Schools Like Mine: Cluster Analysis of New Zealand Schools

Technical Report 14, Project asTTle
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This report summarises a procedure and rationale developed to allow comparison of student achievement in literacy and numeracy by type of school attended. The power of socio-economic status to describe schools is analysed and found inadequate. The clustering procedure uses school size, student ethnicity, region, size of civil jurisdiction, and socio-economic status to group schools for comparison. All schools are placed into one of twenty clusters that are used in the asTTle software as a basis of student achievement comparison.

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A major consideration for teachers, principals, Boards of Trustees, and parents is the comparison of the performance of their students to peers in schools similar to their own (Meagher-Lundberg, 2000). This comparison derives from a concern that achievement scores, such as literacy and numeracy, are often related to critical characteristics of students and families beyond the control of teachers, and/or by some set of expectations that "similar" schools should add similar educational value.

This paper aims to identify the critical student, family, and school context variables and to propose a procedure to cluster all New Zealand schools such that teachers and others can meaningfully compare the students in their school to students in "schools like mine." The most widely known variable that, at present, distinguishes schools (for better and for worse) is the index of socio-economic status, which in New Zealand is termed "deciles".

Socio-Economic Status.

It is widely recognised that the socio-economic status of students is a major predictor of achievement. In an early meta-analysis, White (1982) found an overall effect-size, based on 102 studies, of .70 between parental SES and children's IQ scores -- which is among the higher effect-sizes found when predicting achievement, (see also Fleming & Maloine, 1983, effect-size = .61 from 47 studies).

The typical arguments for these effects of socio economic status on education relate to (a) power of career interests and role models, (b) information resources provided in families from different socio-economic groups (Williams, et al., 1993b; Power, & Robertson, & Beswick, 1985), (c) lower resources for education costs such as higher education costs (Postle, Clarke & Bull, 1995), (d) less access to private schooling or mixing with peers who can provide access to more lucrative jobs (Williams, 1987), and (e) different attitudes, beliefs, expectations and values about further education (Clark, Zimmer & Main, 1997).

Perhaps the most powerful influence is the effect of parental expectations. Driskell and Mullen (1990) concluded from their meta-analysis that socio-economic status seemed to influence expectations, and expectations seemed to influence behaviour. However, there seemed to be little direct influence of status on behaviour, beyond that which could be attributed to the effect of status on expectations.

There has been a long history of measuring socio-economic status, and despite the power of expectations, most are based on some index of parental occupation, or income. Hauser and Warren (1997) traced the history of these developments, noting the advantages of using occupations across all people and not separating details for males and females, and most importantly concluded that it is much more defensible and effective to "index occupations by their educational level alone than by any of the usual weighted combinations of educational level and earnings" (p. 251).

Although the New Zealand system uses the school as the unit of analysis, it is truly the socio-economic status of student that is the major variable of interest. There is a very effective measure of student socio-economic status in NZ. Davis, McLeod, Ransom, and Ongley (1997) outlined an occupationally derived indicator of socioeconomic status for New Zealand, modeled on the International Socioeconomic Index (ISEI, Ganzeboom, et al., 1992, 1996). The NZSEI is based on a model that claims that occupation is a latent, intervening variable that converts a person's main resource, their education, into their principle reward (income). This index is an improvement on the widely used Elley-Irving scale (1972, 1976, 1985), which used data from the 1966 Census to derive median education and income level scores for incumbents of each occupational group, and then assigned occupational groups to one of six levels. Instead, the NZSEI converts occupations onto a continuous scale from 10 to 90. Table 1 provides some examples.

Table 1.
Examples of occupations, the NZSEI, and number of persons in occupation category.

Occupation	NZSEI	New Zealand N. in Occupation
Non-Ordained Religious Associate Professionals	10	387
Market Farmers and Crop Growers	22	22779
Leather Goods Makers	30	756
Fishery Workers, Hunters and Trappers	40	3306
Nursing and Midwifery Professionals	60	18948
Business Professionals	71	21888
Physicists, Chemists and Related Professionals	82	1458
Health Professionals (except Nursing)	90	10464

Such data, however, are not available for New Zealand students. Instead, the MoE uses a school-based estimate and then divides schools into deciles on the basis of this estimate. It is important to note that the decile system is a categorization of a school based on some overall profile, and thus, reflects the school, but not necessarily all the students within it – although the latter is how it is most often used (Fiske & Ladd, 2000).

School Based Deciles

The decile system arose from a review of school resourcing, and this is its main purpose: schools are differentially funded depending on the overall school socio-economic index. The major aims were to provide an index that was transparent, simple to calculate, seemingly fair (i.e., included all dimensions considered relevant, combined in an acceptable way), had face validity, and had technical validity.

The decile scores involve three steps: (1) obtaining addresses from schools, (2) determining the areas from which schools draw students, and obtaining appropriate Census and school ethnicity data, and (3) combining school catchment data, Census data, and school ethnicity data to calculate the

socio-economic indicator for each school. The addresses from a random sample of students (i.e., all students for schools with rolls of less than or equal to 60, 60 students in schools with rolls of 61 to 179, and one-third of students in schools with rolls of 180 plus). Each address is located in the smallest unit of analysis, a mesh block, in the NZ Census, and the proportion of students in each mesh block determined.

