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THE IMPACT OF SCHOOL RESOURCING AND FINANCIAL MANAGEMENT ON EDUCATIONAL ATTAINMENT AND ACHIEVEMENT

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ABSTRACT

The study assesses the impact of school resources on academic outcomes by following a national cohort of upper secondary school students in New Zealand schools from 2006 through to 2008. The academic outcomes were measured by total credits gained in a year and attainment of Level 2 and 3 qualifications in the National Certificate of Educational Achievement, the official secondary school qualification in New Zealand. In total, 144 regression models (72 linear regression models and 72 binary logistic regressions) estimated the impact of per student revenue and expenditure on student's attainment while controlling for a range of individual background and school factors. The main findings suggest that the differences in overall level of school resources and financial management practices of the school have little to no impact on differences in achievement. Thus, differences in levels and uses of school funding are not related to differences in disparities across schools. Further, it is possible that the school funding model distributes resources to schools equitably but that it fails to affect educational disparity.

To my daughter, Khulan

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CHAPTER ONE: INTRODUCTION

One role of government is to ensure the provision of essential services to the public, including health, education and public order. In New Zealand, almost a fifth of total government expenditure is spent on education (New Zealand Treasury, 2012). For example, in 2010 about 18% of total government expenditure was allocated to education services (New Zealand Treasury, 2012). It is essential, therefore, to make sure that the funding system in the education sector can meet the needs of educational institutions, and that educational institutions are productive and efficient, ensuring that young New Zealanders have the skills and knowledge needed to participate in creating a knowledge-based economy and a sustainable and equitable society.

In New Zealand, the funding of education is a shared responsibility between government, parents, and communities. Educational institutions, schools in particular, manage their own finances and for schools to operate efficiently and effectively. It is critical that available resources they have are directed at improving the educational outcomes of students. Knowledge of resource allocation patterns and their impact on learning outcomes of students, if guided by appropriate educational policies, can be a powerful tool in effective allocation of resources both from the funding agency and at the school-level.

The aim of this study is to enhance the understanding of the association between overall level of resourcing, resource management at the school-level, and learning outcomes of students. The leading questions are whether variations in resource levels and uses affect student outcomes and whether there are effective financial management practices associated with better student achievement? There are two main research questions raised in this study: (i) what is the impact of the overall level of per-student resources available and spent at school-level on the attainment of students? and (ii) what is the impact of indicators of a school's financial management on achievement of students?

New Zealand implemented major reforms in the administration of the education sector in the late 1980s and beginning of the 1990s (Levin, 2001; Picot, 1988; Wylie, 1994). The

Picot committee, established to review the administration of the sector, found that effective management practices were lacking in education and that the information needed by people in all parts of the system to make informed choices was seldom available, and so they made several recommendations to ensure the efficiency of education administration (Picot, 1988). These reforms substantially changed the financial management of the education sector, shifting the accountability and authority for education spending from the former Department of Education and Regional Education Boards to each school's Board of Trustees.

In New Zealand, each Board of Trustees is responsible for the governance and the management of their school. Boards of Trustees are treated as crown entities responsible for setting a school's strategic direction in consultation with parents, staff, and students. They are responsible for ensuring that the school provides a safe environment and quality education for all its students (Ministry of Education, 2012a). Boards are also responsible for overseeing the management of personnel, curriculum, property, finance, and administration. Boards usually consist of the school principal, an elected staff (teacher) trustee, three to seven elected parent trustees, and a student trustee (at secondary schools).

Each school receives government funding in the form of an operational grant, teachers' salaries, direct property funding, and some other government funding based on Ministry of Education's discretion. Boards of Trustees have full discretion to set their spending priorities and to allocate the total operational grant as they think necessary to achieve the objectives and goals. The one exception is the School Tertiary Alignment Resource (STAR), which is funding to provide unconventional subjects to senior secondary students (Ministry of Education, 2010a). The salaries of teachers employed at State and State-Integrated schools (public schools) are transferred on behalf of the schools directly to the accounts of teachers each fortnight. Although they do not pass through the accounts of the school, they are considered for this study to be part of the school's funding package. State schools receive capital funding from the Ministry of Education; however, they do not have discretion over its spending, mainly because the land and buildings of State schools belong to the New Zealand Government. On an annual basis, schools' audited accounts are

provided to the Ministry of Education for accountability, reporting, and future funding purposes.

This study follows a cohort of students who started a senior secondary education in 2006, through to their second and third year of senior secondary schooling. The population studied was limited to all students attending mainstream State and State-Integrated[1] secondary schools in New Zealand that offer the National Certificate of Educational Achievement (NCEA) as the only option for academic assessment. This means that students attending schools that offer other qualifications such International Baccalaureate (IB) Schools, Cambridge examinations or mix of these qualifications are excluded. These schools represent 82% of all public secondary schools in 2007 and 2008. The administrative data on schools, their funding, financial performance, and the achievement of individual students on the NCEA allows tracking of students' progress over time, and enables the linking of student- and school-level information using the students' unique National Student Number and Ministry of Education's unique institutional number given to all educational institutions. The achievement of students is measured by total number of credits gained on NCEA in a year and attainment of NCEA qualifications. Specifically, the study measures the attainment of NCEA Level 2 and NCEA Level 3 qualifications by students in their second and third year of upper secondary schooling.

This thesis contributes to knowledge on the effects of financial resources on student attainment by providing evidence on the effect of overall level of resources (per student revenue and expenditure) on achievement of upper secondary students from New Zealand, a jurisdiction where schools are financially self-governed. Although there is rich data available on student achievement, resourcing, and expenditure of New Zealand schools, there is a lack of empirical evidence, especially longitudinal research that employs robust quantitative methodologies in measuring the impact of resources in the New Zealand context.

[1] Both State and State-Integrated schools will be referred as public schools from hereinafter. State-Integrated schools are former private schools that integrated into the state system under the Private Schools Conditional Integration Act of New Zealand (1975).

Education production and school effectiveness studies mainly measure the impact of the overall level of resources or, in some cases, the impact of individual components of resources on students' achievement, while controlling for a variety of student- and school-level factors (Archibald, 2006; Levačić, Jenkins, Vignoles, Steele & Allen, 2005). However, none of these studies provide a comparison across schools that are treated in a similar manner under the current funding system, or schools that have similar financial management practices. Controlling for these factors is essential to estimate whether additional resources would have an impact on student achievement across schools with the same resourcing and financial management practices. Although school financial management and its effectiveness at improving student outcomes are widely debated in this field, none of the earlier studies in this field have developed quantifiable measures of financial management, nor have they measured their impact on student outcomes while simultaneously comparing schools with the same level of disposable funds or per student spending.

A further contribution of this study is also in its methodological approach. The models developed in this study merge the concepts of school resources and financial management. While complementing each other, these concepts provide deeper insight into the fiscal operations of schools. The advantage of this methodology is its simplicity and applicability. Such a methodology could become a powerful tool in the hands of policy makers in assisting them develop appropriate policies, or reviewing existing funding arrangements from both at the level of funding agency and the schools' perspective. This methodology could also be easily adopted in other government funded sectors.

This thesis is comprises eight chapters. Following this introduction, Chapter Two reviews the literature. It briefly presents the evolution of research in the field, provides an overview of factors affecting student achievement, and then reviews in more detail ten major studies aimed at answering similar research question using similar datasets and employing a similar methodology. Chapter Three describes the current system of school administration, resourcing, and resource management in New Zealand to provide background information about how New Zealand schools are funded; the main sources of school revenue; the major components of expenditure, which describe the pattern of resource allocation in secondary

schools in New Zealand. In Chapter Four the NCEA qualification is introduced and explained as an assessment system for secondary education. Chapter Five presents the methodology and describes the population studied and the data sources used. It also provides specifications of the models developed to answer the leading research questions. The empirical part of this study addresses the research questions through statistical analysis of the relationships between school resourcing, financial management factors, and student outcomes, the findings of which are presented in Chapter Six. Chapter Seven discusses the policy implications of findings and recommendations are presented in the final chapter, Chapter Eight.

CHAPTER TWO: LITERATURE REVIEW

In this study, the focus is given to studies that add robust empirical evidence on the impact of school resources on student achievement. This literature review is limited to studies conducted in the last two decades, partly due to the expansion of research during this period and partly due to the greater robustness and quality of more recent research as lessons gained from previous studies and improved methodologies are applied to richer datasets. The review begins with a summary of how research on the impact of school resources on academic outcomes has evolved and presents the key findings emerging from the general literature. It then focuses on ten selected studies that have attempted to answer the same research questions that are addressed in this thesis. For each study, an overview of the scope and the main findings is presented. The chapter concludes by presenting the evidence on determinants of student achievement in New Zealand, by highlighting the key messages from the literature review and by summarising the contribution of this study to the literature in this field.

Evolution of research in this field

The literature on educational productivity originated in the United States (US) after the Civil Rights Act of 1964. The study by Coleman (1966) on equality of educational opportunity was the first significant contribution to the field. This study was conducted on a large population of elementary and secondary students (N= 645,000) and found evidence of a consistent relationship between the socioeconomic status (SES) of students and their achievement levels. It also suggested that there are few or no causal relations between the inputs to a school and the achievement levels of its students, raising important questions such as; What is the role of teachers and schools in increasing educational attainment of their students? and Does money matter in increasing educational attainment?

A Nation at Risk, a report by the National Commission on Excellence in Education (US Department of Education, 1983), had a significant impact on education policies in the US and became the basis for educational reforms in the US in the ensuing years as well as stimulating the development of a body of literature in this field. In light of this report, educational researchers shifted their focus from issues of equity to productivity in

education. Of the many studies that followed, a significant contribution was made by Hanushek (1989). He reviewed 189 studies of the relationship between spending and school performance and concluded that variations in school expenditures were not systematically related to variations in student performance. Among the questions he raised were: What is the cause of the apparent waste of resources? Why is there so little pressure for schools to operate efficiently? and What can be done to incentivise schools to improve their efficiency?

Hanushek's study probably became one of the most critiqued pieces of research, and yet it is still one of the most influential studies in education production research. Its methodology and findings were challenged by many scholars. Hedges, Greenwald, and Laine (1996a) (1996a), for example, disputed Hanushek's simple summary method, which they argued failed to detect the positive relationship between school resources and student achievements. Greenwald and his colleagues (1996a) employed two meta-analytic methods using combined significance testing and effect magnitude estimation and found that the global resource variables, such as per-student expenditure showed a strong and consistent relationship with achievement. Smaller schools and smaller classes were also positively related to student achievement. In addition they found that resource variables that attempted to describe the quality of teachers (i.e., teacher ability, teacher education, and teacher experience) exhibited strong associations with student achievement (Greenwald et al., 1996a). Krueger (2003) also reviewed in detail the studies summarised by Hanushek (1989), and described Hanushek's methodology as "vote counting". He criticised Hanushek for giving weights to studies in proportion to their number of estimates, leading to a non-systematic relationship between resources and achievements.

According to Levačić and Vignoles (2002), two separate research traditions have evolved since the Coleman report. These traditions are 'education production studies' and 'school effectiveness studies'. Education production studies are usually conducted by economists, whereas school effectiveness studies are mainly conducted by educationalists who attempt to measure the impact of different school factors — including school processes factors — on achievements. It is noteworthy that apart from class size, and teacher quality variables, school effectiveness studies tend to neglect school resource factors (Levačić & Vignoles, 2002).

The body of knowledge in this area has, however, developed rapidly in the past two decades. The renewed interest in the economics of education has been particularly noticeable in the United Kingdom (UK) (Feinstein & Symons, 1999; Holmlund, McNally, & Viarengo, 2008; Levačić et al., 2005; Steele et al., 2007). The UK studies have been mainly micro studies where student-level achievement and background variables are linked to school-level resource data. These studies have led to substantial progress in improving the research methodology in the area of school effectiveness. A more recent study in the United States by Grubb (2009) has made a significant step forward in this field, providing a more complete picture of school resources. This study has been described as "a study that did a masterful job of opening the 'black box' of public schools" (Rumberger, 2009). Much of the literature in this field is summarised in the volume 1 and 4 of Handbook of the Economics of Education (Hanushek et al. (eds) ,2011; Hanushek & Welch, 2006).

Key findings emerging from the general literature

School financial resource factors

Expenditure per student is the traditional and still the most common measure of school resources (Costrell, Hanushek, & Loeb, 2008; Grubb, 2009, 2010; Hanushek, 2003). Expenditure per student is commonly used in almost all comparative studies (Afonso & St. Aubyn, 2005; Beese & Liang, 2010) and tends to be measured at a country level or, for many US studies, at a district or state level. Some more recent studies, however, measure expenditure per student at school level (Diane Pan, Rudo, & Smith-Hansen, 2002; Womack, 2000). Despite the myriad of studies on the impact of expenditure per student on educational outcomes, and regardless of how it is measured, overall the findings are inconsistent and often contradictory.

Some studies suggest, that there is no systematic relationship between school resources and student outcomes, and the amount of financial resources spent per student has no effect on students' outcomes (Ceci, Papierno, & Mueller-Johnson, 2002; Elliot, 1998; Hanushek, 1989, 1997, 2003; Jacobs & Schuh, 2005; Lips, Watkins, & Fleming, 2008; Perez & Socias, 2008; Womack, 2000). In contrast, there are numerous studies that suggest some

systematic positive effect of expenditure per student (Greenwald et al., 1996a; Greenwald, Hedges, & Laine, 1996b; Holmlund, McNally, & Viarengo, 2009; Jenkins, Levacic, & Vignoles, 2006; Levačić et al., 2005; Machin, McNally, & Meghir, 2007), while others suggest a significant negative effect (Du & Hu, 2008; D Pan, Rudo, Schneider, & Smith-Hansen, 2003; Steele et al., 2007). In cases where some statistical association was found, the effects reported were usually marginal in magnitude (Greenwald et al., 1996a; Heinesen & Graversen, 2005).

Student-teacher ratio is (the number of students divided by the number of teachers or full time equivalent teachers) is another commonly used measure of school resources in this field (Borland, Howsen, & Trawick, 2005; Dustmann, Rajah, & van Soest, 1998; Feinstein & Symons, 1999). This ratio can be calculated at a district/Local Education Authority (LEA) or school-level, and is a very rough proxy of average class size. Student-teacher ratios measured at the school-level are also an indicator of school resourcing, and can be a policy tool to increase or decrease the resources directed at schools. Like the major debates around the impact of financial resources on student educational outcomes, there is also a debate about the effect of class size. There are many studies defending the argument that reducing class size leads to more interaction between teacher and students, more feedback, more time for diagnosis and student evaluation, and hence they lead to improvements in learning outcomes (Akerheim, 1995; Angrist & Lavy, 1999; Creene, Huerta, & Richards, 2007; Finn, 2002; Finn et al., 1990). Most of the empirical studies, however, have not supported a positive effect of class size reduction (Dianis, 2002; Hanushek, 1998; Jacobson, 2008; Shea, 1998). Hattie (2009), using meta-analysis with 96 studies and 785 effects, concluded that the effect of class size is small (but positive) and suggests that unless teacher strategies change with reduction of class size the effect would continue to be small.

Grubb (2009) presented a more complex, broader, and more complete definition of school resources, that was not limited by traditionally defined school resources and measured by either per student expenses, student-teacher ratios, class sizes or school materials and assets (books, learning materials, etc.). Instead, Grubb (2009) identified simple, compound, complex, and abstract school resources. According to Grubb (2009), simple resources include the traditionally defined school resources mentioned above, such as per student

expenditure; compound resources are two or more resources that complement each other, for example teachers with experience, or teachers with credentials in specific subjects and teach in their fields of specialization; complex resources are the resources not easily bought, such as instructional approaches and pedagogical practices. Abstract resources are also hard to measure, and include features such as a school's culture or organisational structure, or any resources that are embedded within complex relationships and practices in schools.

Teacher and teaching related factors

The literature reveals that teachers with effective teaching skills and strategies acquired through effective teacher training programmes, professional development, and/or classroom experience are among most valuable assets that schools could have. The quality of teachers and teaching was found to be one of the most significant predictors of student achievement in many studies (City, E.A et al, 2009; Darling-Hammond, L, 2010; Beese & Liang, 2010; Jepsen & Rivkin, 2009). As noted above, Hattie's (2009) recent summary of meta-analyses related to student achievement showed that, overall, the combined contributions from teacher, curriculum, and teaching are about the same as the contributions from students, home, and school. In both fields of education production and school effectiveness, the quality of teachers and of teaching are not commonly used factors. It noteworthy to mention that teaching quality and quality of teachers are two separate concepts and quality of teachers is not necessarily always associated with quality of teaching. However, in some studies where the quality of teaching or teachers is considered, teachers' qualifications, years of experience, or a teacher's salary scale are often used as proxies. These are typically aggregated at the school-level.

Student background factors

Student background factors such as gender, ethnicity, or prior achievement of students are commonly used in education production and school effectiveness studies as determinants of student achievement. According to Hattie's (2009) synthesis of over 800 meta-analyses related to achievement, on average, teacher, teaching, and curricula related factors combined had more impact on outcomes than did student, home, and school factors. Studies that estimated the impact of school financial resources on student achievement

were commonly limited to school resources, student background determinants, and maybe some district and local area related SES factors. Only a few studies capture teacher, teaching, and curriculum related determinants, largely because information about these is not systematically collected and is often not easily available to researchers.

Nevertheless, there are many studies highlighting *gender* differences in the educational attainment of students and this is probably one of the most well-researched subject areas in education (Achor, Imoko, & Ajai, 2010; Clark, Flower, Walton, & Oakley, 2008; Clay, 2008; Mulvey, 2010). There is a general tendency to magnify the effects and role of gender in education especially among policymakers. Hattie's (2009) summary of 41 meta-analyses based on almost 3000 studies concluded that the effect of gender on achievement was small ($d > .12$ effect sizes) and this indicated that the differences between males and females should not be a major concern. Similarly, Hyde's (2005) summary of evidence from 128 meta-analyses concluded that males and females are very similar. A few notable exceptions were where there were gender differences in physical abilities (or motor behaviours) and some aspects of sexuality. On aggregate, the gender differences were moderate in magnitude (Hattie, 2009; Hyde, 2005).

Concluding comments

Overall, the literature on student achievement highlights that school or institutional settings have a smaller impact on student achievement than contributions from teachers, students or home. This aligns with scholars (in New Zealand) suggesting that within-school variation in student achievement is much greater than between the school variances (Alton-Lee, 2003). The key findings emerging form general literature on impact of school resources on student achievement suggest that the impact of schools' financial resources, commonly measured by expenditure per student and student-teacher ratio, is not consistent and, even when some impact is found, the effect is small in magnitude. The literature suggests that student background factors, especially socio-economic status and factors related to teacher and teaching practices are powerful determinants of student achievements.

Scope and overview of the reviewed studies

Given the rich literature on educational production and school effectiveness, their origins, and their evolution, the studies reviewed were limited to those conducted since the mid-1990s. The literature reviewed includes studies published in refereed journals, books, and reports produced by government departments, research institutes and projects. The Education Resource Information Centre (ERIC) database, Education Research Complete, the Australian and New Zealand reference catalogues, and the library resources of the New Zealand Ministry of Education were the main databases searched. "Education production function", "school resources", "school funding", "allocation of resources" and "academic achievement" were the primary descriptors or keywords used in the searches of all the databases.

The literature search was not limited by the study's country of origin, although the vast majority of literature was from the UK and the US. The reviewed studies were, however, limited to studies where the unit of analysis was students and school resources were measured at the school-level. This excluded studies that analysed the impact of resources on educational outcomes at an aggregated level, such as districts, states, and municipalities in the US, or LEAs in the UK. In other words, only studies that analysed the impact of school resources directly on student achievement, where resources were measured at school-level, and student achievement was measured at individual level were selected for review.

Researchers studying the links between spending and student outcomes traditionally relied on district level expenditure and school or district/municipality level data (Loeb & Bound, 1996). Hanushek (1997) argued that aggregation of explanatory variables reduces the precision of the any estimates but suggested that it does not necessarily lead to biased estimates. In the United Kingdom, a considerable proportion of education production function studies, particularly early ones, used outcome data at the school rather than the student level, as well as using resource data at the LEA level (Levačić & Vignoles, 2002). However, recent studies used student-level achievement and school-level resourcing data and there has been an apparent shift towards using better quality data in more recent studies. In addition, some experts in school finance have argued that student-level data collection has the potential to be more cost effective and more useful in improving the

understanding of student learning (Picus, 2000). Therefore, the review of the literature focuses on studies that used student-level outcome data linked to school-level resource information. Such criteria exclude country-level international comparative studies such as Trends in International Mathematics Science Study (TIMSS), Programme for International Student Assessment (PISA), Progress in International Reading and Literacy Study (PIRLS) and other similar studies, where the focus of the studies is on comparisons across countries at an aggregate level. These studies are, therefore, outside the scope of this literature review.

In this empirical study, student achievement is measured by credits gained in a year and attainment of NCEA qualifications. In order to allow a comparison of findings, the studies in this review were also filtered by the measure of outcome variables and limiting to the studies that assessed the effects of school resources on test scores or attainment of qualification. Studies that analysed the effect of school resources on post-secondary outcomes or earnings were excluded from this review and so were studies that analysed the effect of resources on student attitude or motivation. The reviewed studies were at both primary and secondary schooling levels, although the primary focus of this study is on the achievement of students at secondary schools.

The quality of data and sample size were other important selection criteria. In addition, the inclusion of variables relating to socio-economic status (SES) was also an essential selection filter. There is an immense volume of literature in education highlighting the significance of students' family and SES on achievement of students (Duckworth, 2008; Gorard & See, 2009; G. Marks, 2006; Perry & McConney, 2010; Putwain, 2008; Rangel & Lleras, 2010; Snook & O'Neill, 2010). According to Dustmann et al., (1998) omitting parental background variables, parental preferences, community variables and the child's past performance leads to a substantial inflation of the effect of the school quality variable. A recent OECD report (2012) also emphasizes that schools with a higher proportion of disadvantaged students are at greater risk of challenges that can result in low performance. Such schools often lack internal capacity or support to provide quality learning experience for the most disadvantaged (OECD, 2012). It is also possible that such schools also lack financial management practices to support disadvantaged groups of students. Therefore, studies that do not control for student SES by comparing students from the different status

groups have not been selected. Finally, in order to ensure that the findings of this study relate to similar previous studies, where evidence was derived from analysis of large representative samples of population, only studies with samples larger than 2000 have been included.

Once these selection filters were applied, many studies that analysed the impact of resources on educational outcomes of students that originated in the US were excluded. This was partially because resources were measured at district level rather than at school-level but also due to inequity in school funding across schools/districts which makes these studies of limited value for the purposes of this study. Ultimately, only 10 studies met all the criteria. These studies were published between 1998 and 2011. Six of the studies were from the UK, three studies were from the US, and one was from Denmark. Table 1 presents a summary of the reviewed studies. It includes the publication year, the country of origin, years of scope, data source, models utilised, sample analysed, and dependent and type of explanatory variables (moderators) included in the models. For each study, the source of the data, the sample size of the studied population or observation, the statistical models used, and the dependent and explanatory variables included in the models will be discussed further.

In terms of datasets utilised, the three older UK studies (Dearden, Ferri, & Meghir, 2002; Dustmann et al., 1998; Feinstein & Symons, 1999) used the British National Child Development Survey. More recent UK studies by Levačić (2005), Jenkins (2006) and Steele et al. (2007) used the National Student Database and Student Level Annual Schools Census. Studies from the US by Elliot (1998) and Grubb (2009) both used the National Educational Longitudinal Study, while Archibald (2006) used administrative data from the Nevada district. The only study from Denmark (Heinesen & Graversen, 2005) used the Danish administrative register data. All reviewed studies based their findings on large datasets with populations that ranged from over 2,000 to 450,000 (see Table 1).

Table 1

Summary of reviewed studies

First Author and Year	Years	Data Source	Model(s) Utilised	Sample Analysed	Educational Outcomes	School Resource Related Variables	Moderators/Control Variables
Archibald, S. (2006)	2002-2003	District (Nevada) administrative data	Hierarchical linear model (HLM)	7000 nested in 420 classrooms and 55 schools	Reading and Maths test scores at primary/elementary school	School expenditure broken out into 4 categories: instruction, instructional support, leadership, and operations and maintenance	Previous achievement, student demographic variables, teacher experience and instruction practice related variables, school size and poverty level
Dearden, L. (2002)	1981 and 1991	British National Child Development Survey	Logistic regression (probit model) for qualifications.	Cohort of students born in March 1958; 2412 females and 2232 males	Qualification levels attained; hourly rate of wages at the age of 23 and 33	Student-teacher ratio for school	Parental education and SES of family, school type and gender and variables that describe local area characteristics
Dustmann, C. (1998)	1974	British National Child Development Survey	Tobit model for pass rate and multinomial logit model for pathway outcome model	4,000 cases	Number of O level GCSE Grade passed at age 16; the decision at the age of 16 (to stay at school, get a job, or continue with tertiary education)	Student-teacher ratio for school	Previous achievement, parental education, SES and involvement in education and expectations, school type and gender, labour/workforce related variables at local authority level
Elliot, M. (1998)	1990	National Education Longitudinal Study:88 and 90 and Surveys on finances and teachers	Hierarchical linear model (HLM)	6318 individuals (Maths test scores) and 5343 individuals (Science). About 708 schools included.	Maths and Science test scores (gains in Maths and Science test scores between the 8th and 10th grade)	Expenditure per student (District level expenditure but, to make district level expenditure more representative, created a variable of differential need that takes into account free lunches, special education students and other factors)	Student demographic variables, SES, educational track, teacher qualification and pedagogy strategies, classroom resources and other administrative characteristics of the school

First Author and Year	Years	Data Source	Model(s) Utilised	Sample Analysed	Educational Outcomes	School Resource Related Variables	Moderators/Control Variables
Grubb, N. (2009)	1988, 1990,1992, 1994 and 2000	National Educational Longitudinal Survey of the Class of 1988 (NELS88)	Hierarchical linear model (HLM)	Sample range from 11,887 to 13,623 depending on outcome variable	Maths, science, reading, history test scores scaled, class rank (percentile), high educational and occupational aspirations, plans to continue education past high school, total credits earned, completed standard academic programme. High school diploma received	Simple resources: student teacher ratio, low/high teacher salary; Compound resources: teacher experience, planning and staff development time, educational track and etc. Complex resources: teacher use of time, type of teaching (conventional/innovative teaching), teacher sense of efficacy, department supports innovation and etc. Abstract resources: Positive/negative school climate, college pressure, internal school/principal control and etc.	Student demographic variables; family characteristics; teacher experience, teacher preparation and other variables related to teaching and classroom environment; student ability and benefit related variables as well as exogenous school structure and policy variables
Fienstein, L. (1999)	1969-1974	British National Child Development Survey	Ordinary least squares (OLS) regression analysis	2,487 individuals (English test scores), 3,181 individuals (Maths) and 2,403 individuals on all exams	Reading and Maths ability at age 16 and index of exam performance in all subjects	Student-teacher ratio for school	Previous achievement, parental education and SES of family; peer group related variables; variables that describe the local area/neighbourhood of students

First Author and Year	Years	Data Source	Model(s) Utilised	Sample Analysed	Educational Outcomes	School Resource Related Variables	Moderators/Control Variables
Heinsesen, E. (2005)	1981–1996	Danish administrative register data	Ordinary Least Squares (OLS) and logit models	10 % random sample of the cohorts born between 1965 and 1,970 (covered 274 municipalities, 39,362 individuals)	Attainment of an education (upper secondary or vocational) after lower secondary school	School expenditure at municipal level and three measures of student-teacher ratios: (i) the total number of teacher wage hours per student, (ii) the total number of teacher lessons per student, and (iii) the number of teacher lessons in normal classes	The highest level of completed education, family and socio economic status of family; municipals' socioeconomic characteristics
Jenkins, A. (2006)	1999/2000-2002/03	National Student Database (NPD), Student Level Annual Schools Census	Ordinary least squares (OLS) regression analysis	3,000 secondary schools and over 450,000 students (144 LEA).	Capped GCSE Points score, highest Maths, Science, and English score (Key Stage 3)	Expenditure per student, the average student-teacher ratio in the school, and the ratio of students to non-teaching staff	Previous achievement, student demographic and SES variables; school-level administrative variables including identifier for various government funding; at local authority level standard spending assessment per student, variables of political/party control and relative teachers' pay
Levačić, R. (2005)	2000/1-2002/3	Student Level Annual Schools Census database	Ordinary least squares (OLS) regression models	Around 3000 secondary schools and over 430,000 students.	Key Stage 3 Maths score, Key Stage 3 Science score and Key Stage 3 English score	Expenditure per student, the average student-teacher ratio in the school and the ratio of students to non-teaching staff	Prior attainment, variables of student demographic and SES; school type and student population, school type and gender variables

First Author and Year	Years	Data Source	Model(s) Utilised	Sample Analysed	Educational Outcomes	School Resource Related Variables	Moderators/Control Variables
Steele et al.(2007)	2002-2003	National student database and student level annual schools census	Multilevel modelling, Simultaneous Equation Model (SEM)	430,061 students in 2950 schools in 147 LEAs	Maths, Science, English test scores at the age of 14	Expenditure per student, student-teacher ratio, student-non-teaching staff ratio: expenditure per student is clustered at Local Education Area level	Prior achievement, student demographic and SES; school administrative variables including the participation in government intervention programmes, school's SES and attainment related variables; unemployment rate and other variables at local authority level

As previously mentioned, the studies selected for review were limited by the choice of dependent/outcome variable in order to enable comparison with the findings of this study. Reviewed studies from the UK often used the performance of students on Key Stage 3 tests in maths, science and English (schooling years 7 to 9, when students are aged 11 to 14). Some reviewed studies measured performance on test scores at the age of 14 or 16, (i.e., Grade 10 or 12 respectively), or attainment of a specific qualification or diploma. The exception was the study by Archibald (2006), where the outcome measures were reading and maths test scores at primary/elementary school. All other studies measured the educational outcome at post primary/elementary school, mainly in lower and upper secondary education.

Expenditure per student, student-teacher ratio, or student-non-teaching staff ratio were the resource variables used in all reviewed studies. For example, Dustmann (1998), Feinstein, L., & Symons, J. (1999) and Dearden (2002) used the single measure of school resource as student-teacher ratio and assessed its impact on the attainment of students, whereas others like Hiensen (2005), Jenkins (2006), Levačić et al., (2005), and Steele et al. (2007) also assessed the effects of expenditure per student on student outcomes, in addition to student-teacher ratio and student- non-teaching staff ratio. Archibald (2006) and Grubb (2009) were exceptions. Archibald (2006) estimated individually the impact of various components of expenditure such as instruction, instructional support, leadership and operations and maintenance on reading and maths test scores in primary/elementary school; while, Grubb (2009) took a whole new approach to school resources by grouping most of the traditionally defined school resources such as expenditure per student and student-teacher ratios as simple resources. Although at the school level the resource usage varies substantially between levels of schooling, especially between primary/elementary and secondary schooling; due to the limitation of studies that analysed the impact of individual components of school resources, the study by Archibald (2006) was retained. As previously explained (see pages 19 and 20), in addition to simple resources, Grubb (2009), suggests there are compound, complex, and abstract resources that are integral to schools' resources. However, although compound, complex and abstract resources complete the full picture of school resources, in practice information on these types of school resources has not been systematically measured and has not been routinely collected by education administrators even in developed countries. In general, such information is not easily

available to researchers without specific resources being allocated to collect details from students, teachers and education managers.

The identified moderator variables included in the reviewed studies are also presented in Table 1. All of the reviewed studies allow the comparison of students of the same abilities by either controlling for previous achievement, by having prior test scores as moderator variables, or by having the dependent variable measured by gains in test scores (see Table 1). The reviewed studies controlled for students' SES mainly by measuring parental education, occupation, family income, or socio-economic characteristics of the neighbourhood. In addition to SES and prior attainment, a wide range of moderator variables at student-level were used in these studies. These included factors such as gender, ethnicity, eligibility for free school meals, and number of children or siblings.

Similarly, there were other moderator variables that described characteristics of the teacher, classroom, school, or district/local area. Three studies included teacher and classroom related moderator variables. Archibald (2006) controlled for teacher experience and education, and also included a measure of instructional practice. Similarly, the model estimated by Elliot (1998) controlled for teacher qualification, class size, pedagogic strategies, and classroom resources. Grubb (2009) included control variables that described teacher experience, teacher preparation and other variables related to the teaching and the classroom environment. In these studies the comparison was between students taught by teachers with the same level of experience, or learning in classroom environments with the same characteristics. All studies included some type of school moderator variables in addition to school resource factors. School type, school gender type, school size, and the proportion of students eligible for free school meals were the variables commonly included as moderator variables in the reviewed studies.

Other than the school and student-level moderator variables mentioned above, studies by Dearden (2002), Dustmann (1998), Feinstein, L., & Symons, J. (1999), and Steele et.al. (2007) used variables to control for local area socio-economic characteristics. Unemployment rate and ethnic composition of the local area were common choices of moderator variables included in the above-mentioned studies, although all of these studies controlled for the SES of students at the student-level.

In terms of statistical models utilised, studies by Archibald (2006), Elliot (1998), and Grubb (2009), used Hierarchical Linear Model (HLM), whereas most of the other reviewed studies used Ordinary Least Squares (OLS) regressions models or logistic regressions, depending on the outcome variable measured (see Table 1). The exception was the study by Steele et.al. (2007), that developed a Simultaneous Equation Model (SEM).

Summary of findings of reviewed studies

School financial resource factors

Expenditure per student

The reviewed studies that used expenditure per student as a measure of school resources found positive effects, especially the studies from the UK. Jenkins at el., (2006), Levačić et al., (2005), and Steele et al., (2007) found that expenditure per student had a statistically significant positive effect on attainment: in terms of magnitude, however, these effects were very small. Another study by Jenkins at el., (2006) suggested that additional expenditure of £100 per student per annum over 5 years would be associated with an improvement of about 0.3 in the capped General Certificate of Secondary Education (GCSE) point score, with an addition of about 0.05 of a grade in science GCSE. Similarly, Levačić et al., (2005) found the spending £1,000 more per student in a year would raise maths and science attainment at Key Stage 3 on average by 0.4 of a level. The magnitude of the effects from the simultaneous equation model developed by Steele et al. (2007) indicated that an additional funding of £1,000 per student would increase student achievement by an average of 0.07 in level of standardized test score in maths, and just under 0.2 of a level in the standardized test score in science. Studies by Archibald (2006) and Elliot (1998) also supported a positive association between schools' expenditure per student and test scores. According to Archibald (2006), per student total expenditure had statistically significant positive effects on reading scores but not in mathematics. Elliot's (1998) findings suggested that per student expenditure indirectly increased students' achievement by giving students access to educated teachers who used effective pedagogies. Evidence from Elliot's (1998) study suggested that a USD 1,000 increase in core expenditure per student was associated with an effect-size of 0.60 in reading, and a 0.20 point increase in maths test scores between 8th and 10th grades. Elliot (1998), however, did not find any statistically significant effects of core expenditures per student on science

achievement. The study by Heinesen (2005) investigated the effect of per student expenditure on attainment of an upper secondary or vocational education qualification and found that an increase in per student expenditure was associated with greater likelihood to attain a higher level degree; however, the estimated effect of per student expenditure was rather small. A rise in expenditure per student by 10% is associated with an increase of 1.0 percentage point in the average sample person's probability of passing a qualification. Findings suggested that it would cost about a DKK 4 million (USD 570,000) increase in school expenditure to have just one extra student completing upper secondary or vocational education and, according to the authors, this cost estimate is considerably higher than estimates of comparable net benefits to society, based on the differences in lifetime incomes between groups with differing levels of education.

