006). In order to staff their schools, school boards have been making cuts in other areas. Small schools have faced a steady decrease in the amount of full-time principals, librarians, specialized teachers and guidance counselors. Intensifying the debate is a current government-mandated reduction of class sizes in junior kindergarten through to the third grade, with an implementation of a hard cap of twenty students per class.

Research has shown that communities hold schools accountable for students' academic achievement (Lee, & Loeb, 2000). Knowledge concerning whether the size of a school impacts academic success is invaluable in informing community decisions to consolidate or maintain small schools and establish effective funding formulas. The purpose of this study was to determine whether there is a relationship between school size and student academic achievement, and if there is, to investigate the nature of the relationship.

Literature Review

Historical Overview

Historically, there is little agreement over what constitutes the most effective school size. From the evolution of the one-room schoolhouse to the mega-schools of today, debates on whether to consolidate or maintain small schools had been raging for a long time (Howley, 1995). In a book about rural education, Cubberley (1922) traced the school consolidation trend back to a Massachusetts law in 1867, which marked the loss of independent self-control over individual schools and the commencement of local town management. Prior to this law, most schools were small in size and many were considered rural in nature. The introduction of town management resulted in the effective consolidation of country schools. The consolidation trend continued throughout the 1920s, as schools grew larger as a consequence of the increasing immigrant populations in major cities. The large influx of new students caused districts to con-

solidate administration, instruction and curriculum (Abbott, Joireman, & Stroh, 2002).

Additionally, the President of Harvard University, Conant (1959), further solidified North American consolidation efforts with the publication of the book, *The American High school Today*, which claimed that larger schools were the solution to narrowing the learning gap and winning the space race. The Harvard educator believed that small schools did not allow for a beneficial diversified curriculum and reasoned that larger high schools offered more comprehensive instructional programs of greater quality at lower costs.

Having reviewed nearly 120 studies conducted between 1924-1972 pertaining to school size and its relationship to school effectiveness, Stemnock (1974) found that the studies generally served as justifications for larger schools. The research studies tended to focus on the relationship among input variables, including the curriculum, teacher credentials and teaching styles. The few studies which related school size specifically to academic achievement were found to be void of any recommendations in reference to optimal school size.

Throughout the literature, consolidation advocates have also relied heavily on expenditure theories as justification for the abolition of small schools (McGuffey, & Brown, 1979). They have maintained that the reduced per pupil expenditures feasible in larger schools, translated into greater student achievement. This relationship was achieved through the calculated investment of monetary savings into various methods of school improvement. Fiscally this argument was very appealing to educational policy makers, and in an era of economic pressure, the trend to consolidate continued.

The association between reduced expenditure and achievement previously reported (McGuffey, & Brown, 1979) was not found in subsequent replication studies in the 1980s (Burrup, Brimley, & Garfield, 1988; Monk, 1987). Consequently, the enthusiasm to consolidate began to fade, as the effectiveness of large schools was questioned (Guthrie, & Reed, 1986). Sergiovanni (1995) argued that school size was associated with valuable process variables that large schools disabled or suppressed, and urged educational decision-makers to go beyond simple per student cost and consider the ratio of productivity to cost. Additional research concluded that per student expenditure was positively related to student achievement and that a ten percent increase in per pupil expenditures was related to an increase in student achievement of one standard deviation over 12 years of schooling (Greenwald, Hedges, & Laine, 1996).

Contemporary Advocation for Small Schools

Researchers (Greenwald, Hedges, & Laine, 1996) performed a meta-analysis of studies from the 1960s and found student achievement in small schools to be superior to that in large schools. Using the American National Educational Longitudinal Study data set, Lee, Smith and Croninger (1997) similarly found that larger high schools had a negative influence on academic achievement particularly in mathematics and science. In a study of the reading and mathematics proficiency scores from every high school in North Dakota, Hylden (2005) found that schools with over 500 students had the poorest performance rates.

At the elementary level, research on third graders in 1,021 New York schools found that increasing school size had a negative effect on academic achievement (Wendling, & Cohen, 1981). In a large urban Missouri school district, Alspaugh and Gao (2003) studied the results of the Stanford 9 Normal Curve Equivalent (NCE) scores among fifth grade students. Controlling for socioeconomic status (SES), Alspaugh found a decline in achievement levels as enrolment increased, particularly in inner city and suburban schools. Similar findings of a positive relationship between academic achievement and small schools had been replicated in many other studies (Eberts, Kehoe, & Stone, 1982; Fowler, & Walberg, 1991; Miller, Ellsworth, & Howell, 1986; Wasley et al., 2000).