The decile indicator was then developed from the following six dimensions.

1) *Equivalent Household Income* (i.e., household income adjusted for the number and age of persons living in the household). Equivalent income is calculated using the Jensen scale. The Jensen scale and its use in describing the distribution of New Zealand household incomes are outlined in Rutherford, et al (1990) and Mowbray (1993). For each mesh block the proportion of households in the lowest 20% in terms of equivalent income was calculated.
2) *Parents' Occupation*. For each mesh block the proportion in either of the Census categories of elementary occupations or machine operators and assemblers is calculated.
3) *Household Crowding*. The average number of persons per bedroom is calculated for each mesh block.
4) *Parents' Educational Qualifications*. For each mesh block the proportion of parents with no educational qualifications is calculated.
5) *Income Support Payments Received by Parents*. The number of parents who had received Domestic Purposes Benefit, Unemployment Benefit, and Sickness or Invalids Benefit in the year preceding the Census is summed, and expressed as a proportion of all parents in the mesh block.
6) *Maori and Pacific Islands Ethnicity*. The number of Maori and Pacific Islands' students at the school as a proportion of all students (excluding foreign students) is calculated.

Figures for each school for each dimension are then compared, and schools ranked according to the percentile that they fall into on each dimension. After this process, each school has a ranked score for each of the six dimensions of the indicator. These are then combined, with each ranked score weighted equally, and then schools are ranked into deciles.

Table 2 indicates a profile of schools at deciles 1, 4, 7, and 10 on the six variables to illustrate the variability. "On average, over half of parents in decile 1 school catchments are without a school qualification, compared to less than a fifth of parents in decile 10 school catchment areas. Close to a half of parents in decile 1 school catchments were not in the labour force, and 42% received income support in the year preceding the Census, compared to seven percent for decile 10 school catchment areas. Eighty-four percent of students in decile 1 schools are Maori or Pacific Islands students, compared with just five percent in decile 10 schools" (MoE, 2001, p. 10).

It is important to recall that deciles were devised to assist in differential funding to schools. For example, decile 1 schools receive about $300 per student, decile 4 $55, decile 7 $25, and decile 10 zero. For this usage, deciles may be beneficial, but it is the common use of deciles as an indicator of school performance that is at issue here.

Deciles Can Set False Expectations

It is noted that "one of the key principles in developing the indicator was that the indicator should target learning need" (MoE, 2001, p. 20), and it was claimed there is much evidence of the power of deciles to relate to learning. For example, the Auckland Herald (May 4/5, 2000) published the School Certificate results for 177 North Island secondary schools (in 2000) in rank order of pass rates. The correlation between the percentage of mean SC pass marks and decile level is .70, as substantial as can be found in education. A major issue however, is that this is a school based indicator and it has long been known that this artificially increases the

relationship compared to what the correlation would have been for an individual student.

Table 2.
Profile of school catchment areas by socio-economic status, 1997

School Catchment Profile	Decile of School			
	1	4	7	10
Equivalent Household Income (Proportion in Lowest 20%)	26.4	19.4	15.5	8.7
Average Number of Persons per Bedroom	1.5	1.3	1.2	1.2
Parents Without School Qualifications	52.9	36.2	28.7	16.5
Parents Receiving Income Support	42.0	24.0	13.9	6.6
Parents in Lower Occupational Groups	29.3	18.8	12.9	6.7
Maori and Pacific Islands Students	83.6	29.9	14.0	5.0
Parents not in the Labour Force	46.8	28.6	20.0	17.2
Mothers Aged <20 at First Childbirth	22.9	14.2	9.4	5.3

Note. All numbers in Percent

Perhaps the most invidious implication of misinterpreting the high .70 correlation is that schools thus should compare their students (each and all) with students in similar decile schools. This can lead to false expectations for students. It is possible that a large decile 6 school could have many students from low socio-economic homes (similar in number to a decile 1), and many from high socio-economic homes, and thus having an expectation of an "average decile 6 school" may not be in the best educational interest of the students.

Deciles As Indicators Of School Quality

In their extensive documentation of the New Zealand school system, Fiske and Ladd (2000) clearly documented the strong perception of parents that deciles could be used as the best short-hand index of school quality. The decile of the school, rather than the performance of the students, was the litmus test of acceptability.

> The first and most dramatic point to emerge from the data is that students gravitated from low decile schools and towards high decile schools. That is, they moved towards schools that served the more economically and socially advantaged students and that had lower proportions of minority students. As a result, low decile schools on average became smaller, while high decile schools got bigger. (Fiske & Ladd, 2000, p. 184)

How Teachers Use Deciles

The effects of the use of deciles have not just been on parental choice, but also on teacher movement. Because it is "often easier, and for some more satisfying, to teach students who are motivated and ready to learn, it would not be surprising to find that high-quality teachers gravitate to high-decile schools, in which the teaching environment is less harsh than in low-decile schools" (Fiske & Ladd, 2000, p. 205). The limited evidence they could assemble supported this movement. Thus the categorisation of a school as "low" decile leads to various expectations – less achievement occurs, lower quality teachers abound, and students have to mix with Maori and Pacific Islanders – so teachers move out of these schools as fast as possible. A further effect is likely to be a stereotype threat in the lower decile schools.