Student-teacher ratio

Five of the ten reviewed studies included student-teacher ratios as school resource factors in their models. Most of them found evidence of negative effects of student-teacher ratio; that is, reducing class size did not increase achievement. For example, Steele et al., (2007) found that an increase in student-teacher ratio was associated with a decrease in test scores in maths (b = -.126, $p < 0.001$) and science (b = -.168, $p < 0.001$). In the UK, Dustmann et al., (1998) found that a one standard deviation increase in student teacher-ratio decreased the number of O-Levels students achieved by about 0.7 (exam results), and reduced the probability that the student stayed on in full-time education by nine percentage points. Similarly, a study by Levačić et al., (2005) found that an increase in student-teacher ratio had a low but significant negative effect on the students' likelihood of attaining higher achievements. They also found that, reducing the student-teacher ratio for the whole school raised maths attainment at Key Stage 3 by just under 0.1 of a level, and in science by 0.12 levels[2]. However, some studies' estimated models produced non-significant effects of student-teacher ratio on student attainment. Dearden (2002), for example, found that primary and secondary student-teacher ratio had no effect on outcomes for either males or females and Feinstein, L., & Symons, J. (1999) found that the association between achievement and student-teacher ratio was insignificant.

[2] The exam results were recalibrated to make the marks from different tiers equivalent in Key Stage levels, producing marks in fractions of a level

Individual components of school expenditure

Among the reviewed research, only the study by Archibald (2006) had a rich dataset on financial resources which allowed estimating the effect of individual components of school expenditure on achievement. In the models, where the per-student spending included only spending on instruction and instructional support, the results showed that these resources had a positive effect on reading. In maths, however, the sign of the coefficient changed from positive to negative. Archibald speculated that such findings were due to there being less variation in the variable when only expenditure for instruction and instructional support were included. Neither result was, however, statistically significant in maths and Archibald (2006) did not find any systematic effects of individual components of expenditure on student attainment.

Broader defined school resources

The study by Grubb (2009) was based on a rich, more complex and broadly defined set of school resources data, compared to previously published studies in this field. Grubb (2009) measured the effects of school resources on twelve outcomes: four subject test scores (maths, science, reading and history); three educational aspirations variables (high educational aspirations, high occupational aspirations and continuing education); and five variables of educational progress measured as total credits gained - completion of standard academic programme, receipt of high school diploma, enrolment in four-year college and enrolment in two-year college. Grubb (2009) found that having more students per teacher *(simple resource)* reduced maths scores significantly (b=-.021, $p < .05$), and reduced the likelihood of students completing a standard academic programme (b = -.039, $p < .10$) and continuing to a four year college degree (b = -.067, $p < 0.001$). However, increases in student-teacher ratios increased the likelihood of graduation with an incomplete qualification (b = .05, $p < 0.001$) and going to community college (b = .8, $p < 0.001$) (Grubb, 2009). Teachers' salaries, as the only proxy for quality available, enhanced three of the four subject test scores as well as occupational aspirations, the intention to continue in schooling, and the accumulation of credits. These multiple effects suggest that efforts to attract and retain teachers through higher salaries generated positive outcomes. However, overall, the effects of these simple resources were modest and not powerful. The largest coefficient was 0.041, and most of the significant effects were closer to 0.03. According to Grubb (2009), there were more consistent and larger effects on test scores related to the secondary school experience of teachers, *a compound variable* that combines length of

experience with experience solely at the secondary level. On test scores, statistically significant effects of secondary school experience of teachers ($p < 0.001$) ranged from 0.031 to 0.045. Teaching an individual's major discipline also enhanced three of the four test scores, though the effects were small (Grubb, 2009). C*omplex school resources,* such as the perceptions by teachers of their own efficacy; teacher perceptions that their department encouraged innovation; innovative and constructivist teaching, particularly in maths; and conventional and behaviourist teaching all led to lower test scores (Grubb, 2009). Having teachers who reported being in control of their teaching enhances test scores (except in history) as well as credits earned and enrolment in four-year colleges, indicating that efforts to adopt scripted curricula reduced teacher control and were counterproductive. Overall, the magnitude of these effects was not large and the most statistically significant effects ranged from 0.2 to 0.47 ($p < 0.001$). Finally the *abstract resources* of the school, such as positive climate as reported by students increased test scores, while negative events such as stealing, drug-dealing, physical threats, and fights depressed them and reduced the likelihood of completing an academic programme (Grubb, 2009).

Teacher and teaching related factors

Only three out of the ten reviewed studies controlled for teacher and teaching related attributes (see Table 1). Archibald (2006) suggested that a teacher's quality indicator, measured by the teacher's standards-based evaluation score derived from the district's performance based evaluation system, had a positive statistically significant effect on students' achievement and outcomes. However, Archibald (2006), did not find any effects related to having a Master's degree or to pay scales or years of experience of teachers. In a study by Elliot (1998), teacher education and experience as well as a stronger emphasis on higher order thinking, were also found to be positively related to students' achievement in maths. The recent study by Grubb (2009) suggested that teacher experience, especially experience at the secondary level, had consistent and large effects on test scores.

Student background factors

Overall, the findings of the reviewed studies presented inconsistent evidence on the effect of *gender*. Some UK studies found that there was no statistically significant difference between performance of girls and boys (Archibald, 2006; Levačić et al., 2005). Some

studies that analysed the effect of resources on subject performance found that boys outperformed girls in maths, science and history subjects but not in English or reading (Elliot, 1998; Feinstein & Symons, 1999; Grubb, 2009; Holmlund et al., 2008; Jenkins et al., 2006). The study by Feinstein and Symons (1999) also suggested that overall girls outperformed boys. The effects of gender on student achievement described above were after all other factors were controlled for, including the school resourcing variables.

Like gender, there is voluminous evidence documenting *ethnic or racial* differences in educational attainment. For example, evidence from the US consistently shows that minority Black and Hispanic students have lower achievement than White students (Ayers et al., 1992; Carsrud & Burleson, 1982, March; Ferguson, 2002; Keith, 1999). Similarly, in the UK, existing literature that studied the effects of resources on educational achievement provided evidence that minority ethnic groups underperformed in education (Connolly, 2006; Frederickson, 2008; Sammons, 1995). Also, there is a large literature providing evidence of educational gaps between minority students and students from European decent in both Australia and New Zealand (Clinton, Williams, & Clancy, 1991; Keith, 1999; Marie, Fergusson, & Boden, 2008; McInerney, 2008). Among the ten reviewed studies, Grubb's (2009) study provided evidence that Black, Latino, and American Indian students performed more poorly on tests, and had lower rates of completion of high school and progression to college than White and Asian students. However, according to Grubb (2009) their aspirations were not lower than White and Asian students. Similarly, Archibald (2006) and Elliot (1998) found that performance of minority ethnic groups was significantly lower. In contrast, the study by Levačić et al., (2005) found that ethnicity had no significant effect on student performance.

Socioeconomic status and its effect on educational outcomes is also a well-researched topic and disparities in education based on SES remains one of the key issues for educators and policy makers in both developed and the developing world. SES is usually measured by parental education, occupation, or family income and all of these reflect the status of the family resources. There is general agreement among scholars that there are significant achievement disparities between students based on SES, and the higher the SES the higher the achievement (Duckworth, 2008; Gorard & See, 2009; Hankerson, 2011; Owoyele & Olagunju, 2010; Rector, 2011; Snook & O'Neill, 2010). Although the reviewed studies

used different variables to measure SES, all the studies found that SES was a significant predictor of achievement. For instance, lower SES, measured by being eligible for free school lunches, was associated with lower performance. Elliot (1998) found that SES measured by composite score of parents' educational levels, occupation and family income have powerful effect on students' educational outcomes. Similarly, Dustmann, et al., (1998) and Sammons (1995) found that parents' educational level and occupation had a significant effect, where higher educational level and more highly skilled occupations of parents was associated with higher performance.

A student's *previous achievement* has also been found as one of the best predictors of subsequent performances (Feinstein & Symons, 1999). All reviewed studies controlled for previous achievement either by having prior test scores as moderator variables or by having a dependent variable, measured by gains in test scores (see Table 1). Elliot (1998). Feinstein and Symons (1999) and Sammons (1995) found consistent positive effects of prior achievement. Moreover, Jenkins et al., (2006) found that marginal increases in resources improved overall scores for all students, but particularly for student from the bottom 60% of prior achievement distribution. Similarly, Levačić et al., (2005) found that resources had an effect more on mid- and top-ability students from low SES groups (i.e., those eligible for free school lunches).

A few studies included information about student's *vocational or academic track*. For instance, Elliot (1998) found that students on vocational track had lower performance. This was also consistent with Grubb's (2009) findings that suggested the general or vocational track depressed outcomes compared to the academic track, and placement on remedial programmes had even more powerful negative effects. According to Grubb (2009), these tracks were sometimes chosen by students, and were usually combined with lower level content teachers with lower expectations. Grubb (2009) also found that students who spent more time on homework, or had habits of reading, did better. He also found that watching TV, employment, attendance problems, and hanging out with dropouts had a negative effect on student performance.

The reviewed studies also highlighted the underachievement of *special needs students*. Archibald (2006) and Jenkins et al., (2006) found that special education students are less

likely to perform well. However, Levačić (2005) suggested that being a special needs student had no effect on an individual's performance. Some studies included analyses using students with English not as mother tongue or English as an additional language. For example, Jenkins et al. (2006) found that students who did not have English as their mother tongue performed better.

School factors other than resourcing

Grubb's (2009) empirical model included abstract school resources, such as school climate, and the findings indicated that such resources affected students outcomes. More specifically, stealing, drug dealing, physical threats, and violence experiences at school reduced the likelihood of completing academic programmes. Grubb's findings in this respect are consistent with those of Archibald (2006), who found that school-level poverty had a significant negative effect on student attainment.

Some studies found that school characteristics had some effects on student performance and outcomes. Grubb (2009) found that private religious schools encouraged completion of academic programmes and progression to four-year colleges, while public magnet schools and schools of choice had no significant effects. Similarly, Dearden et al., (2002) found that attending grammar schools and private schools positively affected outcomes. The findings of the reviewed studies suggest that school gender type also contributes to performance of students. Jenkins et al., (2006) found that girls' schools performed better than co-educational schools, but effects of boys' schools on performance were only found for English. Similarly, Feinstein and Symons (1999) found that single-sex girls' schools did better overall and on English, but not in maths.

Concluding comments

The reviewed studies that measured resources by expenditure per student or student-teacher ratios find inconsistent effects of school resources on student outcomes that support the key findings of general literature summarised above. Archibald's (2006) study that anlaysed the impact of individual components, for example, did not find any consistent systematic effects of individual components of expenditure on student outcomes. Grubb's (2009) study, on the other hand, showed that some school resources like teacher

experiences, perceptions by teachers of their own efficacy and other broadly defined school resources are found to have some statistically significant impact on student achievement.

Although reviewed studies found some inconsistent effects of some student demographic factors such as gender, they agree that SES of students is an important determinant of student outcomes. The reviewed studies also agree that there are some ethnic differences in the achievement of students, where minority ethnic groups underperform. In addition, some of reviewed studies that used other school factors such as school type or gender type found that these factors also explain variation in student achievement.

Evidence from New Zealand

There are no New Zealand empirical studies available for comparison that used a robust statistical methodology and assessed the impact of school resources on students' achievement. However, there are many empirical studies investigating the determinants of student achievement in New Zealand (Boustead & Strathdee, 2008; Gibb, Fergusson, & Horwood, 2008; Marie et al., 2008; G. N. Marks, 2008; Meyer, McClure, Walkey, Weir, & McKenzie, 2009; Otunuku & Brown, 2007). The impact of *gender* disparities in attainment is also a well-studied topic in New Zealand (Eley, 2001; Gibb et al., 2008; Harker, 2000; Meyer, McClure et al., 2009; Wilkinson, 1998). For example, Fergusson et al., (2008) found that at co-educational (mixed gender) schools there were consistent and statistically significant tendencies for females to outperform males on measures of high school and tertiary education attainment. They argued that after adjustment for a series of covariates related to school choice, there were significant differences between single-sex and co-educational schools. At co-educational schools, there was a statistically significant gap favouring females, while single-sex schools had insignificant effects on students' achievement. Harker (2000) also explored the relative achievements of girls in single-sex and co-educational schools with careful controls for the student population differences at the two types of school. Overall he found that the apparent differences between the two types of school reduced to non-significance.

Additionally, there is overwhelming evidence from New Zealand on educational disparities across *ethnic groups* (Biddulph, Biddulph, & Biddulph, 2003; Boustead & Strathdee, 2008; Crooks & Caygill, 1999, November; Marie et al., 2008; Nash, 2001; Otunuku & Brown, 2007; Rubie-Davies, Hattie, & Hamilton, 2006). These studies documented the relative underachievement of students from Māori and Pacific ethnic groups. There is also an abundance of evidence indicating the significant impact of SES on achievement and student outcomes (Biddulph et al., 2003; Carpenter, 2010; Crooks & Caygill, 1999, November; D.M. Fergusson, Horwood, & Boden, 2008; D. M. Fergusson, Horwood, & Lloyd, 1991; Jones, 1982; Marie et al., 2008; Snook & O'Neill, 2010).

According to New Zealand Ministry of Education studies, those students who regularly speak English at home perform better (Biddulph et al., 2003; Caygill, 2008; Satherley, 2006). For example, a recent study by Kirkham (2011) suggested that reading achievement was significantly higher, on average, among students who regularly spoke English at home. Students who had at least one parent born in New Zealand had significantly higher digital reading achievement, on average, than those whose parents were not born in New Zealand.

Concluding comments

This review of general literature and examination of specific studies suggest that school-level variables have little impact on educational attainment, unless they are factors related to teaching, teaching practices or curriculum. It also suggests that there is no inconsistency in the impact of school financial resources on educational attainment and even when some studies find statistically significant associations between school resources and outcomes of students, the effects are small in magnitude.

This review also reveals that some student background factors, such as socio-economic status, prior achievement and ethnicity are clearly important determinants of student achievement and, as such, it is essential to include these factors in the design of the models used in this study. In addition, the review of literature originating in New Zealand reveals that to date there have been no robust empirical studies conducted to investigate the impact of school financial resources on educational attainment, despite the collection of rich data on attainment and educational finance nationally.

As was noted earlier, the majority of the literature in this field originated in the United States or United Kingdom, from jurisdictions where financial decisions on allocating school resources are made at the system level. The main contribution of this study to the existing literature in this field is in providing empirical evidence from New Zealand, where schools are self-administered and financial decisions on how to allocate school resources are made at the school level. It is possible that financial decisions made by people who are most knowledgeable about student abilities, potential and learning experiences may lead to better associations/ links with student outcomes.

In addition, although the issue of schools' financial effectiveness is a significant source of debate in this field, none of the previous studies actually quantified financial management. The most commonly used measures of school resources are the student-teacher ratio and per student expenditure (see Table 1). Another contribution of this study is in its methodological approach. In this study, school's financial management decisions are quantified as a proportional allocation of resources into different components of revenue and expenditure and the impact of these decisions on student achievement are systematically estimated.

The following chapter provides background on school resources and resource management in New Zealand.

CHAPTER THREE: SCHOOL RESOURCING AND RESOURCE MANAGEMENT IN NEW ZEALAND

The purpose of this chapter is to provide background information on school resourcing and resource management in New Zealand. This chapter contains two sections: the section on school resourcing and is followed by the section on financial management.

School Resourcing

New Zealand's investment in education is below the OECD average in per student terms, yet forms an above average share of GDP. Differences in the relative wealth and demographic structure lie behind these apparently differing results (Ministry of Education, 2013d). Base teacher salaries compare favourably with those of OECD counterparts in benchmarks that the OECD uses, though are below OECD averages in absolute terms. New Zealand student to teacher ratios compare favourably with OECD average levels at pre-primary and upper secondary levels (Ministry of Education, 2013d).

Schools in New Zealand are highly subsidised by government grants, which account for more than 85% of total school revenues, although this varies by the socio-economic decile of the school (see below). The remaining 15% of school revenues are from locally raised funds, usually garnered from parents and the local community. This section will discuss the main types of government and non-government revenues of the schools and their drivers and determinants.

Government funding

Government funding varies across schools depending on the demographic and socio-economic composition of the school's population, and the ability of schools to raise local funds, which mainly depends on the capacity of parents and communities to support the school financially. For example, in 2009 the government allocated around NZD 5 billion through operational grants, teachers' salaries, and capital funding to public schools. Table 2 shows the direct funding provided to all public schools in recent years. For example in 2009, about 67% of total government funding is for teachers' salaries, about 22% is operational grants, and the remaining 11% is capital funding (see Table 2).

Table 2

Direct funding to public schools

Funding Type/Year	2006	2007	2008	2009
Teachers' salaries	2,706	2,801	3,162	3,268
Operational grant	948	986	1,026	1,095
Capital funding	405	345	473	543
Total government funding	4,058	4,132	4,661	4,906
Teacher salaries as % of total funding	66.7%	67.8%	67.8%	66.6%
Operational grant as % of total funding	23.4%	23.9%	22.0%	22.3%
Capital funding as % of total funding	10.0%	8.3%	10.1%	11.1%

Source: Ministry of Education (2010c)

Notes: Goods and Services Tax (GST) exclusive amounts in millions of NZD. Based on the calendar year.

As in many developed nations, government funding of education institutions is based on key principles such as equity, adequacy, effectiveness, efficiency, value for money, and transparency (Glover & Levacic, 2007). In this chapter, concepts such as horizontal equity, vertical equity, and adequacy will be applied in discussion of the funding system in New Zealand.

The concept of *horizontal equity* recognises that all schools should be treated the same (Glover & Levačić, 2007). In New Zealand, an example of horizontal equity is the base funding and per student funding components which are the starting points in the calculation of operational funding. In most education systems, horizontal equity funding counts for the majority of funding. This is also the case for New Zealand. The per student component of operational funding to schools alone accounts for almost half of the operational funding received by public schools.

Vertical equity recognises that different groups of students may have different needs and aims to provide additional funding to meet the needs of some students such as those from lower socio-economic backgrounds or those with disabilities and special needs (Glover & Levačić, 2007). Examples of vertical equity in New Zealand are the Targeted Funding for Educational Achievement (TFEA), Special Education Grant and the Isolation funding components of operational funding. The components of operational funding that schools receive will be discussed in the next section in more detail.

Operational grant

The operational grant is the funding provided from the Ministry of Education to the Board of Trustees for the day-to-day operations of schools. The operational grant comprises more than 20% of total funding from the Ministry of Education to schools, and does not include funding for teachers' salaries or the purchase of large capital items.

The operational grant has several components, and each component has its own driver and funding formula. Table 3 presents the operational grant provided to public schools in 2009, broken down by their components and stating the objectives and drivers of each component. based on the experiences in several countries that have formula funding, Ross and Levačić (1999) grouped the components of funding into four distinct categories: (i) basic student allocation, (ii) curriculum enhancement, (iii) student supplementary educational needs, and (iv) school site needs. This classification has been applied to the components of the operational funding in Table 3. As mentioned above, for the majority of components schools can redistribute funding across components and they are not accountable for them individually.

Table 3

Operational grant to public schools in 2009 by components

Component	Objective	Main driver	2009	
			NZD million	%
Basic student allocation			696	62
Base funding	Compensate for absence of economies of scale	Rolls	65	6
Per student funding	General running of the school	Rolls	566	50
Relieving	Assist with the cost of employing relief teacher in the absence of permanent teaching staff	Rolls	65	6
Curriculum enhancement			19	2
Māori language	Provision of Māori Language Immersion Programmes	Rolls	15	1
Kiwi sport	Increase participation in organised sport	Rolls	3	0
Arts coordinators	Assist schools with coordination of art and cultural events		1	0
Student supplementary additional needs			176	16
Careers	Provision of career guidance	Rolls and school decile[3]	5	0
Secondary Tertiary Alignment Resources	Provision of non-conventional programmes for senior students	Rolls	30	3
Special Education Grant	Provide extra assistance to students with moderate learning needs	Rolls and school decile	35	3
Targeted Funding for Educational Achievement	Assist schools to overcome barriers to educational achievement that is associated with low socio-economic status	Rolls and school decile	106	9
School site needs			150	13
Heat, Light and Water	For the supply and consumption of energy and water	Based on average cost of past years	56	5
Maintenance and cleaners, caretakers	Property maintenance or minor capital work and cost of cleaning		79	7
Vandalism	Help Board of Trustees to reduce the vandalism	Rolls and vandalism risk rating	7	1
Isolation	Recognises additional cost as a result of isolation	Rolls and isolation index	8	1
Miscellaneous			89	8
Adjustment	Adjustments due to unexpected changes in rolls or school circumstances	Based on individual application	57	5
Other funding components	Small components that are application based	Based on individual application	32	3
Grand Total			1,130	100

Source: Ministry of Education (2010b)

[3] A school's decile indicates the extent to which the school draws its students from low socio-economic communities (1) to high socio–economic communities (10).

The largest component of operational funding of public schools, which accounts for almost two-thirds of operational funding, is the *Basic student allocation*. Base funding and per-student funding are provided to all public schools based on the school rolls. Both the base funding and per-student funding are for the general running of the school, with the only difference being that base funding is to compensate for the absences of economies of scale (this means that schools with smaller rolls get more of this component than those schools with relatively higher rolls). Per-student funding is provided based on a standard fixed rate at four funding levels. Per student funding recognizes that the higher the level of study, the higher the cost of education. For example, in 2009 State schools received NZD 708 for each student in Years 1 to 6, NZD 794 for Year 7 and 8 students, NZD 905 for Year 9 to 10 students, and NZD 1,004 for students studying in Years 11 to 15. The relief teaching component is also based on a per student allocation. These components of operational funding are means or tools to ensure the horizontal equity in funding.

Curriculum enhancement components include Māori Language Programme funding, NCEA grant, Arts Coordinators, and Kiwi Sports. This includes funding for programmes that are related to specific government policies or strategies in the sector, such as for schools that provide Māori language programmes. For instance, the Māori Language Programme funding is based on the number of students enrolled in these programmes and the intensity of these programmes at schools. Compared to the basic student allocation, this category of funding is relatively small. For example, in 2009 it comprised only 2% of total operational funding received by all public schools.

The components of funding classified under *student supplementary educational needs* are to meet the needs of disadvantaged groups who tend to have attendance or behavioural problems, or need guidance in pathway choices during the transition from secondary to tertiary education. For public schools such funding represented over 16% of the total operational funding in 2009. This includes Targeted Funding for Educational Achievement (TFEA), and the Special Education Grant (SEG), Careers Grant, and Secondary Tertiary Alignment Resources (STAR). The largest component is TFEA, which aims to assist schools increase the achievement of students from low SES groups; the calculation of this funding component is based on the deciles of each school. Decile is a ranking ranging from 1 to 10 given to schools, where decile 1 schools are the 10% of schools with the highest

proportion of students from low socio-economic communities and decile 10 schools are the 10% of schools with the lowest proportion of these students. With every new census each school provides a random sample of student addresses and these are used to determine which areas each school is drawing its students from. The Ministry of Education links the addresses of students attending public schools to the characteristics of mesh blocks[4] and calculates the decile ranking for schools. Decile ranking reflects five dimensions: household income, parental/guardian occupations, level of household crowding, parental/guardian educational qualifications, and level of government income support (Ministry of Education, 2013a). For TFEA funding the schools with the highest proportion of lower SES students attract more per student funding than other schools, which means that there is a negative association between decile ranking and the rate of TFEA funding. TFEA funding is an example of vertical equity funding. For example, under current regulations, the per student rate of TFEA funding for low decile (decile 1 to 3) schools ranges from NZD 780 to NZD 160, it ranges from NZD 150 to NZD 60 for medium decile (decile 4 to 7) schools; and is NZD 40 and NZD 24 for decile 8 and 9 schools respectively. Under current policy, decile 10 schools do not receive any TFEA funding. The Special Education Grant (SEG) works in a similar manner. Lower decile schools get more money per student than higher decile schools to assist students with moderate learning needs. STAR and Career funding are different from TFEAs and SEGs. The funding for these components is based on a fixed per student rate for secondary students. The Special Education Grant, STAR and Careers funding are the examples of horizontal equity funding. For example, 2012 rates for Special Education Grant range from NZD 62 (for decile 1 schools) to NZD 32 (for decile 10 schools) per student, plus base funding of NZD 1,200 to all schools.

School site related components: School site related funding components include funding to cover heat, light and water expenses; the property maintenance grant; and vandalism and isolation funding. Heat, light and water funding is based on the average historical spending for the last 3 – 4 years for each school. School buildings and land at State schools are owned by the Crown; however, State schools get a property grant to maintain the land and property based on information held by the Ministry of Education. The funding for

[4] Meshblocks are the smallest Census areas. A meshblock contains around 50 households.

vandalism is based on each school's risk to vandalism, which is based on the history of schools. Generally, schools can apply for a top-up during the year depending on their vandalism cases. This funding is driven by rolls and an isolation index calculated for each school. All school-site related funding can be considered horizontal equity funding although the majority of funding depends on the actual and historical expenditure of the schools on utilities.

The components of funding described above are the major operational funding categories for which most schools are eligible to receive funding. However, there are other funding components that are one-time payments disbursed on an application basis. For example, the funding that helps to equip new classrooms generated by roll increases or adjustment to the operational grant are one-time payments. The funding formula for delivering operational grants has both elements of horizontal and vertical equity. If generalised, student rolls and school decile are the main drivers of the operational grant. Although some of the funding is based on decile ranking or socio-economic composition of school populations, proportionally the operational grant comprise about 12% of the operational grant.

Teacher salaries

Teacher salaries are centrally distributed by the Ministry of Education by transferring funds directly to the teachers on behalf of schools. Only public schools receive government funding for teacher salaries. Teacher salary funding is based on entitlement staffing, which is derived from the year level rolls of the school. Schools can hire additional staff over the entitlement set by the Ministry if they have financial resources generated through locally raised funds from parents or by reallocating their operational grant. Teacher unions negotiate general employment contracts with the government (Ministry of Education) and individual teachers can either join unions or decide not to join teacher unions. In both cases, employment contracts are signed between teachers and schools.

There are three main components of staffing entitlement: curriculum staffing, management staffing, and additional guidance staffing. Table 4 presents total government funding of teacher salaries, and the total confirmed staffing entitlement. In 2009 teacher salary funding from government was NZD 3.3 billion allocated, to more than 47,000 Full Time Teacher Equivalents (FTTEs).

Table 4

Total funding for teacher salaries and entitlement

Calendar year	2006	2007	2008	2009
Total Funding (NZD millions)	2,706	2,801	3,162	3,268
Total Entitlement (FTTE)	44,476	44,955	45,964	47,244
Curriculum staffing (FTTE)	34,193	34,730	35,476	35,386
Management staffing (FTTE)	3,760	4,176	4,421	4,365
Guidance staffing (FTTE)	827	842	846	851
Other staffing (FTTE)	5,696	5,206	5,219	6,641

Source: Ministry of Education (2010b)

Curriculum staffing is the main staffing entitlement of schools and it represents almost 80% of total staffing entitlements for the schools (Table 4). It is calculated using student-teacher ratios based on the number of students who are taught in Māori language for more than 12.5 hours per week and the remaining non Māori immersion students at each year level. The Māori immersion student-teacher ratio is greater than the non-Māori immersion student-teacher ratio. For example, for Years 4 to 8, the Māori immersion teacher-student ratio is 18:1, compared to 29:1 for the non-Māori immersion teacher-student ratio (Ministry of Education, 2010b). This is one of the ways of supporting the teaching of Māori language in New Zealand schools. However, a relatively small proportion of curriculum staffing entitlement is based on the Māori immersion teacher-student ratio. Curriculum staffing consists of FTTEs for (i) primary curriculum for Years 1-8; (ii) technology education for Years 7-8; (iii) secondary curriculum for Years 9-15; and (iv) curriculum staffing for Years 9-15.

Management staffing represents about 10% of all staffing entitlements for public schools and it is also a roll driven entitlement for schools calculated using year-level weighted rolls. It has two components: (i) a roll generated component, and (ii) a base management staffing (secondary and area schools) or professional leadership staffing (all other schools) component. The increase in school rolls is associated with increases in management staffing entitlements.

Additional *guidance staffing* allocations ranging from 0.08 to 0.45 FTTEs is provided for each year level taught from year 9 to 13. In addition to the above staffing entitlements,

schools get extra funding for expenses related to teachers' additional responsibilities. One example is the staffing allocation for managing special needs students. Teacher salary funding is the main source of revenue for schools and it is clear that the school rolls at each year level and the student-teacher ratio are the main drivers of teacher salary funding for New Zealand schools.

Capital Funding

The Ministry of Education prepares a business case as part of the overall government budget cycle, which sets out the funding programmes required to improve the quality of existing buildings or construction of new buildings or classrooms. State schools set a five-year property plan for upgrading or increasing the capacity of school premises to address health and safety issues, meet growing demand, or modernizing their school. Once the Ministry makes an allocation, schools can draw funds against their five-year property plan by providing invoices to the Ministry. There is also discretionary funding that schools can apply for if unforeseen work is needed to modify buildings to meet the requirements of special needs students, and for replacement or upgrade of buildings. Funds provided to increase the size of the school property portfolio are discretionary funds and are provided on a case by case basis to schools to meet roll growth, new education initiatives, purchase of new sites, etc. Buildings and land of the State schools belong to Government and therefore only State schools are eligible for property funding. Table 5 shows the total property funding allocated to State schools from 2003 to 2009: capital funding to State schools reached NZD 543 million in 2009.

Table 5

Property funding to State schools

Year	2003	2004	2005	2006	2007	2008	2009
Capital funding	315	342	434	405	345	473	543

Source: Ministry of Education (2010b)

Notes: GST exclusive millions of NZD

Since land and school property belong to the Crown and they are counted as assets of the Ministry of Education, property related transactions do not go through the accounts of schools, except for the funding provided to purchase furniture and equipment, or operational funding for maintenance of school property. Capital funding is government

funding, or investment for the benefit of current and future students and it is excluded from the scope of this study.

Other Government Funding

Other than the operational grant and funding for teacher salaries, there several other types of government funding to New Zealand schools. The majority of such funding is in the form of contestable funds, which are for specific government interventions based on applications from schools. For example, they include funding for programmes such as *Enhanced Programme Fund, Extending High Standards Across Schools,* and *Funding for Development of Gifted and Talented Students*. In 2008, for example about 8% of public schools received NZD 12 million through contestable funds. Although in absolute terms this funding represented a very small amount of the funding allocated to schools, this was one of the main funding sources targeted to increase student achievement.

Non-government sources of revenue

Locally raised funds come from parents and the community, and they fall into six broad categories: donations, activities, trading, fundraising, as well as revenues generated from foreign fee paying students and the running of hostels. Overall, around 15% of all school revenues are from locally raised funds. Schools collect donations from parents and caregivers. These donations are sometimes referred as school fees, although legally they are voluntary. “Activity fees” are most common in primary schools, and include the contributions that are requested from parents and caregivers to meet the cost of school camps or field trips. For intermediate and secondary schools there are additional expenses for sports and music activities. There are some areas where schools undertake the purchase of goods for subsequent sale on a semi-commercial basis (trading). Examples include the supply of school uniforms, stationery and school lunches. Schools also engage in a variety of fundraising activities for purposes such as building an adventure playground, funding for equipment such as whiteboards or computers, or raising funds for school camps or field trips, music trips, etc.

Schools also can attract funds through enrolling foreign fee paying (international) students, or running hostels attached to the school. Revenues generated from hostels generally cover the expenditures associated with running them. Also, schools receive a grant for use of

land and buildings from proprietors (for State-Integrated schools) and Ministry of Education (for State schools). These are non-monetary transactions recorded both on revenue (as a grant received) and expenditure sides of school accounts (as a rent paid for using land and buildings). The amount of these funds and their expenditure is not determined by schools, and there is no decision involved in generating this income or allocating the resource. Therefore for the purposes of this study, these transactions have been excluded from both revenue and expenditure of the schools.

To provide an understanding how much schools generate as non-government revenue, Table 6, below, shows average non-government revenue per student (M) and basic variance statistics for primary and secondary public schools in 2008.

Table 6

Per student non-government sources of revenue of public schools in 2008 by school type

	N	M	Minimum	Maximum	SD
Primary schools	1643	702	326	1,575	291
Secondary schools	279	973	343	1,577	330

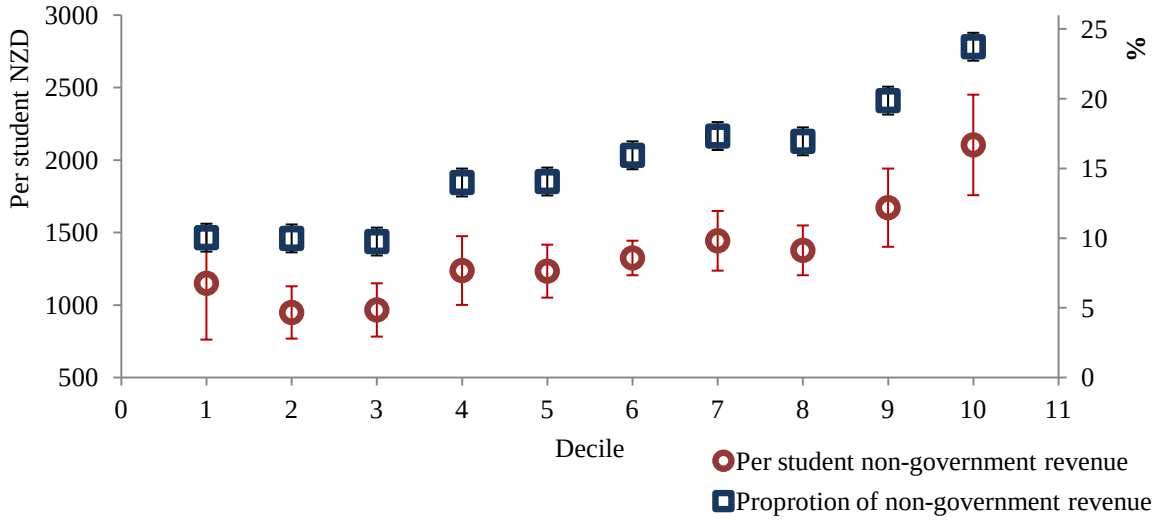
Source: Ministry of Education (2010b).

Notes: This is national sample of all public schools with the 5% of schools with highest or lowest per student funding excluded to present the distribution for mainstream schools only. Excluded schools are mainly rural schools or closing schools. The sample of the population of schools studied is different from the sample included in this Table.

Non-government sources of revenue per student will vary across schools depending on the composition of the student body. It is known that per student donations for secondary students are much higher than for primary students, which are consistent with per student rates of funding being higher for secondary students than for primary. Variations in non-government sources of revenue across schools are also explained by the SES of students that a school draws. Figure 1 shows mean per student non-government revenues and the mean proportion of non-government revenue by school deciles for secondary schools in 2008.