Other Variables in the Size and Achievement Relationship

Some researchers have cautioned that school size and academic achievement should not be correlated in isolation, and have concluded that other variables, particularly socioeconomic status (SES), must be considered in this relationship. Having dubbed this association the Matthew Principle (Howley, 1995), after the biblical reference to the phenomenon of the rich getting richer and the poor getting poorer, Howley found that the relationship between school size and academic achievement was completely dependent on the socioeconomic status of the community in West Virginia. Results indicated that small school size mitigated the negative effects of poverty on academic achievement.

Extending the work of the Matthew Project, research in Montana, Georgia, Texas and Ohio, also found that smaller school size cut the variance in achievement associated with SES by 20 to 70 percent (Howley, Strange, & Bickel, 2000). The percentage was usually 30 to 50 percent, depending on the grade level. The relationship was notably weakest in Montana, where there was a large percentage of small schools. In a report on their findings, Howley, Strange, and Bickel (2000) concluded that the correlation between poverty and lower academic achievement in the four States of interest was ten times stronger in large schools than in small ones. Research further indicated that larger schools served the same function for affluent communities. An exact replication study in Washington reached the same conclusion (Abbott, Joireman & Stroh, 2002). Other researchers also found that as school size increased, achievement levels for schools with economically deprived students decreased (Bickel, Howley, Williams & Glascock, 2001; Caldas, 1993; Franklin & Crone, 1992).

Another variable that was correlated with school size and academic achievement was grade level. In a study of students in California, Friedkin and Necochea (1988) looked at the 3rd, 6th, 8th and 12th grades. They concluded that large schools were associated with greater achievement for the 12th grade students, but small schools were associated with greater achievement for students in the 3rd, 6th and 8th grades. In a similar study, the Texas Education Agency (1999) found that students in the elementary and middle school grades were more adversely affected by school size than at the high school level. The Agency concluded that any potential benefits of large school size may be negated until students had acquired foundational academic skills, such as reading and arithmetic, and had become capable of independent learning.

Canadian researchers have also studied the relationship between academic achievement and school size (Lytton, & Pyryt, 1998; Ma, & Klinger, 2000). Lytton and Pyryt used data collected through the completion of the Alberta Achievement Test by almost all the elementary schools in the Calgary Board of Education in 1996. Controlling for the variable of socioeconomic status, the researchers found no relationship between school size and achievement. In a similar study in New Bruns-

wick, Ma and Klinger (2000) used the New Brunswick School Climate Study of 1996 to accumulate data, which evaluated student achievement in mathematics, science, reading and writing. The researchers focused on the entire grade six population in the English school system. Using a hierarchical linear model, they found no association between achievement and school size.

Optimal School Size

Taking cognizance of the reported benefits of small schools, many researchers sought to numerically clarify what constituted an optimal school size. Long ago, large school advocate, Conant (1959), urged schools to have a graduating class of 100, which is notably small by today's standards. Other high school researchers reported that there was no reason for a high school to have more than 400 students (Haller, & Monk, 1988). Sergiovanni (1995) recommended no more than 300 students attending a school, at either the high or elementary school level. Meier (1996) had concluded that schools with enrolments of 300 to 400 students were optimal for seven reasons, namely, governance, respect, simplicity, safety, parent involvement, accountability and belonging. Lee and Smith (1997) concluded that a curvilinear relationship existed because they found that high school achievement increased as enrolment levels rose to 600, stayed steady up to 900, and then decreased as enrolment size further rose. They recommended an optimal high school enrolment of 600 to 900 students. Research conducted primarily at the elementary level concluded that the optimal upper limit of enrolment in an effective school would be 300 students (Goodlad, 1984).

In summary, there has been vigorous debate over the optimal size of efficient schools. Research has provided little clarity on whether there is a relationship between school size and academic achievement. Some research has shown a correlation between the two variables, while others have concluded that the relationship is totally dependent on other sociological and economic factors, and still others have found that there is no relationship at all. Researchers who have concluded that there is a correlation between school size and academic achievement do not concur on what the optimal size of a school should be. There is also no conclusive clarification of what impact, if any, the innate characteristics of small and large schools have in the achievement and size relationship. With the foregoing as an impetus, this study set out to explore the issue further, focusing on the Province of Ontario, Canada, where the EQAO (Education Quality and Accountability Office)—a standardized achievement test—is routinely administered, and used to assess the academic achievement of elementary school students.