How Parents Use Deciles

The major issue that Fiske and Ladd (2000) identified was that this flight from low-decile schools to higher-decile schools was evident among all ethnic groups, although "Pakeha families have been more aggressive in taking advantage of their new option, with the result that ethnic minorities have become increasingly concentrated in low-decile schools" (p. 189). This

concentration of minorities in lower decile schools is more attributable to the exercise of school choice rather than to changes in the residential patterns of Pakeha and minority families. The major driving force behind this choice, according to Fiske and Ladd, is racial. "Students are fleeing from schools with high proportions of minorities rather than seeking schools with more advantaged students or higher test scores " (pp. 201-202). The preference by parents is for "high decile, low Maori schools" (p. 197).

Deciles Are Premised On Racial Bias

It must be noted that the decile calculations have an in-built, almost racist, basis as the index uses the percentage of Maori and Pacific Island students in a school as an index of lower decile. Given that deciles were built to relate to learning, then being Maori or Pacific Islander is an indicator of low achievement!

Deciles Can Provide A Stereotype Threat Leading To Lower Achievement

There are many explanations to account for the differences in achievement between lower and higher SES students. These include: differences in academic preparation, fewer resources for educational resources, fewer physiological necessities (food, sleep), and differing linguistic adaptation to school. Whatever the reasons, the use of deciles can lead to a 'stereotype" that students in lower decile schools are less academically able, lower decile school are less academically effective, and/or that teachers in lower decile schools are less proficient. Croziet and Claire (1998) administered a general ability test to two groups of students. Half the students were told that the study aimed to "assess your intellectual ability for solving verbal problems", whereas those in other group was informed that the study aimed to "test several hypotheses about the role attention plays in the functioning of lexical memory". That is, the study used an ability or non-ability referenced distinction. As expected, participants with lower SES performed worse than those with higher SES when an intellectual test was presented as a measure of their verbal intellectual ability. There were no such differences when the task was presented other than as a measure of intellectual ability.

This stereotype threat has been more fully explored in terms of race. Steele (1992, 1997; Steele & Aronson, 1995), for example, found that when African Americans take an academic exam, they are subject to the stereotype threat that their behaviour, if they fail, may confirm a reputation of low ability among African Americans. When the stakes are high for the individual, the very likelihood of confirming poor performance may in itself impair performance. This is because it is "self-threatening, enough to have disruptive effects on its own" (Steele & Aronson, 1995, p. 797). Their evidence has provided much support for these claims, and they are most applicable to the NZ deciles given the race-basis in the definition of deciles.

Croziet and Claire (1998) concluded "if prolonged exposure to stereotypes results in a systematic vulnerability to impaired performance in certain testing situations for low SES students, then the tests themselves corrupt assessment of these students' ability" (p. 1192). Merely knowing you are low SES in a higher stakes testing situation lowers performance – it is the knowing that you are a member of a lower SES and thus are expected to perform poorly that leads to this notion of stereotype threat and, thence, lower academic performance.

The pervasiveness of the decile system as an indicator of school success, of teacher quality, of student achievement, and of quality of the school is demeaning to the many teachers and students who excel in these schools. Further, continuing to build the expectation that lower decile schools are not achieving can lead to promoting the very lower achievement that many work hard to change. The stereotype threats, based on the use of deciles, as a surrogate for learning or quality needs to be further investigated in New Zealand.

It is difficult, however, to exclude socio-economic status as a variable in any clustering

of schools. Its inclusion, however, will be balanced with other variables to ensure that there is no one surrogate or correlate of achievement that could be used inappropriately to "categorise" schools, and to reduce the misinterpretation that this one indicator has engendered in the minds of parents, teachers, and students.

For this study, the schools were grouped into low (deciles 1-3), medium (4-7), and high (8-10) decile schools. Table 3 presents the distribution across all NZ schools.

Table 3.
Distribution of all NZ schools by decile groupings (2000)

	Total		Excluding Missing
	No.	Percent	Valid Percent
Valid			
Low 1-3	803	29.7	30.5
Med 4-7	1053	38.9	39.7
High 8-10	793	29.3	29.8
Total	2649	97.9	100.0
Missing	58	2.1	
Total	2709	100.0	

Concluding Comment on Deciles

There is no doubting the power of socio-economic status as among the most influential indicators of prior achievement. Any analysis of the effects of schools needs to consider socio-economic indicators, and in New Zealand the deciles are powerful predictors of subsequent achievement success. While introduced for funding purposes, they have come to be quick and crude indicators of "school quality" and becoming more used (with little evidence to support the interpretation) as indicators of teacher quality. What is often forgotten is that higher decile schools have, by their definition, a larger cohort of those who achieve more than those in lower decile schools (that decile is a predictor of prior achievement accounts for this finding). What may be of more importance is any effect of "school" when achievement is controlled. For example, imagine two students of similar academic achievement. It may not matter so much which decile school these two students attend, as their own prior achievement that is more important than the number of similarly decile background students with whom they go to school (Wilkinson, et al., 2000).

