

School Districts and Student Achievement in British Columbia: A Preliminary Analysis

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The recent emphasis in process-product studies on school effectiveness has largely ignored the school district context within which schools operate. This paper examines the hypothesis that, in British Columbia, when variables measuring SES, district resources, and basic district characteristics are controlled, no significant differences between aggregated student achievement will remain to be explained.

A series of stable measures of family background and of district resources and characteristics is used in correlational analyses with mathematics achievement as the outcome measure. These data and analyses suggest several conclusions: that districts are quite significant sources of achievement variation, that resources and achievement are negatively related, and that a substantial amount of achievement variance between districts is not accounted for by any of the measures used here. Speculatively, the paper proposes a *district ethos* paralleling findings at the school level, but this would have to be identified via qualitative research.

Lors d'études récentes, l'accent mis sur l'efficacité scolaire n'a pas suffisamment tenu compte du contexte du district scolaire dans lequel les écoles évoluent. Le présent travail examine l'hypothèse que, en Colombie britannique, lorsqu'on réussit à contrôler les variables qui mesurent les ESE, ainsi que les ressources et les caractéristiques de base du district, il ne reste plus de différences notables à expliquer quant à l'ensemble du rendement scolaire.

Une série de mesures stables d'antécédents familiaux et de ressources et caractéristiques propres au district ont servi à l'analyse corrélationnelle, le rendement en mathématiques étant la mesure du résultat. Ces données et analyses permettent de tirer certaines conclusions, à savoir: que les districts sont des sources importantes de divergence de rendement, que les ressources et le rendement ont entre eux un rapport négatif, et qu'une bonne partie des différences de rendement d'un district à l'autre ne sauraient être expliquées par aucune des mesures utilisées ici. Spéculativement, le travail propose un "éthos de district" parallèlement aux conclusions tirées au niveau scolaire, mais cela devrait faire l'objet d'une étude qualitative.

This paper reports the results of a preliminary investigation of some basic and often examined relationships in educational administration, those between certain status variables and educational outcomes measured by test scores. The replication of common types of analyses in a different administrative environment (in this case British Columbia) is often revealing: in this instance the results varied surprisingly from American findings.

The work reported here was the first step in a lengthy investigation of the status of school districts in British Columbia. This first step was intended to establish a basic set of relationships via simple statistical procedures and to generate hypotheses for later and more intensive examination, the later focus being *school district ethos* or climate and the methodology being a mixture of qualitative and quantitative approaches.

In recent years, process-product studies (see Benson, 1978, for a description) have focused on the school as the unit of analysis, and on *outlier* methodologies, in order to identify the major correlates of student achievement. Mackenzie (1983) has summarized the convergence of different research topics and methodologies and has produced a consistent, detailed, and convincing portrait of the instructionally effective school.

However, Goodland (1983) has argued that there is no strong empirical case for treating the school as the preferred unit of analysis. Previous reviews of research have asserted that a number of school district variables have influenced student achievement. Centra and Potter (1980), for example, find evidence that school size, teacher salaries, pupil-teacher ratio, administrator-teacher ratio, professional staff services, urban location, and student social class all affect achievement. Bidwell's study (1974-75) in Colorado provides specific information on the nature of these relationships in one jurisdiction.

There are a number of reasons for believing that school districts might constitute an important unit of analysis. The picture provided by Mackenzie of the instructionally effective school contains many elements which are subject to influence from outside the school. Some seem to require district level support, particularly amongst the leadership dimensions. Since assertive and instructionally focused leadership by the principal has emerged as critical to effectiveness and since principals are almost universally appointed and maintained in office by school district authorities, one might even argue that instructionally effective schools are evidence of effective school districts.

Another reason for focusing on school district variables is that Mackenzie's summary contains many elements which are likely to vary between districts as well as schools. For example, the core leadership dimensions of "positive climate and overall atmosphere" and "goal-focussed activities" might easily be descriptors of school districts. Berman and McLaughlin (1979) have provided an interesting case study of the contrast between *maintenance* and *developmental* districts suggesting that these descriptors can indeed be applied to school districts.