Method

Participants

The target population for the study was the Grade three and Grade six students in Ontario school boards that participated in the EQAO assessment in May of 2003. A sample of ten English-Language public school boards was selected from the population. Sampling of the Ontario school boards was done strategically, resulting in a clustered sample. School board selection was based on the following criteria: the geographical location of the board, the existence of both rural and urban areas within each school board district and an assortment of different-sized schools within the board. With regard to geographical location, school boards were strategically selected so that they spanned across the entire province. Eight of the ten school boards were located in the Southern area of the province, and two were located in the Northern area. The ten school boards included in the clustered sample were: Algoma District School Board (DSB), Bluewater DSB, Durham DSB, Grand Erie DSB, Greater Essex County DSB, Kawartha Pine Ridge DSB, Lakehead DSB, Limestone DSB, Ottawa-Carleton DSB, and Peel DSB. In total, 48,482 third and sixth Grade students who attended the 541 schools within the ten selected school boards, and participated in the 2002/2003 EQAO assessment were subjects in this study.

Within the sample, some individual school results were suppressed by the Education Quality and Accountability Office. Suppression occurred when the schools had fewer than fifteen students at the Grade three or Grade six level who were eligible to participate in the assessment. All suppressions were made in the interest of protecting personal information, so that individual results could not be inferred from the data. As a result of the EQAO suppression practices, the data for 15 schools were not available for inclusion in this study. Schools that did not have both Grade three and Grade six classes were also omitted from this study. This purposeful exclusion was done to maintain a more homogeneous sample because the researchers did not want any variables resulting from the specialization of educational experiences within primary and junior schools to skew the results.

Instrumentation

Description of EQAO

The study relied on data emanating from the Education Quality and Accountability Office (EQAO) assessments in the selected schools. The EQAO assessment measures the variable of academic achievement. EQAO was established based on the recommendation of the Ontario Royal Commission of Learning in 1995 (EQAO, 2005). The Commission concluded that province-wide assessments would meet the societal demands for greater quality and accountability in the publicly funded school system. The purpose of the EQAO assessment is to provide "accurate, objective and clear information about student achievement that teachers and parents can use to improve learning for all students" (EQAO, 2003a, p.1). Included in the EQAO Assessment package was the *Administration Guide* for the Grade 3 and Grade 6 Assessments of Reading, Writing and Mathematics and the *Teacher's Daily Plans* (EQAO, 2003b). Both books contained all the policies, procedures and instructions needed to administer the assessment in the most fair and consistent manner possible. These instructions included the sequence of the activities for each day, information about which resources were permitted, introductory activities, time allotments and the exact wording that the teacher should use when introducing each segment of the assessment. Strict adherence to these procedures was mandatory so as to ensure the reliability of the results across the province.

The 2002/2003 EQAO assessment for Grades three and six came in individualized student packages that consisted of a reading magazine, a reading answer booklet, a writing booklet, a mathematics booklet and a multiple choice booklet. All of the student booklets at a particular Grade level were identical, with the exception of the multiple-choice booklets. There were four versions of the multiple-choice booklets within each class. The only difference in the versions was the sequencing of the questions within the booklet. Each reading magazine comprised of two selections—a fictional story and an information article.

Students answered questions based on these readings in the accompanying reading answer booklets. The writing component of the EQAO assessment comprised of two assignments. At the Grade three level the students were to write a fictional adventure story and a journal entry. At the Grade six level the students were to write a fictional adventure story and a letter of persuasion.

The format of the mathematics component was also similar in both the Grade three and Grade six versions of the EQAO assessment. The mathematics booklets were broken into three sections, entitled Investigations 1, 2 and 3. They consisted respectively of 7 questions, 7 questions and 6 questions in the third Grade assessment and 7 questions, 6 questions and 7 questions in the sixth Grade assessment. The questions integrated many of the mathematical expectations outlined in *The Ontario Curriculum for Mathematics* for the respective Grades, covering all five strands of Data Management and Probability, Number Sense and Numeration, Geometry and Spatial Sense, Measurement, and Patterning and Algebra.

Implementation

The EQAO assessment is administered yearly to pupils in Grades three and six in Ontario. EQAO ensured validity of the 2002/2003 assessment by basing all of the reading, writing and mathematics tasks on the appropriate grade expectations outlined in The Ontario Curriculum, Grades 1 - 8 (Ontario Ministry of Education, 2006). The 2002/2003 assessment was administered over a period of five days. Testing occurred for no more than two hours and thirty minutes per day. At the end of the five-day period, all the student packages were returned to the Education Quality and Accountability Office for evaluation.

Many steps were taken to ensure examiner reliability. EQAO ensured that the work of every person chosen to evaluate the assessment was of consistently high quality through a careful selection process, comprehensive training and monitoring. Training consisted of two full days prior to the evaluation of the assessment, as well as ongoing training throughout the marking period. The ongoing training included the completion of training booklets, orientation papers, paired marking, marker readiness exercises and group marking.