In the asTTle project we were loathe to continue to reify a measure that is becoming so adversely interpreted (Messick, 1989). Instead, we created the "Schools like me" concept that included deciles, to take into account the power of socio-economic status as well as placing it alongside other key attributes of schools.

Rural to Urban Location.

There can be major differences between urban and rural schools. Population density in political units defines urban and rural areas (i.e., population up to 999 is rural, 1000 to 9,999 is minor urban, 10,000 to 29,999 is secondary urban, and 30,000+ is main urban).

All schools in NZ were divided into four groups using the MoE classification (Table 4). For this study, the cluster analysis below indicated very little differences between Main and Secondary Urban so these were grouped into "City" schools, and between Minor Urban and Rural and these were grouped into "Country" schools.

Table 4.
Distribution of all NZ schools by location of the school (2000)

	Total	
Location	No.	Percent
City		
Main Urban	1359	50.2
Secondary Urban	190	7.0
Sub Total	*1549*	*57.2*
Country		
Minor Urban	293	10.8
Rural	864	31.9
Sub Total	*1157*	*42.7*
Total	2706	100.0

Size of School

The size of a school may influence student learning over and above individual characteristics students bring to a school.

There are two important and opposing viewpoints evident in school-size research (Lee, Bryk, & Smith, 1993). One viewpoint is based on an economic efficiency argument in favour of 'economies of scale', which claims that financial savings accrue when costs are spread over larger numbers of students. It is also suggested that larger schools, because they have greater numbers of students with similar needs, are better placed to create specialised services to meet these needs. In contrast, smaller schools are forced to focus their resources on core programs. Evidence that increased school size equals greater resource strength is contradictory, however, and it is unclear whether the cost benefits claimed for large schools ever materialise (Lee, et al., 1993). Some studies found that, as the number of students served by a school or district increases, more fiscal resources become available for teachers' salaries, instructional materials, and support for professional development. However, the academic consequences of economies of scale and greater resource strength were not clear (Lee, et al., 1993).

The other viewpoint apparent in school-size research is concerned with the influence of size on the formalisation of social interactions and the consequences that flow from this formalisation (Lee, et al., 1993). Advocates of small schools claim that smaller schools, particularly small high schools, can maximise interrelations among students. Lee and Smith (1995) found that smaller size was considered a feature of school structure that moved schools towards a communal organisation. Using the National Education Longitudinal Study (NELS) 1988 data, they reported that students in smaller schools learned more in reading, maths, history, and science. The effects of increased school size on cognitive gains were negative and significant, with effect sizes ranging from –.30 to –.40. Furthermore, students in smaller schools were more engaged in their courses. Achievement was also distributed more equitably in smaller schools. Lee and Smith suggested that school size has an indirect effect on learning and engagement as it can affect the economic, academic, or social organisation of high schools, and these characteristics could in turn have consequences for students. Lee and Smith (1997) reported that students who attended high schools that enrolled between 600 and 900 students were found to have optimal learning, and that learning was more equitable.

Howley (1995) and Friedkin and Nocochea (1988) showed that large schools might benefit high socio-economic status students but that small schools may benefit low socio-economic status students. Large schools magnified the disadvantage of low socio-economic status students and small schools reduced the advantages experienced by high socio-economic status students.

The economies of scale arguments that suggest that students in large schools are at an advantage academically are not substantiated by research. However, there is considerable support for the view that schools of 600-800 students can optimise interrelations among students, and there is good evidence to suggest that schools of this size enhance academic achievement, particularly that of disadvantaged students. Such schools are more likely to have positive social environments and less diversification of instruction.

We know of no New Zealand research examining effects of school size. However, there are frequent observations that students in small schools, particularly in rural areas, achieve at a lower level than their urban counterparts, though this may be a reflection on the socio-economic and ability intake of these schools (Ministry of Education, 1991). A report of the Education Review Office (1999) on small schools concluded that, in almost all areas of curriculum management and delivery, small schools (those enrolling between 50 and 150 students), had lower levels of performance than a group of larger schools. The report was based on 500 performance reports on full (Years 0 to 8) or contributing (Years 0 to 6) state primary schools, 400 of which were classified as small schools. According to the report, small

schools performed well on indicators of school climate and of relationships within the school (i.e., between the board, principal, and staff, and between staff and students) and of relationships between the school and the community. These findings are broadly consistent with those of the recent United States studies that smaller schools promote positive interrelations among students and staff.

The schools were divided into four equal-sized groups based on number of students. Thus, there are 25% small schools (i.e., roll between 1-67), 25% medium (i.e., roll between 68-184), 25% medium large (i.e., roll between 185-368), and 25% large (roll greater than 368). The analysis below indicated little difference between small and medium schools, so these were grouped into "Smaller size" schools. Likewise little difference was found between medium large and large schools, and so these were grouped into "Larger size" schools.