Figure 1

Per student non-government revenues (2008)



Source: Ministry of Education (2010b).

Notes: The sample of the population of schools studied is different from the sample included in this Figure. Vertical bars represent 95% confidence interval for the mean.

It is apparent that both per student revenue and proportions increase as decile ranking of the school goes up. Figure 1 clearly shows that schools can be clustered into low (decile 1 to 3), middle (decile 4-7) and high decile (decile 8-10) groups and also the variance in per student non-government revenues are greater within decile 1 and 10 schools. Schools with a higher number of international students or schools that raised substantial contributions from parents and community (mainly high decile schools) will have a higher per student non-government revenues.

Concluding comments

This section provides background on school resourcing in public schools in New Zealand. The main determinants or drivers of resource allocation from Ministry of Education and the types of non-government revenue sources are reviewed and discussed. To sum up, school rolls at each year level and school decile are the major determinants of operational funding. The main determinants of teacher salaries are student-teacher ratios as well as school rolls at each year level. As school decile increases, per student government funding decreases but locally raised funds from parents and community increases. A clear understanding of what determines the funding is essential in developing a model where the

main factors and drivers of school resources are included or controlled. The following section provides a background on how these resources have been allocated at the school-level.

Financial management

Each school's Board of Trustees is responsible for the school's financial and physical resources and they are publicly accountable for the school's financial governance. They are responsible for the allocation of funds to reflect the school's priorities. Principals are usually delegated to run the day to day financial management of the school, and must ensure that funds are properly spent according to the Board's plan and budget. The purpose of this section is to provide an overall picture of how resources have been allocated at secondary schools in New Zealand. It starts with the overall allocation of resources at the national level and describes the main categories of school expenses. Then it focuses on secondary schools and provides some descriptive analysis of spending patterns across schools of different deciles drawing on an example from school expenditures in 2008. In this section, secondary schools are defined as all public secondary schools in New Zealand. This includes *all* schools, not only schools that provide NCEA qualifications, which is the population of schools included in the analysis.

Main categories of expenditure

New Zealand schools have full discretion to determine spending priorities, except they have limited flexibility to manage teacher salary related expenditures. It is limited because government determines how many FTTEs a school is entitled and transfers funds directly to teachers on behalf of schools. However, there is some room for flexibility, as schools are allowed to hire additional staff if they can afford it. Table 7 below shows the expenditure of public schools by main expenditure categories. Although the proportional distribution of funds will vary from school to school, Table 7 provides a general understanding of how funds are allocated at the sectoral level by main categories of spending.

Table 7

Total spending of schools by category of expenditure for public schools (2008)

	Primary (N = 1992)			Secondary (N = 314)			Other (N = 148)		
	NZD millions	%	NZD per student	NZD millions	%	NZD per student	NZD millions	%	NZD per student
Administration	185	7.4	432	140	6.7	541	37	9.2	1,270
Depreciation	80	3.2	187	63	3.0	243	10	2.5	341
Teacher salaries	1,848	73.7	4,324	1,415	68.0	5,463	269	66.8	9,218
Learning resources	108	4.3	253	164	7.9	633	31	7.6	1,047
Local funds expenditure	98	3.9	230	145	7.0	561	13	3.1	430
Property	187	7.5	438	144	6.9	554	22	5.5	761
Other expenses	2	0.1	5	9	0.4	36	21	5.2	722
Total expenditure	2,509	100.0	5,869	2,081	100.0	8,031	402	100.0	13,790

Source: Ministry of Education (2010b)

Notes: Excludes hostel expenditure and expenditure on use of land and buildings. Amount of NZD are exclusive of GST. This is national sample of all public schools. The sample of the population of schools studied is different from the sample included in this Table. Other schools include composite schools and special schools.

Administrative expenses represent about 7% of total expenditure, the main part of which is the salaries of principals and administrators (see Table 7). This category also includes the expenses of Boards of Trustees and all communication and audit related expenses. Depreciation expenditures comprise about 3% of total school expenditure of both primary and secondary schools. This category includes the depreciation on furniture, equipment, and physical assets of schools; however it does not include depreciation on building and property that belong to proprietors (mainly churches and religious groups), and to the Ministry of Education. Expenditure on teacher salaries is the largest component of schools' expenditure and it represents about 74% and 68% of total schools' expenditure for primary and secondary schools respectively and includes expenses for teacher' aides. Expenditure on learning resources represents 4% and 8% of total school expenditure for primary and secondary schools respectively and includes spending on purchase, repair, and maintenance of learning materials, equipment, as well as spending on extracurricular activities. Expenditure to raise funds comprises about 4% of primary and 7% of total expenditure of secondary schools, and it includes expenses for attracting international students, trading and fundraising activities. School property related expenses constitute about 6% of all expenses. These include the salaries of cleaners and caretakers, and

expenses related to the upkeep of school sites such as grounds, repairs and maintenance, heating, lighting and water expenses. There are unclassified school expenditures that do not fit into the above expenditure categories and these are classified as 'other expenses'; on an aggregate level they represent less than 1% of total expenditure. Given current reporting requirements, this expenditure category cannot be broken down further.

The proportional allocation of funds reveals more about the spending needs and priorities of the schools than per student expenditure, which provides approximate absolute dollar amounts spent on each specific category. In order to interpret trends in resource allocation at secondary schools across deciles, presented in the following sections of this chapter, it is important to know the number of schools and average school size in each decile. This information is presented in the Table 8 below. It should be noted that the number of schools in each school decile is not equal to 10 percent of all secondary schools. The government decile system assigns 10% of all 2400 primary, intermediate, and secondary schools to each decile and consequently the distribution is distorted within the secondary sector.

Table 8

Number of public secondary schools by deciles

School decile	Number of schools	Percentage	Average school rolls
Decile 1	19	6%	582
Decile 2	29	9%	624
Decile 3	32	10%	525
Decile 4	33	11%	788
Decile 5	38	12%	808
Decile 6	43	14%	851
Decile 7	31	10%	851
Decile 8	36	12%	1,044
Decile 9	33	11%	988
Decile 10	19	6%	1,225
Total	313	100%	828

Source: Ministry of Education (2010b)

According to Table 8, only about 6% of all New Zealand public secondary schools are designated decile 1 schools and 6% decile 10 schools. In terms of size, decile 1 to 3 schools are relatively small schools, with 500 to 600 students on average, compared to

decile 4 to 7 schools with 800 to 850 students and decile 8 to 10 schools with 1,000 to 1,200 students, on average. It should be also noted that average school rolls presented in Table 8 are only average rolls for each decile and within decile groups the school size can vary substantially.

The following sections review expenditure per student and proportional allocation of funds at secondary schools nationwide, which reveals some differences in spending across secondary schools of different deciles.

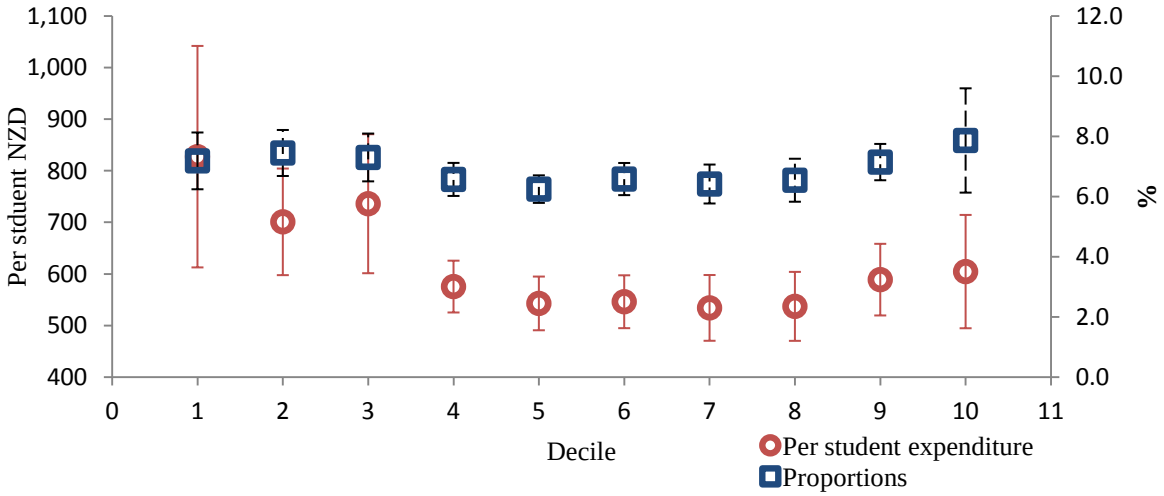
Resource Management in Secondary Schools

Expenditure on administration

Allocation of resources to recruit and retain experienced and qualified principals to deal with low achievement, retention and attendance explains why some schools allocate proportionally more funds to administration. Another reason some secondary schools have high administration expenses could be to deal with a wider range of subjects or extracurricular activities offered at the school. Figure 2 shows the average per student expenditure and average proportion of administration expenditure with 95% confidence intervals.

Figure 2

Per student expenditure on administration and proportions of expenditure on administration for public secondary schools by school deciles (2008)



Source: Ministry of Education (2010b)

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean.

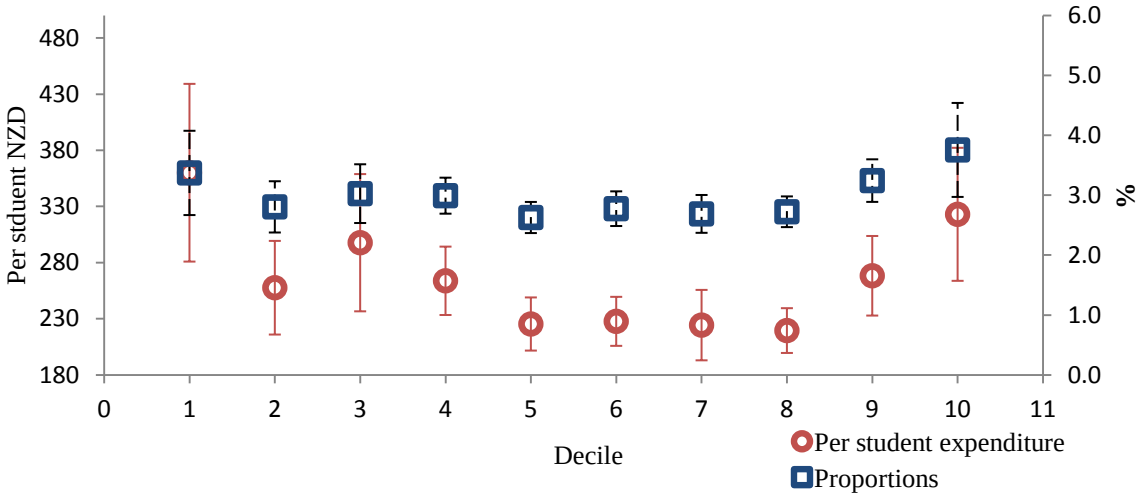
It appears from Figure 2 that the proportion of funds allocated to administration vary slightly across secondary school of different deciles with average proportions varying between 6% to 8%, although decile 1 to 3 and decile 8 to 10 schools tend to allocate slightly more on administration than decile 4 to 7 schools. It is apparent that in per student terms, the variations in per student expenditure on administration are large within decile 1 to 3 and decile 10 schools (see Figure 2). These large variations are partially explained by the low number of secondary schools in these deciles, especially decile 1 and 10 schools (see Table 8). Figure 2 also shows that decile 1 to 3 secondary schools have higher per student spending power and, proportionally, allocate a bigger share of total resources to administration despite being smaller schools. The proportion of resources allocated on administration at decile 1 schools is substantially higher than decile 10 schools, which approximately spend same amount of resources in per student terms.

Expenditure on depreciation

The proportion of expenses on depreciation depends on the fixed asset portfolio of the school and on the historical value of the assets. Larger, more established schools have more tangible assets and hence have higher depreciation expenses. Schools that invested substantial amounts on Information Technology (IT) will also have higher depreciation expenditure per student as computers and IT equipment are not only expensive but also have relatively higher depreciation rates compared to other fixed assets. Figure 3 presents average per student expenditure and proportion of expenditure on depreciation by school deciles.

Figure 3

Per student expenditure on depreciation and proportions of expenditure on depreciation for public secondary schools by school deciles (2008).



Source: Ministry of Education (2010b).

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean.

Figure 3 show that approximately 3% to 4% of total expenditure in secondary schools is allocated to depreciation, although there are wide variances across schools within the same decile. It seems that depreciation expenditure is proportionally slightly higher in decile 1, 9 and 10 schools. The trend in per student expenditure on depreciation across school deciles follows the trend in proportional allocation on this expenditure category, although there are wide variations in the average per student amount within low and high decile schools, which are explained by the low number of decile 1 and 10 schools. Such trends suggest that overall schools have similar fixed asset portfolios, as shown by the similar proportion of resources allocated to depreciation but vary in terms of school size and number of students enrolled in these schools.

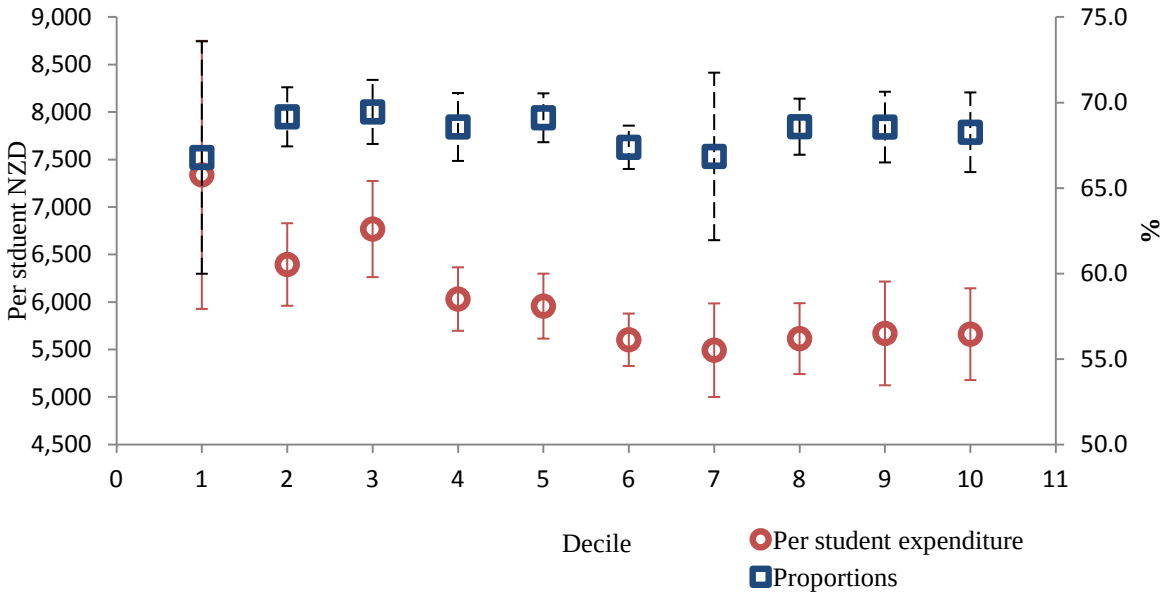
Expenditure on teachers

The variance in teacher salaries needs to be discussed in relation to the composition of the student body of the school and student-teacher ratio. Teacher salaries per student can be very high at small rural schools where there may be one full time teacher per 3 to 5 students. The teacher-student ratio is also relatively high for early years of primary schooling and for the last few years of secondary schooling. Schools that recruit more qualified or experienced teachers and tend to have higher expenditure on teachers. In the

case of rural schools that usually have problems retaining qualified and experienced teachers, the Boards of Trustees can provide teachers with an additional allowance subsidising the time and cost associated with travel. All the above can contribute to the variances in per student teacher salaries across schools. The proportional distribution of total expenditure of schools on teacher salaries for secondary schools in New Zealand is presented in Figure 4.

Figure 4

Secondary schools' expenditure on teacher salaries by school deciles (2008)



Source: Ministry of Education (2010b).

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean

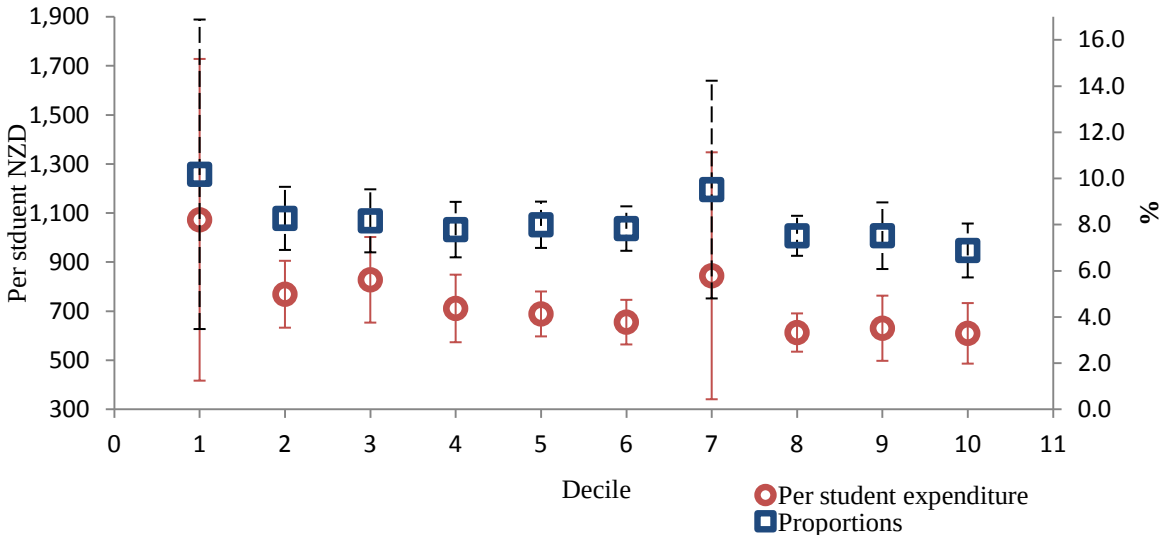
Figure 4 shows that on average, secondary schools allocate relatively the same percentage of their resources to teacher salaries regardless of school decile. This is mainly because the student-teacher ratio is kept at the same level across schools, although some schools can hire more teachers if they have sufficient funds raised from non-government sources.
In per student terms, it is apparent that low decile schools tend to spend more on teacher salaries than medium and high decile schools and, in particular, there are large variances in the average per student expenditure within decile 1 schools. Some of this variation is partially explained by small rural schools and the low number of schools, especially in decile 1.

Expenditure on learning resources

The proportion of expenditure allocated for learning materials by school deciles is presented in Figure 5. On average, secondary schools allocate about 8% of total expenditure to learning resources, about NZD 600 to NZD 800 per student each year.

Figure 5

Secondary schools' expenditure on learning resources by school deciles (2008)



Source: Ministry of Education (2010b)

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean

There are some large variations within secondary schools in terms of per student dollars allocated to learning resources, especially decile 1 to 3 schools. Decile 1 to 3 schools have relatively higher per student expenses on learning than other decile schools. Some this variance, especially for decile 1 schools, is explained by low number of schools in this group. However, it seems that in terms of proportions of funds spent on this expenditure category the variations across schools of the same decile are comparable with exception of decile 1 and 7 schools that spend higher proportion of their resources on learning (see Figure 5).

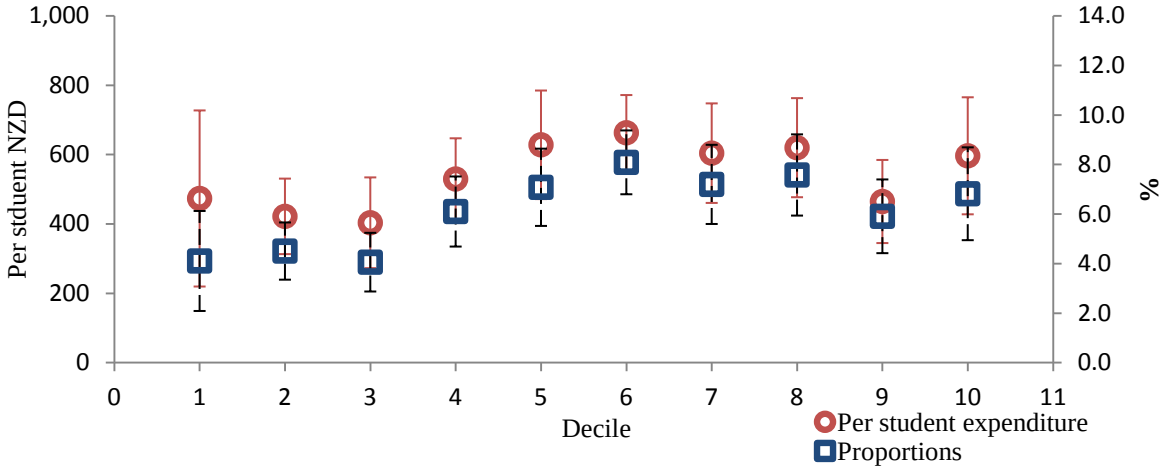
Expenditure on locally raised funds

Variances in school expenses for raising funds locally — in per student terms — can also be high at schools that draw students from higher socio-economic backgrounds, or who proactively engage in international student enrolments. Usually once a year schools

organize a school fair, where they raise funds from the community and from parents, although organising such activities has some cost. Average percentages of expenses to raise local funds as a proportion of total school expenditures are presented in Figure 6.

Figure 6

Secondary schools' expenditure on raising local funds by school deciles (2008)



Source: Ministry of Education (2010b)

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean

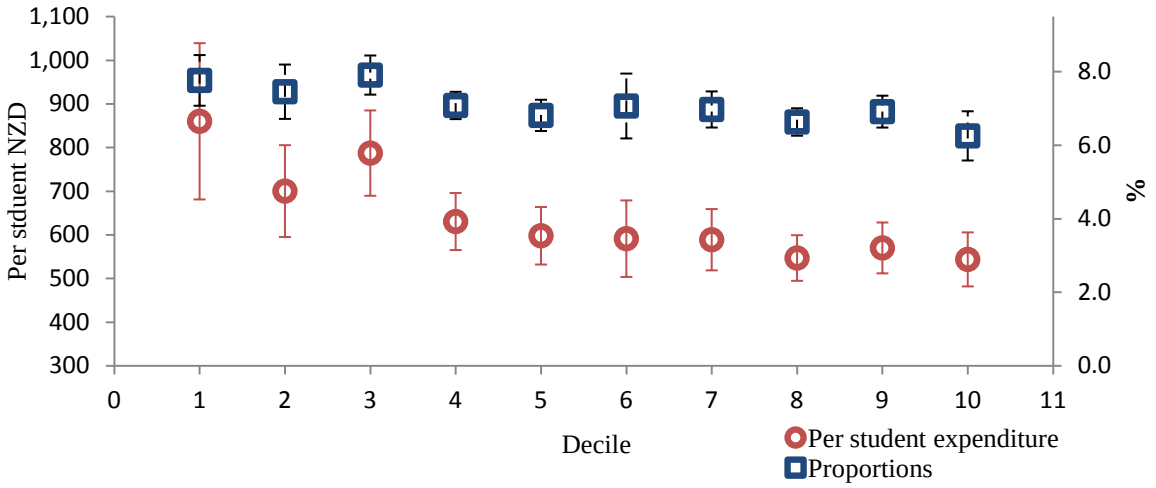
The wide range of confidence bars suggest that the percentage of spending on locally raised funds varies across schools of the same decile. Some schools may be more proactive in fundraising to compensate for the lower funding received from the government, or they may take a more proactive approach to attracting international students, which could involve expensive overseas travel. Figure 6 suggests that this might be the case for decile 4 to 10 schools. Altogether this possibly explains their relatively high percentage of spending on locally raised funds both in terms of proportion of total expenditure but also in per student expenditure.

Expenditure on property maintenance

Proportion and per student expenditure on property by school deciles is presented in Figure 7. Overall, regardless of decile, schools spend approximately about 7% of their total expenditure on property maintenance, although a slight downward trend can be seen with an increase in school decile (see Figure 7).

Figure 7

Average proportion of expenditure on property maintenance by school deciles (2008)



Source: Ministry of Education (2010b)

Note: Per student expenditure is exclusive of GST. Vertical bars represent 95% confidence interval for the mean

Per student expenditure follows a similar trend across deciles, with the exception of low decile schools. Decile 1 to 3 schools spend more funds per student on property than decile 4 to 10 schools, but great variation also exists in the decile 1-3 category. This variance is mainly explained by the relatively lower number of schools in these deciles.

Concluding comments

This chapter provided a background to resource allocation in schools, the main categories of expenditure, and the variations across and within secondary schools of the same deciles. Based on the descriptive analysis provided in this chapter, it is apparent that there are some variations in per student expenditure and financial management across schools of different deciles. It is important to note that the analysis above is descriptive analysis based on aggregated statistics on schools. The regression results of the models developed in this study would reveal whether there are statistically significant associations between school financial resources and student outcomes when range of moderator variables is controlled. It is possible that some variations across school of different decile observed above would disappear once model controls for moderator variables.

To answer the research questions of this study and to detect any of associations between student educational outcomes and school resource and financial management factors, the analysed schools were grouped into three decile groups (i.e., 'high', 'medium' and 'low'). Statistical analyses were run within each decile grouping. Based on the graphs presented in this chapter, it is apparent that schools in deciles 1, 2 and 3 are similar and can be grouped together as the low group. There are also obvious similarities in terms of per student expenditure and proportion in different expenditure categories between decile 9 and 10 schools (i.e., high) and schools in deciles 4 to 7 (i.e., medium). However, decile 8 schools appear to be borderline cases in that they share some characteristics with both the medium and high groups.

There are three main reasons for putting decile 8 schools in the high group. Firstly, the number of schools in the high group, based on deciles 8 to 10 (n=88), is relatively comparable to the number of schools at in the low group (n=80) (see Table 8). This means that any analyses of differences between the low and high groups will be based on relatively comparable sized groupings. Secondly, the grouping of schools into these three decile groups (i.e., low=1-3; medium=4-7; high=8-10) is commonly used by the Ministry of Education in its reporting on financial performance of schools (Ministry of Education, 2008a, 2009a). Most importantly, the descriptive analysis at aggregate level presented in this chapter shows that the relationship between student achievement, which increases with decile ranking, may not have a linear relationship with school resource variables, which is not necessarily showing a linear trend with increases in school decile ranking. It is also apparent that some graphs presented in this section present a "U" shape and show large variances at low and high decile schools.

Grouping schools into three bands will assist with improving the model performance. An increased number of schools analysed in each model creates a greater variance within each decile band. Such models will be more suitable in this study compared to models either developed for each decile or combined models for all schools. Hence, it seems defensible to proceed with comparisons based on these groupings, notwithstanding the ambiguity surrounding the 36 schools in decile 8.

CHAPTER FOUR: NATIONAL CERTIFICATE OF EDUCATIONAL ACHIEVEMENT

The National Certificate of Educational Achievement (NCEA) is the official secondary school qualification in New Zealand, and students study towards achieving NCEA qualifications in the final three years of their secondary schooling-years 11 to 13 (Crooks, 2010). This chapter provides a background to NCEA by mentioning the history of the introduction of NCEA in New Zealand, providing understanding of the main concepts behind NCEA, and by presenting some key indicators of students' achievement on NCEA at the national level.

The Introduction of NCEA in New Zealand

From early 1990s the move to assess students against criteria rather than rank students against one another was starting to become widespread and grow in New Zealand (Dobric, 2006; Ministry of Education, 1990, 1994; Peddie, 1992). Such a move was influenced by a strong desire to move from rank-order derived total percentage scores, that didn't tell much about competences of students, to a more descriptive criterion and standards-referenced approach to qualifications, similar to the changes introduced by neighbouring Australia (New South Wales and Western Australia) (Strachan, 2001). The introduction of new standards-based assessment was intended to reject social discrimination biases, ranking, and selection approaches, and move to assessment against standards rather than cohort-based ranking, thus meet the needs of a broader range of students. Towards the end of the decade, the design for a National Certificate of Educational Achievement (NCEA) emerged. NCEA Levels 1, 2, and 3 replaced respectively, the older qualifications School Certificate (SC), Sixth Form Certificate (SFC), and University Bursaries (UB). School Certificate and University Bursaries were predominantly examination-based qualifications, while Sixth Form Certificate was internally (school-based) assessed. NCEA was subsequently implemented in stages. In 2002 NCEA Level 1 was introduced at Year 11 (the first year of upper secondary education), NCEA Level 2 at Year 12, in 2003, and in 2004 Level 3 and Scholarship were introduced in the final year of secondary schooling, Year 13.

The basics concepts of the NCEA

Most students take NCEA Level 1 standards in Year 11, Level 2 standards in Year 12, and Level 3 standards and above in Year 13. There are two types of standards in use for assessment of learning — achievement standards and unit standards. All schools have their own curriculum that outlines their teaching and learning programme. The school's curriculum is a part of the national curriculum framework and achievement standards align to this. Unit standards, on the other hand, are not usually related directly to the New Zealand curriculum and tend to be used more in workplace-related subjects such as hospitality, tourism, and engineering (Ministry of Education, 2009b). Each standard has its own value or credit. Credits are assigned to the standards by New Zealand Qualification Authority (NZQA) depending on the difficulty and the estimated time involved in passing the standard; each standard falls into subjects, fields, domains, and learning areas. Achievement standards can be internally or externally assessed and they specify three levels of achievement: achieved, achieved with merit, and achieved with excellence. Unit standards are usually a forerunner to achievement standards, and they are competency-based, specifying the standard of a pass/fail level only. When NCEA was first implemented student failure on unit standards did not require reporting and only from 2008 have schools reported fully on student achievement on unit standards.

In order to attain NCEA Level 1 students are required to gain a total of at least 80 credits at any level (Level 1, 2, or even 3) including 8 credits in literacy (reading and writing) and 8 in numeracy (maths). To attain NCEA Level 2, a total of 60 additional credits are required at Level 2 or above, plus 20 credits from any other level. To gain the NCEA Level 3 qualification, students are required to gain another 60 credits at Level 3 or above, and have 20 credits from Level 2 and above (New Zealand Qualification Authority, 2009a).

Since its introduction, NCEA has been criticised for negatively affecting the motivation of well performing students and it has been seen as credit collection assessment system that does not place sufficient emphasis on quality (Meyer, McClure, Walkey, & Weir, 2006; Meyer, Weir, McClure, Walkey, & McKenzie, 2009; Moeed & Hall, 2011; Taylor, 2008). Since the introduction of endorsements in 2009, however, it seems such criticism has largely disappeared.

NCEA achievements at the National Level

To bring a quality measure to NCEA, an endorsement system was introduced in 2007. To get an endorsement with Excellence, students have to earn 50 credits with excellence results, and to be endorsed with Merit, students have to gain 50 credits in total with either excellence or merit results(New Zealand Qualification Authority, 2011).

Table 9 shows the number of students on the 2009 July roll return, and their attainment by the end of the year. For example, NZQA reported that in 2009 about 65% of students in Year 11 achieved NCEA Level 1, of which, about 8% of students achieved the qualification with an excellence endorsement, and 27% of students with a merit endorsement.

Table 9

Number of students and qualifications attained under New Zealand Qualification Framework (NZQF) in 2009

	Year 11	Year 12	Year 13
No. of students on 1 July Roll	62,140	54,101	42,523
No. of candidates achieving NQF qualifications			
Level 1	40,273	45,816	38,048
Level 2	1,042	36,785	37,054
Level 3	113	456	23,089
No. of candidates achieving NCEA qualifications			
NCEA Level 1	40,016	45,400	37,596
Achieved with Excellence	3,158	2,790	2,536
Achieved with Merit	10,754	10,725	10,592
No Endorsement	26,104	31,885	24,468
NCEA Level 2	949	36,103	35,828
Achieved with Excellence	38	2,078	1,645
Achieved with Merit	139	6,977	6,465
No Endorsement	772	27,048	27,718
NCEA Level 3	106	409	22,743
Achieved with Excellence	4	22	1,189
Achieved with Merit	5	75	4,781
No Endorsement	97	312	16,773

Source: New Zealand Qualification Authority (2009a).

Table 10 below shows the average pass rate (M) on standards by their type and assessment for 2008 and 2009. These years included failure reporting on internally assessed unit

standards; therefore, they represent the complete picture of success across standards. Scholarship standards are the most challenging and the pass rate for these standards nationally is the lowest. According to Table 10 the average pass rate for Scholarship standards is around 22%. The pass rate for externally assessed achievement standards is around 69% to 70%. It seems that the pass rate on achievement standards that are internally assessed is much higher than for externally assessed achievement standards (85% to 86% pass rate on internally assessed versus 69% to 70% on externally assessed standards). Table 10 shows that, on average, only 5% of those who took unit standards failed.

Table 10

Pass rate on NCEA standards by standard and assessment type

Year	Standard type	Assessment type	Number of standards	M	Median	SD
2008	Achievement standards	External	341	69%	68%	14%
		Internal	626	80%	83%	16%
	Scholarship standards	External	28	22%	22%	6%
	Unit standards	Internal	5,651	85%	96%	20%
2009	Achievement standards	External	344	70%	69%	12%
		Internal	611	81%	83%	17%
	Scholarship standards	External	33	22%	22%	7%
	Unit standards	Internal	5,701	86%	95%	19%

Source: Ministry of Education (2010b)

Notes: Results of students that are not available, absent and not attempted are excluded.

Table 11 presents the proportional distribution of results (marks) of students by standard and assessment type for years 2008 and 2009. Only 23% of scholarship standards attempted result in a pass, of which just less than 3% gained “Outstanding” marks. Around 7% of externally achieved achievement standards turn out with an ‘excellence’ endorsement compared to 15% to 16% on internally assessed achievement standards. In contrast to externally assessed standards, internally assessed standards are designed for easier achievement of pass or excellence grades. Some students can collect credits by choosing internally assessed standards, and these could be easier to achieve and collect than the same credits completed by another student who chose externally assessed achievement standards.

Table 11

The proportional distribution of students' results on NCEA for years 2008 and 2009

Year	Standard type	Assessment type	Excellence (%)	Merit (%)	Achieved (%)	Not achieved (%)	Outstanding scholarship pass (%)	Scholarship pass (%)	Total (%)
2008	Achievement	External	7.1	19.6	42.2	31.1	Na	na	100
		Internal	15.3	24.2	39.4	21.1	Na	na	100
	Scholarship	External				76.7	2.8	20.5	100
	Unit	Internal	0.0	0.0	74.7	25.2	Na	na	100
2009	Achievement	External	7.6	20.3	41.6	30.5	Na	na	100
		Internal	15.9	24.1	38.7	21.2	Na	na	100
	Scholarship	External	na	na	na	76.6	2.8	20.7	100
	Unit	Internal	0.0	0.0	75.0	25.0	Na	na	100

Source: Ministry of Education (2010b)

Choosing the right standards is critical when it comes to choosing a pathway at the end of secondary schooling. Some standards are identified by the New Zealand Qualification Authority, the New Zealand Universities Vice Chancellors Committee, and the Ministry of Education as belonging to "university approved subjects". Table 12 below shows the number of "university approved" and "university not approved" standards within the New Zealand Qualification Framework (NQF) for NQF Level 1, Level 2, and Level 3 (this corresponds to NCEA Level 1, Level 2, and Level 3 respectively).