Some booklet-related steps were also taken to ensure reliability of the assessment. Every student was assigned a barcode, to remain anonymous to the evaluator. Booklets were scrambled to ensure that individual schools and school boards could not be identified during the evaluation process. Each booklet was evaluated by multiple markers. The blind reinsertion of student papers was also done to check the consistency of markers' scoring. EQAO also conducted a generalizability study of the 2002/2003 assessment. This study allowed for EQAO to report on the consistency of the examiners and assessment items and estimate an overall generalizability coefficient.

Design and Procedures

The design of this quantitative study is correlational. The data for achievement and school size utilized in the study is a matter of public record. The Grades three and six 2002/2003 EQAO assessment results for each school in the stratified sample were obtained from the official EQAO Web site. EQAO reported the findings from the assessments in two ways: Methods 1 and 2. Method 1 reported leveled data in percentage format from all eligible students in the grade, including those that were exempt and students who did not provide enough data on the assessment to score. Method 2 is an alternative view of the results. It did not include the results of those that were exempt, or those students who did not provide enough data to score, in the final formulation of the percentages.

This study utilized the results that were reported only in Method 1. This decision was based on the researchers' perception that the results for Method 1 provided a more accurate and complete description of actual student achievement because these results included all eligible Grades three and six students, not just those who participated and achieved at specific levels. The view of the researchers is similarly reflected in the media presentation of the EQAO results. Newspaper reports present the assessment scores only in Method 1 form. The main focus of the study was on the percentage of students in the third and sixth Grades who achieved a level three or higher on the 2002/2003 EQAO assessment in each school in the selected school boards. The achievement of level three or higher indicated that the student was performing at or above the provincial standard for that grade. The percentages of those who achieved at levels one and two, those who performed below the level one standard, and those who did not include enough information to score, were also obtained for analysis.

Included in the EQAO assessment results was the number of students who participated in the assessment in May 2003, in both the third and sixth Grades, for each selected school. These data were used to categorize each selected school as a small, medium, or large school. For the purposes of this study, small schools were defined as having less than 245 students, while the enrolment figure for medium-sized schools was between 246 and 420, and large schools had more than 420 students.

Data Analysis

The EQAO results, represented in percentage form, were arranged in a Microsoft Excel spreadsheet table for each school. Each school table was divided into a Grade three and a Grade six section, and sub-divided by subject; reading, writing, and mathematics. The results were further sorted into six achievement categories—Not Enough Information to Score (NEIS), Not Enough Information to Score a Level One (NE1), followed by Level One, Level Two, Level Three, and Level Four. In addition, the researchers classified each school according to size, that is, small, medium, or large. All of the EQAO results were then aggregated because if a student had achieved a Level 4, then he/she had also logically achieved Levels 1, 2 and 3.

Using the Statistical Package for the Social Sciences, (SPSS), a one-way analysis of variance (ANOVA) was conducted to evaluate the relationship between school size and student academic achievement. The independent variable was school size and the dependent variable was student academic achievement. Variations both within and between each of the groups were analyzed statistically, yielding F-values. The significance level for this procedure was established at the .05 level.

Hypothesis

This study tested the null hypothesis that there would be no statistically significant correlation between school size and academic achievement under the seven categories:

- In Grades three and six;
- At the *Not Enough Information to Score* level in Grades three and six;
- At the *Not Enough Information to Score a Level One* level in Grades three and six;
- At *Level One* in Grades three and six;
- At *Level Two* in Grades three and six;
- At *Level Three* in Grades three and six;
- At *Level Four* in Grades three and six.

Summary of Results and Findings

A one-way analysis of variance was performed and results indicated that there was no statistically significant correlation between school size and academic achievement in Grades three and six. Table 1 summarizes the results.

An ANOVA was performed and results indicated no statistically significant correlation between school size and academic achievement at the *Not Enough Information to Score* level and at the *Not Enough Information to Score a Level One* level in Grades three and six. Tables 2 and 3 summarize the results.

Results shown in Tables 4 and 5 indicated no statistically significant correlation between school size and academic achievement at Level One and at Level Two in Grades three and six.

Results shown in Table 6 indicated no statistically significant correlation between school size and academic achievement at Level Three in Grade three in the areas of reading and math, so a fail-to-reject decision was reached. Results indicated that there was a statistically significant correlation between school size and academic achievement at Level Three in Grade three in the area of writing, so the null hypothesis for this comparison was rejected at the .05 level of significance. Results also indicated that there was a statistically significant correlation between school size and academic achievement at Level Three in Grade six in the areas of reading, writing and math, so the null hypothesis for this comparison was rejected at the .05 level.