The current emphasis on school effectiveness has generally ignored the district setting, but Mackenzie has argued that:

no single element of school effectiveness can be considered in isolation from all the others, or from the total situation in which it is found When effective schools are examined in vivo what emerges is not a checklist of specific ingredients but a "syndrome" or culture of mutually reinforcing expectations and activities. (1983, p. 8)

In a Canadian setting, Coleman (1982) illustrates the implementation of a policy of teacher evaluation which effectively creates mutually reinforcing expectations in a group of schools. Similarly, Cooley (1983) has shown how monitoring school effectiveness can support goal-focused activities.

It is at least feasible, then, that school districts incorporate variables which might significantly affect the schools such that consistent differences exist between the schools of District A and the schools of District B and that these school-level differences have an impact on student achievement. There may well be instructionally effective school districts, that is, districts which contain an unusually high proportion of instructionally effective schools.

FRAMING HYPOTHESES

In the province of British Columbia, the ministry of education conducts learning assessments at regular intervals in different subject areas. One such assessment provided data on mathematics achievement aggregated by school district for Grades 4, 8, and 12 in 1981. These data are described in Robitaille (1981); information on test reliability is given in *Guidelines for Interpretation* (Ministry of Education, 1981). Other researchers have argued that mathematics scores provide purer measures of educational effects than, for example, reading scores, perhaps because they are less subject to out-of-school learning (Rutter, Maughan, Mortimer, Ouston, & Smith, 1979). The criterion variables for this analysis are, then, mathematics achievement scores.

Following the lead provided by school effectiveness studies and previous research on school district effects, a series of null hypotheses can be framed:

1. When the effects of district-level socioeconomic status (SES) variables are controlled, no achievement differences between districts will be found.
2. When the effects of district-level socioeconomic status variables are controlled together with the effects of district resources such as teacher experience and training, pupil/teacher ratio, and operating expenditures, no achievement differences will be found.
3. When SES and resource effects are controlled together with district

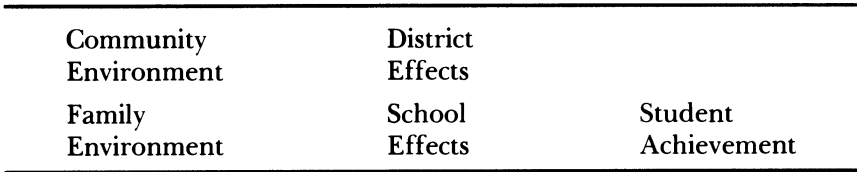


FIGURE 1
District Level and School Level Effects on Student Achievement

characteristics such as size, geographical location, and mean school size, no achievement differences will be found.

The assumptions common to these hypotheses are that the district itself has no impact on student achievement; that is, that school-level effects on achievement,¹ if any exist, are distributed randomly with respect to school districts. Should the hypotheses be disconfirmed, it would indicate that districts have an effect on student achievement, presumably through the development and maintenance of instructionally effective schools. The relationships being examined here can be represented graphically as in Figure 1.

Some important limitations of this analysis must be described. First, the family-environment and school-effects elements are not measured here; their existence is inferred from other research. Thus, for example, nothing is known about the relationship between community environment and family environment. Family environment is commonly measured by socioeconomic proxies. Walberg and Marjoribanks (1976) have argued that the use of such proxies, although convenient, introduces some error. However, should a relationship appear between achievement and community environment measures, this model allows it to be explained only via the link between community, school district, and school or via the link between community, family, and school. Second, and similarly, should a relationship appear between school district effects and achievement, this model allows it to be explained only via school effects. Third, and most importantly, the district effects measured here focus on resource or status variables rather than on the kinds of variables summarized in Mackenzie's review of school effectiveness.