Table 12

University approved and university not approved standards within NQF (2010)

NQF Level	Standard type	Assessment type	Not Approved	Approved	Number of standards	% of standards Approved
1	Achievement	External	332	-	332	0%
		Internal	312	-	312	0%
	Unit	Internal	3,378	-	3,378	0%
2	Achievement	External	267	-	267	0%
		Internal	299	-	299	0%
	Unit	Internal	11,770	-	11,770	0%
3	Achievement	External	8	254	262	97%
		Internal	13	246	259	95%
	Scholarship	External	17	133	150	89%
	Unit	Internal	18,697	1,051	19,748	5%

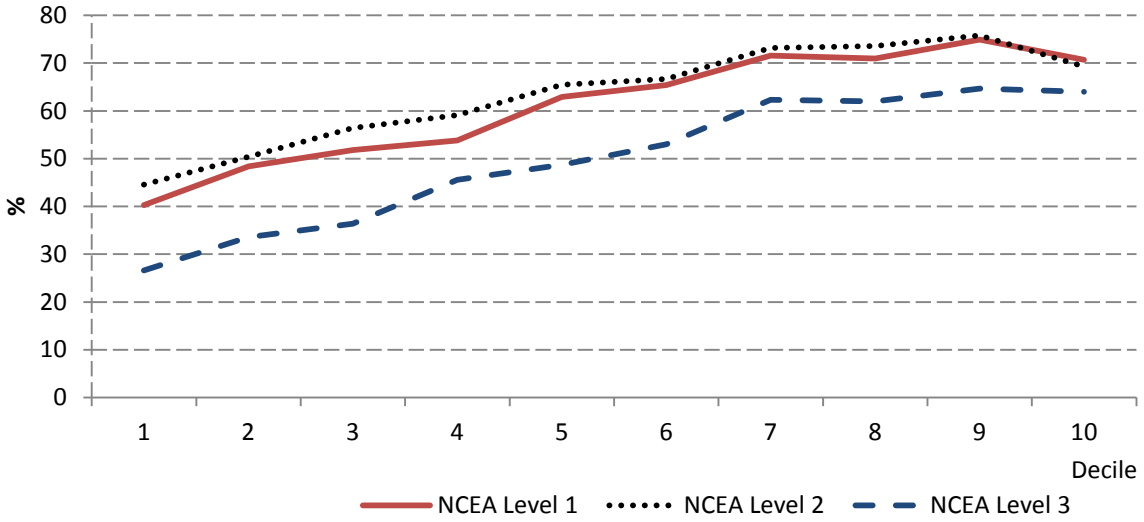
Source: Ministry of Education (2010b)

The Ministry of Education reports that about 39% of school leavers in 2008 left school qualified with University Entrance (UE) standard. In order to qualify for basic entrance to a New Zealand university students need to meet three conditions: (i) have at least 42 credits on NCEA Level 3 or higher, including a minimum of 14 credits in each of two subjects from the "approved subjects" list and gain a further 14 credits from not more than two additional domains on the National Qualifications Framework or "approved subjects"; (ii) have 8 credits in English or Te Reo Māori at Level 2 or higher, of which 4 credits must be in reading, and 4 in writing; and (iii) have at least 14 credits in maths or statistics and probability at Level 1 or higher (New Zealand Qualification Authority, 2009a, 2009b). However, university admission requirements differ from university to university, and within universities, the requirements differ across faculties.

Figure 8 presents the proportion of the national cohort of Year 11, 12, and 13 students who achieved NCEA Level 1, 2, and 3 qualifications in 2008. Disparities in the attainment of NCEA qualifications across deciles are striking; only 27% of Year 13 students from low deciles achieved NCEA Level 3 qualifications compared with 64% from decile 10 schools. The achievement gap was wider at the bottom of the decile scale and narrowed from decile 7 to 10.

Figure 8

Attainment of expected NCEA qualifications in 2008 by school deciles.



Source: Ministry of Education (2012a)

There are many studies and unpublished material showing trends across deciles for the NCEA (Ministry of Education, 2007; Ministry of Education, 2008b, New Zealand Qualification Authority, 2013). Variability across deciles is shown in this study (see for example Figure 8). Since the data utilized in this study is administrative data on student achievement for entire NCEA cohort, it also has been done here by decile groupings (see Tables 15 to 17, Chapter 6).

It can be a challenge for schools to provide a sufficient variety of subjects to meet the needs of their students and at the same time balance the cost of offering more subjects, in terms of more instructors' time as well as material and physical resources. For students and parents, understanding how NCEA works, what it can offer, and the selection of the right

set of standards throughout secondary schooling is essential. In some cases choosing the school that offers the right curriculum is also critical.

CHAPTER FIVE: METHODOLOGY

The aim of the study is to assess the impact of school resources and financial management on student achievement. Based on the evidence from the literature and findings from the reviewed studies a model is developed that estimates both the impact of the overall level of resources and financial management indicators on student achievement. This chapter describes the methodology devised to achieve this objective by presenting the populations studied and providing a description of the datasets utilised. The main section in this chapter provides a description of variables and model specifications.

Populations Studied

This longitudinal study focused on a cohort of Year 11 students who started upper secondary education in 2006 at State and State-Integrated mainstream secondary schools in New Zealand offering NCEA qualifications. Using information about the schools concerned, student achievement data was linked to school profile and financial information. Students were followed through their second and third years' of upper secondary education (2007 and 2008). In New Zealand, compulsory attendance stops when students reach 16 years of age (this falls in Year 11 for most of the students). From Year 11, therefore, the cohort size reduces as students leave school; thus, the population of students who continued to Years 12 and 13 is different from the original cohort of Year 11 students.

Some schools have been excluded from the scope of this study due to data limitations. In addition, students who attended schools where there was an option of choosing an alternative assessment system (i.e., Cambridge International Examination and the International Baccalaureate) were excluded. The population of students was limited to only students who attended State and State-Integrated schools because of the unavailability of financial data for private schools. This means that those students of the original cohort who later joined private schools in Years 12 or 13, as well as students who joined the cohort after 2007, have been excluded. The financial data analysis is limited to 2007 and 2008, the second and third year of NCEA for students of this cohort. This means that 2006, the first year of NCEA for the studied cohort, has been excluded from analysis.

When the aforementioned schools and students are excluded, the analysed population of students included students who continued to their second year (N = 33,218) and third year (N = 25,393) of NCEA. Table 13 presents the number of students and schools included in the analysis aggregated by school decile groups. Low decile schools included schools with decile rankings 1 to 3, medium and high decile schools included schools with decile rankings 4 to 7, and 8 to 10, respectively. For practicality and policy application such decile grouping is commonly used by government in reporting on financial performance of New Zealand schools (Ministry of Education, 2008, 2009a).

Table 13

The population of students and schools included in the analysis

	2007		2008	
	Students	Schools	Students	Schools
Low decile schools	4,947	59	4,270	64
Medium decile schools	17,778	135	12,005	129
High decile schools	10,493	64	9,118	66
Total	33,218	258	25,393	259

From the second to the third year of NCEA, the number of students in the studied cohort who were at low decile schools reduced by 14%, by 32% at medium decile schools, and by 13% at high decile schools. The analysis was limited to the effects of school resources on achievements of students who continued and remained in the education system. From year to year, there is constant movement of students; some students leave the education system, those who remain may move from public schools to private schools, or change from one public school to another. Student drop out (including migration) and intra-school movements are the reasons for change in the population of schools analysed in years 2007 and 2008 (see Table 13). In addition, changes in the population of schools affects the number of schools included in this study as schools close, new schools open and others merge. Fewer than 1% of public secondary schools have been restructured in 2007 and 2008 (Ministry of Education, 2013c). School restructures happen at the end of the academic and financial reporting year, hence such movement would not affect our analysis, even if the number of restructured schools were large.

The following sections of this chapter describe the datasets utilised and the variables included in the models, their basic distribution statistics, and the decisions made to deal with data limitations.

Description of Datasets

All data used in this study were obtained from the Education Information and Analysis Division of the Ministry of Education, with permission to use the data for research purposes granted by the Senior Manager of this division. The dataset did not contain student names and their National Student Number had been made anonymous.

There are two main data sources: first, national datasets on NCEA results from 2006 to 2008, and second, the corresponding financial information for schools. The NCEA national dataset contained student background information, such as gender, ethnicity, student type (a variable that helped to identify local students from foreign fee paying students) and student addresses. There was no missing data reported by agency on demographic characteristics of students and their addresses.

The NCEA datasets also contained students' performance data on each standard, which allowed construction of student-level achievement variables. The records were excluded when students did not attempt the standard or were absent and excluded where results were not available. Not attempting a standard and absence were treated as failure. The records where students did not attempt a standard or were absent represented 6% of all national records in 2008, and records with no results comprised about 1% of all national records in 2008. It is acknowledged that exclusion of these records would have an impact on the number of credits students gained (one of the outcome variables measured) in the year, but it was assumed that the impact of this decision would not influence the findings of this study.

School profile information such as school authority, decile and gender type is based on the snapshot taken on 1st of July in each given year. School authority and gender type were used in the models. The quality of school profile information was excellent and there was no missing data. The decile of the schools was used to split the population of students into

three subgroups by decile of the school they attended: low (1 to 3 decile schools), medium (4 to 7 decile schools), and high (8 to 10 decile schools).

Schools' financial information contained summarized audited financial accounts of State and State-Integrated schools. Although the quality of data was good, with no missing data, there were some data limitations. Financial information on schools for 2006 was not comparable with the other years because in 2007 the Ministry of Education adopted International Financial Reporting Standards for schools. As a result, the classification of school revenues and expenditures changed substantially from 2007 onwards making the revenue and expenditure categories for 2006 incomparable with revenue and expenditure categories for 2007 and 2008. This justifies the decision to limit the current study to 2007 and 2008, the second and third year of NCEA for this cohort of students.

The Variables

The purpose of this section is to discuss how dependent and independent variables included in the models were devised. It starts with discussion of outcome variables, followed by main resourcing variables, and student and school-level moderator variables.

Outcome variables

There are two outcome variables for students: (i) credits gained in a year, and (ii) attainment of NCEA qualifications. In calculating the total credits gained by students during the year, all credits gained by students are summed. As previously explained, the majority of students aim to attain NCEA Level 1 in the first year of NCEA, Level 2 in the second and Level 3 in the third year of NCEA. From a policy perspective it is desirable that students who aim to follow an academic track complete upper secondary education in three years and leave upper secondary education having attained NCEA Level 3. Therefore, in this study it is expected that students gain NCEA Level 2 by the end of second year of NCEA (i.e., 2007), and NCEA Level 3 by the end of third year of NCEA (i.e. 2008). The dependent variables are binary variables and take the value of 1 in 2007 if students achieved NCEA Level 2 or above by the end of 2007, the value of 1 if students achieved NCEA Level 3 by the end of 2008, and zero for students who were not able to meet these requirements. About 70% of all students in the second year of NCEA achieved

NCEA Level 2 and about 58% of all students who studied in third year of NCEA achieved NCEA Level 3 qualification in that year. More detailed descriptive analysis and distribution of outcome variables will be discussed in the following chapter.

Resourcing and financial management variables

For each school in a given year, per student total revenue and expenditure has been calculated. Per student revenue and expenditure have not been adjusted for inflation because of the short term (two years) follow up timeframe. If the follow up timeframe was three or more years, it would be appropriate to adjust for inflation. It should be also noted that the impact of inflation would affect all schools equally and given the inflation rate increase from 2007 to 2008 was less than 3%, the magnitude of inflation effect on student achievement is likely to be negligible.

For the purposes of this study, these form the school resourcing variables in order to distinguish them from the financial management variables. These variables measure the overall level of resources generated in per student terms, and the overall level of resources spent per student. Using disaggregated information on the components of revenue and expenditure, the proportion of each revenue or expenditure component to total revenue or total expenditure was calculated. These are called the financial management variables. All school financial management variables are expressed as percentages.

As a result, there are five variables of financial management variables on the revenue side:

(i) the proportion of operational grant,
(ii) the proportion of teacher salaries,
(iii) the proportion of other government grants,
(iv) the proportion of locally raised revenues, and
(v) the proportion of other revenues.

Similarly, the main components of school expenditure as a proportion of total school expenditure have been calculated. School financial management variables on the expenditure side include the following variables:

(i) the proportion of expenditure on administration,
(ii) the proportion of expenditure on teacher salaries,

(iii) the proportion of depreciation expenditure,
(iv) the proportion of expenditure on learning resources,
(v) the proportion of expenditure on locally raised funds,
(vi) the proportion of expenditure on property, and
(vii) the proportion of expenditure on other expenses.

For the purposes of this study, revenues and expenditures associated with hostels and use of land and buildings were excluded. Only a few schools have hostels, and the financial resources of hostels are usually kept separate from the rest of school financial resources. Financial transactions related to use of land and buildings are non-cash, accrual transactions and the amount depends on the value, size, and condition of the land and school buildings. Schools do not have any influence over the amount of revenue from use of land and buildings and since they are non-cash transactions they also have no power to reallocate them.

Student-level independent variables

The variables that describe the demographic characteristics of students are gender; ethnicity; the residence status of students, or identifier of foreign or domestic student status; and students' SES. Student demographic information reported to NZQA in the first year of upper secondary education (2006) was used to determine these student characteristics.

The gender variable took the value of 1 for female and 0 for male students: the reference group is male students. Based on ethnicity variables, five ethnic groups have been identified. These are: New Zealand European (NZ European), Asian, Māori, Pacific and Other ethnic groups[5]. The reference group is NZ European, and dummy variables for Asian, Māori, Pacific, and Other ethnic groups have been created, where it took value 1 if students belong to that particular ethnic group and zero if they did not.

The variable of student SES requires a more detailed explanation. Using a geographical mapping application, student addresses were linked to meshblocks. The meshblock is the

[5] Ethnic group other than NZ European Asian, Māori or Pacific

smallest geographic unit for which statistical data is collected (approximately 50 households in each meshblock) and processed by Statistics New Zealand. An aggregated index of deprivation is calculated for each meshblock following every census (2006 was a census year). Called the New Zealand Deprivation index (NZDep), it reflects the following dimensions: income, home ownership, single parent family or not, employment, adult qualifications, living space, communication and transport. The scale of the NZDep index ranges from 1 to 10, with 10 being the most deprived (Salmond, Crampton, & Atkinson, 2007).

The addresses of students in 2006 were geocoded and, in cases where students' addresses were not successfully linked to meshblocks, addresses provided subsequently in 2007 and 2008 were used as substitutes. The NZ deprivation index was reverse scored to the variable of SES ranging from 1 to 10, where 1 is the most deprived. This has been done to make interpretation of findings easier. After geocoding, about 4% of addresses were missing, mainly because students had provided Post Office Box addresses for correspondence. These missing values were computed using a method where the students' ethnicity and territorial authority of the attended school were determinants of SES. The regression equation is presented in Equation 1 below.

Equation 1
The regression equation used to estimate missing values for SES of students.

$$Y = a + b_1X_1 + b_2X_2 + e$$

Where, dependent variable Y is a categorical variable of SES, a is a constant, X1 and X2 are categorical variables for ethnicity of the student and territorial authority, B1 and B2 are respective coefficients for X1 and X2 and e is the standard error of the estimate.

Māori and Pacific students represent the majority of students from low socio-economic backgrounds; the proportion of students from these ethnic groups among higher socio-economic groups is relatively small. For example in 2007, about two thirds (66%) of students from the lowest SES groups were Māori (33%) and Pacific (36%); conversely, only about 8% of students from highest SES group were Māori and Pacific students. There

is an overlap between ethnicity and SES and including these variables in the model could create a problem with multicolleniarity. One of the ways to test whether or not these variables are creating a multicollinearity problem is to check that the Variance Inflation Factor (VIF) (O'Brien, 2007) is less than 6. In all regression models tested here, the VIF was less than 6, which indicated that inclusion of both of these variables in the model does not cause a serious multicollinearity issue.

The identifier for domestic student versus foreign student was derived from the student type variable from roll return (annual school census) information. Exchange students, foreign fee paying students, and the children of overseas students studying in the tertiary institutions in New Zealand and funded through the Ministry of Foreign Affairs and Trade are all considered foreign students for the purposes of this study.

School moderator variables

There are two school-level moderator variables: these are school authority, and the gender type of the school. State schools take the value of 1, and State-Integrated schools are coded 0. Gender type refers to whether schools are co-educational or single-sex boys or girls schools. The reference group is co-educational schools and the dummy variables are created for girls-only and boys-only schools. These dummy variables take the value 1 when students attend single-sex schools, and 0 if they did not.

Specifications of the models tested

This section presents the models developed to answer the research questions in this study. Studied populations have been grouped into three decile groups (low, medium, and high). Within each decile group, for the two outcome variables measured for students, twelve models are tested. The same models are run separately for 2007 and 2008, the second and third year of NCEA for the studied cohort. All models share the common moderator variables, but are different from each other by the type of resourcing or financial management variables included. Total revenue per student is included in the models with financial management variables (revenue), or proportions of each component of revenue of the schools. Similarly, total expenditure per student is included in all models, combined with financial management (expenditure) variables or proportions of expenditure components. Each model includes the combination of one resourcing variable (either per

student revenue or per student expenditure), and one financial management variable (either proportion of revenue or proportion of expenditure, depending on the choice of resourcing variable) in addition to student and other school-level variables. Table 14 below lists all variables included in the models.

Table 14

The list of explanatory variables

Variables	Descriptions	Range of values
Dependent variables:		
Credits gained	Number of credits gained in a year	0 to 246 credits
Qualification attained	Attainment of expected NCEA qualification in a year	0-No, 1-Yes
Resourcing variables:		
Per student revenue	Total school revenues divided by school rolls	65.2 to 129.9 hundred dollars
Per student expenditure	Total school expenditure divided by school rolls	65.9 to 126.7 hundred dollars
Financial management variables (revenue):		
Operational grant	Operational grant as proportion of total revenues	13% to 91%
Teacher salary funding	Teacher salary funding as proportion of total revenues	34% to 73%
Other government grants	Other government grants as proportion of total revenues	0.06% to 86%
Locally raised funds	Locally raised funds as proportion of total revenues	0.03% to 37%
Other revenues	Other revenues as proportion of total revenues	0.02% to 42%
Financial management variables (expenditure):		
Administration expenditure	Administration expenditure as proportion of total expenditure	2% to 18%
Depreciation expenditure	Depreciation expenditure as proportion of total expenditure	1% to 9%
Teacher salaries	Teacher salaries as proportion of total expenditure	56% to 83%
Learning resources	Learning resources as proportion of total expenditure	0.04% to 82%
Expenses to raise local funds	Expenses to raise local funds as proportion of total expenditure	0.02% to 21%
Property expenses	Property expenditure as proportion of total expenditure	2% to 24%
Other expenses	Other school expenses as proportion of total expenditure	0.02% to 23%
Student-level moderator variables:		
Female student	Female student (reference group-male students)	1-female, 0-male
Asian student	Asian students (reference group-NZ European)	1-Asian, 0-not Asian
Māori student	Māori students (reference group-NZ European)	1-Māori, 0-not Māori
Pacific student	Pacific students (reference group-NZ European)	1-Pacific, 0-not Pacific
Other student	Other ethnic group (reference group-NZ European)	1-Other ethnic, 0-not Other ethnic
SES	Socio-economic status of students	1 to 10, where 1 = lowest
Foreign student	Foreign students (reference group-domestic students)	1-foreign, 0-domestic
School-level moderator variables:		
State school	State schools (reference group-State-Integrated schools)	1-State, 0-State-Integrated
Girls only school	Girls only school (reference group-co-educational schools)	1-girls-only school, 0-other schools
Boys only schools	Boys only school (reference group-co-educational schools)	1-boys-only school, 0-other schools

In total, 144 regression models were tested or 72 different models in each year on the same dataset (two outcome variables for each decile band and twelve financial management variables). The Bonferroni correction method is used for multiple comparison corrections. When several hypotheses are tested on the same set of data, there is a possibility of statistical significance of associations occurring by chance. To avoid this problem, the level of significance is adjusted by dividing the initial significance level by the number of models tested. In this study, the initial significance was set to 0.01, which gives 0.0001 (0.01/72) as the adjusted significance level after the Bonferroni correction.

SPSS (Statistical Package for Social Science) version 12 allows one to perform hierarchical multiple regression, a variant of the basic multiple regression procedure that allows the researcher to specify a fixed order of entry for variables in order to control for the effects of covariates or to test the effects of certain predictors independent of the influence of others. Such models have been tested. The structure of the datasets is hierarchical and therefore the hierarchical regression models are developed in two blocks where the first block includes variables related to the individuals (student-level variables), irrespective of the school they attend, and the second block includes school variables that may have an additional impact on outcomes. The “entry” selection was used in all models, which means that models retained all independent variables.

There are two outcome measures of achievement for each student: credit gained in a year and attainment of NCEA qualification. For models where the dependent variable is a binary variable (attained expected NCEA qualification, Yes = 1 or No = 0), the binary logistic regression models are tested. For simplicity, depending on the dependent variable included in the models, the term ‘credit and qualification models’ is used hereinafter. There are two distinct groups of independent variables: student and school-level variables. Each student within a school carries the characteristics of the school they attend, their gender type, school authority, and school resourcing and financial management variables.

Multiple linear regression models are used and the main assumption is that there are linear, and not non-linear, associations between dependent and independent variables. This means that per student revenue or expenditure is assumed to be linearly related to students’ achievements. Ordinary Least Squares (OLS), a method to minimize the sum of squared

vertical distances between the observed and predicted responses, is a concept underlying the linear regression models. In the cases where the dependent variable is binary and measured by attainment of expected NCEA qualification, the binary logistic regression has been estimated.

Multilevel modelling or Hierarchical Linear Modelling (HLM) is commonly used in the field of education. Among reviewed studies, studies by Archibald (2006), Elliot (1998), Steele et al.,(2007) and Grubb (2009) also used HLM to estimate the impact of school resources. There are two known advantages of using HLM over OLS method. These are: (i) HLM takes into account the hierarchical structure of the data when estimating standard errors. It considers the correlated errors between levels and provides more realistic and conservative statistical testing, (ii) HLM efficiently deals with interactions (Ferron et.al, 2004).

HLM has been considered as an alternative method for this study. While HLM is an appropriate procedure with samples, this study is a population level study and no sampling has been carried out. In population level studies the emphasis is given to the magnitude of effects rather than significance and standard errors. In addition, no interactions exist between individual and school level variables that have been selected. However, if HLM had been selected as a modelling strategy, the estimate of within-school adjusted effects (i.e., the beta's that are carried from level 1 (student level) into the level 2 (school level) model), are estimates for an "average student", where "average" depends on how the data is centred. This is particularly important in multilevel modelling because the student level coefficients become outcomes to be explained in school level models. There are three commonly known methods of centering (Ferron et al., 2004):

(i) subtracting the grand mean of the predictor variable from each score. For example, if we had to use grand centering method, this would mean that average student SES of each school will be subtracted from individual students' SES.

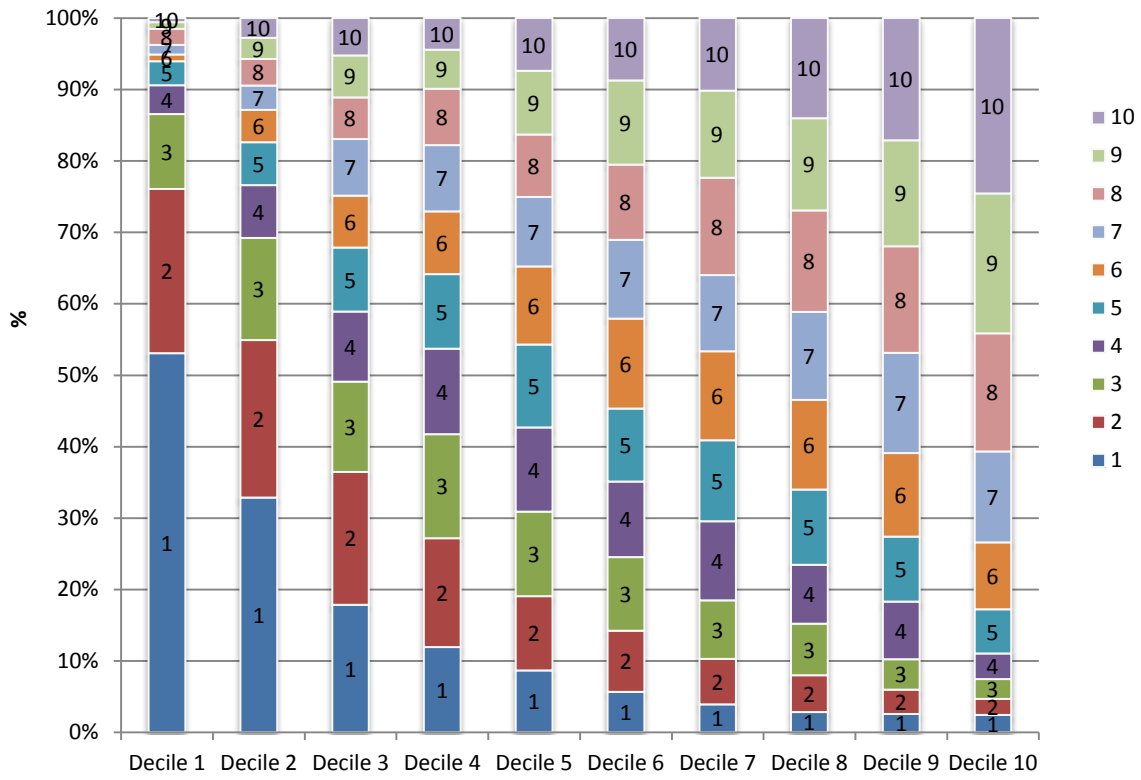
(ii) subtracting level 2 unit mean of the predictor variable from each score. This approach is called group mean centering. If such an approach is used in this

study, the average SES value for the entire population studied will be subtracted from each student's SES and beta coefficient calculated.

(iii) Third approach is to subtract a theoretically meaningful value from each score. This approach is very similar to the grand mean centering method.

If HLM were to be utilised in this study, the SES variable which is a continuous variable, would be centered using any of three methods described above. To assume that there are many average SES students in the given schools is doubdful, especially at middle and high decile schools, where student population is diverse in terms of their SES. Figure 9 shows the SES composition within each school decile group, which will be consistent with SES composition at school level. Figure 9 clearly shows a diverse range of SES students in each decile group.

Figure 9. Socio-economic composition of student population by school deciles (2007)



Notes: Figure produced based on the population studied in this study.

Thus, in HLM, the beta coefficient for SES that is carried to level 2 will be poorly estimated, especially at medium and high decile schools and difficult when it comes to

interpretation of results. Since SES is known to be one of the strongest predictors of student achievement, considering the explanatory variables selected for modelling, population studied and nature of data, it has been decided to estimate OLS models instead. By using OLS models, the impact of SES will not be centred, which means more precise student level SES proxy is used in the model.

As empirical evidence of the differences between HLM and OLS approaches, the Appendix 1 is presented in this study. It contains the comparison results of both HLM and OLS models on selected models. The findings suggest that fixed effects of HLM and OLS produce the same results at low and to a lesser extent at high decile schools. Especially at middle and high decile schools where population of students is not homogeneous in terms of SES, there are big differences between in the results of OLS and HLM models when the raw SES variable is used. When the grand centering method is applied to the SES variable, the fixed effects from HLM model show consistent signs for Beta coefficients and significance levels.

However, there are some differences in magnitude of effects are observed, especially at medium and high decile schools (see Appendix 1). According to Cohort (1992) small, medium and large effect sizes are 0.1, 0.3 and 0 .5. Overall, the difference in effect sizes between HLM and OLS models are greater for medium and high decile schools than for low decile schools. It is likely that these differences are attributed to differences in estimation of SES variable in HLM and OLS models. Most importantly, it should be noted, that across different models, the difference in impact of financial variables are trivial and in terms of the differences in effect sizes they will be considered as trivial (Cohen, 1992).

Hence, once SES variable is centered in the HLM model, it would produce relatively similar results to OLS as measured by sign of beta coefficients, level of significance and the effect sizes. The differences in magnitude of effects are likely to be attributed to poor estimation of beta coefficient for SES. In addition, in terms of interpretation of results and policy application, using OLS method over HLM method would be more advantageous. Hence, in this study the preference is given to OLS models.
The following chapter presents the descriptive analysis and results of the regression analysis.

CHAPTER SIX: RESULTS

The results are organised in the following order. First, the descriptive analysis focuses on the distributions of the main variables of interest, followed by the analyses of the similarities and differences between student achievements and school resourcing, as well as financial management variables across decile groups. Second, the impacts of school financial variables on student achievements are presented. These are presented separately for low, medium and high decile schools. Third, the effects of moderator variables are described, again separately for each decile group. Finally the chapter concludes with a presentation of the overall performance of the models.

Descriptive analysis

The descriptive analyses presented in this section support and supplement the findings of the regression models. This section is organised as follows. First, the distribution of school resourcing, and financial management variables by decile groups are presented; and secondly, the distribution of student outcomes and the similarities and differences between financial variables and student outcomes within each decile group are outlined. The purpose of this analysis is to present the differences in students' outcomes before a comparison is made between students with same demographic backgrounds who are attending similar schools.

School revenues and its composition

In this section the differences and similarities in total per student revenues and its composition across low, medium and high decile schools are discussed. First, a one-way ANOVA test is conducted on differences in these resourcing and financial variables across decile groups (see Table 15). Second, the independent sample *t*-test is used to check whether the total per student revenue and its composition changes from 2007 to 2008. It also should be noted that from 2008, the new collective agreement for teachers[6] came into

[6] Collective agreements are employment agreements between New Zealand Government and Teacher unions.

effect, which means that there was an increase in the amount of government funding for teacher salaries. In 2008 the annual increase in teacher salary funding to public schools from 2007 to 2008 was 13% in nominal terms , this is compared to 4% nominal increase in 2007 (MOE, 2010c). Since the change will equally affect all schools, such change has no meaningful effect on the model results and interpretation of results.

Table 15
One way ANOVA test: The differences in distribution of school's revenue side financial variables by decile groups

School resourcing and financial management variables		Decile Groups	2007					2008				
			N	*M*	*SD*	*F*	*p*	*N*	*M*	*SD*	*F*	*p*
Per student revenue (NZD)*		Low	59	91.8	15.1			64	90.3	13.5		
		Middle	134	83.9	13.2	9.0	0.00	129	84.2	12.5	8.4	0.00
		High	64	82.4	12.9			66	81.6	11.9		
Proportions (%)	Operational grant	Low	59	24.0	3.7			64	23.0	3.3		
		Middle	134	19.6	2.7	78.7	0.00	129	19.8	6.9	17.4	0.00
		High	64	17.8	2.1			66	17.6	2.1		
	Teacher salaries	Low	58	60.8	4.4			63	62.0	4.0		
		Middle	134	61.2	4.9	0.5	0.59	128	61.6	4.1	1.9	0.16
		High	64	60.5	5.1			66	60.6	4.5		
	Other government funding	Low	54	6.7	9.0			59	7.1	8.5		
		Middle	127	5.0	7.9	5.0	0.01	116	4.4	2.8	11.2	0.00
		High	55	2.4	1.7			57	2.8	2.9		
	Locally raised funds	Low	59	8.7	4.1			64	7.7	3.4		
		Middle	135	13.0	5.1	48.3	0.00	128	13.7	5.0	67.3	0.00
		High	64	17.8	6.1			66	17.6	5.9		
	Other revenues	Low	59	1.4	1.2			64	1.8	2.1		
		Middle	135	2.0	4.5	0.7	0.51	129	1.6	1.9	0.3	0.73
		High	64	1.8	2.5			66	1.8	2.3		

Notes: * Per student revenue is measured in 100 NZD

The main results of the descriptive analysis are summarised below:

1. On average, low decile schools generate more revenue per student than medium and high decile schools. This means that low decile schools have more resources to spend per student. For example in 2007, low decile schools had about NZD 790 more per student of disposal revenue than medium decile schools, and NZD 940 more than high decile schools. These differences slightly reduced in 2008. Also, these differences in per student revenues across decile groups are statistically significant ($F = 9.0$, $df = 2$, $p < .0001$ in 2007, and $F = 8.4$, $df = 2$, $p < .0001$ in 2008).
2. On average, government funding in the form of operational grants comprise a higher proportion of schools' total revenues at low decile schools than at medium and high decile schools. This is expected: medium, and higher decile schools have higher proportion of locally raised funds to compensate for lower government funding. These differences between low, medium, and high decile schools are also statistically significant ($F = 78.7$, $df = 2$, $p < .0001$ in 2007 and $F = 17.4$, $df = 2$, $p < .0001$ in 2008). If translated into per student dollars, these differences were about NZD 560 between low and middle decile schools and NZD 740 between low and high decile schools in 2007. However, these differences reduced slightly in 2008.
3. On average, across low, medium and high deciles, there is no statistically significant difference in the proportion of funds received from government in the form of teacher salaries. This means that teacher salary funding comprises about the same proportion of overall resources, regardless of whether the school is a low, medium or high decile school. ANOVA results shows that the difference in the proportion of teacher salary funding across decile groups is not statistically significant ($F = 0.5$, $df = 2$, $p < .59$ in 2007, and $F = 1.9$, $df = 2$, $p < .16$ in 2008). Hence, it is unlikely that different deciles have, on average, teachers of differing experience.
4. On average, other government grants comprise a higher proportion of school revenues at low decile schools than at medium and high decile schools. This means that, on average, low decile schools receive more funds for government intervention programmes. This is expected, since the majority of government intervention programmes tend to target underachieving schools, or students at risk

who are more likely to be concentrated at low decile schools. The differences between low, medium and high decile schools are found to be statistically significant (F = 5.0, df = 2, p <.01 in 2007, and F = 11.2, df = 2, p <.0001 in 2008). For example, in 2007, the difference between low and medium decile schools, in per student dollars, was NZD 200 and NZD 420 between low and high decile schools. The gap between low and medium decile schools widened to NZD 270 and narrowed slightly to NZD 410 between low and high decile schools in 2008.

5. On average, locally raised funds comprise a considerably large proportion of total revenues of high decile schools. The differences across deciles in the proportion of school revenues coming from locally raised funds are statistically significant (F = 48.3, df = 2, p < .0001 in 2007, and F = 67.3, df = 2, p < .0001 in 2008). This means that, proportional to total revenues, the contribution from parents and community is greater at high decile schools than at medium and low decile schools. For example, in 2007 the per student dollar difference between high and medium decile schools is NZD 300 and NZD 670 between high and low decile schools. The percentage difference between low and medium decile schools increased from 4% in 2007 to 6% in 2008.
6. The results of an independent sample *t*-test shows that within each decile group the total per student revenue and its proportional composition has not changed from 2007 to 2008, even though there have been increases in teacher salaries due to the introduction of a new collective agreement in 2008.