Results shown in Table 7 indicated there was no statistically significant difference between school size and academic achievement at Level Four in Grade three in the areas of reading and math, so a fail-to-reject decision was reached. Results indicated that there was a statistically significant correlation between school size and academic achievement at Level Four in Grade three in the area of writing, so the null hypothesis for this comparison was rejected at the .05 level. Results also indi-

Table 1.
Correlation between school size and academic achievement.

		Sum of Squares	df	Mean Square	F	Sig.
AA	Between Groups	.000	2	.000	.000	1.000
	Within Groups	9467.500	3243	2.919		
	Total	9467.500	3245			
3 reading	Between Groups	36.888	2	18.444	.060	.942
	Within Groups	999168.896	3243	308.100		
	Total	999205.784	3245			
3 writing	Between Groups	27.064	2	13.532	.034	.966
	Within Groups	1280284.672	3243	394.784		
	Total	1280311.736	3245			
3 math	Between Groups	16.393	2	8.197	.023	.977
	Within Groups	1159602.596	3243	357.571		
	Total	1159618.990	3245			
6 reading	Between Groups	22.644	2	11.322	.035	.966
	Within Groups	1056323.515	3243	325.724		
	Total	1056346.159	3245			
6 writing	Between Groups	15.787	2	7.894	.024	.977
	Within Groups	1084003.002	3243	334.259		
	Total	1084018.789	3245			
6 math	Between Groups	23.444	2	11.722	.041	.960
	Within Groups	925000.503	3243	285.230		
	Total	925023.947	3245			

Table 2.
Correlation between school size and academic achievement at the not enough information to score level.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	60.882	2	30.441	.365	.694
	Within Groups	44881.403	538	83.423		
	Total	44942.285	540			
3 writing	Between Groups	18.535	2	9.267	.408	.665
	Within Groups	12222.911	538	22.719		
	Total	12241.445	540			
3 math	Between Groups	144.282	2	72.141	.944	.390
	Within Groups	41107.400	538	76.408		
	Total	41251.682	540			
6 reading	Between Groups	81.173	2	40.587	.947	.388
	Within Groups	23049.374	538	42.843		
	Total	23130.547	540			
6 writing	Between Groups	72.497	2	36.249	1.615	.200
	Within Groups	12075.384	538	22.445		
	Total	12147.882	540			
6 math	Between Groups	7.639	2	3.820	.068	.934
	Within Groups	30326.176	538	56.368		
	Total	30333.815	540			

Table 3.
Correlation between school size and academic achievement at the not enough information to score a level one level.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	.153	2	.076	1.438	.238
	Within Groups	28.535	538	.053		
	Total	28.688	540			
3 writing	Between Groups	.615	2	.307	1.141	.320
	Within Groups	144.968	538	.269		
	Total	145.582	540			
3 math	Between Groups	.029	2	.015	.214	.808
	Within Groups	36.658	538	.068		
	Total	36.688	540			
6 reading	Between Groups	.048	2	.024	.382	.683
	Within Groups	33.479	538	.062		
	Total	33.527	540			
6 writing	Between Groups	.052	2	.026	.707	.493
	Within Groups	19.881	538	.037		
	Total	19.933	540			
6 math	Between Groups	.021	2	.011	1.148	.318
	Within Groups	4.962	538	.009		
	Total	4.983	540			

cated that there was a statistically significant correlation between school size and academic achievement at Level Four in Grade six in the areas of reading, writing and math, so the null hypothesis for this comparison was rejected at the .05 level.

Table 4.
Correlation between school size and academic achievement at level one in grades three and six.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	347.350	2	173.675	1.253	.287
	Within Groups	74580.514	538	138.625		
	Total	74927.863	540			
3 writing	Between Groups	206.527	2	103.263	1.568	.209
	Within Groups	35431.473	538	65.858		
	Total	35638.000	540			
3 math	Between Groups	264.452	2	132.226	1.071	.343
	Within Groups	66422.868	538	123.463		
	Total	66687.320	540			
6 reading	Between Groups	8.572	2	4.286	.051	.951
	Within Groups	45455.646	538	84.490		
	Total	45464.218	540			
6 writing	Between Groups	10.043	2	5.021	.078	.925
	Within Groups	34675.772	538	64.453		
	Total	34685.815	540			
6 math	Between Groups	102.333	2	51.166	.562	.570
	Within Groups	48960.421	538	91.005		
	Total	49062.754	540			