One other important feature should be described. The undesirability of using cross-sectional analysis for drawing conclusions relevant to educational policy has been described elsewhere (Coleman & LaRocque, 1983). The measures of achievement used here are *cumulative* in two senses. First, early mathematics achievement predicts later achievement (Bloom, 1976); second, both district and school effects themselves are

likely to have cumulative impact. Thus, for instance, major shifts in pupil/teacher ratio (PTR) between school districts over the period that instruction assisted students to develop the knowledge assessed would presumably distort the relationship between the 1981 PTR measure and achievement. It is essential then to measure the stability over time *between districts* of the variables being used as predictors.

THE VARIABLES

The variables, with sources, are listed in Table 1. The variance amongst the 75 school districts in the province is shown by means and standard deviations in the right hand columns. For community environment variables, Canada census data for 1971 and 1981 are used. For school district characteristics, data from annual summaries of school district budgets for 1977 and 1981 are used. The cost data from various budget categories are converted to per-pupil costs. The category, *administrator costs*, includes only district level administrators. This measure is considered a proxy for administrative intensity, paralleling Bidwell (1974-75). *Teacher salary costs* are a result of dividing the total salary budget by the number of teachers. Since salaries in British Columbia are a function of years of experience and years of training, this measure is a proxy for those two elements but does not allow discrimination between them. *Total operating costs* incorporates the above cost measures and clearly is very much influenced by pupil/teacher ratio. The confounding of these variables will be addressed in the second stage of the analysis.

FIRST LEVEL FINDINGS

The first level of analysis is a set of correlation coefficients, intended to produce a general sense of the major relationships. The results are summarized in Table 2. Four general issues emerge.

First, the stability of district characteristics is clearly very high. The correlations for the community environment measures between 1971 and 1981 indicate that, despite very extensive changes in the province as a whole, districts have varied together, not differentially, to a very large extent. Similarly, with regard to resources, the districts have varied together. Only the PTR is somewhat unstable. The standard deviation has risen from 1.1 to 1.4, while the mean PTR has dropped, between 1977 and 1981, from 18.2 to 16.6 (Table 1). The correlation coefficient here is the weakest measure of stability. Overall, the stability of district characteristics allows use of 1981 measures to predict achievement with some confidence.

Second, the community environment measures are associated with

TABLE 1
List of Variables, Means, and S.D.s

Variables	Description	Years		
		Mean	S.D.	Mean
<i>Community environment^a</i>		1971		1981
Average family income		N.A.		27307
Family education level	% of households with some post-secondary education	29.3	6.1	29.7
	% of households for which English is first language	92.9	4.9	94.3
Language of household				3.3
<i>School district resources^b</i>		1977		1981
Pupil/teacher ratio	No. of pupils ÷ no. of teachers	18.2	1.1	16.6
Administrative costs per pupil	Budgeted costs ÷ no. of pupils	69.7	37.9	143.4
Teacher salary costs per pupil	Budgeted salary costs ÷ no. of pupils	1164.2	127.8	1914.7
Total operating costs per pupil	budgeted operating costs ÷ no. of pupils	1755.1	312.4	2813.9
<i>Other district characteristics</i>				495.6
Mean school size	No. of pupils ÷ no. of schools	279.0	102.0	261.0
District size	Total no. of pupils	7037	9284	8374
<i>Outcome measures^c</i>				1981
Grade 4 mathematics	Mean % correct for district			57.3
Grade 8 mathematics	Mean % correct for district			53.9
Grade 12 mathematics	Mean % correct for district			57.8

^aFrom Statistics Canada

^bFrom B.C. School Trustees Association (1977)

^cFrom Ministry of Education

TABLE 2
Correlations Between School District Variables (Pearson Correlation Coefficients)