To sum up, it is apparent that the overall level of resources and the composition of revenues at low, medium and high decile schools are significantly different (see Table 15). As expected, in absolute terms, low decile schools have higher overall levels of resources at their disposal. Their generally small size and large population of underachieving students is compensated for by government funding for economies of scale and underachievement (Ministry of Education, 2013c). In comparison with medium and high decile schools, a higher proportion of revenue for low decile schools comes from operational grants and other government grants for intervention programmes and a smaller proportion from locally raised funds. Proportionally, low, medium and high decile schools receive the same level of resources for teacher salaries and other unspecified revenues.

Also, within each decile group there is no statistically significant change in the overall level of per student revenue and its composition from 2007 to 2008.

School expenditures and their composition

This section presents the differences and similarities in per student expenditure of schools and its proportional composition across and within decile groups based on descriptive analyses. As in the previous section, first, one-way ANOVA tests were conducted to test whether there are differences in per student expenditures and its composition across decile groups. The results of these ANOVAs are presented in Table 16. Further independent sample *t*-tests are used to check whether the levels of funding received in 2007 and 2008 are similar across schools within each decile group.

Table 16

One way ANOVA test: The differences in distribution of school's expenditure side financial variables by decile groups

School resourcing and financial management variables		Decile groups	2007					2008				
			N	*M*	*SD*	*F*	*p*	*N*	*M*	*SD*	*F*	*p*
Per student expenditure*		Low	59	92.1	15.5			64	90.3	13.5		
		Medium	135	84.5	13.1	8.8	0.00	129	84.3	12.2	8.1	0.00
		High	64	82.4	13.1			66	81.9	12.0		
Proportions (%)	Administration expenditure	Low	59	7.1	1.9			64	7.0	1.8		
		Medium	135	6.6	2.0	1.6	0.20	129	6.4	1.6	2.4	0.09
		High	64	6.9	1.8			66	6.7	2.0		
	Depreciation expenditure	Low	59	3.1	1.3			64	3.0	1.2		
		Medium	135	2.9	1.0	3.5	0.03	129	2.7	0.8	3.5	0.03
		High	64	3.3	1.2			66	3.1	1.0		
	Teacher salaries	Low	59	67.3	12.9			64	69.4	8.5		
		Medium	135	68	4.7	0.2	0.82	129	68.2	7.6	0.7	0.50
		High	64	67.8	5.8			66	68.2	4.9		
	Expenses on learning resources	Low	58	9.6	12.9			64	8.7	8.2		
		Medium	133	7.9	3.1	1.4	0.24	127	8.5	6.8	0.4	0.67
		High	63	7.7	3.4			66	7.8	3.1		
	Expenses to raise local funds	Low	57	5.1	3.5			62	4.0	2.8		
		Medium	135	7.2	4.7	5.8	0.00	127	7.2	4.2	16.6	0.00
		High	61	7.3	4.1			63	7.4	4.2		
	Expenses on property	Low	59	7.9	2.1			64	7.6	1.6		
		Medium	135	6.8	1.5	9.4	0.00	129	6.9	1.9	5.8	0.00
		High	64	7.0	1.3			66	6.7	1.2		
	Other expenses	Low	24	0.8	1.6			29	0.8	1.8		
		Medium	48	1.8	3.9	0.8	0.44	41	0.8	2.2	0.5	0.58
		High	21	1.2	3.2			25	1.4	3.2		

Notes: * Per student expenditure is measured in 100 NZD

The main findings of the statistical analyses are summarised below:

1. On average, low decile schools have higher per student expenditure than medium and high decile schools, and such differences between different groups is unlikely to be random ($F = 8.8$, $df = 2$, $p < 0.001$ in 2007, and $F = 8.1$, $df = 2$, $p < 0.001$ in 2008). The differences here are, not surprisingly, about the same as they are for school revenues. In 2007, the difference in per student expenditure between low and medium decile schools was about NZD 760 per student, and it was NZD 970 between low and high decile schools. The difference in per student expenditure narrowed slightly in 2008. Previous descriptive analysis suggested that low decile schools had higher per student revenues than medium and high decile schools, indicating that low decile schools had more funds available in per student terms, and this analysis suggests that more funds available, the higher the expenditure (see item 1 in the section above).
2. There are no statistically significant differences in the proportion of funds allocated to administration, depreciation, teacher salaries, expenses on learning resources and other unclassified school expenses between low, medium, and high decile schools (see Table 16). This means that regardless whether it is a low, medium, or high decile school, on average schools allocate proportionally comparable amounts of funds on the above expenses.
3. On average, high and middle decile school spend proportionally more on raising local funds than low decile schools, which is consistent with the greater amount they raise in this way. These differences between low, medium, and high decile schools are statistically significant ($F = 5.8$, $df = 2$, $p < 0.001$ in 2007, and $F = 16.6$, $df = 2$, $p < 0.001$ in 2008). For example, in 2007, the per student differences in this expenditure category between low and middle decile schools was about NZD 130 per student, which is the same as the difference between low and high decile schools. In 2008, the difference between decile groups increased to NZD 250. This implies that while high and medium decile schools have higher proportion of their revenues generated through locally raised funds than low decile schools, they also face relatively higher expenses to raise these finds (see item 5 in the section above).
4. There are statistically significant differences in proportional allocation of resources on property maintenance across decile groups. On average, low decile schools

spend proportionally more on property maintenance than medium and high decile schools. These differences are statistically significant ($F = 9.4$, $df = 2$, $p < 0.001$ in 2007 and $F = 5.8$, $df = 2$, $p < 0.001$ in 2008). The calculations show that low decile schools spent about NZD 150 per student more on property maintenance per student than middle and high decile schools in 2007.

5. The results of an independent sample *t*-test shows that within each decile group, the total per student expenditure and its proportional allocation has not changed from 2007 to 2008.

To sum up, in absolute terms, low and medium decile schools spend more per student than high decile schools. However, in terms of the proportion allocated to different expenditure items, low, medium and high decile schools spend relatively the same proportion of funds on administration, depreciation, teacher salaries, expenses on learning resources, and other unclassified expenses. The only statistically significant difference is in the proportional allocation of resources to generate funds locally, and on expenses related to property maintenance. Within each of the decile groups, the resource allocation patterns in 2007 and 2008 were very similar.

Student outcomes and school financial factors

This section examines the links between school resourcing, financial management variables, and student outcomes. First, the distribution of student outcomes across and within decile groups is presented. Second, Pearson correlations are run between per student revenue and expenditures, the proportions of school revenues and expenditures and credits gained by students in order to test their linear dependence. Third, using the same resourcing and financial management variables, the independent sample t-test is run to investigate whether there are statistically significant differences between these variables for the group of students who achieved expected NCEA qualifications and those who did not. It is essential to highlight that any associations or statistically significant differences are based on descriptive analyses, and the effects presented in this section do not control for moderator variables mentioned in the previous chapters.

Student outcomes

On average, students at medium and high decile schools gain more credits in a year than students at low decile schools. The average credits gained by students at high and medium decile schools are significantly higher than average credits gained by their counterparts at low decile schools and these differences are statistically significant in both years ($F = 730.36$, $df = 2$, $p < 0.0001$ in 2007 and $F = 460.69$, $df = 2$, $p < 0.0001$ in 2008).

Error! Reference source not found. shows basic descriptive statistics from an ANOVA test. The decrease in achievement gap between decile groups from 2007 to 2008 is observed. Credits gained during the year are higher in the second year of NCEA than in the third year. Within each decile group, the average credits gained by the population of students studied in the third year of NCEA is less than the average credits gained by the population of students who studied in the second year of NCEA. The differences in credits between those who studied in the second year and those who studied in the third year are unlikely to be a result of chance. Statistical tests show that achievement in the third year is significantly lower than in the second year of NCEA ($F = 117.59$, $df = 1$, $p < .0001$ for low decile schools; $F = 507.11$, $df = 1$, $p < .0001$ for medium decile schools and $F = 733.06$, $df = 1$, $p < .0001$ for high decile schools).

Table 17

Average credits gained by students in 2007 and 2008 by decile groups.

Year	Decile group	N	Mean (M)	Median	Std. Deviation (SD)	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
2007	Low	4,947	65.8	65.0	37.1	64.8	66.9
	Middle	17,778	79.7	82.0	39.2	79.2	80.3
	High	10,493	90.3	94.0	35.1	89.6	91.0
2008	Low	4,270	57.7	57.0	34.2	56.7	58.8
	Middle	12,005	69.7	72.0	35.8	69.0	70.3
	High	9,118	77.1	81.0	32.9	76.4	77.8

Within each decile group, students who dropped out after the second year of NCEA are students who, on average, attained fewer credits in their second year of NCEA. Table 18 presents the average credits gained for groups of students who continued to the third year of NCEA, and those who dropped out after the second year.

Table 18

The difference in credits between students who continued to third year and students who dropped out after second year

Status	Decile group	N	M	Median	SD	95% CI for Mean	
						Lower Bound	Upper Bound
Retained to third year	Low	3,157	76	76	34	75	77
	Middle	11,876	93	94	34	92	94
	High	7,972	99	102	30	98	100
Dropped out after second year	Low	1,790	48	42	35	46	49
	Middle	5,902	53	50	36	52	54
	High	2,521	63	64	37	61	64

The differences in credits gained between the population of students who stayed and those who dropped out after the second year of NCEA are statistically significant (t = 27.60, $df = 1$, $p < .0001$ for low decile schools, $t = 72.33$, $df = 1$, $p < .0001$ for medium decile schools and $t = 50.67$, $p < .0001$ for high decile schools). Differences in credits gained by students in 2007 compared to 2008 are partially explained by population change due to school leavers, increasing difficulty of NCEA Level 3 qualification requirements as well as decile recalculations following the Census 2006.

The proportion of students who achieved expected NCEA qualifications within each decile group is shown in Table 19. The proportion of students who achieved expected qualifications increases from low to high decile schools. A Chi-square test confirms that across low, medium and high decile schools there are statistically significant differences in student attainment of expected NCEA qualifications in both years ($\chi^2 = 1428.82$, $df = 2$, $p < .0001$ for 2007 and $\chi^2 = 1354.76$, $df = 2$, $p < .0001$ for 2008).

Table 19

The proportion of students who gained expected qualifications by decile group (2007 and 2008)

		Achieved expected NCEA qualification	Did not achieve expected NCEA qualification	% achieved	Total
2007	Low decile	2,493	2,454	50.4	4,947
	Medium decile	12,000	5,778	67.5	17,778
	High decile	8,411	2,082	80.2	10,493
	Total	22,904	10,314	69.0	33,218
2008	Low decile	1,522	2,748	35.6	4,270
	Medium decile	6,832	5,173	56.9	12,005
	High decile	6,316	2,802	69.3	9,118
	Total	14,670	10,723	57.8	25,393

Within each decile group, students in the second year were more successful at gaining the expected NCEA qualification (Level 2) than students in the third year were at gaining NCEA Level 3, and this applies to all decile groups. The statistical tests confirm that within decile groups these differences in achievements of students are statistically significant (F = 0202.81, df = 1, $p < .0001$ for low decile schools, F = 345.63, df = 1, $p < .0001$ for medium decile schools and F = 309.28, df = 1, $p < .0001$ for high decile schools).

Table 20 presents the attainment of NCEA Level 2 qualifications for groups of students who continued to their third year, and those who dropped out. Within each decile group relatively successful students continued to their third year in 2008, and the highest proportion of students who dropped out are those who did not gain NCEA Level 2 by the end of 2007. The differences in attainment for these groups of students are statistically significant (χ^2 = 4484.66, df = 1, $p < .0001$).

Table 20

Attainment of NCEA Level 2 for population of students who continued to third year and students who dropped out

Status	Decile group	N	% achieved NCEA Level 2
Continued to third year	Low	3,157	61%
	Middle	11,876	80%
	High	7,972	88%
Dropped out after second year	Low	1,790	32%
	Middle	5,902	42%
	High	2,521	54%

To sum up, student attainment increases from low to high decile schools, and the differences in attainment across decile groups are statistically significant. Within each decile group, more successful students transition from second to third year. However, students who continued to the third year of NCEA tend to gain fewer credits, and fewer of them gain expected NCEA qualifications than in the second year. In other words, their number of credits drops, as evidenced by the lower number of credits gained in the third year and by the proportion of students who attained expected qualifications.

School financial factors and credits

Table 21 presents the correlation coefficients between total credits gained and school resourcing and financial management variables. Within each decile group, credits gained by students are not correlated with any resourcing and financial management variables.

Table 21

The correlation coefficients between the credits gained and school resourcing and financial management variables (r).

Resourcing and Financial Management Variables	2007				2008			
	Low decile	Medium decile	High decile	All schools	Low decile	Medium decile	High decile	All schools
Operational grant	-0.06**	-0.01	0.00	-0.14**	-0.04**	-0.01	-0.06**	-0.09**
Teacher salary funding	0.03	0.04**	0.01	0.02	0.03*	-0.02	0.02	-0.02**
Other government grants	0.07**	-0.04**	-0.13**	-0.06**	-0.01	-0.13**	-0.13**	-0.14**
Locally raised funds	-0.01	0.06**	0.05**	0.15**	0.01	0.10**	0.11**	0.18**
Other revenues	-0.07**	-0.01	-0.03**	0.01	-0.02	-0.02**	-0.09**	-0.04**
Total per student revenue	0.01	-0.04**	0.03**	0.06**	-0.07**	-0.06**	0.05**	-0.07**
Administration expenditure	0.02	-0.00	0.05**	0.00	0.02	-0.03**	0.02	-0.02**
Depreciation expenditure	-0.07**	-0.01	0.05**	0.03**	-0.03*	0.02*	0.11**	0.06**
Teacher salaries	-0.00	0.00	0.03**	0.01	0.05**	-0.03**	0.01	-0.02**
Expenses on learning resources	0.00	0.01	0.05**	-0.01	-0.05**	0.06**	0.02*	0.01
Expenses on raising local funds	-0.01	-0.03**	0.02	0.02**	0.01	-0.05**	-0.01	0.06**
Expenses on property	0.02	-0.01	-0.04**	-0.05*	-0.00	0.01	0.00	-0.07**
Other expenditures	-0.01	0.00	-0.14**	-0.04**	-0.03	-0.03	-0.09**	0.04**
Total per student expenditure	0.01	-0.03**	0.03**	-0.06**	-0.08**	-0.07**	0.05**	-0.07**

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed).

In absolute terms, the correlation coefficients presented in the Table 21are all less than 0.18 (or R^2 is less than 3.24%), although in some cases the correlation coefficient is significant at $p<.01$. This means that school resource and financial management variables explain less than 3.24% of variance in credits gained by students or, in other words, there is a zero to trivial relationship between credits gained and school resource and financial *management v*ariables.

School financial factors and qualifications

The independent sample t-tests show some significant differences in the proportion of revenue and expenditure of the schools attended by those who gained expected NCEA qualifications and those who did not. The main findings are summarised below.

At low decile schools

1. Within low decile schools, those students who attain expected NCEA qualifications are at schools that receive proportionally less operational funding from government (t = -2.7, df = 4,945, p < .01 in 2007 and t = 4.5, df = 4,268, p < 0.001 in 2008).
2. Those students who achieve NCEA Level 2 in their second year of upper secondary education are more likely to be at schools that proportionally receive more on teacher salaries, other government funding (funding for intervention programmes) and other unclassified revenues. However, such differences are not statistically significant in the third year of NCEA, and it should be noted that such findings are based on the independent sample t-test, which did not take into account any of the moderator variables discussed earlier.
3. At low decile schools, students who attained expected NCEA qualifications, and those who did not, attend schools with similar expenditure management practices. Or, in other words, there is no statistically significant difference in the proportional composition of expenditure between the schools these two groups of students attend.

At medium decile schools

1. Those students who attain expected NCEA qualifications are at schools that have fewer resources (per student revenues) available (t = -2.8, df = 17,776, p < 0.001 in 2007 and t = -7.0, df = 12,003, p < 0.001 in 2008) and receive proportionally less other government funding (t = -5.6, df = 17,776, p < 0.001 in 2007 and t = -12.5, df = 12,003, p < 0.001 in 2008) but generate more locally raised funds (t = 6.8, df = 17,776, p < 0.001 in 2007 and t = 8.1, df = 11,920, p < 0.001 in 2008).
2. Students who attain expected qualifications are at schools that receive proportionally less operational funding from government (t = -2.9, df = 12,003, p < 0.001 in 2008) but receive proportionally more funding for teacher salaries (t = 2.6, df = 12,003, p < 0.001 in 2007); however, the results of an independent sample t-test are not consistent in both years.
3. At medium decile schools, those who attain qualifications are at schools with lower per student expenditure (t = -2.6, df = 17,776, p < .01 in 2007, and t = -6.7, df = 12,003, p < 0.001 in 2008). Also those who attained NCEA Level 3 are at schools where proportionally less is spent on teacher salaries (t = -3.0, df = 12,003, p < .01 in 2008), less on property maintenance (t = -5.9, df = 12,003, p < 0.001 in

2008), but more on learning resources (t = 5.5, df = 12,003, $p < 0.001$). However, the statistically significant differences do not replicate in the second year of NCEA.

At high decile schools

1. At high decile schools, those students who attained NCEA Level 3 qualifications are at schools that, overall, have more resources available (t = 3.4, df = 9,116, $p < 0.001$ in 2008). However, the results of the independent sample t-test did not show a statistically significant difference for attainment of NCEA Level 2 in 2007.
2. Those students who achieve expected NCEA qualifications are at schools that have proportionally less operational funding (t = -3.8, df = 10,491, $p < 0.001$ in 2007, and t = -6.1, df = 9,116, $p < 0.001$ in 2008), less other government funds (t = -7.7, df = 10,491, $p < 0.001$ in 2007 and t = -9.0, df = 9,116, $p < 0.001$ in 2008) but more locally raised funds (t = 6.7, df = 10,491, $p < 0.001$ in 2007 and t = 11.0, df = 9,116, $p < 0.001$ in 2008) .
3. Those students who attained NCEA Level 3 are at schools that have higher per student expenditure (t = 4.0, df = 9,116, $p < 0.001$). However, the differences between students who attained NCEA Level 2 in their second year and those who did not were not statistically significant.
4. Those who attain expected NCEA qualifications are at schools that have proportionally higher depreciation expenditure (t = 7.1, df = 10,491, $p < 0.001$ in 2007, and t = 9.6, df = 9,116, $p < 0.001$ in 2008) and less other unclassified expenses (t = -6.2, df = 10,491, $p < 0.001$ in 2007, and t = -7.2, df = 9,116, $p < 0.001$ in 2008).
5. There are some statistically significant differences in proportional allocation of funds on administration (t = 3.0, df = 10,491, $p < 0.001$ in 2007) and expenses on locally raised funds (t = -4.4, df = 10,491, $p < 0.001$ in 2007) at the schools attended by these groups of students in the second year of NCEA. However, the differences were not statistically significant in the third year.

Summary

There are no statistically significant relationships between credits gained by students and schools' resource and financial management variables. However, there are some differences in schools' resource and financial management characteristics between schools attended by students who attained expected NCEA qualifications, and those who did not,

although some of these differences do not appear to be consistent across the decile groups or across years. Importantly, it should be taken into consideration that these results are the findings of descriptive analysis, where the link between achievement of students and school resources does not control for the range of student background factors to make a fair comparison between students with similar backgrounds. The following sections of this chapter present the results of regression models where all moderator variables are controlled.

Results of regression analysis

This study focuses on the effects of school resources and financial management on student achievement. The results of regression analyses for low, medium and high decile schools are the main focus of this section. For low, medium and high decile schools separately, it presents the effects of school resources and financial management variables on educational outcomes. Although school resources are the primary focus of this study, student demographic factors and some other school characteristics remain some of the strongest predictors of student achievement. Therefore, for the three decile groups the summary of effects of student background factors and other school factors is also discussed. This sub-section concludes with an overview of the variance explained by the models, and ends with the summary of main findings of the regression models.

When interpreting the results of the regression models, it should be noted that only statistically significant effects replicated across years are considered systematic effects. Effects that did not replicate across years are interpreted as random variations in data. It is also noted that the majority of tables presented in this chapter summarise the effects of the individual variables or groups of variables (financial management variables) in all regression models, and each coefficient is an output of one regression model.

Low decile schools: The impact of school resources and financial management

Overall level of resources

The overall level of resources available for schools has no effect on credits attained on NCEA or on attainment of expected NCEA qualifications for students at low decile schools. This means that even when the comparison is made across students with similar

backgrounds attending similar schools that have the same proportional composition of revenues (or that are treated equally under the current funding system) there is no relationship between the overall level of resources and the performance of students. This implies that under the current funding system, or the way New Zealand secondary schools generate revenue, those students who gain more credits at low decile schools are not necessarily at the schools that have more funds available to spend.

Table 22 presents the effects of per student revenue and expenditure at low decile schools, when financial management and other moderator variables are controlled for. The majority of models with revenue proportions show that there are no consistent statistically significant associations between per student revenues and educational outcomes, with a few exceptions that are possibly due to random variation (see Table 22).

Table 22

Low decile schools: The effects of overall level of resources on achievement of students

Variable for which the effects are measured	Controlled financial management variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*b*	*β*	*Exp (B) (Odds Ratio)*	
Per student revenue	Operational grant	-0.02	-0.01	-0.11	-0.04	1.00	1.00
	Teacher salary funding	-0.03	-0.01	-0.22**	-0.08**	1.00	0.99
	Other government grants	0.00	0.00	-0.13	-0.05	1.00	1.00
	Locally raised funds	-0.02	-0.01	-0.19**	-0.07**	1.00	1.00
	Other revenues	0.03	0.01	-0.13	-0.05	1.00	1.00
Per student expenditure	Administration expenditure	-0.02	-0.01	-0.15	-0.05	1.00	0.99
	Depreciation expenditure	-0.02	-0.01	-0.13	-0.05	1.00	1.00
	Teacher salaries	-0.05	-0.02	-0.16	-0.06	1.00	0.99
	Expenses on learning resources	-0.01	-0.00	-0.14	-0.05	1.00	1.00
	Expenses on raising local funds	-0.09	-0.03	-0.16	-0.06	0.99	0.99
	Expenses on property	-0.02	-0.01	-0.13	-0.05	1.00	1.00
	Other expenditures	-0.01	-0.00	-0.14	-0.05	1.00	1.00

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models, and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except per student revenue and expenditure variables.

Similarly, the comparison across schools that spent money in the same manner suggests that students who gain more credits or attain expected NCEA qualifications are not

necessarily at schools that spend more dollars per student. Such findings support the results of the descriptive analyses, suggesting that there is no statistically significant relationship between per student revenue and expenditure, and student performance on NCEA.

Financial management

Currently, the way schools are funded and manage their financial resources has no effect on the achievement of students at low decile schools. Table 23 shows the effects of financial management variables when per student revenue or expenditure and other moderator variables are controlled. The majority of models tested show that there are no statistically significant associations between the proportions of revenue and expenditure components, and achievement measures, with a few exceptions (see Table 23). The only consistent associations are between a school's proportion of locally raised funds and the attainment of qualifications. The results show that similar students attending similar schools that spent more funds to generate more revenue from parents and the local community have about a 6% greater chance of attaining expected NCEA qualifications (*Exp (b)* = 1.06, $p < 0.001$ in 2007, and 2008, Table 23).

Table 23

Low decile schools: The effects of financial management variables on achievement of students.

Variable for which the effects are measured	Controlled resourcing variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*b*	*β*	*Exp (B) (Odds Ratio)*	
Operational grant	Per student revenue	-0.47	-0.04	0.54	0.05	0.97	1.04
Teacher salary funding		-0.34	-0.03	-0.82**	-0.09**	0.97	0.95**
Other government grants		0.18	0.02	0.20	0.02	1.01	1.01
Locally raised funds		0.22	0.02	0.62	0.06	1.02	1.03
Other revenues		-3.42**	-0.1**	-0.17	-0.01	0.84**	1.08
Administration expenditure	Per student expenditure	0.14	0.01	0.36	0.02	1.01	1.03
Depreciation expenditure		-0.08	0.00	0.88	0.03	1.07	1.09
Teacher salaries		-0.24	-0.03	-0.25	-0.03	0.97	0.98
Expenses on learning resources		-0.17	-0.02	-0.44	-0.05	1.00	0.99
Expenses on raising local funds		0.83**	0.07**	0.73	0.06	1.06**	1.06**
Expenses on property		-0.75	-0.03	-0.25	-0.01	0.94	0.99
Other expenditures		-1.45	-0.04	1.48	0.02	0.93	1.07

Notes: **Indicate the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential B (odds ratio) is presented for qualification models. Control variables include all independent variables except financial management variables.

Table 23 also shows some inconsistent random effects. It suggests that students gain more credits and are likely to attain qualifications at schools that receive proportionally less funding for teacher salaries from the government, other unclassified revenue, and spend proportionally more to generate locally raised funds.

To sum up, the findings mean that even when the comparison is made between students of the same background who are attending schools that generate the same amount of resources or spend the same amount per student, generating proportionally more revenue from particular sources, or spending on particular expenditure items, has no discernible effect on performances of students.

Medium decile schools: The impact of school resources and financial management

Overall level of resources

The overall level of resources available for schools has an effect on credits attained in the third year of NCEA, specifically on attainment of NCEA Level 3. When all moderator variables are controlled, especially the school-level financial management variables, all models consistently show a significant association between overall level of resources (per student revenue and expenditure), credits gained, and attainment of NCEA Level 3 in the third year of NCEA (see Table 24). In terms of the impact, the findings suggest that students attending schools that generate NZD 100 more in per student revenue or spend NZD 100 more per student, on average gain about 0.2 fewer credits in the third year of NCEA and their likelihood of attaining NCEA Level 3 is about 1% less (see Table 24); however, there was no such effect in the second year of NCEA. Therefore, these effects are considered to be random effects, which is also consistent with similar findings in low decile schools (see Table 22).

Table 24

Medium decile schools: The effects of overall level of resources on achievement of students.

Variable for which the effects are measured	Controlled financial management variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Per student revenue	Operational grant	-0.08	-0.02	-0.21**	-0.06**	1.00	0.99**
	Teacher salary funding	-0.07	-0.02	-0.29**	-0.09**	1.00	0.98**
	Other government grants	-0.07	-0.02	-0.20**	-0.06**	1.00	0.99**
	Locally raised funds	-0.05	-0.01	-0.26**	-0.08**	1.00	0.99**
	Other revenues	-0.07	-0.02	-0.21**	-0.06**	1.00	0.99**
Per student expenditure	Administration expenditure	-0.09	-0.02	-0.21**	-0.06**	0.00	0.00
	Depreciation expenditure	-0.09	-0.02	-0.21**	-0.06**	1.00	0.99**
	Teacher salaries	-0.08	-0.02	-0.27**	-0.08**	1.00	0.99**
	Expenses on learning resources	-0.09	-0.02	-0.22**	-0.07**	1.00	0.98**
	Expenses on raising local funds	-0.08	-0.02	-0.24**	-0.07**	1.00	0.99**
	Expenses on property	-0.09	-0.02	-0.19**	-0.06**	1.00	0.99**
	Other expenditures	-0.09	-0.02	-0.23**	-0.07**	1.00	0.99**

Notes: **indicate the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential B (odds ratio) is presented for qualification models. Control variables include all independent variables except per student revenue and expenditure variables.

Financial management

On average, students who attend schools that allocate more resources to generate locally raised funds, and hence generate proportionally more revenue through locally raised funds, gain fewer credits on NCEA. Table 25 presents the effects of financial management variables when the overall level of resources, student background factors, and other school factors are controlled. The results of regression analyses show that once the level of per student expenditure is controlled, those schools that spend proportionally more resources on raising local funds from parents and community have students who gain more credits on NCEA ($b = 0.42$, $p < 0.001$ in 2007, and $b = 0.68$, $p < 0.001$ in 2008) and they are more likely to attain the expected NCEA qualification (*Exp (B)* = 1.02, $p < 0.001$ in 2007, and *Exp (B)* = 1.03, $p < 0.001$ in 2008). It should be noted that such consistent effects of local fund raising are not observed at low decile schools, although some random effects are observed (see Table 23). Other than the main findings on proportion of locally raised

funds, there are some other random negative effects of teacher salary funding and other revenues that are replicated from low to medium decile schools (see Table 23 and Table 25).

Table 25

Medium decile schools: The effects of financial management variables on achievement of students.

Variable for which the effects are measured	Controlled resourcing variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	Per student revenue	-0.12	-0.01	0.09	0.01	0.99	1.00
Teacher salary funding		0.19	0.02	-0.65**	-0.07**	1.00	0.97**
Other government grants		-0.27	-0.02	-0.28	-0.02	0.97**	0.98
Locally raised funds		0.42**	0.05**	0.68**	0.09**	1.02**	1.03**
Other revenues		-0.98**	-0.04**	-0.11	-0.01	0.98	1.02
Administration expenditure	Per student expenditure	-0.55	-0.02	-0.52	-0.03	0.96**	0.96
Depreciation expenditure		-1.01	-0.03	1.14	0.03	0.96	1.08
Teacher salaries		0.16	0.02	-0.48**	-0.06**	1.00	0.97**
Expenses on learning resources		0.19	0.02	0.25	0.02	1.02	1.02
Expenses on raising local funds		0.37**	0.04**	0.64**	0.07**	1.02**	1.03**
Expenses on property		0.01	0.00	-1.71**	-0.05**	1.05	0.94
Other expenditures		0.32	0.01	0.62	0.02	1.11**	1.06

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except financial management variables.

Similarly on the expenditure side, once moderator variables are controlled, those schools that allocate proportionally more resources to raising local funds are schools where students gain more credits ($b = 0.37$, $p < 0.001$ in 2007, and $b = 0.64$, $p < 0.001$ in 2008) and are more likely to attain the qualifications. In other words, on the revenue side, this means that a 1% increase in the proportion of locally raised funds is associated with about 0.42 and 0.68 additional credits, and increases the likelihood of attaining qualifications by 2% and 3% in the second and third years respectively. Similarly, once total per student expenditure is controlled with other moderator variables, a 1% increase in the proportion of expenditure on raising local funds is associated with 0.37 and 0.64 additional credits, and an increase in the likelihood of attaining respective NCEA qualifications in the second and third year of NCEA. It should be noted that such effects were observed at low decile

schools although they were not replicated in credits models in either year (see Table 23). There are also some random effects suggesting negative impacts of expenditure on administration, teacher salaries, expenses on property, and positive effects of other unclassified expenditures (see Table 25). However, as noted above, these effects do not replicate across years.

High decile schools: The impact of school resources and financial management

Overall level of resources

The overall level of resources has no effect on performance of students at high decile schools. When students of the same background are compared across schools with the same proportional composition of revenue and expenditure, the results show that overall level of resources (i.e., per student revenue and expenditure) has no statistically significant relationship to either credits gained on NCEA, or attainment of expected NCEA qualifications (see Table 26).

Table 26

High decile schools: The effects of overall level of resources on achievement of students.

Variable for which the effects are measured	Controlled financial management variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*B*	*β*	*Exp (B)* (Odds Ratio)	
Per student revenue	Operational grant	0.03	0.01	-0.05	-0.01	0.99	1.00
	Teacher salary funding	0.02	0.01	-0.00	-0.00	0.99	1.00
	Other government grants	0.01	0.00	0.00	0.00	0.99	1.00
	Locally raised funds	0.00	0.00	-0.05	-0.01	0.99	1.00
	Other revenues	0.00	0.00	-0.02	-0.01	0.99	1.00
Per student expenditure	Administration expenditure	-0.01	-0.00	-0.02	-0.01	0.99	1.00
	Depreciation expenditure	-0.02	-0.01	-0.01	-0.00	0.99	1.00
	Teacher salaries	0.00	0.00	-0.01	-0.00	0.99	1.00
	Expenses on learning resources	-0.03	-0.01	-0.03	-0.01	0.99	1.00
	Expenses on raising local funds	0.02	0.01	-0.01	-0.00	0.99	1.00
	Expenses on property	-0.01	-0.00	-0.02	-0.01	0.99	1.00
	Other expenditures	0.00	0.00	-0.02	-0.01	0.99	1.00

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except per student revenue and expenditure variables.

This suggests that under the current funding system, or the way schools generate revenues, those students who gain more credits at high decile schools are not more likely to be at the schools that have either more or less funds available to spend. Similarly, the comparison across schools that have the same financial management practices, suggests that students who gain more credits or attain expected NCEA qualifications are not necessarily at schools that spend more or less (in absolute terms) per student. Overall, such findings are consistent with similar findings at low and medium decile schools, although some random effects have been observed at low and medium decile schools (see Table 22, Table 24 and Table 26)

Financial management variables

The financial management practices at high decile schools, or the way schools generate revenue and allocate resources, have no consistent impact on the performance of students in NCEA at high decile schools. The model showed some inconsistent effects that were found to be statistically significant, but this did not replicate across the two years analysed (see Table 27). On the revenue side, some random effects suggest negative effects of the proportion of other government grants and other school revenues, and positive effects of operational grants and locally raised funds. Interestingly, none of these random effects observed on the revenue side replicated across all decile bands (see Table 23, Table 25 and Table 27). On the expenditure side, there are some random positive effects for the proportion of expenditure on depreciation and on other unclassified expenses. The positive effect of other school expenses was also observed at medium decile schools (see Table 25 and Table 27).

Table 27

High decile schools: The effects of financial management variables on achievement of students.

Variable for which the effects are measured	Controlled resourcing variable	Credit models				Qualification models	
		2007		2008		2007	2008
		b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	Per student revenue	0.77**	0.04**	-0.39	-0.02	0.99	0.96
Teacher salary funding		0.19	0.02	0.09	0.01	0.98	0.99
Other government grants		-0.70**	-0.04**	-0.97	-0.06	0.98	0.95**
Locally raised funds		-0.16	-0.02	0.27	0.04	1.01	1.03**
Other revenues		-0.50	-0.02	-1.35**	-0.06**	1.09	0.91**
Administration expenditure	Per student expenditure	-0.03	0.00	-0.54	-0.03	1.00	0.95
Depreciation expenditure		-0.39	-0.01	1.43**	0.04**	1.06	1.11**
Teacher salaries		0.06	0.01	0.03	0.01	1.00	1.01
Expenses on learning resources		0.38	0.03	0.20	0.02	1.01	1.00
Expenses on raising local funds		-0.34	-0.03	-0.12	-0.01	1.00	1.00
Expenses on property		0.01	0.00	-1.71**	-0.05**	1.05	0.94
Other expenditures		0.32	0.01	0.62	0.02	1.11**	1.06

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except financial management variables.

To sum up, the ways high decile schools generate income under the current funding system and allocate financial resources has no systematic effect on student performance. In the following three sections, the effects of student background characteristics on achievement of students at low, medium and high decile schools is presented.

Low decile schools: The impact of individual background factors

Socio-economic status

The findings confirm that the SES of students is one of the important predictors of student achievements at low decile schools. Increases in the SES of students are systematically related to increases in credits gained, but not always to qualifications attained. The results show that the SES variable has a statistically significant effect on the likelihood of attaining NCEA qualification in the third year, but not in the second (see Table 28).