Table 5.
Correlation between school size and academic achievement at level two in grades three and six.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	747.761	2	373.880	1.631	.197
	Within Groups	123360.246	538	229.294		
	Total	124108.007	540			
3 writing	Between Groups	442.804	2	221.402	2.764	.064
	Within Groups	43097.011	538	80.106		
	Total	43539.815	540			
3 math	Between Groups	777.335	2	388.667	1.892	.152
	Within Groups	110510.015	538	205.409		
	Total	111287.349	540			
6 reading	Between Groups	618.479	2	309.239	2.008	.135
	Within Groups	82858.608	538	154.012		
	Total	83477.087	540			
6 writing	Between Groups	281.333	2	140.666	1.495	.225
	Within Groups	50611.407	538	94.073		
	Total	50892.739	540			
6 math	Between Groups	706.352	2	353.176	1.754	.174
	Within Groups	108324.510	538	201.347		
	Total	109030.861	540			

Table 6.
Correlation between school size and academic achievement at level three in grades three and six.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	1324.853	2	662.427	2.001	.136
	Within Groups	178060.906	538	330.968		
	Total	179385.760	540			
3 writing	Between Groups	4886.709	2	2443.355	9.483	.000
	Within Groups	138617.605	538	257.654		
	Total	143504.314	540			
3 math	Between Groups	1904.918	2	952.459	2.021	.134
	Within Groups	253529.803	538	471.245		
	Total	255434.721	540			
6 reading	Between Groups	3996.820	2	1998.410	6.695	.001
	Within Groups	160597.979	538	298.509		
	Total	164594.799	540			
6 writing	Between Groups	6327.488	2	3163.744	13.083	.000
	Within Groups	130100.675	538	241.823		
	Total	136428.163	540			
6 math	Between Groups	3774.297	2	1887.148	4.714	.009
	Within Groups	215388.653	538	400.351		
	Total	219162.950	540			

Table 7.
Correlation between school size and academic achievement at level four in grades three and six.

		Sum of Squares	df	Mean Square	F	Sig.
3 reading	Between Groups	132.070	2	66.035	1.761	.173
	Within Groups	20168.507	538	37.488		
	Total	20300.577	540			
3 writing	Between Groups	703.032	2	351.516	10.892	.000
	Within Groups	17362.388	538	32.272		
	Total	18065.420	540			
3 math	Between Groups	531.877	2	265.939	1.852	.158
	Within Groups	77236.093	538	143.562		
	Total	77767.970	540			
6 reading	Between Groups	633.355	2	316.677	5.711	.004
	Within Groups	29834.578	538	55.455		
	Total	30467.933	540			
6 writing	Between Groups	831.653	2	415.827	9.245	.000
	Within Groups	24199.023	538	44.980		
	Total	25030.677	540			
6 math	Between Groups	713.910	2	356.955	2.578	.077
	Within Groups	74491.646	538	138.460		
	Total	75205.556	540			

To further investigate the statistical significance of the results where the null hypothesis was rejected, the mean percentage number of students who performed at the various levels for each school size was examined. Table 8 summarizes the results.

Results indicate that the mean percentage number of students who performed at Level 3 was highest in large schools in Grade three writing and in Grade six reading, writing and mathematics. The respective mean percentage number of students who performed at Level 3 was lowest in small schools.

Results also indicate that the mean percentage number of students who performed at Level 4 was highest in large schools in Grade six reading and writing. The mean percentage number of students who performed at Level 4 was highest in medium schools in Grade three writing and in Grade six math. All the respective mean percentage numbers of students who performed at Level 4 was lowest in small schools.

Discussion

Implications of the Findings

The results indicated that overall, there was no statistically significant correlation between school size and academic achievement in Grades three and six. This finding reflects similar conclusions reached by many North American researchers, who had previously determined that a size and achievement relationship did not exist (Barker, & Gump, 1964; Borland, & Howsen, 2003; Caldas, 1993; Edington, & Gardner, 1984; Fowler, 1995; Haller, Monk, & Tien, 1993; Howley, 1996; Huang & Howley, 1993; McGuire, 1989; Smith & DeYoung, 1988; Stockard, & Mayberry, 1992).

The main result of the study echoes the findings of some other Canadian studies which also failed to find statistical evidence of a relationship between school size and academic achievement (Lytton, & Pyryt, 1998; Ma, & Klinger, 2000). Like these previous studies, carried out in the Canadian provinces of Alberta and New Brunswick respectively, the researchers focused on elementary schools in Ontario, and used standardized provincial assessments as a means of determining student academic achievement. This study makes a valuable contribution to the growing body of research in Canada, by offering a look at the size and achievement situation in Ontario. Replication of the study in other Canadian provinces, and possibly in different countries in other parts of the world, could be beneficial in helping educators and government officials make decisions regarding the creation or maintenance of schools, and the appropriate allocation of funding.