Table 5.
Distribution of all NZ schools by size of the school (2000)

	Total	
School Size	No.	Percent
Smaller		
Small (1-67)	676	25.0
Medium (68-184)	682	25.2
Larger		
Medium Large (185-368)	672	24.8
Large (369+)	677	25.0
Total	2707	100.0

Area of New Zealand

Despite the abolition of provinces in New Zealand in the 1800's, their power as a measure of identification remains (particularly as a function of sporting teams). Further, pre-1989 Tomorrow Schools, there were regional education offices and these were most important in the business of schools. We retained the more traditional provinces. Table 6 indicates the number of schools in each region.

The one province that turned out to be most problematic is Gisborne/Hawkes Bay. The schools in Gisborne were more similar to other North of Taupo schools, and the schools in Hawkes Bay were more similar to other South of Taupo schools. Schools in these areas may wish to be more particular as to the final cluster they wish to assign to their school.

Table 6.
Distribution of all NZ schools by region of the school (2000)

	Total	
Region	No.	Percent
Northland	155	5.7
Auckland	512	18.9
Waikato	324	12.0
Bay Plenty	157	5.8
Gisborne Hawkes Bay	204	7.5
Manawatu/ Wanganui/ Taranaki	350	12.9
Wellington	263	9.7
Nelson/ Marlborough/ West Coast	139	5.1
Canterbury	330	12.2
Otago/ Southland	272	10.0
Total	2707	100.0

Minority or Majority

It is noted that the percentage of Maori and Pacific Islanders is already included in the decile ratings. It is, however, only one of 6 factors, and it seemed more defensible to include it as a separate factor, as many schools may have different emphases if they have a majority of Maori or Pacific Island students (as perhaps they should). Of the 721,834 students in NZ schools in 2000, 65% are Pakeha, 20% Maori, 7.8% Pacific Nations, 5.9% Asian, and 1.2% Others. There are 1451 (or 54% of schools that are predominantly Pakeha (i.e., > 66% of all students), 11% predominantly Maori (i.e., > 50%), 20% European and Maori (i.e., > 33% and > 25%, respectively), 4% European and Asian (i.e., > 50% and > 15%, respectively), 2.3% were predominantly Pacific, 2.8% Maori and Pacific, and 5.5% mixed across all groups. After a number of preliminary analyses, the most salient measure for clustering schools appeared to a simple percentage of majority (Pakeha) and minority students. There were 50% of schools

with a minority population of greater than 25%.

The cluster analysis below indicated that the major difference was between those with more than 25% majority students and those with less than 25% minority students. Table 7 presents this distribution of minority and majority schools, which divides the nation's schools into two halves.

Table 7.
Distribution of all NZ schools by minority or majority presence in the school (2000)

	Total	
	No.	Percent
Majority	1305	48.2
Minority	1402	51.8
Total	2707	100.0

Method

In 2000 there were 110 Composite, 844 Contributing, 1235 Full primary, 141 Intermediate schools, 91 Years 7-15 schools, and 243 Yrs 9-15 schools in NZ. There were 61 Kura Kaupapa schools (i.e., Maori-medium schools which emphasize Maori language and are based on Maori cultural practices and having their own status under the Education Act 1989), and 45 Special schools such as Health Camps, Deaf, or cerebral palsy schools. Table 8 presents a breakdown of the five major dimensions for primary (the major focus of asTTle), which includes special and Kura schools and secondary schools.

Table 8.
Distribution of all primary and secondary NZ schools by major cluster dimensions (2000)

	Primary, Kura, Special		Secondary	
Cluster Dimensions	No.	%	No.	%
Decile				
Low 1-3	721	31	81	24
Medium 4-7	899	39	154	46
High 8-10	698	30	95	28
Area				
Rural	841	36	23	7
Minor Urban	225	10	68	20
Secondary Urban	155	7	35	10
City Large	1148	48	210	63
District				
Northland	140	6	15	5
Auckland	438	19	74	22
Waikato	286	12	38	11
Bay of Plenty	139	6	18	5
Gisborne/ Hawkes Bay	179	8	25	7
Manawatu /Wanganui /Taranaki	309	13	41	12
Wellington	225	10	38	11
Nelson/ Marlborough/ West Coast	125	5	14	4
Canterbury	291	12	39	12
Otago	237	10	34	10
Ethnicity				
Majority	1147	48	158	47
Minority	1223	52	178	53
Size of School				
Small 1-67	669	28	7	2
Medium 68-184	669	28	13	4
Medium Large 185-368	620	26	52	16
Large 369+	412	17	264	79

Cluster Analysis

Cluster analysis is a method for defining groups of "like" attributes. The distance between every school in New Zealand is calculated across the five dimensions (decile, region, size, minority, and rurality) using Euclidean distances. A series of iterations is then undertaken to cluster "like" schools together, and a dendogram of the final solution can be inspected to ascertain the most interpretable number of clusters and thence their meaning.