Table 28

Low decile schools: The effects of students' SES on student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	1.24**	0.08**	1.08**	0.08**	1.05	1.08**
Teacher salary funding	1.30**	0.09**	1.10**	0.08**	1.05**	1.08**
Other government grants	1.25**	0.09**	0.99**	0.07**	1.05	1.07**
Locally raised funds	1.25**	0.09**	0.98**	0.07**	1.05	1.07**
Other revenues	1.23**	0.08**	0.99**	0.07**	1.05	1.07**
Administration expenditure	1.24**	0.08**	0.99**	0.07**	1.05	1.07**
Depreciation expenditure	1.24**	0.08**	1.00**	0.07**	1.05	1.07**
Teacher salaries	1.26**	0.09**	0.99**	0.07**	1.05	1.07**
Expenses on learning resources	1.23**	0.08**	1.01**	0.07**	1.05	1.07**
Expenses on raising local funds	1.28**	0.09**	1.00**	0.07**	1.05	1.07**
Expenses on property	1.25**	0.09**	1.00**	0.07**	1.05	1.07**
Other expenditures	1.22**	0.08**	1.01**	0.07**	1.05	1.07**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised b and Standardised β coefficients are presented for credit models and Exponential B (odds ratio) is presented for qualification models. Control variables include all independent variables except for SES variable.

In terms of magnitude, for students at low decile schools, one incremental increase in SES is related with about 1.2 and 1.0 additional credits in the second and third year of NCEA, respectively, and an increase in a student's chance to attain NCEA Level 3 by about 7% (see Table 28). These effects are larger than any of the effects of the financial variables reviewed in the previous sections.

Gender

The results of the model showed the significant gap in educational achievement between girls and boys and, most importantly, in all models such associations are statistically significant. Table 29 contains the coefficients of the gender variable from the regression models.

Table 29

Low decile schools: Gender differences in student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	10.21**	0.14**	9.29**	0.13**	1.56**	1.99**
Teacher salary funding	10.22**	0.14**	9.26**	0.13**	1.56**	2.00**
Other government grants	10.23**	0.14**	9.31**	0.14**	1.56**	1.99**
Locally raised funds	10.24**	0.14**	9.44**	0.14**	1.57**	2.01**
Other revenues	10.16**	0.14**	9.35**	0.14**	1.56**	2.00**
Administration expenditure	10.21**	0.14**	9.36**	0.14**	1.56**	2.00**
Depreciation expenditure	10.21**	0.14**	9.35**	0.14**	1.56**	2.00**
Teacher salaries	10.22**	0.14**	9.33**	0.14**	1.57**	2.00**
Expenses on learning resources	10.20**	0.14**	9.34**	0.14**	1.56**	2.00**
Expenses on raising local funds	10.10**	0.14**	9.24**	0.13**	1.56**	1.99**
Expenses on property	10.19**	0.14**	9.35**	0.14**	1.56**	2.00**
Other expenditures	10.16**	0.14**	9.40**	0.14**	1.56**	2.00**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for student gender variable.

The findings suggest that, on average, girls at low decile schools gain 10.2 and 9.3 more credits than boys (used as reference group in the regression models) in the second and third years of NCEA, respectively. Similarly, girls have a greater chance of attaining expected NCEA qualifications. Regression coefficients suggest that girls are 56% more likely to gain NCEA Level 2 in the second year than boys, and almost twice as likely to gain NCEA Level 3 in the third year (see Table 29). The gender differences in credits and the likelihood of attaining qualifications are consistently greater in the second year than in the third year.

Ethnicity

At low decile schools there are no statistically significant differences in attainment between Asian and NZ European students (reference group for all ethnic comparisons). Table 30 shows the achievement differences between these ethnic groups once other explanatory variables in the models are controlled; however, none of the coefficients show statistically significant associations.

Table 30

Low decile schools: Asian students versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	4.90	0.03	6.55	0.06	1.05	1.15
Teacher salary funding	3.58	0.02	6.79	0.06	0.96	1.16
Other government grants	4.32	0.03	6.46	0.06	1.02	1.14
Locally raised funds	4.16	0.02	7.06	0.06	1.01	1.17
Other revenues	4.24	0.03	6.5	0.06	1.01	1.14
Administration expenditure	4.01	0.02	6.35	0.06	1.00	1.00
Depreciation expenditure	4.09	0.02	6.7	0.06	1.00	1.00
Teacher salaries	4.09	0.02	6.82	0.06	1.01	1.00
Expenses on learning resources	3.84	0.02	5.48	0.05	1.01	1.00
Expenses on raising local funds	3.17	0.02	6.63	0.06	0.95	1.00
Expenses on property	4.51	0.03	6.56	0.06	1.05	1.00
Other expenditures	3.83	0.02	6.48	0.06	0.99	1.00

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Asian students.

At low decile schools, however, there are enormous achievement gaps between Māori and NZ European students, where Māori students, on average, gain about 16 and 15 fewer credits per year and their chances to gain qualifications are 53% and 59% less in the second and third year, respectively. Table 31 presents the regression coefficients for Māori students when all other student and school-level moderator variables are controlled.

Table 31

Low decile schools: Māori students versus NZ European students.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*B*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-16.35**	-0.21**	-15.32**	-0.20**	0.48**	0.39**
Teacher salary funding	-16.85**	-0.22**	-15.04**	-0.19**	0.47**	0.40**
Other government grants	-16.67**	-0.21**	-14.61**	-0.19**	0.47**	0.41**
Locally raised funds	-16.76**	-0.21**	-14.29**	-0.19**	0.48**	0.42**
Other revenues	-17.24**	-0.22**	-14.7**	-0.19**	0.46**	0.41**
Administration expenditure	-16.79**	-0.22**	-14.58**	-0.19**	0.47**	0.42**
Depreciation expenditure	-16.79**	-0.22**	-14.90**	-0.19**	0.47**	0.40**
Teacher salaries	-16.92**	-0.22**	-14.66**	-0.19**	0.47**	0.41**
Expenses on learning resources	-16.75**	-0.21**	-14.86**	-0.19**	0.47**	0.41**
Expenses on raising local funds	-17.10**	-0.22**	-14.70**	-0.19**	0.46**	0.41**
Expenses on property	-16.72**	-0.21**	-14.68**	-0.19**	0.47**	0.41**
Other expenditures	-17.09**	-0.22**	-14.65**	-0.19**	0.46**	0.41**

Notes: **Indicates the significance level of $p < 0.001$(initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Māori students.

There is an even bigger gap in achievement between Pacific and New Zealand European students, where Pacific students gain about 20 and 11 fewer credits, and their chances of gaining expected NCEA qualifications is 67% to 70% less in the second and third years of NCEA, respectively . Table 32 presents the regression coefficients for Pacific students. In all models, with no exceptions, the regression coefficients are statistically significant.

Table 32

Low decile schools: Pacific students versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-20.09**	-0.25**	-11.94**	-0.16**	0.34**	0.28**
Teacher salary funding	-21.34**	-0.27**	-11.99**	-0.16**	0.31**	0.28**
Other government grants	-20.43**	-0.25**	-10.86**	-0.15**	0.33**	0.31**
Locally raised funds	-20.62**	-0.26**	-10.23**	-0.14**	0.33**	0.32**
Other revenues	-21.03**	-0.26**	-10.85**	-0.15**	0.32**	0.31**
Administration expenditure	-20.85**	-0.26**	-10.98**	-0.15**	0.32**	0.30**
Depreciation expenditure	-20.82**	-0.26**	-10.97**	-0.15**	0.33**	0.30**
Teacher salaries	-20.97**	-0.26**	-10.85**	-0.15**	0.32**	0.30**
Expenses on learning resources	-20.81**	-0.26**	-11.41**	-0.16**	0.33**	0.30**
Expenses on raising local funds	-21.02**	-0.26**	-10.71**	-0.15**	0.32**	0.30**
Expenses on property	-20.54**	-0.26**	-10.78**	-0.15**	0.33**	0.30**
Other expenditures	-21.17**	-0.26**	-10.83**	-0.15**	0.32**	0.30**

Notes: **Indicates the significance level of $p < 0.001$(initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Pacific students.

Table 33 (below) contains the regression coefficients measuring the achievement gap between students from other ethnic groups and the reference ethnic group, New Zealand Europeans. None of the coefficients presented in Table 33 show statistically significant associations. Such results indicate that students belonging to these ethnic groups are similar, in terms of their educational attainment.

Table 33

Low decile schools: Students of other ethnic group versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	0.81	0.00	7.40	0.03	0.67	1.09
Teacher salary funding	0.02	0.00	7.92	0.03	0.63	1.13
Other government grants	0.33	0.00	7.34	0.03	0.65	1.09
Locally raised funds	0.18	0.00	8.17	0.03	0.64	1.13
Other revenues	0.42	0.00	7.43	0.03	0.65	1.08
Administration expenditure	0.12	0.00	7.16	0.03	0.64	1.00
Depreciation expenditure	0.28	0.00	7.37	0.03	0.63	1.00
Teacher salaries	0.68	0.00	7.69	0.03	0.68	1.00
Expenses on learning resources	-0.14	0.00	6.32	0.02	0.65	1.00
Expenses on raising local funds	0.88	0.00	7.99	0.03	0.67	1.00
Expenses on property	0.71	0.00	7.57	0.03	0.67	1.00
Other expenditures	0.10	0.00	7.20	0.03	0.64	1.00

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for students from other ethnic groups.

To sum up, at low decile schools Māori and Pacific students significantly underperform by gaining fewer credits per year and being less likely to attain NCEA qualifications than NZ European students. There are no significant differences in achievement between Asian, NZ European and students from other ethnic groups at low decile schools.

Foreign students

As can be seen from Table 34, the results of regression models show that there are no statistically significant differences in the achievement level between foreign and domestic students. The coefficients for the dummy variable identifying foreign students from domestic students are found to be statistically insignificant in all credit and qualification models.

Table 34

Low decile schools: Foreign versus domestic students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	B	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	0.17	0.00	-0.21	0.00	0.86	0.77
Teacher salary funding	1.26	0.00	0.80	0.00	0.92	0.83
Other government grants	0.82	0.00	0.95	0.00	0.89	0.82
Locally raised funds	0.86	0.00	-0.24	0.00	0.89	0.79
Other revenues	1.21	0.00	0.42	0.00	0.91	0.80
Administration expenditure	1.00	0.00	0.38	0.00	0.89	1.00
Depreciation expenditure	1.00	0.00	-0.09	0.00	0.89	1.00
Teacher salaries	0.95	0.00	0.04	0.00	0.89	1.00
Expenses on learning resources	1.12	0.00	1.08	0.00	0.89	1.00
Expenses on raising local funds	2.12	0.00	0.42	0.00	0.97	1.00
Expenses on property	0.63	0.00	0.24	0.00	0.87	1.00
Other expenditures	2.26	0.00	0.35	0.00	0.96	1.00

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for foreign students.

The sub-section above summarises the effects of student background factors on the achievement of students attending low decile schools. Similarly, the following two sub-sections will present the same statistics but for students attending medium and high decile schools.

Medium decile schools: The impact of individual background factors

Socio-economic status

The positive effects of socio-economic status on student achievement are consistent in all models for medium decile schools. Table 35 presents the regression coefficients of the SES variable for medium decile schools. The results of the regression models show that one unit incremental increase in students' SES is related with 1.74 and 1.10 additional credits, and increases the chances of attaining expected NCEA qualifications by 10% and 8%, in the second and third year of NCEA respectively. The effects of SES on students' achievement are somewhat greater at medium decile schools than at low decile schools (compare Table 28 and Table 35).

Table 35

Medium decile schools: The effects of students' SES on student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	1.74**	0.12**	1.11**	0.08**	1.10**	1.08**
Teacher salary funding	1.75**	0.12**	1.10**	0.08**	1.10**	1.08**
Other government grants	1.74**	0.12**	1.10**	0.08**	1.09**	1.08**
Locally raised funds	1.74**	0.12**	1.08**	0.08**	1.10**	1.08**
Other revenues	1.75**	0.12**	1.11**	0.08**	1.10**	1.08**
Administration expenditure	1.73**	0.12**	1.12**	0.08**	1.09**	1.08**
Depreciation expenditure	1.73**	0.12**	1.11**	0.08**	1.09**	1.08**
Teacher salaries	1.73**	0.12**	1.13**	0.09**	1.10**	1.08**
Expenses on learning resources	1.74**	0.12**	1.13**	0.09**	1.10**	1.08**
Expenses on raising local funds	1.72**	0.12**	1.10**	0.08**	1.09**	1.08**
Expenses on property	1.73**	0.12**	1.10**	0.08**	1.10**	1.08**
Other expenditures	1.73**	0.12**	1.12**	0.08**	1.10**	1.08**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for SES variable.

Gender

As for low decile schools, at medium decile schools there are statistically significant gender differences in student achievement. On average, girls gain about 12 and 9.2 more credits in a year than boys, and their chances of gaining NCEA Level 2 in the second year and NCEA Level 3 in the third year is greater by 70% and 95%, respectively. Table 36 shows the coefficients for the gender variable from the regression models. The effect of gender is greater on students attending medium than low decile schools, with the exception of the effects on credits in the third year of NCEA (see Table 29 and Table 36).

Table 36

Medium decile schools: The gender differences in student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	11.99**	0.15**	9.18**	0.13**	1.70**	1.95**
Teacher salary funding	11.95**	0.15**	9.24**	0.13**	1.70**	1.96**
Other government grants	11.98**	0.15**	9.18**	0.13**	1.70**	1.95**
Locally raised funds	12.03**	0.15**	9.31**	0.13**	1.70**	1.97**
Other revenues	11.98**	0.15**	9.17**	0.13**	1.70**	1.95**
Administration expenditure	12.01**	0.15**	9.17**	0.13**	1.70**	1.95**
Depreciation expenditure	12.05**	0.15**	9.13**	0.13**	1.70**	1.94**
Teacher salaries	12.00**	0.15**	9.16**	0.13**	1.70**	1.95**
Expenses on learning resources	11.99**	0.15**	9.14**	0.13**	1.70**	1.94**
Expenses on raising local funds	12.01**	0.15**	9.14**	0.13**	1.70**	1.95**
Expenses on property	12.00**	0.15**	9.19**	0.13**	1.70**	1.95**
Other expenditures	12.00**	0.15**	9.17**	0.13**	1.70**	1.95**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for student gender variable.

Ethnicity

Compared to low decile schools where there is no achievement gap between Asian and NZ European students, there are statistically significant differences in achievement between these ethnic groups at medium decile schools. Table 37 presents the regression coefficients from the models which suggest that Asian students gain about 11 to 12 more credits and have about a 50% greater likelihood of gaining NCEA qualifications than New Zealand European students.

Table 37

Medium decile schools: Asian students versus NZ European students.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	10.62**	0.08**	12.04**	0.11**	1.51**	1.57**
Teacher salary funding	11.13**	0.08**	10.46**	0.09**	1.53**	1.44**
Other government grants	10.60**	0.08**	11.91**	0.11**	1.50**	1.56**
Locally raised funds	9.65**	0.07**	9.88**	0.09**	1.43**	1.41**
Other revenues	11.00**	0.08**	12.04**	0.11**	1.52**	1.57**
Administration expenditure	10.27**	0.08**	11.64**	0.10**	1.46**	1.53**
Depreciation expenditure	11.10**	0.08**	11.67**	0.10**	1.54**	1.54**
Teacher salaries	10.87**	0.08**	11.30**	0.10**	1.52**	1.50**
Expenses on learning resources	10.50**	0.08**	11.62**	0.10**	1.49**	1.52**
Expenses on raising local funds	10.76**	0.08**	11.85**	0.11**	1.52**	1.56**
Expenses on property	10.67**	0.08**	11.91**	0.11**	1.50**	1.57**
Other expenditures	10.69**	0.08**	11.93**	0.11**	1.52**	1.56**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Asian students.

As for low decile schools, at medium decile schools, Māori students gain fewer credits, and are less likely to attain expected NCEA qualifications than New Zealand European students, the reference ethnic group. The achievement gap between these ethnic groups is a little greater at medium decile schools than at low decile schools (compare Table 31 and Table 38). Māori students at medium decile schools on average gain 18 and 15 fewer credits than New Zealand European students, in their second and third years respectively, and are approximately 58% to 60% less likely to attain expected NCEA qualifications.

Table 38

Medium decile schools: Māori students versus NZ European students.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-18.44**	-0.17**	-14.90**	-0.14**	0.42**	0.40**
Teacher salary funding	-18.48**	-0.17**	-14.85**	-0.14**	0.42**	0.40**
Other government grants	-18.42**	-0.17**	-14.83**	-0.14**	0.42**	0.40**
Locally raised funds	-18.38**	-0.17**	-14.81**	-0.14**	0.42**	0.40**
Other revenues	-18.51**	-0.17**	-14.92**	-0.14**	0.42**	0.40**
Administration expenditure	-18.42**	-0.17**	-14.93**	-0.14**	0.42**	0.40**
Depreciation expenditure	-18.29**	-0.17**	-15.05**	-0.15**	0.42**	0.40**
Teacher salaries	-18.48**	-0.17**	-14.83**	-0.14**	0.42**	0.40**
Expenses on learning resources	-18.38**	-0.17**	-14.87**	-0.14**	0.42**	0.40**
Expenses on raising local funds	-18.37**	-0.17**	-15.00**	-0.15**	0.42**	0.40**
Expenses on property	-18.44**	-0.17**	-15.01**	-0.15**	0.42**	0.40**
Other expenditures	-18.42**	-0.17**	-14.89**	-0.14**	0.42**	0.40**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Māori students.

Pacific students at medium decile schools also underperform relative to New Zealand European reference group, which is also consistent with the findings at low decile schools. At medium decile schools, Pacific students gain on average about 17 fewer credits, and their chances of gaining NCEA qualifications is 63% to 73% less than for New Zealand European students attending similar schools. Table 39 presents the coefficients from the regression models and they suggest that the achievement gap between these ethnic groups is not by chance. Compared to the achievement gap between Pacific and New Zealand European students at low decile schools, the achievement gap is narrowing in the second year but widening in the third year of NCEA (compare Table 32 and Table 39).

Table 39

Medium decile schools: Pacific students versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-17.2**	-0.11**	-16.34**	-0.11**	0.37**	0.27**
Teacher salary funding	-16.94**	-0.11**	-17.27**	-0.12**	0.37**	0.25**
Other government grants	-17.08**	-0.11**	-16.23**	-0.11**	0.37**	0.27**
Locally raised funds	-17.32**	-0.11**	-17.06**	-0.11**	0.37**	0.26**
Other revenues	-16.87**	-0.11**	-16.33**	-0.11**	0.37**	0.27**
Administration expenditure	-17.28**	-0.11**	-16.62**	-0.11**	0.37**	0.26**
Depreciation expenditure	-16.79**	-0.11**	-16.75**	-0.11**	0.38**	0.26**
Teacher salaries	-17.28**	-0.11**	-16.58**	-0.11**	0.37**	0.27**
Expenses on learning resources	-17.08**	-0.11**	-16.41**	-0.11**	0.37**	0.27**
Expenses on raising local funds	-16.88**	-0.11**	-16.51**	-0.11**	0.38**	0.27**
Expenses on property	-17.20**	-0.11**	-16.56**	-0.11**	0.36**	0.27**
Other expenditures	-17.16**	-0.11**	-16.43**	-0.11**	0.37**	0.27**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Pacific students.

The findings from regression models suggest that at medium decile schools, students from other ethnic groups gain about 11 fewer credits in the second year and are about 54% and 51% less likely to gain expected NCEA qualifications in the second and third year of NCEA respectively. Table 40 presents the effect of ethnicity on students from other ethnic groups attending medium decile schools. The same effects presented for low decile schools suggest that there are no significant differences in achievement between these ethnic groups (see Table 33). It seems, however, that students from other ethnic groups at medium decile schools are different from the New Zealand European reference ethnic group in terms of academic achievement.

Table 40

Medium decile schools: Students of other ethnic groups versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-11.07**	-0.04**	-7.42	-0.03	0.46**	0.49**
Teacher salary funding	-10.70**	-0.04**	-8.18	-0.03	0.46**	0.47**
Other government grants	-11.01**	-0.04**	-7.38	-0.03	0.46**	0.49**
Locally raised funds	-11.38**	-0.04**	-7.79	-0.03	0.45**	0.48**
Other revenues	-10.70**	-0.04**	-7.45	-0.03	0.46**	0.49**
Administration expenditure	-11.17**	-0.04**	-7.39	-0.03	0.45**	0.49**
Depreciation expenditure	-10.82**	-0.04**	-7.46	-0.03	0.46**	0.49**
Teacher salaries	-10.96**	-0.04**	-7.69	-0.03	0.46**	0.48**
Expenses on learning resources	-10.93**	-0.04**	-7.40	-0.03	0.46**	0.49**
Expenses on raising local funds	-10.88**	-0.04**	-7.30	-0.03	0.46**	0.49**
Expenses on property	-11.01**	-0.04**	-7.46	-0.03	0.46**	0.49**
Other expenditures	-10.96**	-0.04**	-7.36	-0.03	0.46**	0.49**

Notes: **Indicate the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential B (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for students from other ethnic groups.

To sum up, there are significant differences in the achievement between ethnic groups at medium decile schools. Asian students outperform New Zealand European students with Māori, Pacific and students from other ethnic groups lagging behind their Asian or New Zealand European counterparts. Overall, for each ethnic group, the effects of ethnicity are greater on students attending medium decile schools than for students at low decile schools.

Foreign students

Table 41 shows the effect of residency on student achievement at medium decile schools. The analysis shows that foreign students gain about 10 fewer credits in the second year of NCEA. However, there are no statistically significant differences between foreign and domestic students in the credits gained in the third year. In addition, these groups of students have the same chances of attaining NCEA qualifications in both years analysed.

Table 41

Medium decile schools: Foreign versus domestic students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-10.57**	-0.03**	-7.11	-0.03	0.68	0.80
Teacher salary funding	-10.72**	-0.03**	-6.45	-0.02	0.68	0.84
Other government grants	-10.50**	-0.03**	-6.96	-0.02	0.68	0.81
Locally raised funds	-10.43**	-0.03**	-6.24	-0.02	0.69	0.85
Other revenues	-10.71**	-0.03**	-7.12	-0.03	0.68	0.80
Administration expenditure	-10.37**	-0.03**	-6.76	-0.02	0.69	0.82
Depreciation expenditure	-11.00**	-0.03**	-6.72	-0.02	0.66	0.82
Teacher salaries	-10.75**	-0.03**	-6.53	-0.02	0.68	0.84
Expenses on learning resources	-10.55**	-0.03**	-6.82	-0.02	0.68	0.82
Expenses on raising local funds	-10.51**	-0.03**	-6.93	-0.02	0.68	0.81
Expenses on property	-10.57**	-0.03**	-7.10	-0.03	0.68	0.81
Other expenditures	-10.61**	-0.03**	-6.96	-0.02	0.67	0.81

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for foreign students.

High decile schools: The impact of individual background factors

Socio-economic status

As for low and medium decile schools, the findings suggest that students' SES has a statistically significant positive effect on the achievement of students at high decile schools. One unit incremental increase in the SES of students is associated with approximately 1.5 and 1.2 additional credits in the second and third years of NCEA. Also, one unit incremental increase in students' SES increases the chances of students attaining NCEA Level 2 in the second year by 11%, and NCEA Level 3 in the third year by 8%. Table 42 below presents the regression coefficients for the SES variable on student achievement at high decile schools. SES has a bigger effect on students at medium and high decile schools than at low decile schools; however, the differences are reasonably small: less than 1 credit in a year, and 0.02 to 0.05 in odds ratios (compare Table 28, Table 35, and Table 42).

Table 42

High decile schools: The effects of students' SES on student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	1.58**	0.11**	1.15**	0.09**	1.11**	1.08**
Teacher salary funding	1.56**	0.11**	1.18**	0.09**	1.11**	1.08**
Other government grants	1.51**	0.11**	1.15**	0.09**	1.11**	1.08**
Locally raised funds	1.57**	0.11**	1.13**	0.08**	1.11**	1.08**
Other revenues	1.55**	0.11**	1.15**	0.09**	1.11**	1.08**
Administration expenditure	1.54**	0.11**	1.17**	0.09**	1.11**	1.08**
Depreciation expenditure	1.55**	0.11**	1.16**	0.09**	1.11**	1.08**
Teacher salaries	1.54**	0.11**	1.17**	0.09**	1.11**	1.08**
Expenses on learning resources	1.56**	0.11**	1.18**	0.09**	1.11**	1.08**
Expenses on raising local funds	1.56**	0.11**	1.18**	0.09**	1.11**	1.08**
Expenses on property	1.54**	0.11**	1.18**	0.09**	1.11**	1.08**
Other expenditures	1.54**	0.11**	1.17**	0.09**	1.11**	1.08**

Notes: **Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for SES of students.

Gender

The effects of gender on student achievement are consistent whether students attend low, medium, or high decile schools. Table 43 presents the regression coefficients of the gender variable. The results suggest that girls gain, on average, 11.6 and 9.9 more credits than boys in their second and their third years respectively, and their likelihood of attaining NCEA qualifications is better by 80% and 97% in these years.

Table 43

High decile schools: The gender differences in student achievement.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*B*	*Exp (B)* (Odds Ratio)	
Operational grant	11.63**	0.16**	9.89**	0.15**	1.80**	1.97**
Teacher salary funding	11.60**	0.16**	9.89**	0.15**	1.81**	1.97**
Other government grants	11.59**	0.16**	9.71**	0.15**	1.80**	1.95**
Locally raised funds	11.61**	0.16**	9.83**	0.15**	1.81**	1.95**
Other revenues	11.63**	0.16**	9.93**	0.15**	1.81**	1.97**
Administration expenditure	11.62**	0.16**	9.89**	0.15**	1.80**	1.97**
Depreciation expenditure	11.64**	0.16**	9.81**	0.15**	1.80**	1.96**
Teacher salaries	11.60**	0.16**	9.90**	0.15**	1.80**	1.97**
Expenses on learning resources	11.62**	0.16**	9.91**	0.15**	1.80**	1.97**
Expenses on raising local funds	11.58**	0.16**	9.90**	0.15**	1.80**	1.97**
Expenses on property	11.62**	0.16**	9.91**	0.15**	1.80**	1.97**
Other expenditures	11.59**	0.16**	9.92**	0.15**	1.80**	1.97**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for gender variable.

The comparison of gender effects on students at low, medium and high decile schools suggest the effects are consistent and the difference in the magnitude of effects on credits is reasonably comparable (less than 2 credits in a year) but there are quite substantial gender differences in the likelihood to attain qualifications. For example, the chances of girls attaining NCEA Level 2 by the end of their second year are 56% greater than for boys at low decile schools, rising to 70% for girls at medium decile schools and 80% for those at high decile schools (see Table 29, Table 36 and Table 43).

Ethnicity

On average, Asian students at high decile schools gain about 9 more credits per year than NZ European students, and their chances of gaining expected qualifications are greater by approximately 45%. As seen from Table 44 below, all credit models and the majority of qualification models show statistically significant effects.

Table 44

High decile schools: Asian students versus NZ European students.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	8.61**	0.09**	8.66**	0.10**	1.44**	1.44**
Teacher salary funding	8.46**	0.09**	9.00**	0.10**	1.41	1.46**
Other government grants	8.00**	0.08**	8.56**	0.09**	1.44**	1.45**
Locally raised funds	8.56**	0.09**	8.39**	0.09**	1.4	1.38**
Other revenues	8.23**	0.08**	8.94**	0.10**	1.43**	1.48**
Administration expenditure	8.16**	0.08**	8.94**	0.10**	1.45**	1.47**
Depreciation expenditure	8.39**	0.09**	8.25**	0.09**	1.39	1.40**
Teacher salaries	8.14**	0.08**	8.92**	0.10**	1.45**	1.47**
Expenses on learning resources	8.76**	0.09**	9.08**	0.10**	1.46**	1.47**
Expenses on raising local funds	8.34**	0.08**	8.96**	0.10**	1.45**	1.47**
Expenses on property	8.25**	0.08**	8.92**	0.10**	1.45**	1.46**
Other expenditures	8.33**	0.08**	8.93**	0.10**	1.47**	1.47**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Asian students.

There are no differences in achievement between Asian and NZ European students at low decile schools. However, at medium and high decile schools Asian students outperform NZ European students with the achievement gap between these ethnic groups being highest at medium decile schools (see Table 30, Table 37 and Table 44).

At high decile schools Māori students gain, on average, 16 fewer credits and their chances of gaining NCEA qualifications are approximately 60% less than for New Zealand European students. Table 45 presents the regression coefficients, which show that for Māori students the associations between ethnicity and academic achievements are statistically significant in all models tested.

Table 45

High decile schools: Māori students versus NZ European students.

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-16.34**	-0.12**	-16.46**	-0.13**	0.41**	0.38**
Teacher salary funding	-16.28**	-0.12**	-16.47**	-0.13**	0.41**	0.38**
Other government grants	-16.26**	-0.12**	-16.34**	-0.13**	0.41**	0.38**
Locally raised funds	-16.32**	-0.12**	-16.47**	-0.13**	0.41**	0.38**
Other revenues	-16.35**	-0.13**	-16.47**	-0.13**	0.41**	0.38**
Administration expenditure	-16.33**	-0.12**	-16.56**	-0.13**	0.41**	0.38**
Depreciation expenditure	-16.34**	-0.12**	-16.51**	-0.13**	0.41**	0.38**
Teacher salaries	-16.30**	-0.12**	-16.47**	-0.13**	0.41**	0.38**
Expenses on learning resources	-16.34**	-0.12**	-16.46**	-0.13**	0.41**	0.38**
Expenses on raising local funds	-16.23**	-0.12**	-16.45**	-0.13**	0.41**	0.38**
Expenses on property	-16.29**	-0.12**	-16.49**	-0.13**	0.41**	0.38**
Other expenditures	-16.26**	-0.12**	-16.46**	-0.13**	0.41**	0.38**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Māori students.

Māori students consistently gain fewer credits and are less likely to attain expected qualifications, regardless whether they are at low, medium or high decile schools. The gap in credits between these ethnic groups is highest at medium decile schools, and Māori students have the lowest chances of gaining qualifications at high decile schools (see Table 31, Table 38 and Table 45).

Similar findings can be seen for Pacific students at high decile schools who gain, on average, 19 and 23 fewer credits, and have about 54% and 79% less chance of gaining respective qualifications in their second and third years of NCEA. All models showed statistically significant associations (see Table 46).

Table 46

High decile schools: Pacific students versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*B*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-19.23**	-0.09**	-24.01**	-0.13**	0.36**	0.21**
Teacher salary funding	-19.27**	-0.09**	-23.84**	-0.13**	0.35**	0.21**
Other government grants	-19.52**	-0.09**	-23.97**	-0.13**	0.36**	0.21**
Locally raised funds	-19.24**	-0.09**	-24.11**	-0.13**	0.35**	0.20**
Other revenues	-19.65**	-0.10**	-23.83**	-0.13**	0.36**	0.21**
Administration expenditure	-19.61**	-0.09**	-24.02**	-0.13**	0.36**	0.21**
Depreciation expenditure	-19.55**	-0.09**	-24.13**	-0.13**	0.35**	0.21**
Teacher salaries	-19.53**	-0.09**	-23.92**	-0.13**	0.36**	0.21**
Expenses on learning resources	-19.25**	-0.09**	-23.78**	-0.13**	0.36**	0.21**
Expenses on raising local funds	-18.86**	-0.09**	-23.81**	-0.13**	0.36**	0.21**
Expenses on property	-19.55**	-0.09**	-23.93**	-0.13**	0.36**	0.21**
Other expenditures	-19.44**	-0.09**	-23.95**	-0.13**	0.36**	0.21**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for Pacific students.

The achievement gap between Pacific and New Zealand European students is greater than the gap between Māori and New Zealand European students, which implies that Pacific students have poorer performance than Māori students. Irrespective of whether they attend low, medium or high decile schools, Pacific students consistently gain fewer credits and are less likely to attain the expected qualification. On average, the achievement gap between these ethnic groups is greatest at high decile schools (see Table 32, Table 39 and Table 46).

At high decile schools, there are no statistically significant differences between the performance of students who belong to other ethnic groups and the reference group. Table 47 presents the results of the regression models, which show that the differences in achievement are not statistically significant.

Table 47

High decile schools: Students of other ethnic group versus NZ European students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-2.68	-0.01	-2.91	-0.01	0.70	0.74
Teacher salary funding	-2.93	-0.01	-2.66	-0.01	0.69	0.75
Other government grants	-3.27	-0.01	-3.02	-0.01	0.70	0.74
Locally raised funds	-2.79	-0.01	-3.02	-0.01	0.68	0.73
Other revenues	-3.1	-0.01	-2.48	-0.01	0.70	0.77
Administration expenditure	-3.12	-0.01	-2.77	-0.01	0.70	0.75
Depreciation expenditure	-3.01	-0.01	-2.99	-0.01	0.68	0.74
Teacher salaries	-3.17	-0.01	-2.75	-0.01	0.70	0.76
Expenses on learning resources	-2.69	-0.01	-2.57	-0.01	0.71	0.76
Expenses on raising local funds	-3.2	-0.01	-2.77	-0.01	0.70	0.76
Expenses on property	-3.07	-0.01	-2.73	-0.01	0.70	0.75
Other expenditures	-2.95	-0.01	-2.71	-0.01	0.71	0.76

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for students from other ethnic groups.

It seems that only at medium decile schools are there some significant differences in the achievement levels between these ethnic groups (see Table 33, Table 40 and Table 47).

Foreign students

At high decile schools there are statistically significant differences between the achievement levels of foreign and domestic students. The regression coefficients presented in Table 48 suggest that foreign students gain, on average, 19 fewer credits in the second year of NCEA, and are 66% and 49% less likely to gain NCEA qualifications in the second and third years respectively. The difference in credits gained in the third year is not statistically significant.

Table 48

High decile schools: Foreign versus domestic students

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*B*	*Exp (B)* (Odds Ratio)	
Operational grant	-19.27**	-0.09**	-8.71	-0.04	0.34**	0.52**
Teacher salary funding	-19.31**	-0.09**	-8.89	-0.04	0.34**	0.51**
Other government grants	-18.99**	-0.09**	-8.79	-0.04	0.34**	0.51**
Locally raised funds	-19.28**	-0.09**	-8.64	-0.04	0.34**	0.52**
Other revenues	-19.10**	-0.09**	-8.98	-0.04	0.33**	0.50**
Administration expenditure	-19.12**	-0.09**	-8.81	-0.04	0.33**	0.51**
Depreciation expenditure	-19.31**	-0.09**	-8.23	-0.04	0.35**	0.53
Teacher salaries	-19.17**	-0.09**	-8.85	-0.04	0.34**	0.51**
Expenses on learning resources	-19.35**	-0.09**	-8.96	-0.04	0.33**	0.51**
Expenses on raising local funds	-19.26**	-0.09**	-8.90	-0.04	0.34**	0.51**
Expenses on property	-19.20**	-0.09**	-8.82	-0.04	0.34**	0.51**
Other expenditures	-19.14**	-0.09**	-8.82	-0.04	0.33**	0.51**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for foreign students.

Only at medium and high decile schools are there some statistically significant differences in the achievement levels between these groups of students. However, statistically significant differences in credits gained in the second year at medium and high decile schools do not replicate to the third year. Only at high decile schools, foreign students consistently less likely to attain expected qualifications, and such statistically significant effects replicate across years.