Predictor variables	Measure of stability	Association of 1981 predictor variables with outcome variables*			
<i>Community environment</i>					
Average family income (AFI)	1971 to 1981 .86 ^a	Grade 4 .31**	Grade 8 .39	Grade 12 .42	
Family educational level (FAMED)	.94	.50	.54	.50	
Language of household (LANG)	.70	.15***	.06***	-.01***	
<i>School district resources</i>					
Pupil/teacher ratio (PTR)	1977 to 1981 .81	Grade 4 .52	Grade 8 .53	Grade 12 .32**	
Administrative costs ^c (ADMIN)	.95	-.51	-.58	-.36	
Teacher salary costs ^c (TSAL)	.91	-.48	-.27	-.27***	
Total operating costs ^c (OP COST)	.90	-.54	-.55	-.27**	
<i>Other district characteristics</i>					
Mean school size (MSS)	.97	.33**	.36	.30**	
District size (D SIZE)	1.00	.22***	.35	.27**	
Log district size (LDISTS)	— ^b ***	.36	.48	.38	
Region (REG)	—	.03***	.09***	.09***	
<i>Outcomes</i>					
Grade 4 mathematics (GRADE 4 MATH)	—	1.00	.68	.34**	
Grade 8 mathematics (GRADE 4 MATH)	—	.68	1.00	.38	
Grade 12 mathematics (GRADE 12 MATH)	—	.34**	.38	1.00	
Mathematics total (MATH TOTAL)	—	.80	.85	.75	

^aDue to change in reporting, this is a rank order correlation between 1971 and 1981 income levels.

^bThe skewed distribution suggested the need for data transformation; Log District Size is used subsequently.

^cPer pupil.

* $p < .001$ unless otherwise indicated; ** $p < .01$; ***not significant.

TABLE 3
Community Environment and District Characteristics

<i>District characteristics (1981)</i>	<i>Community environment (1981)</i>		
	<i>Average family income</i>	<i>Family education</i>	<i>Language</i>
PTR	.28**	.29**	.10***
Administrative costs per pupil	-.38**	-.39*	.09***
Teacher salary costs per pupil	-.22***	-.13***	.11***
Operating costs per pupil	-.25***	-.22***	.10***

* $p < .001$; ** $p < .01$; ***nonsignificant

achievement as expected, except that language of the household is apparently not important. Family income has less influence than education level, a finding which is consistent with findings in other jurisdictions. Walberg and Marjoribanks (1976), for instance, in reviewing various studies in several countries, argue that family education level is often the best proxy for family environment, which is the critical predictor of achievement. The strong association between family education level and all three mathematics scores, because it is entirely consistent with findings elsewhere, does add some credibility to the outcome variables used here.

Third, the relationships between the three outcome measures are suggestive, at least, of the impact of district characteristics. The correlations here are not, of course, the result of early predicting later achievement, since these are different cohorts of students. At this level of analysis, little more can be said than that the school district in which students receive their education does seem to make a difference.

The fourth issue concerns the relationships between community environment and school district characteristics. These are shown in Table 3. Perhaps the most interesting finding here is the lack of significant relationships between operating costs and district socioeconomic features. The traditional positive relationship between district wealth and spending, which was thought to contribute to inequality of educational opportunity, does not exist in British Columbia.

The second interesting relationship is that between community SES measures and PTR. A continuing and intense campaign by the British Columbia Teachers' Federation to reduce the PTR has been effective with at least some community members and resulted in differential pressure on districts to reduce PTR. This helps to explain the lower level of stability of this district characteristic already discussed. Most interesting, however,

is the fact that higher SES districts have been *less* likely to reduce PTR (the 1971 data show no significant relationship between SES and PTR).

The main findings of this stage concern achievement and district characteristics (see Table 2). These are quite unexpected. The strong positive relationship between PTR and achievement, consistent over all three grade levels, runs contrary to some previous research and certainly to teacher opinion. PTR is, of course, a proxy for class size in this relationship. However, it seems to be a fairly good proxy (the most careful Canadian experimental study of class size, Shapson, Wright, Eason, & Fitzgerald, 1980, shows no class size effects on classroom processes or student attitude and almost none on achievement). The importance attached to this measure by teachers has resulted in close scrutiny of class size with equalization within school districts. Few observers in British Columbia would argue that class sizes vary widely within districts.

The cost measures also are associated with achievement in unexpected ways, although consistently with PTR. That is, the higher the costs, the lower the achievement. The relationship is strong and consistent, particularly for the Grade 4 and Grade 8 levels. There seems little doubt that, within the modest ranges existing in the province, those districts which are relatively frugal elicit superior levels of educational achievement from students. The second stage of the analysis will reveal more clearly the relationships between the predictor variables and allow firmer conclusions. One important question remaining, of course, concerns the percentage of the variance in achievement accounted for by these resource measures.