Results further indicated that there was no statistically significant correlation between school size and academic achievement at the *Not Enough Information to Score* level or at the *Not Enough Information to Score a Level One* level in Grades three and six. In addition, data analysis revealed no statistical evidence of a relationship at Level One or at Level Two in either Grade. It should be noted that unlike many of the studies reported in the literature which found evidence of a size and achievement relationship (for example, Abbott, Joireman, & Stroh, 2002), this study did not control for the variable of socioeconomic status. Howley (1995) had cautioned that size and achievement should not be studied in isolation, without the consideration of the influential variable of socioeconomic status. Roeder (2002) had also insisted that poverty was the biggest factor in the achievement and size relationship. Having not directly controlled for the socioeconomic variable may have affected the results of this study. Future replication studies are needed to determine if other variables, particularly socioeconomic status, have an impact on the results.

Table 8.
Mean percentage number of students who performed at the various levels for each school size.

Grade	Academic Achievement	Subject	School Size		
			Small	Medium	Large
3	Level 3	Writing	47.65	53.6	54.41
6		Reading	49.82	54.77	56.5
		Writing	45.45	51.43	54.12
		Math	47.25	52.7	52.75
3	Level 4	Writing	4.89	7.38	6.77
6		Reading	6.68	8.5	9.48
		Writing	7.41	8.83	10.9
		Math	9.95	12.48	11.74

Data analysis also found that there was no statistically significant correlation between school size and academic achievement at Level Three in Grade three in the areas of reading and math. There was however, a statistically significant correlation at the .05 level of significance between school size and academic achievement in the area of writing. These results agree with the finding of some researchers that when a relationship between size and achievement is found it is limited in scope (for example, Slate, & Jones, 2005). Unlike Okpala (2000), who found a relationship in reading alone at a fourth grade level, this study found a correlation only in writing. This finding was also obtained in the Grade three results at Level Four, where writing was the only area in which a statistically significant correlation was observed.

In reviewing the EQAO assessment package to determine what made the writing section unique from that of reading and mathematics, the researchers found one noteworthy difference. Writing was the only section of the assessment that did not contain a multiple-choice component. The student was ultimately assessed entirely on individual output, without the possibility of increasing his/her achievement score solely on the basis of possible successful guesswork. It could, therefore, be concluded that the writing section was the most valid part of the assessment.

The most significant results were observed at Levels Three and Four in Grade six. There was a statistically significant correlation between school size and academic achievement in all areas of the assessment; reading, writing and mathematics. The finding of a consistent correlation at the higher of the two Grade levels was not surprising after the literature review. In previous studies, higher grades were more likely to reveal a statistically significant correlation between student achievement and school size (Howley, 1989). Howley had concluded that school size played a greater role in achievement as students aged.

Reflecting on the immense fundamental differences between Grades three and six, it is not surprising to find disparity in the results. Third graders are still learning the basic components of reading, writing and mathematics. The Grade three curriculum is focused on the mastery of an essential foundation of knowledge, often seen as the basic building blocks of learning. In contrast, sixth graders are expected to have already built such a foundation, and are more focused on utilizing higher level thinking skills to manipulate new knowledge. Education past the primary level becomes more individualized and specialized, allowing students in the junior division to have more freedom and control over their educational experience.

Developmental differences, both physical and psychological, may also account for the different assessment outcomes in Grades three and six. Students in the two respective Grades,

with an approximate three-year chronological age gap, have undoubtedly unique capabilities and characteristics. For example, according to the renowned developmental psychologist, Jean Piaget, third graders would be in the Concrete Operational stage, during which they learn to think logically in concrete situations. Conversely, sixth graders would more likely be in the Formal Operational stage, where they are able to think logically in abstract situations and are more interested in the world of ideas (Wood, Wood, Green Wood & Desmarais, 2005). In addition, unlike their third Grade counterparts, the EQAO assessment is not a new experience for sixth graders. The older students have had the advantage of previously participating in the EQAO assessment when they were in Grade three. This previous experience of what to expect regarding the assessment, both in terms of procedures and format, could be considered advantageous.

In conjunction with the definitions used in this study, medium schools consisted of between 246 and 420 students, and large schools consisted of an enrolment of more than 420 students. When comparing these parameters with those of previous studies, the difference is notable. Throughout the literature, researchers who had found a relationship between school size and academic achievement, particularly those who found a correlation between small schools and higher achievement levels, had recommended an optimal enrolment of around 300 students (Goodlad, 1983; Meier, 1996; Sergiovanni, 1995). This specific level of enrolment coincides with this study's definition of a medium-sized school. Upon closer inspection, the finding that students who attended schools of this size achieved highest in Grade three writing and Grade six math at Level 4, is not surprising. It seems, therefore, that it is not the findings that are contradictory, but rather the conflict lies with the school size parameters as defined by individual researchers.