Low decile schools: The impact of other school factors

This and the following two sub-sections will present the effects of school non-financial factors, such as school authority and school gender type, on student achievement when student background, school resourcing and financial management variables are controlled.

School authority

The regression results suggest that at low decile schools those students who attend State schools gain about 11 fewer credits in the third year of NCEA, and are about 50% less

likely to attain NCEA Level 3 in the third year than similar students who attended State-Integrated schools. The effects of school authority did not replicate across years with two exceptions that are worth mentioning (see Table 49). In the models with proportions of teacher salary funding and locally raised funds, the effects of school authority is replicated across years. This suggests that when a comparison is made across schools, and this generates proportionately the same amount of funding for teacher salaries from government, or generates proportionately the same amount of expenditure to raise local funds, students attending State schools are less likely to gain NCEA qualification than their counterparts attending State-Integrated schools.

Table 49

Low decile schools: State versus State-Integrated schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-6.58	-0.06	-11.09**	-0.11**	0.65	0.49**
Teacher salary funding	-8.44	-0.08	-14.80**	-0.15**	0.55**	0.39**
Other government grants	-6.78	-0.06	-10.78**	-0.11**	0.65	0.51**
Locally raised funds	-6.59	-0.06	-12.31**	-0.12**	0.64	0.48**
Other revenues	-3.90	-0.04	-10.63**	-0.11**	0.75	0.51**
Administration expenditure	-6.00	-0.06	-10.42**	-0.10**	0.67	0.51**
Depreciation expenditure	-6.15	-0.06	-10.23**	-0.10**	0.65	0.53**
Teacher salaries	-7.14	-0.07	-11.38**	-0.11**	0.60	0.48**
Expenses on learning resources	-5.78	-0.05	- 9.75**	-0.10**	0.67	0.51**
Expenses on raising local funds	-7.98	-0.07	-12.37**	-0.12**	0.58**	0.44**
Expenses on property	-4.53	-0.04	-10.29**	-0.10**	0.77	0.51**
Other expenditures	-5.71	-0.05	-10.47**	-0.10**	0.68	0.51**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for State schools.

School gender type

The comparison between girls with similar demographic profiles attending similar schools shows that girls attending single-sex schools gain more credits and are more likely to gain expected qualifications than similar girls at co-educational schools. However, the effects are only statistically significant in the second year of NCEA, which suggests that these

effects are more likely to be due to random variance. Table 50 shows the achievement gap between girls at single and co-educational low decile schools. It should be noted that although the effects are considered to be due to random variance, the differences in achievements are enormous. In credits, this amount is about 23 credits, and girls at single-sex schools are almost 6 to 7 times more likely to gain NCEA Level 2 at the end of the second year of NCEA (see Table 50). Also, only models with a proportion of teacher salary funding and expenses on locally raised funds showed consistent positive effects of single-sex schools in attainment of NCEA qualifications.

Table 50

Low decile schools: Girls only schools versus co-educational schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	23.90**	0.12**	5.49	0.05	6.30**	1.53
Teacher salary funding	22.67**	0.11**	6.11	0.06	5.75**	1.59**
Other government grants	22.55**	0.11**	5.49	0.05	5.93**	1.51
Locally raised funds	23.63**	0.11**	4.62	0.04	6.33**	1.46
Other revenues	28.06**	0.14**	5.24	0.05	7.76**	1.42
Administration expenditure	23.70**	0.12**	5.09	0.05	6.24**	1.48
Depreciation expenditure	23.60**	0.11**	5.20	0.05	6.09**	1.50
Teacher salaries	24.38**	0.12**	5.98	0.05	6.82**	1.59
Expenses on learning resources	23.31**	0.11**	3.73	0.03	6.17**	1.42
Expenses on raising local funds	26.11**	0.13**	5.90	0.05	7.30**	1.58**
Expenses on property	25.26**	0.12**	5.29	0.05	7.10**	1.48
Other expenditures	24.45**	0.12**	4.63	0.04	6.50**	1.44

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for girls only school.

There are no statistically significant differences in achievement levels between boys who attend single and co-educational schools. It seems that school gender type has no effect on the achievement of boys at low decile schools. All coefficients from the regression models presented in the Table 51 show that the effects of school gender type are not statistically significant.

Table 51

Low decile schools: Boys only school versus co-educational school

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	10.57	0.06	0.76	0.00	1.31	0.71
Teacher salary funding	8.90	0.05	-2.86	-0.01	1.14	0.56
Other government grants	10.36	0.06	2.93	0.01	1.29	0.83
Locally raised funds	10.26	0.06	1.46	0.01	1.26	0.78
Other revenues	11.50	0.06	2.53	0.01	1.37	0.85
Administration expenditure	10.84	0.06	2.89	0.01	1.33	1.00
Depreciation expenditure	10.69	0.06	2.81	0.01	1.28	1.00
Teacher salaries	9.24	0.05	2.08	0.01	1.12	1.00
Expenses on learning resources	10.56	0.06	3.88	0.02	1.31	1.00
Expenses on raising local funds	12.32	0.07	2.16	0.01	1.47	1.00
Expenses on property	11.20	0.06	2.78	0.01	1.37	1.00
Other expenditures	10.72	0.06	1.52	0.01	1.31	1.00

Notes: This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for boys only school.

To sum up, it seems that at low deciles, single-sex schools have some positive impacts on achievement for girls, but not for boys. However, the positive effects do not replicate across years and they are only observed in the second year of NCEA.

Medium decile schools: The impact of other school factors

School authority

Table 52 shows that school authority has a significant effect on students' achievement at medium decile schools. Students attending State schools gain, on average, 12 to 13 fewer credits in the second and third year of NCEA, and they are about 50% to 55% less likely to attain expected NCEA qualifications than comparable students attending State-Integrated schools. At medium decile schools the effects of school authority are statistically significant in all models.

Table 52

Medium decile schools: State versus State-Integrated schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-12.41**	-0.09**	-13.03**	-0.11**	0.43**	0.48**
Teacher salary funding	-11.91**	-0.09**	-14.54**	-0.12**	0.44**	0.44**
Other government grants	-11.97**	-0.09**	-12.62**	-0.1**	0.45**	0.50**
Locally raised funds	-12.60**	-0.09**	-13.37**	-0.11**	0.43**	0.47**
Other revenues	-12.14**	-0.09**	-13.02**	-0.11**	0.44**	0.48**
Administration expenditure	-12.51**	-0.09**	-12.47**	-0.10**	0.43**	0.51**
Depreciation expenditure	-12.16**	-0.09**	-13.01**	-0.11**	0.44**	0.48**
Teacher salaries	-11.72**	-0.09**	-14.07**	-0.12**	0.44**	0.46**
Expenses on learning resources	-12.07**	-0.09**	-12.68**	-0.11**	0.44**	0.5**
Expenses on raising local funds	-13.41**	-0.10**	-13.58**	-0.11**	0.41**	0.48**
Expenses on property	-12.18**	-0.09**	-12.09**	-0.10**	0.43**	0.51**
Other expenditures	-11.93**	-0.09**	-12.64**	-0.10**	0.47**	0.50**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for State schools.

Compared to the random effects of school authority observed at low decile schools, at medium decile schools the effects are statistically significant and replicate across years, suggesting that these differences are not due to random variation (see Table 49 and Table 52). The difference in performances of students is greater at medium decile schools.

School gender

Girls at medium decile single-sex schools gain approximately 6 additional credits in the second year of NCEA and are about 50% more likely to attain NCEA qualifications than girls with similar backgrounds attending integrated schools. The effects of school gender are statistically significant only in the second year of NCEA, while the coefficients in the credit models change sign from second to third year, which indicates that these effects are more likely due to random variation (see Table 53). When the same effects are compared with the effects at low decile schools, the findings across low and medium decile schools are similar, and suggest that gender type of the school has no significant impact on achievement of girls in the third year of NCEA (see Table 50 and Table 53).

Table 53

Medium decile schools: Girls only school versus co-educational schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	6.39**	0.06**	0.40	0.00	1.50**	1.10
Teacher salary funding	6.06**	0.06**	0.89	0.01	1.48**	1.13
Other government grants	5.77**	0.06**	-0.17	0.00	1.40**	1.07
Locally raised funds	6.29**	0.06**	-0.79	-0.01	1.49**	1.03
Other revenues	7.19**	0.07**	0.34	0.00	1.52**	1.10
Administration expenditure	6.75**	0.07**	1.26	0.01	1.53**	1.17
Depreciation expenditure	6.83**	0.07**	0.03	0.00	1.52**	1.08
Teacher salaries	6.81**	0.07**	-0.60	-0.01	1.51**	1.04
Expenses on learning resources	6.72**	0.07**	0.23	0.00	1.53**	1.09
Expenses on raising local funds	5.76**	0.06**	0.33	0.00	1.44**	1.10
Expenses on property	6.57**	0.07**	0.25	0.00	1.53**	1.11
Other expenditures	6.53**	0.07**	0.56	0.01	1.49**	1.12

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for girls only school.

Similar effects are observed for boys attending single-sex schools. At medium decile schools, boys attending boys' only schools gain more credits and are more likely to attain NCEA qualifications in their second year of upper secondary schooling. Table 54 presents the effect of school gender type on achievement of boys at medium decile schools. Interestingly, in the expenditure model with the proportion of teacher salaries, although the effects replicate to the third year, the impact changes from positive to negative, suggesting that these effects are more likely to be due to random variation.

Table 54

Medium decile schools: Boys only schools versus co-educational schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	8.24**	0.06**	-3.76	-0.03	1.32**	1.02
Teacher salary funding	8.02**	0.06**	-4.03	-0.03	1.31**	1.01
Other government grants	7.76**	0.06**	-4.13	-0.04	1.26	1.00
Locally raised funds	8.08**	0.06**	-4.13	-0.04	1.31**	1.00
Other revenues	9.02**	0.07**	-3.68	-0.03	1.34**	1.02
Administration expenditure	9.14**	0.07**	-2.53	-0.02	1.42**	1.11
Depreciation expenditure	8.74**	0.07**	-3.90	-0.03	1.35**	1.01
Teacher salaries	8.88**	0.07**	-5.23**	-0.05**	1.33**	0.94
Expenses on learning resources	8.44**	0.06**	-3.48	-0.03	1.34**	1.04
Expenses on raising local funds	7.77**	0.06**	-3.32	-0.03	1.29**	1.05
Expenses on property	8.30**	0.06**	-2.89	-0.02	1.29**	1.07
Other expenditures	8.06**	0.06**	-3.89	-0.03	1.23	1.00

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for boys only school.

These findings can be compared to the similar findings on the impact of school gender type on achievement of boys at low decile schools and suggest that there is no systematic effect of school gender type on achievement of boys (see Table 51 and Table 54).

High decile schools: The impact of other school factors

School Authority

Table 55 presents the findings of regression models on the impact of school authority on achievement of students at high decile schools. The findings suggest that school authority has a significant effect on credits gained in the third year of NCEA; however, such effects did not replicate in the second year. The impact of school authority on attainment of respective NCEA qualifications is consistent in both years analysed, suggesting that students attending State schools are about 40% less likely to attain NCEA qualifications than their counterparts attending State-Integrated schools.

Table 55

High decile schools: State versus State-Integrated schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	-3.53	-0.04	-10.96**	-0.14**	0.62**	0.59**
Teacher salary funding	-3.28	-0.04	-10.68**	-0.13**	0.58**	0.58**
Other government grants	-3.11	-0.04	-9.93**	-0.13**	0.63**	0.62**
Locally raised funds	-3.79	-0.04	-10.90**	-0.14**	0.61**	0.59**
Other revenues	-3.78	-0.04	-9.45**	-0.12**	0.62**	0.65**
Administration expenditure	-3.95	-0.05	-11.23**	-0.14**	0.61**	0.58**
Depreciation expenditure	-3.84	-0.04	-10.97**	-0.14**	0.60**	0.59**
Teacher salaries	-3.74	-0.04	-10.78**	-0.14**	0.61**	0.61**
Expenses on learning resources	-4.05	-0.05	-11.00**	-0.14**	0.61**	0.60**
Expenses on raising local funds	-2.68	-0.03	-10.55**	-0.13**	0.61**	0.59**
Expenses on property	-4.02	-0.05	-10.89**	-0.14**	0.61**	0.60**
Other expenditures	-3.05	-0.04	-10.82**	-0.14**	0.65**	0.59**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for state schools.

The comparison of the effects of State schools across deciles suggests that only at medium decile schools are there consistent statistically significant differences in the achievement of students attending State and State-Integrated schools, where students at State schools gain fewer credits, and are less likely to attain qualifications (see Table 52). The impact of school authority is similar across low and high decile schools. There are statistically significant differences in the credits gained in the third year of NCEA, but these effects are not evident in the second year. However, across decile groups, the findings are consistent suggesting that the likelihood of students attaining expected NCEA qualifications is greater for students attending State-Integrated schools rather than State schools (see Table 49, Table 52 and Table 55).

School gender type

At high decile schools, girls who attend single-sex schools gain approximately 9 and 5 extra credits in a year, and have double the chance of gaining NCEA Level 2. They are also about 60% more likely to gain NCEA Level 3 than girls at co-educational schools (see

Table 56). Such consistent effects are not observed at low and medium decile schools (see Table 50 and Table 53).

Table 56

High decile schools: Girls only school versus co-educational schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	9.83**	0.11**	5.36**	0.07**	2.05**	1.55**
Teacher salary funding	9.37**	0.11**	5.52**	0.07**	2.06**	1.57**
Other government grants	8.70**	0.10**	4.35**	0.05**	2.03**	1.47**
Locally raised funds	9.38**	0.11**	5.12**	0.06**	2.05**	1.51**
Other revenues	9.33**	0.11**	6.85**	0.08**	2.05**	1.75**
Administration expenditure	9.27**	0.11**	5.97**	0.07**	2.08**	1.63**
Depreciation expenditure	9.48**	0.11**	4.34**	0.05**	1.99**	1.43**
Teacher salaries	9.32**	0.11**	5.63**	0.07**	2.07**	1.60**
Expenses on learning resources	9.35**	0.11**	5.52**	0.07**	2.08**	1.57**
Expenses on raising local funds	9.19**	0.11**	5.67**	0.07**	2.07**	1.57**
Expenses on property	9.21**	0.11**	5.52**	0.07**	2.07**	1.59**
Other expenditures	9.87**	0.11**	5.58**	0.07**	2.17**	1.57**

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variables for girls only schools.

Table 57 presents the differences in achievement between boys attending single- and co-educational high decile schools. Only in the second year of NCEA are there statistically significant differences in achievement between boys attending single- and co-educational schools. Since these effects did not replicate in both years, they are considered random effects. When the impact of single gender schools for boys is looked at across decile groups, the overall findings suggest that going to a single-gender school has no effect on boys' achievement (see Table 51, Table 54 and Table 57).

Table 57

High decile schools: Boys only schools versus co-educational schools

Models	Credit models				Qualification models	
	2007		2008		2007	2008
	b	*β*	*b*	*β*	*Exp (B)* (Odds Ratio)	
Operational grant	7.83**	0.07**	-0.38	0.00	1.32	1.04
Teacher salary funding	7.97**	0.07**	-0.06	0.00	1.30	1.07
Other government grants	6.83**	0.06**	-1.61	-0.02	1.27	0.98
Locally raised funds	7.19**	0.06**	0.37	0.00	1.37	1.12
Other revenues	8.26**	0.07**	0.28	0.00	1.26	1.09
Administration expenditure	7.72**	0.07**	0.03	0.00	1.31	1.08
Depreciation expenditure	7.58**	0.06**	0.36	0.00	1.33	1.10
Teacher salaries	7.76**	0.07**	0.05	0.00	1.30	1.09
Expenses on learning resources	8.11**	0.07**	-0.09	0.00	1.31	1.07
Expenses on raising local funds	8.43**	0.07**	0.14	0.00	1.30	1.07
Expenses on property	7.76**	0.07**	-0.07	0.00	1.30	1.06
Other expenditures	7.80**	0.07**	-0.13	0.00	1.32	1.07

Notes: ** Indicates the significance level of $p < 0.001$ (initially $p < 0.01$) corrected for alpha inflation using Bonferroni correction for multiple measurements. This table presents the results of 48 regression models. Unstandardised *b* and Standardised *β* coefficients are presented for credit models and Exponential *B* (odds ratio) is presented for qualification models. Control variables include all independent variables except for dummy variable for boys only school.

The following sub-section will presents the variance explained by all models for low, medium and high decile schools.

The variance explained by the models

The R^2 is an indicator of goodness of fit of a models tested. Adjusted R square is a modification of R^2 that adjusts for the number of explanatory terms in a model. Since the regression models tested in this study are developed in two blocks, where the first block includes variables related to the individuals and the second block includes school variables, the adjusted R square of the first block indicates the variance explained by student level variables and change in adjusted R square between block 1 and 2 indicates the contribution of the school factors in explaining the variance in student achievement. This is comparable with variance partitioning statistics produced by multilevel models.

Models for low decile schools

Table 58 presents statistics on variance in student achievement explained by student and school-level variables by the models for low decile schools. According to the adjusted R-square in Table 58, these models explain about 12% and 10% of variance in credits gained by students in the second and third year respectively. The majority of the variance in credits gained is explained by student-level factors, with only about 24% of the total variance in the second year and about 17 % of total variance in the third year explained by school-level explanatory variables.

Table 58

Low decile schools: The variance explained (R^2) by models.

Models	2007				2008			
	Student	School	Total	% School	Student	School	Total	% School
CREDITS								
Operational grant	8.8	2.7	11.5	23.1	7.9	1.7	9.6	17.3
Teacher salary funding	8.8	3.2	12.0	26.4	7.9	1.8	9.8	18.9
Other government grants	8.8	3.1	11.9	25.7	7.9	1.6	9.5	16.7
Locally raised funds	8.8	2.7	11.5	23.2	7.9	1.7	9.6	17.7
Other revenues	8.8	3.6	12.4	28.9	7.9	1.5	9.4	16.1
Administration expenditure	8.8	2.6	11.4	22.7	7.9	1.6	9.5	16.8
Depreciation expenditure	8.8	2.7	11.5	23.1	7.9	1.6	9.5	16.5
Teacher salaries	8.8	2.7	11.6	23.6	7.9	1.6	9.5	16.9
Expenses on learning resources	8.8	2.7	11.5	23.2	7.9	1.6	9.5	16.5
Expenses on raising local funds	8.8	3.0	11.8	25.2	7.9	1.8	9.7	18.7
Expenses on property	8.8	2.6	11.4	22.7	7.9	1.6	9.5	16.6
Other expenditures	8.8	2.8	11.6	23.9	7.9	1.6	9.5	16.8
QUALIFICATIONS								
Operational grant	7.8	3.9	11.7	33.5	13.2	2.0	15.2	13.3
Teacher salary funding	7.8	5.2	12.9	40.0	13.2	2.1	15.3	13.8
Other government grants	7.8	4.7	12.5	37.9	13.2	1.8	15.0	12.0
Locally raised funds	7.8	3.8	11.6	33.1	13.2	1.8	15.0	12.1
Other revenues	7.8	4.8	12.5	38.1	13.2	1.8	14.9	11.8
Administration expenditure	7.8	3.7	11.5	32.5	13.2	1.8	15.0	12.1
Depreciation expenditure	7.8	3.7	11.5	32.5	13.2	1.8	15.0	12.0
Teacher salaries	7.8	4.0	11.7	33.9	13.2	2.0	15.2	13.2
Expenses on learning resources	7.8	3.9	11.6	33.2	13.2	1.8	15.0	12.0
Expenses on raising local funds	7.8	3.7	11.5	32.5	13.2	1.8	15.0	12.0
Expenses on property	7.8	4.4	12.2	36.4	13.2	2.3	15.4	14.6
Other expenditures	7.8	3.9	11.7	33.6	13.2	1.8	15.0	11.9

Notes: Adjusted R-square and Nagelkerke R-square are reported for credit and qualification models respectively.

The Nagelkerke R-square, as an indicator of variance explained by qualification models, is slightly higher than the R-square of credit models, suggesting that independent variables

combined predict about 12% to 15% of student outcomes in terms of qualification attained in the second and third year of NCEA, respectively. As for qualification models, the majority of the variance is explained by student-level factors, but the contribution from school-level variables is higher than in credit models. They comprise about 35% and 13% of the total variance explained by the qualification models in the second and third years of NCEA (see Table 58) respectively. Interestingly, in both credit and qualification models the contribution of school factors reduce from second to third year, suggesting that the predictability of school-level factors that are included in the models reduce when students move from the second to the third year of NCEA.

Models for medium decile schools

The variance explained by the models for medium decile schools is provided in Table 59 . According to Table 59, all independent variables included in the models explain about 10% to 12% of student variance in credits gained. The higher R-square for the second year suggests that the developed models better explain credits gained in the second year than in the third year. This is almost exactly the same percentage of variance explained at low decile schools (see Table 58). Student-level factors explain the majority of the variance in both years, and in absolute terms, the contribution from school-level independent variables is about 2%, which equates to 15% to 17% of the total variance that is explained.

Table 59

Medium decile schools: The variance explained (R^2) by models

Models	2007				2008			
	Student	School	Total	% School	Student	School	Total	% School
CREDITS								
Operational grant	10.0	1.8	11.7	15.0	8.0	1.5	9.5	15.3
Teacher salary funding	10.0	1.8	11.7	14.9	8.0	1.6	9.7	17.0
Other government grants	10.0	1.8	11.8	15.1	8.0	1.9	9.9	18.9
Locally raised funds	10.0	2.0	12.0	16.6	8.0	2.1	10.1	20.6
Other revenues	10.0	1.8	11.7	15.0	8.0	1.4	9.4	15.3
Administration expenditure	10.0	1.8	11.8	15.4	8.0	1.5	9.5	16.1
Depreciation expenditure	10.0	1.8	11.8	15.4	8.0	1.5	9.5	15.8
Teacher salaries	10.0	1.8	11.8	15.1	8.0	1.9	9.9	18.8
Expenses on learning resources	10.0	1.8	11.8	15.1	8.0	1.6	9.6	16.8
Expenses on raising local funds	10.0	1.8	11.7	15.0	8.0	1.6	9.6	16.6
Expenses on property	10.0	1.8	11.8	15.1	8.0	1.5	9.5	15.5
Other expenditures	10.0	1.8	11.7	15.0	8.0	1.5	9.5	15.8
QUALIFICATIONS								
Operational grant	10.4	2.1	12.4	16.6	11.8	1.7	13.5	12.3
Teacher salary funding	10.4	2.1	12.4	16.7	11.8	1.7	13.5	12.5
Other government grants	10.4	2.1	12.5	16.7	11.8	2.0	13.9	14.7
Locally raised funds	10.4	2.3	12.7	18.4	11.8	2.2	14.0	15.9
Other revenues	10.4	2.1	12.4	16.5	11.8	1.7	13.5	12.3
Administration expenditure	10.4	2.2	12.6	17.4	11.8	1.7	13.5	12.6
Depreciation expenditure	10.4	2.1	12.5	16.7	11.8	1.7	13.5	12.3
Teacher salaries	10.4	2.1	12.4	16.5	11.8	1.9	13.7	13.7
Expenses on learning resources	10.4	2.1	12.5	16.8	11.8	1.8	13.6	13.0
Expenses on raising local funds	10.4	2.1	12.5	17.0	11.8	1.7	13.5	12.3
Expenses on property	10.4	2.1	12.4	16.6	11.8	1.6	13.4	12.1
Other expenditures	10.4	2.1	12.4	16.6	11.8	1.8	13.6	13.1

Notes: adjusted R-square and Nagelkerke R-Square are reported for credit and qualification models respectively.

At medium decile schools, independent variables combined have more predictive power to explain the attainment of expected NCEA qualifications than the total credits gained in a year. On average, across all qualification models the Nagelkerke R-square ranges from 12% to 14%, of which the contribution of school-level factors is about 2% (see Table 59).

The models for low and medium decile schools exhibit very similar patterns. Independent variables combined explain more of the likelihood of attaining a qualification than of the credits gained by students. Credit models for the second year perform better than credit models for the third year; however, this is opposite to that for qualification models (see Table 58 and Table 59).

Models for high decile schools

Table 60 presents the variance explained by credit and qualification models for high decile schools. About 11% of variance in credits gained by students is explained by the models, of which the contribution of school factors constitutes about 2% to 3%. At high decile schools, the models explain more of the variance in the third year and the contribution of school factors is also greater in the third year credits models, which is opposite to how the models performed at low and medium decile schools (see Table 58, Table 59 and Table 60).

Table 60

High decile schools: The variance explained (R^2) by models

Models	2007				2008			
	Student	School	Total	% School	Student	School	Total	% School
CREDIT MODELS								
Operational grant	8.6	2.2	10.8	20.4	8.4	2.7	11.1	24.3
Teacher salary funding	8.6	2.0	10.6	19.2	8.4	2.7	11.1	24.0
Other government grants	8.6	2.2	10.7	20.0	8.4	2.9	11.3	25.5
Locally raised funds	8.6	2.1	10.6	19.4	8.4	3.0	11.4	26.3
Other revenues	8.6	2.3	10.8	20.8	8.4	3.1	11.5	27.0
Administration expenditure	8.6	2.1	10.6	19.3	8.4	2.7	11.1	24.3
Depreciation expenditure	8.6	2.1	10.6	19.4	8.4	2.8	11.3	25.1
Teacher salaries	8.6	2.0	10.6	19.2	8.4	2.7	11.1	24.1
Expenses on learning resources	8.6	2.2	10.8	20.6	8.4	2.7	11.1	24.1
Expenses on raising local funds	8.6	2.1	10.7	19.7	8.4	2.7	11.1	24.0
Expenses on property	8.6	2.1	10.6	19.3	8.4	2.7	11.1	24.0
Other expenditures	8.6	2.3	10.9	21.3	8.4	2.9	11.3	25.6
QUALIFICATION MODELS								
Operational grant	8.6	2.7	11.3	23.8	10.2	2.3	12.4	18.3
Teacher salary funding	8.6	2.9	11.4	24.9	10.2	2.2	12.3	17.5
Other government grants	8.6	2.7	11.3	23.9	10.2	2.4	12.6	19.2
Locally raised funds	8.6	3.0	11.6	25.9	10.2	3.1	13.2	23.1
Other revenues	8.6	2.7	11.3	23.9	10.2	2.8	13.0	21.7
Administration expenditure	8.6	2.7	11.3	23.9	10.2	2.2	12.4	17.9
Depreciation expenditure	8.6	2.8	11.4	24.4	10.2	2.4	12.5	19.0
Teacher salaries	8.6	2.7	11.3	23.9	10.2	2.2	12.3	17.5
Expenses on learning resources	8.6	2.7	11.3	24.0	10.2	2.1	12.3	17.3
Expenses on raising local funds	8.6	2.7	11.3	23.9	10.2	2.2	12.3	17.7
Expenses on property	8.6	2.7	11.3	23.9	10.2	2.2	12.3	17.7
Other expenditures	8.6	2.8	11.4	24.6	10.2	2.7	12.9	20.9

Notes: Adjusted R-square and Nagelkerke R-square are reported for credit and qualification models respectively.

The student- and school-level independent variables combined predict about 11% to 13% of the likelihood of attaining expected NCEA qualifications. It is apparent that student factors have more predictive power than school factors. School factors add about 3 additional percent to the total variance explained. Qualification models for high decile schools perform similarly to qualification models for low and medium decile schools. All of the models explain more attainment of qualifications in the third year than in the second year, and the contribution of school factors is greater in the second year (see Table 58, Table 59 and Table 60).

The following sub-section summarises only the main findings of sub-sections of results presented above.

Summary of main findings

Overall level of resources

Although some models for low and medium decile schools show negative associations between per student revenues/expenditures and attainment of students, none of these effects replicate across years; thus, it is more likely that these effects are due to random variation. Table 61 summarises the findings of this study on the impact of overall level of resources on the attainment of students presented in Table 22, Table 24 and Table 26.

Table 61

The impact of school resources on achievement of students

Variables	Low decile schools	Medium decile schools	High decile schools
CREDITS			
Per student revenue	Inconsistent impact (significant negative effects in some models in the third year of NCEA)	Inconsistent impact (significant negative effects only in the third year of NCEA)	No impact
Per student expenditure	No impact		
QUALIFICATIONS			
Per student revenue	No impact	Inconsistent impact (significant negative effects only in the third year of NCEA)	No impact
Per student expenditure			

To sum up, the overall level of resources has no meaningful effect on credits and attainment of NCEA qualifications. This means that when students with similar backgrounds attending similar schools with similar financial management practices are compared, schools that have more disposable income, or spend more per student, are not necessarily schools where students perform better.

Financial management variables

The overall findings of this study of the impact of financial management variables on achievement of students is that the financial management practices, or the way schools generate their revenues and allocate them, has no meaningful effect on the attainment of students — *with one exception*. At medium decile schools, the findings suggest that students gain more credits and are more likely to gain qualifications at schools that generate proportionally more funds locally, and also allocate more resources in order to generate these funds. The positive impact of locally raised revenues and expenditures was also observed at low and high decile schools. However, these effects did not replicate across years like they did at medium decile schools. In addition, on the revenue side, some models showed negative impact of teacher salary funding and other school revenues, but positive effects of operational grants.

On the expenditure side, the negative impact of expenses on administration, teacher salaries, property maintenance, but the positive impact of depreciation expenditure and other unclassified school expenses is observed. However, these effects did not replicate across years and, therefore, are more likely to be due to random variance. Table 62 summarises the findings of the impact of financial management variables on student achievement presented in Table 23, Table 25 and Table 27.

Table 62

The summary table on the impacts of school resources and financial management variables across deciles

Group of variables	Variables	Low decile schools	Medium decile schools	High decile schools
CREDITS GAINED				
Proportions of revenue	Operational grant	No impact		Inconsistent impact (positive in the 2nd year)
	Teacher salary funding	Inconsistent impact (negative in the 3rd year)		No impact
	Other government grants	No impact		Inconsistent impact (negative in the 2nd year)
	Locally raised funds	No impact	**Positive impact**	No impact
	Other revenues	Inconsistent impact (negative in the 2nd year)		Inconsistent impact (negative in the 3rd year)
Proportions of expenditure	Administration expenditure	no impact		
	Depreciation expenditure	No impact		Inconsistent impact (positive in the 3rd year)
	Teacher salaries	No impact	Inconsistent impact (negative in the 3rd year)	No impact
	Expenses on learning resources	No impact		
	Expenses on raising local funds	Inconsistent impact (positive in the 2nd year)	**Positive impact**	No impact
	Expenses on property	No impact	Inconsistent impact (negative in the 3rd year)	No impact
	Other expenditures	No impact		Inconsistent impact (positive in the 2nd year)

Group of variables	Variables	Low decile schools	Medium decile schools	High decile schools
QUALIFICATION ATTAINED				
Proportions of revenue	Operational grant	No impact		
	Teacher salary funding	Inconsistent impact (negative in the 3rd year)		no impact
	Other government grants	No impact	Inconsistent impact (negative in 2nd year of NCEA)	Inconsistent impact (positive in 3rd year of NCEA)
	Locally raised funds	No impact	**Positive impact**	
	Other revenues	Inconsistent impact (negative in 2nd year of NCEA)	No impact	
Proportions of expenditure	Administration expenditure	No impact	Inconsistent impact (negative in 2nd year of NCEA)	No impact
	Depreciation expenditure	No impact		Inconsistent impact (positive in 3rd year of NCEA)
	Teacher salaries	No impact	Inconsistent impact (negative in 3rd year of NCEA)	No impact
	Expenses on learning resources	No impact		
	Expenses on raising local funds	Inconsistent impact (positive in 2nd year of NCEA)	**Positive impact**	No impact
	Expenses on property	No impact		
	Other expenditures	No impact	Inconsistent impact (positive in 2nd year of NCEA)	

Individual background factors

The findings of this study suggest that student demographic variables are the most significant determinants of student outcomes. Student SES has a significant positive impact on achievement outcomes. The impact of SES on achievements is consistent across years and across the decile groups analysed. Similarly, the gender of students is a significant determinant of student performance. Girls consistently gain more credits than boys and are more likely to gain expected qualifications. Such findings are also consistent across years and decile groups analysed. The variation in educational attainment across ethnic groups is enormous. Asian students tend to gain more credits and are more likely to achieve expected NCEA qualifications than New Zealand European students, but only at medium and high decile schools. Regardless of decile group, Māori and Pacific students gain substantially fewer credits and are less likely to gain expected qualifications than New Zealand European students. The achievement gap between Pacific students and New Zealand European students is greater than the gap between Māori and New Zealand European students. Only at medium decile schools are students from other ethnic groups less likely to attain NCEA qualifications than New Zealand European students. Overall, there are no substantial differences in achievement between local and foreign students. Only at high decile schools are foreign students consistently less likely to attain expected qualifications.

Other school factors

Among school factors, non-financial factors such as school authority and school gender type seem to contribute more to the variation in student achievement than school resourcing and financial management variables. Only at medium decile schools are there statistically significant differences across years in student achievement between students attending State and State-Integrated schools, where students at State-Integrated schools gain more credits and are more likely to gain NCEA qualifications. Only at high decile schools do girls who attend single gender schools gain more credits and are more likely to attain qualifications across years. There is no consistent effect at low and medium decile schools. Single gender schools have no impact on the achievement of boys.

Performance of the models

All models perform reasonably well. On average, about 10% to 11% of variation in credits gained is explained by variables captured in the models. Also, all independent variables combined predict about 11% to 15% of the likelihood of attaining NCEA qualifications within expected timeframes. Contributions of school factors are small compared to the contribution of student level factors. The remaining unexplained variation is due to factors that are not captured by the models. At the student level, these can include student motivation, inspiration, peer pressure and factors related to the home environment. At the school level, the inclusion of variables that measure teacher qualifications, experience and teaching methods, and many other school factors, might increase the variance explained.

CHAPTER SEVEN: DISCUSSION OF RESULTS

The purpose of this chapter is to discuss the main findings while comparing them with the findings of the general literature and reviewed studies that attempted to answer the same research questions in different contexts.

Impact of overall level of resources

Educational researchers and economists often use per student expenditure as a measure of school fiscal resources; using per student revenue is not common. In New Zealand, every year about 50% of secondary schools have operational surpluses and, between 2007 and 2009, about 21% of New Zealand secondary schools had three consecutive years of operational surplus (Ministry of Education, 2008a, 2009a). This implies that not all schools spend all available resources during the year and this study attempted to see whether the models would produce different results when per student revenue is used instead of per student expenditure.

The results of the empirical model developed in this study showed that the increase in overall level of resources available for a school had no statistically significant effect on either the credits gained by students, or the attainment of qualifications. Similarly, the findings suggest that per student expenditure had no consistent effect on student achievement across low, medium and high decile schools. There were some exceptions. Models at low and medium decile schools showed a statistically significant negative association between per student revenues and expenditure and student outcomes. Since the effect was not consistent in both years, it is hard to claim that these associations are systematic.