Other district characteristics also are associated with the achievement measures. School size, district size, and region are all positively associated, although less strongly than the resource measures. Again, there is serious confounding of the variables: in British Columbia, small schools occur disproportionately in small districts, which are overwhelmingly rural (Coleman & LaRocque, 1984).

SECOND LEVEL FINDINGS

The second stage of analysis uses multiple stepwise regression to disentangle the interaction of predictors and measure their individual influence on achievement. Table 4 presents the results of this analysis. The choice of dependent variable has a major effect on the predictors, with family education important in every case but apparently becoming more important in secondary schools. Since this analysis concerns itself with district influences rather than family effects, the mathematics total score is judged the most important dependent variable with this set of

TABLE 4
Stepwise Multiple Regression Analysis with Several Dependent Variables

<i>Dependent Variable</i>	<i>Predictor</i>	β	r	<i>Multiple R</i>	<i>Stepwise R²</i>	<i>R² Increment</i>
Grade 4 Math	OP COST	-.451	-.54	.54	.29	—
	FAMED	.399	.50	.66	.44	.15
Grade 8 Math	ADMIN	-.014	-.58	.58	.33	—
	FAMED	.436	.54	.67	.45	.12
	OP COST	-.440	-.55	.70	.48	.04
Grade 12 Math	FAMED	.468	.50	.50	.25	—
	TSAL	-.202	-.27	.53	.29	.04
Math Total	FAMED	.544	.64	.64	.41	—
	OP COST	-.433	-.55	.77	.59	.18

relationships in the table the most relevant. Only two important variables emerge. *Family education level* accounts for 41% of the variance, and *district operating costs* account for an additional 18%. A substantial amount of the variance is left unaccounted for. The reliability of the mathematics tests was judged by reliability coefficients for subtests; these averaged .92 (Ministry of Education, 1981). Given this level of reliability, at least 30% of the variance in test scores between districts remains to be explained by other factors.

CONCLUSIONS AND INTERPRETATION

The three null hypotheses are not confirmed. The district characteristics used in this analysis as predictors of achievement are useful but not sufficient. Additionally, the rather strong negative relationship between resource measures and achievement is quite unexpected. Although this relationship is not entirely without precedent (e.g., Rutter et al., 1979, cite a British study with somewhat similar findings), it is sufficiently contrary to common sense and received opinion to require further investigation. It is tempting to speculate that the unexplained variance and the negative relationships are somehow connected. These two findings can be linked, tentatively, in the following way.

Mackenzie has pointed out that the substantial knowledge now available on school effectiveness constitutes "the accumulated impact of at least two decades of effort and investment in educational research" (1983 p. 7). Much recent effort has focused on processes — instructional, change

implementation, and leadership – as opposed to resource measures. The well-known work of Rutter and his colleagues provides a useful example. It is longitudinal, uses multiple outcome measures, and concludes that resource measures like class size and pupil/teacher ratios are not significantly associated with success. Rather, school ethos, a “combined measure of overall school process” is the important predictor of achievement (1979, p. 182).

In British Columbia, a recent study of policy implementation has shown the importance of district culture and school norms in implementation (LaRocque, 1983). Common to these two and many other recent studies is the use of qualitative methods intended to yield precise and detailed descriptions of complex and subtle interactions between participants in schools and school districts.

An attempt to describe the district characteristics which account for the achievement variance unexplained by the predictors in this analysis could usefully adopt Mackenzie’s description of the elements of the effective school, redefine these for the district level, and investigate qualitatively the extent to which these elements discriminate between unusually effective districts and others.

Based on the relationships between resources and achievement, the set of characteristics comprising “district ethos” in the unusually effective districts identified by such an investigation would be predicted to include a commitment to frugality of operation and a focus on instruction rather than management. This might well be the district-level equivalent of the *effective use of instructional time* which is one element of Mackenzie’s *efficiency* grouping. The correlations between resource measures and achievement are, then, unlikely to be important in themselves. However, the attitude syndrome which hypothetically involves these relationships might be very important.