These results, and the review of the literature, have also raised some questions concerning the current initiatives promoting small schools. With such disparity in the findings, the investment of large amounts of money in small school projects becomes a questionable venture. Does the scientific evidence actually support the establishment of such expensive initiatives? Certainly the results of this study, as well as many others, indicate that not enough is currently known about the size and achievement relationship to make critical decisions for educational reform. Howley (1995) had cautioned that some small school advocates were misrepresenting or misinterpreting research findings as a means of furthering their own agenda. With such ambiguity in the literature, advocation for schools of a specific size, based primarily on the achievement and size relationship, should be cautioned. With activist groups, like the *People for Education*, campaigning for the maintenance of small schools throughout Ontario, it is clear that more research is needed so that fully informed decisions can be made.

Limitations

This study relied on data provided by a province-wide assessment given to students in the third and sixth grades throughout Ontario, as a measurement of student academic achievement. Despite strict guidelines provided for the administration of the assessment and mandated adherence to the policies, procedures, and instructions given, there may have been deliberate or unintended effects of individual administrators on the students.

The EQAO assessment is considered to be valid because it is based on The Ontario Curriculum, Grades 1 - 8. In practice, however, the content validity of the test is questionable. Educators throughout Ontario are encouraged to adopt a constructivist philosophy to teaching. Constructivism is based on the tenet of creating educational experiences in which the students can construct their own meaning. It is a learn-by-doing approach. The questions in the EQAO assessment do not reflect this philosophy. This contrast between how the students learn, and ultimately how they are assessed, is obvious in mathematics. The routine use of manipulatives in learning math is a standard practice in Ontario classrooms. Students constructively use the manipulatives to facilitate the learning of math. However, on the 2002/03 EQAO assessment, there was only one question which demanded the use of manipulatives. If standard classroom teaching practices are not reflected in the assessment, the content validity must be questioned.

Additionally, the EQAO assessment, like all tests, can only be considered a snapshot of an individual student's academic achievement level. There are many variables that could affect a student's performance during the five days of the assessment which would limit the reliability of the results. These variables could include illness, fatigue, and environmental factors.

Canada prides itself on being a multicultural country. The student communities within many Ontario schools reflect the wide diversity of the Canadian population. There needs to be more research into whether the EQAO assessment accurately reflects the interests of all Ontario students and their various cultural backgrounds.

The researchers also could not control for full participation in the EQAO assessment within each school. All third grade and sixth grade students were mandated by the Ontario provincial government to participate in the 2002/2003 assessment. Exemptions from the assessment were only granted students who were in the *Individual Education Plan*, or *English as a Second Language* students who were in the early stages of English Language acquisition. Some parents disagreed with the administration of the assessment and withheld their children from school during the testing period. Therefore, the EQAO test scores may not have been accurate reflections of all academic achievement levels within a given class.

The suppression of some of the individual school assessment results by the Education Quality and Accountability Office also limits the conclusions drawn from this study. With the mandate for suppression being an enrolment of fewer than 15 students in the class, this directly affected the small school achievement results. Classes with such a small enrolment would have been included in the small school category, if the results had been available.

Suggestions and Recommendations

Based on the findings of the study, the researchers make the following recommendations:

1) Additional studies are needed to investigate the relationship between school size and academic achievement at the elementary school level;

2) Replication studies, in which the socioeconomic status variable is controlled, are needed to provide more information on the size and achievement relationship. Future research studies should focus specifically on smaller schools with the goal of finding more information within this variable, including optimal enrollment and if extreme smallness could be considered detrimental;

3) School board officials, educators, government officials, and policy makers who are in the position to make decisions

regarding the sizes of schools in their districts should be fully informed with regard to the entire body of research on the relationship between school size and academic achievement;

4) The Education Quality and Accountability Office should consider developing a rotational schedule, in which a limited number of proctors would administer the EQAO assessment throughout the province, in the hope of improving the reliability of the assessment;

5) Future research by the Education Quality and Accountability Office should be done to ensure that there is no cultural bias in the assessment, and that the interests of the entire Ontario student body are reflected in the test;

6) The Education Quality and Accountability Office should ensure that the EQAO assessment accurately reflects standard classroom practices and expectations in Ontario schools so as to increase the content validity of the assessment;

In conclusion, this study indicates that the relationship between school size and academic achievement is limited. Evidence of a relationship is more likely to be found at the higher grade levels, as shown in both the literature and in the study. These results should be read with caution, with particular attention paid to how a researcher defines school sizes. Additional studies in which other variables that may influence the size and achievement relationship are also needed. Finally, until the literature becomes less ambiguous, advocation for elementary schools of a certain size should face critical and thorough analysis before any major change-advocating action is taken.

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