A hierarchical means cluster analysis was used for primary age students (i.e., full, composite, contributing, and intermediate

schools), and separately for secondary age students (Years 7-12 and 9-12). The Kura Kaupapa and Special schools were assigned to unique clusters independent of the other analyses. The cluster analysis identified the major attributes of the groups, although there were many schools that were grouped into more than one cluster. The attributes were thus used to devise specific Boolean equations to uniquely identify each school into a cluster (see appendix A).

There are about 4% of schools in each cluster, and Table 9 provides a brief description of each cluster, the number of schools and the percentage across New Zealand. Note, the assignment of the schools into these clusters is based on the more up-to-date 2001 Schools information (provided by the MoE), and clusters them into the 22 categories independently. The 23rd cluster (Integrated schools) includes the 256 schools already clustered. Teachers will be first shown which of the 22 clusters their school is in and if they wish comparison to all Integrated schools they will have to choose this 23rd cluster.

Altogether there are 16 clearly identifiable clusters for primary, 4 clusters for secondary schools, plus Kura and Special schools. It can be seen that the major discriminators among schools (at least over these five dimensions) are region, then decile, city/country location, with more minor discriminations related to minority/majority ethnicity, and school size (smaller and larger). It certainly is the case that no one variable sufficed to discriminate across New Zealand schools and that the current emphasis solely on decile is not justifiable.

Further, the patterns from the clustering of all 10 regions indicated that there were four major regions of New Zealand: Auckland, North of Taupo, South of Taupo, and the South Island. As mentioned earlier, the Gisborne/Hawkes Bay schools were best grouped with those North of Taupo.

Table 9.*Attributes of each cluster, number of schools, and percentage across NZ (2001)*

Cluster	Description	No.	%
Primary, Kura & Special			
1	Auckland, low decile, high Maori, Pacific and other non-European, city	140	5.2
2	Auckland, high decile, city schools	138	5.1
3	North of Taupo (not Auckland), low decile, city schools	103	3.8
4	North of Taupo, medium decile, city schools	190	7.0
5	North of Taupo, low decile, smaller country schools	144	5.3
6	North of Taupo, medium decile, smaller country schools	141	5.2
7	North of Taupo, low & medium decile, larger country schools	89	3.3
8	North of Taupo (not Auckland) high decile schools	148	5.5
9	South of Taupo, medium to high decile, city schools	215	7.9
10	South of Taupo, medium to high decile country schools	178	6.6
11	South of Taupo, low decile, high Maori, Pacific and other non-European schools	122	4.5
12	South Island, high decile, mostly European, city schools	101	3.7
13	South Island, high decile, mostly European, country schools	152	5.6
14	South Island, medium decile, mostly European, country schools	129	4.8
15	South Island, medium decile, mostly European, city schools	126	4.6
16	South Island, low, (medium and high Maori, Pacific and other non-European) decile schools	123	4.5
17	Kura Kaupapa Schools	60	2.2
18	Special schools	45	1.7
Secondary			
19	North Island, high decile, city schools	55	2.0
20	North Island, low-medium decile, high Maori, Pacific and other non-European schools	142	5.2
21	North Island, low-medium decile, mostly European schools	41	1.5
22	South Island schools	88	3.2
23	Integrated schools (not unique)	256	9.4
	Not assigned due to missing information (no decile rating)	45	1.7

Recommendations For asTTle CD Programming

It is recommended that these clusters form the basis of school comparisons in the asTTle project. As there are schools that close, merge, or open anew, it is recommended that when a teacher first logs into the CD-ROM, that the schools be automatically loaded from a database of school clusters (based on the five dimensions). Where there is **no** information in the database, then the teacher will be asked to nominate a cluster they most wish to compare with their school. Only one cluster will be assigned.

An advantage of this twofold process is that when the various parameters are updated (especially decile and size) the CD could incorporate these values readily.

There are two ancillary issues. First, it has been requested that "Integrated schools" be a separate cluster. We have assigned schools into the first 22 clusters (and this will be automatically loaded for teachers' to accept), but if teachers wish to compare to Integrated Schools they will have to take the second option above and manually reassign their school to Integrated (cluster 23).

Second, there are a number of schools that have changed names, etc. from 2000 to 2001. We did a manual search of these schools and assigned a cluster to each. If teachers disagree with the cluster assigned, they will be able to override these decisions.

School Composition Effects

An alternative procedure would be to make more fine discriminations and make comparisons between individual schools. As well as probably leading to invidious league tables, there is little evidence that the size of "school" effects are sufficiently identifiable, or that they could be attributed to the particular composition of individual schools. The debate about school composition effects is lively, especially in New Zealand (Harker & Nash, 1996, Lauder & Hughes, 1990, 1999, Thrupp, 1997, 1999; Wilkinson, 1998). Harker and Nash (1996) used data from the Progress at School Project (Nash & Harker, 1998, 1997) to conduct a value-added analysis of effective schools. They concluded that school composition explained essentially zero percent of the total variance in student achievement.

> The model suggests that once the character of a school's intake has been taken into account no systematic differences can be detected in the performance of schools when School Certificate marks are used as the criterion. The hypothesis that the 'ability' or social class composition of a school has an independent effect on a school's performance is shown to be doubtful (p. 5).