The major conclusion, then, is that the socioeconomic predictors account for some but not all of the variance in student achievement between school districts in the province of British Columbia. The resource predictors are all negatively associated with achievement, suggesting that, in districts where student achievement is high, a norm of frugality exists. Speculatively, one can argue that this norm is part of a district ethos peculiar to unusually effective school districts, that unusually effective schools are found disproportionately in such districts, and that some district influences on these schools help them to become and remain instructionally effective.

Given the unexpected findings of this analysis, it seems imperative to attempt to assess the relationship between resource measures and achievement at the district level of analysis in other jurisdictions in

Canada. Should this result for B.C. be replicated elsewhere, the consequences for government funding policies must be extremely serious. Even more interesting is the puzzle of school district effectiveness: are some districts more effective than others in producing high levels of student achievement, even in the (relative) absence of substantial resources?

There is a subsidiary question here, arising from the very simplified model of influences above (Figure 1): How do school districts influence schools so as to increase their effectiveness? Our knowledge at present can only suggest that the principal is an important link in the chain of influence, as is the superintendent of schools. Some negative evidence has been provided by a Canadian case study (LaRocque & Coleman, 1985) and some positive evidence by an American one (Berman & McLaughlin, 1979), but our information on this topic and others suggested here, and all critical questions for public policy in education, is totally inadequate at present.

NOTE

- ¹ The first hypothesis is the most general since it envisages the possibility that nothing about school districts affects student achievement. This is, by inference at least, the assumption of most school effectiveness research. The second and third hypotheses specify selected district characteristics for testing.

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Die Betonung welche in jüngster Zeit auf Arbeitsverfahren-Ergebnis Untersuchungen gelegt worden ist, hat zum großen Teil den Kontext des Schulbezirkes in dem sich die Schule befindet übersehen. Diese Abhandlung prüft die Hypothesen, daß in British Columbien, solange die Variablen die SES messen (d.h. Mittel und Grundzüge des Bezirkes) kontrolliert werden, die zusammengefassten Leistungen der Schüler kaum Unterschiede aufweisen.

Eine Reihe von beständigen Maßstäben, wie Familienhintergrund und Mittel und Eigenschaften des Bezirkes werden in der Korrelations-analyse angewendet. Leistung in Mathematik ist der Maßstab des Ergebnisses. Diese Daten und Analysen erlauben mehrere Schlüsse: Bezirke sind zum großen Teil für Leistungsunterschiede verantwortlich; Mittel und Leistungen haben ein negatives Verhältnis zueinander; die Methoden die in verschiedenen Bezirken angewendet werden haben geringen Einfluß auf Leistungsunterschiede. Es wird vermutet das ein Bezirks "Ethos" für Leistungen in Schulen verantwortlich ist; dieses jedoch müßte durch qualitative Untersuchungen bestätigt werden.

El énfasis que se ha dado en estudios recientes a la eficacia de la escuela, no ha tomado en cuenta el contexto del distrito escolar en el que operan las escuelas. Esta investigación examina la hipótesis de que, en la Colombia Británica, cuando se controlan las variables que miden los ESE, así como los recursos distritales y sus características básicas, no quedan diferencias significativas por explicar en el rendimiento escolar total.

Se usa una serie de medidas estables de antecedentes familiares y de recursos y características distritales para análisis de correlación, siendo el rendimiento en matemáticas la medida del resultado. Estos datos y análisis sugieren varias conclusiones: que los distritos son fuente significativa de la variación en el rendimiento escolar, que recursos y rendimiento tienen una relación negativa, y que una buena parte de la variación en el rendimiento escolar entre distritos no pueden explicarse por ninguna de las medidas que usamos. De forma especulativa, el informe propone un "carácter de distrito" en paralelo con los resultados a nivel escolar, pero esto debería ser objeto de una investigación cualitativa.