Lauder, et al. (1999) analysed data from the Smithfield Project to assess the impact of various New Zealand Government reforms on a cohort of 3,300 students as they moved from Year 7 (towards the end of primary) to Year 11 (third year of secondary). They found that, on average, differences between schools accounted for about 8 % of total variance in the outcome measures.

> The mean SES of the students in the school, their mean prior achievement scores, and the like are related to performance over and above the relationships found at the individual level. Schools with larger proportions of students with high initial achievement, larger proportions of students with high socio-economic status, fewer ethnic minority students, stable rolls, and the like are at an advantage, and students will perform better in them than they will in schools with the opposite mix of students (p. 127).

Wilkinson, et al. (2001) reviewed these studies and concluded that Harker and Nash's (1996) analysis underestimated the effects of school composition (because of sampling issues of schools, use of School Certificate results, limited set of compositional variables). Conversely, they concluded that Lauder, et al.'s (1999) analysis overestimated the effects of school composition (because of

small sample of schools, excluding non-significant student-level variables from the models). They, thus, concluded that the proportion of total variance in student achievement that is attributable to school composition in New Zealand lies within the range of zero to eight percent.

Note, for example, a recent analysis by Nash (2000) wherein he demonstrated that given two students of similar ability, it may be that they experience more effective learning in a lower decile school (as they are a bigger fish in a smaller pond, have closer attention to their needs, and have higher expectations and attention to learning). Nash concluded that "it does not help teachers who work in low-decile schools, students who receive their education in them, or parents who support them, to be told that their efforts are ineffective and that their schools are not improving, when the evidence properly interpreted shows that many – one can probably say most – are in fact doing at least as well as might be expected" (p. 189).

Given similar student abilities, the choice of school a student attends is not among the more powerful influences on later achievement. The main message is that school based comparisons are not that powerful. There are, however, more critical student variables (such as ability, and student SES) that are implicated in learning and it is important to note that these are student level and not school level variables. Any model that includes "school" as a point of comparison, therefore, needs to be carefully constructed so that we do not make the mistake of interpreting the school characteristics in any way that limits the options, expectations, and descriptions of the students. At best, it is more defensible to cluster schools across a number of dimensions and conduct research at this cluster level.

The notion of "Schools Like Mine" deliberately includes a number of variables to draw a weighted composite of schools. These variables are among the most commonly used by teachers and parents in describing schools, and the composite aims to minimise any particular one variable as the "short cut" for adjudging school quality.

References

Clark, J., Zimmer B., & Main, R. (1997). *Under-representation in Australian Higher Education by the socio-economically disadvantaged: Review of trends and practices, and implications for University Planning*. Paper presented at the eighth international conference, Australian Acquisition for Institutional Research, Adelaide November.

Davis, P., McLeod, K., Ransom, M., & Ohgley, P. (1997). *The New Zealand Socioeconomic Index of Occupational Status (NZSEI)*. Research and Analytical Report #2, NZ Government.

Driskell, J. E. & Mullen, B. (1990). Status, expectations, and behavior: A meta-analytic review and test of the theory. *Personality and Social Psychology Bulletin, 16*(3), 541-553.

Harker, R., & Nash, R. (1996). Academic outcomes and school effectiveness: Type A and type B effects. *New Zealand Journal of Educational Studies, 3*1, 143-170.

Hauser, R.M., & Warren, J.R. (1997). Sociological indexes for occupations: A review, update and critique. *Sociological Methodology, 27*, 177-298.

Lauder, H. & Hughes, D. (1990). Social inequalities and differences in school outcomes. *New Zealand Journal of Educational Studies, 25, 37-60.*

Lauder, H., Hughes, D., Watson, D., Waslander, S., Thrupp, M., Strathdee, R., Simiyu, I., Dupuis, A., McGlinn, J., & Hamlin, J. (1999). *Trading in futures: Why markets in education don't work.* Buckingham: Philadelphia: Open University Press.

Meagher-Lundberg, P. (2000). Technical Report 1.

Ministry of Education. (1997). *Socio-economic Indicator for Schools*. Data Management and Analysis Section, Ministry of Education, November 1997.

Nash, R. (2000). School performance and access to tertiary education: The within-class selection model. *New Zealand Journal of Educational Studies, 35*, 179-192.

Nash, R. & Harker. R.K. (1997). *Progress at School*: Final report to the Ministry of Education. Wellington, NZ: Ministry of Education.

Nash, R. & Harker. R.K. (1998). *Making progress: Adding value in secondary education*. Palmerston North, NZ: Massey Printery.

Postle, G. D., Clarke, J.R., & Bull, D.D. (1995). Equity programs and strategies. In G.D. Postle, E. Skuja, D.D., Bull, K. Batorowica, & H.A. McCann (Eds.). *Towards excellence in diversity: Educational equity in the Australian Higher Education Sector in 1995: Status, Trends and future directions*. University of Southern Queensland Press, Toowoomba.

Power, C. & Robertson, R., & Beswick, G. (1985). *Access to higher education: participation, equity, and policy, Final Report.* National Institute of Labour Studies Incorporated.

Thrupp, M. How school mix shapes school processes: A comparative study of New Zealand schools. *New Zealand Journal of Educational Studies, 32(*1), 53-82.

Thrupp, M. (1999). *Schools making a difference: Let's be realistic! School mix, school effectiveness and the social limits of reform.* Buckingham: Open University Press.

Western, J., McMillan, J., & Durrington, D., (1998). *Differential access to higher education: The measurement of socio-economic status, rurality, and isolation*. Educational and Investigations Report #98/14: Canberra, Australia: Department of Employment, Education, Training and Youth Affairs.

White, K. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*(3), 461-481.

Wilkinson, I. (1998). Dealing with diversity: Achievement gaps in reading literacy among New Zealand students. Reading Research Quarterly, 33, 144-167.

Williams, T. (1987). *Participation in Education*. ACER Research Monograph, No. 30. ACER, Hawthorn, Victoria.

Williams, T., Long, M., Carpenter, P., & Hayden, M. (1993). *Year 12 in the 1980's* Australian Government Publishing Service, Canberra.

Appendix A: SPSS Boolean equations for assignation to each cluster.

Type classification:
1 = primary, composite, contributing, or intermediate
2 = secondary or restricted composite
3 = special

Kura kaupapa classification:
1 = Kura Kaupapa
2 = not Kura Kaupapa

Decile classification:
1 = low (decile of 1-3)
2 = medium (decile of 4-7)
3 = high (decile of 8-10)

Ethnicity classification:
1 = at least 75 percent European
2 = less than 75 percent European

Region classification:
1 = Northland
2 = Auckland
3 = Waikato
4 = Bay of Plenty
5 = Gisborne
6 = Hawkes Bay, Manawatu, Wanganui, or Taranaki
7 = Wellington or Chatham Islands
8 = Nelson, Marlborough, West Coast, or Tasman
9 = Canterbury
10 = Otago or Southland

Area type classification:
1 = rural (< 1000) or minor urban (1000-9,999)
2 = secondary urban (10,000-29,999) or main urban (> 30,000)

Size classification:
1 = small (total roll of 1-67)
2 = medium (total roll of 68-184)
3 = medium large (total roll of 185-368)
4 = large (total roll >= 369)

Authority classification: 1 = state
2 = integrated
3 = private

Cluster: 1 = type classification of 1 and (decile classification of 1 and ethnicity classification of 2 and region classification of 2 and area type classification of 1)
2 = type classification of 1 and (decile classification of 3 and region classification of 2 and area type classification of 1)
3 = type classification of 1 and (decile classification of 1 and (region classification of 1 or (region classification >= 3 and region classification <= 5))) and area type classification of 1
4 = type classification of 1 and (decile classification of 2 and (region classification >= 1 and region classification <= 5) and area type classification of 1)
5 = type classification of 1 and (decile classification of 1 and (region classification >= 1 and region classification <= 5) and area type classification of 2 and size classification <= 2)
6 = type classification of 1 and (decile classification of 2 and (region classification >= 1 and region classification <= 5) and area type classification of 2 and size classification <= 2)
7 = type classification of 1 and ((decile classification of 1 or decile classification of 2) and (region classification >= 1 and region classification <= 5) and area type classification of 2 and size classification >= 3)
8 = type classification of 1 and (decile classification of 3 and (region classification of 1 or region classification of 3 or region classification of 4 or region classification of 5))
9 = type classification of 1 and ((decile classification of 2 or decile classification of 3) and (region classification >= 6 and region classification <= 7) and area type classification of 1)
10 = type classification of 1 and ((decile classification of 2 or decile classification of 3) and (region classification >= 6 and region classification <= 7) and area type classification of 2)
11 = type classification of 1 and (decile classification of 1 and ethnicity classification of 2 and (region classification >= 6 and region classification <= 7))
12 = type classification of 1 and (decile classification of 3 and ethnicity classification of 1 and (region classification >= 8 and region classification <= 10) and area type classification of 1)
13 = type classification of 1 and (decile classification of 3 and ethnicity classification of 1 and (region classification >= 8 and region classification <= 10) and area type classification of 2)
14 = type classification of 1 and (decile classification of 2 and ethnicity classification of 1 and (region classification >= 8 and region classification <= 10) and area type classification of 2)
15 = type classification of 1 and (decile classification of 2 and ethnicity classification of 1 and (region classification >= 8 and region classification <= 10) and area type classification of 1)

16 = type classification of 1 and ((decile classification of 1 or (decile classification of 2 and ethnicity classification of 2)) and (region classification >= 8 and region classification <= 10))
19 = type classification of 2 and decile classification of 3 and region classification <= 7 and area type classification of 1
20 = type classification of 2 and decile classification <= 2 and region classification <= 7 and ethnicity classification of 2
21 = type classification of 2 and decile classification <= 2 and region classification <= 7 and ethnicity classification of 1
22 = type classification of 2 and region classification >= 8 secondary cluster:
17 = kura kaupapa classification of 1
18 = type classification of 3
23 = type classification of 1 and authority classification of 2