Such findings have important policy implications. Evidence of the impact of the overall level of resources on student achievement implies that under the current funding system, and within the current fiscal management practices at schools, when making comparisons across students with similar backgrounds attending schools with similar fiscal situations, those schools that receive more funding per student or spend more on students in absolute terms are not necessarily the academically higher performing schools. When the funding

system does not change and schools continue to have the same composition of revenue, and continue to deliver educational services to students in the same manner, just increasing the absolute amount of funds available for schools would not make a difference. The findings also suggest that, even among students with similar backgrounds who attend similar schools, those students who perform well, gain more credits, and gain NCEA qualifications are not necessarily at the schools that have more funds at their disposal. A further interpretation infers that the current funding system, under the current financial management practices in schools, has no detrimental impact on education outcomes. The findings suggest that students of the same background have equal chances to succeed and that the current funding system of schools is equitable for both schools and students in New Zealand.

The literature on educational economics and school efficiency provides limited empirical evidence on the impact of overall levels of funding, and there are no studies that look at the impact of overall levels of funding while simultaneously controlling for the proportions of various components of funding; or, in other words, comparing schools that have equal funding situations. This is not surprising as in many jurisdictions funding for schooling is distributed from central government to local government(s), where it is topped up with additional funding generated from local taxes, before being distributed to schools. At each level of government different determinants and drivers of funding are used. In New Zealand, school funding is administered at the central government level, making it possible to identify the sources of funding and their determinants.

The majority of reviewed studies that used per student expenditure as a main resource variable either found small but significant positive effects (Elliot, 1998; Heinesen & Graversen, 2005), or overall inconsistent effects (Archibald, 2006; Jenkins et al., 2006; Levačić et al., 2005; Steele et al., 2007). Later studies found inconsistent effects on test scores across different subjects like maths, science and English. In the cases where these associations have been found to be statistically significant, the magnitude of the impact was usually very small (Archibald, 2006; Jenkins et al., 2006; Levačić et al., 2005; Steele et al., 2007). The findings of this study are consistent with studies which found that per student expenditure, or the absolute amount of fiscal resources of the schools, has no impact on the achievement of students.

Impact of financial management practices

When achievements of similar students who attend schools with the same amount of disposable funds are compared, the way schools generate revenue has no impact on the attainment of students at low and high decile schools. Specifically, those low and high decile schools that generate proportionally more revenue, either in the form of operational grants, teacher salaries, or locally raised funds, are not necessarily schools that, on average, are performing well or are underperforming. However, the results show that this is not the case at medium decile schools. Those medium decile schools that generate more locally raised funds, and spend more funds to raise these funds, are schools with better performing students. It is possible that the effect of locally raised funds is an indicator or a proxy of parental engagement, or the school's connectedness to the community, which was found to have an effect on the achievement of students (Cowhey, 2009; Cunningham, 2002; Klein, 2008; Maryland State Department of Education, 1990). The impact of the proportion of locally raised funds and expenses used to raise these funds are very small in magnitude. However, the fact that similar effects, although not consistent, were also found at low and high decile schools possibly suggests that these findings are not due to random variation.

Some models also indicate a negative effect of teacher salaries and other unclassified school revenues. Although the negative effect of teacher salary funding and other unclassified school revenues does not replicate in both years, the effects can be interpreted as schools that receive proportionally less from government, in the form of teacher salary funding and other unclassified revenues, are schools where students perform better. However, overall, it can be concluded that the way schools generate revenue has little impact on the achievement of students. Alternatively, the current funding system is distributed equally, such that it has no detrimental effect on educational disparity. However, it is apparent that large disparities in academic achievement still exist, despite the comparison across schools that have the same amount of disposable per student revenue and have similar revenue compositions.

Similarly, on the expenditure side, students with similar background characteristics attending schools that spend equal amounts, in per student terms, have been compared and the impact of resource allocation on student attainment has been estimated. Other than consistent effects of expenditure on locally raised funds at medium decile schools, and

some inconsistent random effects at low decile schools, the majority of models tested showed that the various components of school expenditure have no consistent effect on student achievement. This implies that under the current spending patterns, those schools that allocated more or less to specific expenditure were similar in terms of the educational achievement of their students. However, it is still unknown whether, if schools allocated resources differently, these new patterns of resource allocation would show different outcomes.

Despite these findings, some models indicated associations between resource allocation and student achievement that are worth mentioning and investigating further. Some models showed negative effects of expenditure on administration, teacher salaries, and the expense of property maintenance; and the positive effect of expenditure on depreciation and other unclassified school expenditure. The negative effect of administration expenditure suggests that schools that spend proportionally more on administration, on average, have lower performing students. There are two interpretations of this phenomenon. On the one hand, it is possible that in these schools resources are being wasted; on the other, it may be that these schools have to allocate more resources to administration to deal with issues of low participation, high stand-down rates and detention problems that are associated with low achieving students.

The negative effect of teacher salaries suggests that schools that spend proportionally more on teacher salaries have lower performing students. This may mean that higher paid teachers (hence older, more experienced teachers) are not necessarily the most effective teachers for these students, or it may mean that less experienced (possibly younger) teachers at the beginning of their teaching career are more effective in increasing educational attainment in this environment.

The negative impact of property maintenance suggests that schools that spend more on property maintenance have, on average, lower performing students. This may be an indicator of waste, although it should be noted that this effect might disappear once the size of the school or area of the school in square meters is controlled. The positive impact of depreciation, on the other hand, infers that schools with more assets have better performing students, suggesting that having more computer labs, science equipments or other physical

assets is associated with higher achievements. Schools that have other unclassified expenses are possibly schools that engage in some unconventional activities or provide additional services to students and it is possible that these activities are the reason for higher achievements. Empirical studies like this are not be able to identify the cause of such effects or explain their meaning, they are able to indicate only the associations that are worth exploring further.

Performance of the models

Overall, both credit and qualification models explained 10% to 12% of variance in credits and 11% to 15% of expected NCEA qualifications. The advantage of multilevel and hierarchical linear modelling is that they provide information about the variance explained at both student and school-levels, as compared with regression models based on the Ordinary Least Square (OLS) method, which provides information on total variance explained by a model only. However, when independent variables are included in separate blocks, the hierarchical structure of the data is reflected in the choice of variables included in each block. The OLS regression models, if run in blocks, can produce comparable statistics on variance explained. Since the first block includes student-level variables, and the second block school-level variables, the adjusted R-square of the first block produces the variance explained by student-level variables, and the difference between adjusted R-squares of the second block and the first block are the contributions to the variance by school-level factors. The analysis in this study suggests that about 12% to 25% of the total variance in student achievement is explained by school-level factors. Some of the reviewed studies had similar findings. For example, in the model devised by Archibald (2006), about 82% of the variation in post-test scores occurred at the student-level, 4% between classrooms, and 16% between schools.

Compared to some reviewed studies that utilised the same statistical models, the models developed in this study produce slightly lower R-square statistics. However, it should be noted that the previous achievement of students is not included in these models and the inclusion of prior attainment of students would have increased the overall R-square of the models. For example, the models developed by Dearden et al., (2002), where the student-teacher ratio was included as a resource variable, explained about 13% to 18% of the variation in levels of qualification attained. Also, the model devised by Levačić et al.,

(2005), where expenditure per student, average student-teacher ratio and student non-teaching staff ratio were included, accounted for about 60% of the variation in the capped points score and maths score at GCSE, about 55% for GCSE English and about 50% in GCSE science. However, the model developed in this study explained more of the variation than the model developed by Heinesen and Graversen (2005), which accounted for about 9% of variation. In order to compare the performance of the models developed in this study with the performances of the models in the reviewed studies, the choice of independent variables and their measurement, and the choice of resource variables have to be taken into consideration.

This section has summarized the main findings of the research by comparing them with the findings of similar studies that attempted to answer the same research questions. This chapter leads to the final chapter, which concludes this study by discussing policy implications and recommendations based on the findings of this study. It also outlines the main contributions of this thesis.

CHAPTER EIGHT: CONCLUSION, IMPLICATIONS, AND RECOMMENDATIONS

The main conclusion of this study is that there is no systematic relationship between overall level of school resources, financial management practices of schools, and the achievement of students in secondary schools in New Zealand. Based on these findings, several policy implications are introduced, and recommendations for both policy makers and educational researchers are elaborated. This chapter also articulates the contribution of this thesis to the body of knowledge in this area and provides recommendations for further research.

The overall level of resources has no effect on student achievement, which indicates that the current funding system may not deal with underachievement. Given that closing the achievement gap is considered a desirable outcome to achieve, this study shows that just a modest increases in per student funding are unlikely to increase student achievement. Similarly, at the school-level, unless schools change their spending priorities, having additional funds may not bring about increases in student achievement. Policy makers should not expect increases in overall levels of student achievement by simply adjusting annual funding rates, which is a common claim for delivering more funding to schools. If an increase in student achievement is desired, alternative funding models should be considered that have stronger links to the variables that do affect student outcomes. This could mean initiating government interventions that specifically target the underachieving population of students or students at risk, funding to improve the professional development of teachers, introducing performance-based remuneration to teachers, or investing in the creation of school resources other than fiscal resources. However, the implementation of such initiatives needs to be based on rigorous research and investigation, and the use of models such as those outlined in this thesis. From another perspective, the above findings also imply that the current school funding model is distributed equitably, such that it has no detrimental effect on educational disparity. This suggests essentially, the current funding system is not a barrier for student success and such findings endorse of the equity funding model utilised in New Zealand.

A further major finding of this study is that current financial management practices at the school-level have no impact on student achievement. This means that, even though some schools allocate proportionally more resources to learning materials, teacher salaries, or school site related expenses, student achievement is not systematically higher in these schools. Such findings also suggest that variations in the proportional allocation of resources across schools may be too small to detect the systematic impact of financial management on achievement. An important finding of this research on funding is that the revenue and expenditure variation from school to school may be too small to detect the impact of these different patterns. Further to these main findings, there are some associations that indicate some associations between resource allocation and student achievements. These are areas that would be extremely worthwhile to explore further.

To sum up, allocation of resources in a school, on average, has no association with the overall level of student achievement in that school. This possibly indicates that among all school resources, those other than simple fiscal resources, as identified by Grubb (2009), matter the most. A synthesis of over 800 meta-analyses relating to achievement by Hattie (2009) also highlighted how other school factors such as classroom climate, peer influence, the lack of disruptive students in the classroom, curricula that suits the needs of different groups of students with different abilities, as well as school leadership are the strongest predictors of student achievement at school-level.

It is also strongly recommended that policy makers review their current data collection mechanisms and consider collecting information on school activities and outputs other than traditionally collected information on expenditure and revenue types. This would provide more insight into how schools operate, and what is happening in the school and the classroom. One recommendation is to move from collecting information on what money was spent at schools, to what funds were spent on particular activities, and in what activities students were involved. Traditional functional classification of school revenue and expenditure is useful in understanding the overall financial position of schools; however, it is not sufficient to understand what activities were conducted and how the resources were utilised in learning improvements. Linking resources to activities and programmes, and linking students to activities might reveal a different story about the impact of resources. If such information is collected and analysed, the findings could be

used to develop evidence-based policies to improve the performance and effectiveness of New Zealand schools, and hence assist in increasing overall achievement levels of school-aged students. Studies by Picus (2000) also highlighted the need for better and more meaningful data on school resources.

One of the main contributions of this study is that it provides empirical evidence from New Zealand on the impact of overall levels of resourcing and indicators of financial management of the schools on educational attainment of students. Compared to other jurisdictions like United States or United Kingdom, New Zealand schools are self-administered, where decisions about school funding and financial management are made at the school level. Previous studies in this field analysed the impact of financial decisions made at the system level on achievement of students. This study systematically assesses the impact of financial decision making at the school level on student achievement. It is also an example of how rich data on student achievement and school revenue and expenditure can be combined to inform policy.

Another contribution of this study is in its methodological approach. The methodology allows estimates of both the overall level of resources (per student dollars), and financial management indicators (proportions). From a methodological perspective, it suggests using both proportions and per student dollars simultaneously in the model. It suggests estimating the impact of dollars while controlling for proportional composition of resources, as some schools might receive and spend more funds in absolute terms to deal with disadvantages of economies of scale. At the same time, the model, with both per student dollars and proportions, allows estimation of the impact of financial management indicators, the proxy of resource allocation and management decisions at school-level, while comparing schools that have the same amount of funds for disposal. This methodology allows the model to estimate the true impact of per student dollars and provides more insight into the impact of resource allocation on student achievement, while equalising comparisons across schools. To design such models requires school-level financial resource information and breakdown by components. Once such information is available, the methodological concept developed in this model can easily be applied and used by policy makers at any level of government. At the same time, the limited availability or accessibility of data on school resourcing and financial

management for educational research and financial management and administration differences across countries is recognised. To sum up, this contribution is in combining both the overall level of resources and financial management indicators in the same study, hence being able to compare their impact. Other studies measured only one of those factors which did not allow such a comparison and none of these studies had quantifiable measure of financial management practices. There are very few studies have gone beyond looking at aggregate levels of resourcing to look at the category by category impact as well.

While there is no consensus among economists and educational researchers on the impact of school resources on the educational attainment of students, both educational economists and researchers seem to agree that student related factors are the most significant determinants of student achievement. If overall levels of resources and financial management factors have no significant impact on student achievement, the question becomes 'what other school factors matter?' and 'what can schools contribute to improve outcomes for their students?' The evidence of determinants of achievement of school-aged children is summarized by Hattie (2009) who stated, based on the analysis and synthesis of over 800 meta-analyses related to the influence on achievement, that the most powerful effect of the school relates to features within schools, such as teacher practices, the climate of the classroom, peer influence, and school leadership. Some of these factors or features are hard to measure, but they can be named as the "abstract resources" as defined by Grubb (2009). It would be hard not only to quantify and measure these features but also to define the source of activities and contribution of stakeholders and the financial resources used in their creation and then relate them to both to resources and achievement outcomes. It is recommended that policy makers review their data collection and reporting processes as an essential step towards developing evidence-based policies to improve the learning outcomes of students.

It is also recommended that both policy makers and educational researchers validate the findings of this study by conducting similar studies based on achievement data from several cohorts of students. The model should be tested by applying different classifications to school expenditure. It is possible that more refined classification of school expenses would reveal interesting patterns in resource allocation across schools. In

this study locally raised funds and expenses to raise these funds were treated separately, alternative approach where the net amount of locally raised funds is can be tested.

Since 2007, with all standards assessed internally, it also became feasible to measure the quality of student outcomes by calculating NCEA GPA. If the findings are consistent, and the overall level of resources has no impact on student outcomes, policy makers should reconsider whether allocating additional resources by increasing current funding rates is an effective policy decision. It is also recommended to analyse the impact of school resources on pathways of students and to compare the impact of resources on student achievement at public and private schools.

School funding systems across many countries has similar components to those in New Zealand even though the some details in funding formula, student teacher ratio, the way how schools manage their resources or whether school level data is systematically collected or not may differ. The conclusions of this study, methodology employed in assessing the impact of school resources and financial management factors are applicable for policy makers in other countries and researchers in the field of educational economics and finance.

Educational researchers paid more attention to the achievement of students at primary, intermediate/elementary schooling, while not many studies have been conducted in the New Zealand on achievement of secondary schooling using population level data. Since introduction of NCEA, more detailed student level achievement data became available for policy makers and educational researchers. However, little work has been done to link student achievement data to administrative data on schools and inform country's educational policies. This study is one of the first studies in New Zealand where administrative data on school finances has been linked to student achievement data and another analytical work that can be used to inform policy makers about the impact of school resources. The impact of school's financial management practices on student outcomes has not been well studied in New Zealand, in particular, studies that used population level student and school level administrative data. The conclusions of this study, methodology employed in assessing the impact of school resources and financial

management factors are also informative for policy makers in other countries and researchers in the field of educational economics and finance.

REFERENCES

Achor, E. E., Imoko, B. I., & Ajai, J. T. (2010). Sex Differentials in Students' Achievement and Interest in Geometry Using Games and Simulations Technique. *Necatibey Faculty of Education Electronic Journal of Science & Mathematics Education, 4*(1), 1-10.

Afonso, A., & St. Aubyn, M. (2005). *Cross-country Efficiency of Secondary Education Provision: A Semi-parametric Analysis with Non-discretionary Inputs*: European Central Bank.

Akerheim, K. (1995). Does class size matter? *Economics of Education Review, 14*(3), 229-241.

Alton-Lee, A. (2003). *Quality Teaching for Diverse Students in Schooling: Best Evidence Synthesis*. Wellington, New Zealand: Ministry of Education.

Angrist, J., & Lavy, V. (1999). Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement. *Quarterly Journal of Economics, 114*(2), 533-575.

Archibald, S. (2006). Narrowing in on Educational Resources That Do Affect Student Achievement. *Peabody Journal of Education, 81*(4), 23-42.

Ayers, D., Keeling, D., Bryant, S., Parsons, S., Cotman, T., Wilcox, G., et al. (1992). *A Study of the Participation and Achievement of Black, Hispanic and Female Students in Mathematics, Science and Advanced Technologies in Virginia Secondary Schools*: Richmond, VA: Virginia State Department of Education.

Beese, J., & Liang, X. (2010). Do Resources Matter? PISA Science Achievement Comparisons between Students in the United States, Canada and Finland. *Improving Schools, 13*(3), 266-279.

Biddulph, F., Biddulph, J., & Biddulph, C. (2003). *The Complexity of Community and Family Influences on Children's Achievement in New Zealand: Best Evidence Synthesis Iteration (BES)*. Wellington, New Zealand: Ministry of Education.

Borland, M. V., Howsen, R. M., & Trawick, M. W. (2005). An investigation of the effect of class size on student academic achievement. *Education Economics, 13*(1), 73-83.

Boustead, T., & Strathdee, R. (2008). The gender-ethnic divide: Mathematics and English progress of Pakeha, Māori, and Pasifika students. *New Zealand Journal of Educational Studies, 43*(1), 33-49.

Carpenter, V. M. (2010). Opening eyes to different worlds. *Waikato Journal of Education, 15*(1), 121-133.

Carsrud, K. B., & Burleson, J. A. (1982, March). *The Effect of Court-Ordered Desegregation on Minority Students' Achievement: There's No Place Like Home*. New York: Annual Meeting of the American Educational Research Association.

Caygill, R. (2008). *Trends in year 5 Science achievement 1994 to 2006: New Zealand results from three cycles of the Trends in International Mathematics and Science Study (TIMSS)*. Wellington, New Zealand: Ministry of Education.

Ceci, S. J., Papierno, P. B., & Mueller-Johnson, K. U. (2002). The Twisted Relationship Between School Spending and Academic Outputs: In search of a New Metaphor. *Journal of School Psychology, 40*(6), 477-484.

City, E.A. et.al. (2009). *Instructional Rounds in Education: A Network Approach to Improving Teaching and Learning.*: Harvard Education Press, Cambridge.

Clark, M. A., Flower, K., Walton, J., & Oakley, E. (2008). Tackling male underachievement: Enhancing a strengths-based learning environment for middle school boys. *Professional School Counseling, 12*(2), 127-132.

Clay, V. (2008). Gender differences in Measures of Satisfaction with School and General and Academic Self-Concept. *International Journal of Learning, 15*(8), 31-40.

Clinton, A. R., Williams, T., & Clancy, J. (1991). The academic attainment of ethnic groups in Australia: A social psychological model. *Australian Council for Educational Research, 64*(2), 111-126.

Cohen, J (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159.

Coleman, J. (1966). *Equality of Educational Opportunity (Coleman) Study (EEOS).* Washington D.C: Department of Health, Education and Welfare.

Connolly, P. (2006). The effects of social class and ethnicity on gender differences in GCSE attainment: A secondary analysis of the Youth Cohort Study of England and Wales 1997-2001. *British Educational Research Journal, 32*(1), 3-21.

Costrell, R., Hanushek, E. A., & Loeb, S. (2008). What Do Cost Functions Tell Us About the Cost of an Adequate Education? *Peabody Journal of Education, 83*, 198-223.

Cowhey, M. (2009). Learning to roar. *Teaching Tolerance, 36*, 26-29.

Creene, G. K., Huerta, L. A., & Richards, G. (2007). Getting real: A Different Perspective on the Relationship Between School Resources and Student Outcomes. *Journal of Education Finance, 35*(1), 49-68.

Crooks, T. (2010). National assessments. In P. Peterson, E. Baker & B. McGaw (Eds.), *International Encyclopedia of Education* (3rd ed., pp. 89–94). Oxford, UK: Elsevier.

Crooks, T., & Caygill, R. (1999, November). *New Zealand's National Education Monitoring Project: Māori Student Achievement, 1995-1998*. Paper presented at the Joint Conference of the Australian Association for Research in Education and the New Zealand Association for Research in Education.,

Cunningham, C. (2002). *Engaging the Community To Support Student Achievement. (ERIC Digest No.157)*. Washington, DC.: Eric Clearinghouse on Educational Management.

Darling-Hammond, L (2010). The Flat World and Education: How America's Commitment to Equity Will Determine Our Future. New York: Teachers College Press.

Dearden, L., Ferri, J., & Meghir, C. (2002). The Effect of School Quality on Educational Attainment and Wages. *Review of Economics & Statistics, 84*(1), 1-20.

Dianis, L. (2002). Size Really Doesn't matter. *District Administration, 38*(11), 14.

Dobric, K. (2006). Drawing on discourses: Policy actors in the debates over the National Certificates of Educational Achievement 1996-2000. *Annual Review of Education in New Zealand, 15*(85-109).

Du, Y., & Hu, Y. (2008). Student Academic Performance and the Allocation of School Resources: Results from a Survey of Junior Secondary Schools. *Chinese Education and Society, 41*(5), 8-20.

Duckworth, K. (2008). *The influence of context on attainment in primary school: interactions between children, family and school contexts*. London: Centre for Research on the Wider Benefits of Learning, Institute of Education.

Dustmann, C., Rajah, N., & van Soest, A. (1998). *School quality, exam performance and career choice*. Tilberg, Netherlands: Tilburg University, Center for Economic Research.

Eley, L. (2001). How Janet and John feel about reading: Gender differences in New Zealand primary students' attitude to reading. *Waikato Journal of Education, 7*, 147-155.

Elliot, M. (1998). School Finance and Opportunities to Learn: Does Money Well Spent Enhance Student's Achievement? *Sociology of Education, 71*(3), 223-245.

Feinstein, L., & Symons, J. (1999). Attainment in Secondary schools. *Oxford Economic Papers, 51*(2), 300-321.

Ferguson, R. F. (2002). *What Doesn't Meet the Eye: Understanding and Addressing Racial Disparities in High-Achieving Suburban Schools*. Oak Brook, IL: North Central Regional Educational Laboratory.

Fergusson, D. M., Horwood, L. J., & Boden, J. M. (2008). The transmission of social inequality: Examination of the linkages between family socioeconomic status in childhood and educational achievement in young adulthood. *Research in Social Stratification & Mobility, 26*(3), 277-295.

Fergusson, D. M., Horwood, L. J., & Lloyd, M. (1991). Family ethnicity, social background and scholastic achievement - A eleven year longitudinal study. *New Zealand Journal of Educational Studies, 26*, 49-63.

Ferron, J. et. al. (2004). Hierarchical Linear Modeling: A Review of Methodological Issues and Applications. Annual meeting of the American Educational Research Association, Sand Diego, April 12-16, 2004.

Finn, J. D. (2002). Small Classes in American Schools: Research, Practice, and Politics. *Mid-Western Educational Researcher, 15*(1), 19-25.

Finn, J. D., Achilles, C. M., Bain, H. P., Folger, J., Johnston, J. M., Lintz, M. N., et al. (1990). Three years in a small class. *Teaching and Teacher Education, 6*(2), 127-136.

Frederickson, N. (2008). Ethnic, gender, and socio-economic group differences in academic performance and secondary school selection: A longitudinal analysis. *Learning and Individual Differences, 18*, 144-151.

Gibb, S. J., Fergusson, D. M., & Horwood, L. J. (2008). Effects of single-sex and coeducational schooling on the gender gap in educational achievement. *Australian Journal of Education, 52*(3), 301-317.

Glover, D., & Levacic, R. (2007). *Educational Resource Management: An International Perspective*. London: Institute of Education, University of London.

Gorard, S., & See, B. H. (2009). The Impact of Socio-Economic Status on Participation and Attainment in Science. *Studies in Science Education, 45*(1), 93-129.

Greenwald, R., Hedges, L. V., & Laine, R. D. (1996a). The Effect of School Resources on Student Achievement. *Review of Educational Research, 66*(3), 361-396.

Greenwald, R., Hedges, L. V., & Laine, R. D. (1996b). Interpreting Research on School Resources and Student Achievement: A Rejoinder to Hanushek. *Review of Educational Research, 66*(3), 411-416.

Grubb, W. N. (2009). The money myth: School resources, outcomes and equity, The Russell Sage Foundation, New York

Grubb, W. N. (2010). Correcting the Money Myth: Re-Thinking School Resources. *Phi Delta Kappan, 91*(4), 51-55.

Hankerson, P. S. (2011). *Schooling and Achievement: A Discussion on African American Students from Low Socio-Economic Households and Their Over-Diagnoses of Learning Disabilities*. Lynchburg, Virginia: Liberty University.

Hanushek, E. A. (1989). The impact of differential expenditures on school performance. *Educational Researcher, 18*(4), 45-51,62.

Hanushek, E. A. (1997). Assessing the Effects of School Resources on Student Performance: An update. *Educational Evaluation and Policy Analysis, 19*(2), 141-164.

Hanushek, E. A. (1998). *The Evidence of Class Size: Summary of Testimony*. Subcommittee on Early Childhood, Youth and Families, Committee on Education and the Workforce, U.S. House of Representatives, Washington. DC: Retrieved from http://hanushek.stanford.edu/sites/default/files/publications/Hanushek 1998 HouseTestimony Class Size.pdf.

Hanushek, E. A. (2003). The failure of input-based schooling policies. *Economic Journal, 113*, 64-98.

Hanushek, E., & Welch, F. (Eds.). (2006). *Handbook of the Economics of Education, Volume 1*: Amsterdam: North Holland

Hanushek, E., Machin, S., & Woessmann, L. (Eds.). (2011). *Handbook of the Economics of Education (Volume 4)*: Elsevier.

Harker, R. (2000). Achievement, Gender and the Single-Sex/Coed Debate. *British Journal of Sociology of Education, 21*(2), 203-218.

Hattie, J. A. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Heinesen, E., & Graversen, B. K. (2005). The effect of school resources on educational attainment: Evidence from Denmark. *Bulletin of Economic Research, 57*(2), 109-143.

Holmlund, H., McNally, S., & Viarengo, M. (2008). *Impact of school resources on attainment at Key Stage 2*. London: Department for Children, Schools and Families.

Holmlund, H., McNally, S., & Viarengo, M. (2009). *Does money matter for schools?* London: Centre for the Economics of Education.

Hyde, J. S. (2005). The Gender Similarities Hypothesis. *American Psychologist, 60*(6), 581-592.

Jacobs, B. A., & Schuh, J. H. (2005). *Promoting Student Success: Using Financial and Other Resources to Enhance Student Success* (Occasional Paper No. 7), Blookington, IN: Indiana University Center for Postsecondary Research, National Survey of Student Engagement.

Jacobson, L. (2008). Class-Size Reductions Seen of Limited Help On Achievement Gap. *Education Week, 27*(25), 9-12.

Jenkins, A., Levacic, R., & Vignoles, A. (2006). *Estimating the relationship between school resources and pupil attainment at GCSE* (DfES Research Report No. RR727). Research Report No. RR727, London: Department of Education and Skills.

Jepsen, C., & Rivkin, S. (2009). Class Size Reduction and Student Achievement: The Potential Tradeoff between Teacher Quality and Class Size. *Journal of Human Resources, 44*(1), 223-250.

Jones, J. (1982). Access to University Education in New Zealand. *Studies in Higher Education, 7*(2), 159-168.

Keith, T. Z. (1999). Effects of General and Specific Abilities on Student Achievement: Similarities and Differences across Ethnic Groups. *School Psychology Quarterly, 14*(3), 239-262.

Kirkham, S. (2011). *PISA 2009: Digital readers at age 15: An overview of the PISA 2009 Electronic Reading Assessment*. Wellington, New Zealand: Ministry of Education.

Klein, C. C. (2008). Intradistrict Public School Funding Equity, Community Resources, and Performance in Nashville, Tennessee. *Journal of Education Finance, 34*(1), 1-14.

Krueger, A. (2003). Economic considerations and class size. *The Economic Journal, 113*(485), 34-63.

Levačić, R., Jenkins, A., Vignoles, A., Steele, F., & Allen, R. (2005). *Estimating the relationship between school resources and pupil attainment at Key Stage 3*.

Levačić, R., & Vignoles, A. (2002). Researching the Links between School Resources and Student Outcomes in the UK: A Review of Issues and Evidence. *Education Economics, 10*(3), 313-331.

Levin, B. (2001). *Reforming Education: From Origins to Outcomes*. London: Routledge Falmer.

Lips, D., Watkins, S. J., & Fleming, J. (2008). *Does Spending More on Education Improve Academic Achievement?* . Backgrounder. No. 2179, Washington, DC: The Heritage Foundation.

Loeb, S., & Bound, J. (1996). The effect of measured school inputs on academic achievement: Evidence from the 1920s, 1930s and 1940s birth cohorts. *Review of Economics & Statistics, 78*(4), 653-664.

Machin, S., McNally, S., & Meghir, C. (2007). *Resources and standards in urban schools* . CEE Discussion Paper 0076, London, UK: Centre for the Economics of Education, London School of Economics and Political Science.

Marie, D., Fergusson, D. M., & Boden, J. M. (2008). Educational Achievement in Māori: The Roles of Cultural Identity and Social Disadvantage. *Australian Journal of Education, 52*(2), 183-196.

Marks, G. (2006). Are between- and within-school differences in student performance largely due to socio-economic background? Evidence from 30 countries. *Educational Research, 48*(1), 21-40.

Marks, G. N. (2008). Accounting for the gender gaps in student performance in reading and mathematics: evidence from 31 countries. *Oxford Review of Education, 34*(1), 89-109.

Maryland State Department of Education. (1990). *Building Student Success through Parent/Community Involvement: A Report of the Maryland School Performance Program, State Parent/Community Involvement Team*. Baltimore, MA: Maryland State Department of Education.

McInerney, M. D. (2008). Personal investment, culture and learning: Insights into school achievement across Anglo, Aboriginal, Asian and Lebanese students in Australia. *International Journal of Psychology, 43*(5), 870-879.

Meyer, L. H., McClure, J., Walkey, F., & Weir, K. (2006). *The Impact of the NCEA on Student Motivation*. Wellington: College of Education and School of Psychology, Victoria University of Wellington.

Meyer, L. H., McClure, J., Walkey, F., Weir, K. F., & McKenzie, L. (2009). Secondary student motivation orientations and standards-based achievement outcomes. *British Journal of Educational Psychology, 79*(2), 273-293.

Meyer, L. H., Weir, K. F., McClure, J., Walkey, F., & McKenzie, L. (2009). *Motivation and Achievement at Secondary School. The relationship between NCEA design and student motivation and achievement: A Three-Year Follow-Up*. Wellington: Jessie Hetherington Centre for Educational Research and the School of Psychology, Victoria University of Wellington.

Ministry of Education. (1990). *Tomorrow's Standards: The Report of the Ministerial Working Party on Assessment for Better Learning*. Welllington: Learning Media.

Ministry of Education. (1994). *Assessment: Policy to Practice*. Wellington, New Zealand: Learning Media.

Ministry of Education. (2007). Boys' Achievement A Synthesis of the Data. Learning Policy Frameworks. Ministry of Education. Wellington. Retrieved from http://www.educationcounts.govt.nz/publications/schooling/25052/7 on 7 March, 2013

Ministry of Education. (2008a). *New Zealand schools: Ngā Kura o Aotearoa (2007)* Wellington, New Zealand: Ministry of Education.

Ministry of Education, (2008b) Senior Secondary Student Achievement Fact Sheet 2004-2007. Retrieved from http://www.educationcounts.govt.nz/publications/schooling/ncea_factsheets/24939 on 7 March, 2013

Ministry of Education. (2009a). *New Zealand schools: Ngā Kura o Aotearoa (2008)* Wellington, New Zealand: Ministry of Education.

Ministry of Education. (2009b). *Understanding NCEA*. Wellington, New Zealand: Ministry of Education.

Ministry of Education. (2010a). *Funding, Staffing and Allowances Handbook.* Wellington: Ministry of Education.

Ministry of Education. (2010b). Data provided by Schooling Analysis Unit, Education Information and Analysis Division, Wellington, New Zealand.

Ministry of Education. (2010c). Statistics: Funding to Schools. Retrieved 25 March, 2010, from http://www.educationcounts.govt.nz/statistics/schooling/resourcing/47696

Ministry of Education. (2012a). NCEA Achievement by School Deciles. Retrieved 25 Feburary, 2012, from http://www.educationcounts.govt.nz/statistics/schooling/ncea-attainment/ncea-achievement-data-roll-based/ncea-attainment

Ministry of Education. (2012b). The role of the board. Retrieved 25 January, 2011, from http://www.minedu.govt.nz/Boards/EffectiveGovernance/Overview.aspx

Ministry of Education, (2013a). Deciles - questions and answers. Retrieved 25 February, 2013 from http://www.minedu.govt.nz/NZEducation/EducationPolicies/Schools/SchoolOperations/Resourcing/OperationalFunding/Deciles/FrequentlyAskedQuestionsAboutDeciles.aspx

Ministry of Education. (2013c) Statistics: July School Roll Returns (Student numbers, School type). Downloadable spreadsheets containing time series on student and school numbers. Retrieved 6 February, 2013, from http://www.educationcounts.govt.nz/statistics/schooling/july_school_roll_returns

Ministry of Education. (2013 d) How does New Zealand's education system compare? OECD's Education at a Glance 2010. Strategy and System Performance, Ministry of Education, Wellington, New Zealand

Moeed, A., & Hall, C. (2011). Teaching, learning, and assessment of science investigation in Year 11: Teachers' response to NCEA. *New Zealand Science Review*, *68*(3).

Mulvey, J. (2010). The Feminization of Schools: Young Boys Are Being Left behind. What Targeted Teaching Strategies Can Help Them Reach Their Potential? *Education Digest: Essential Readings Condensed for Quick Review*, *75*(8), 35-38.

Nash, R. (2001). Models of Maori Educational Attainment: Beyond the "Class" and "Ethnicity" debate. *Waikato Journal of Education, 7*, 23-36.

New Zealand Qualification Authority. (2009a). National Certificate of Educational Achievement Retrieved 30 November, 2009, from http://www.nzqa.govt.nz/qualifications-

standards/qualifications/ncea/understanding-ncea/how-ncea-works/ncea-levels-and-certificates/

New Zealand Qualification Authority. (2009b). Understanding NCEA. 2009

New Zealand Qualification Authority. (2011). NCEA endorsements. Retrieved May 21, 2011, from http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/understanding-ncea/how-ncea-works/endorsements/

New Zealand Qualification Authority. (2013) Annual report 2012/2011. New Zealand Qualifications Authority. Retrieved from http://www.nzqa.govt.nz/assets/About-us/Publications/Strategic-publications/annual-report-2010-11.pdf on 7 March, 2013.

New Zealand Treasury (2012). Data - Fiscal Time Series Historical Fiscal Indicators 1972-2012. Retrieved August 1, 2012, from http://www.treasury.govt.nz/government/data.

O'Brien, M. R. (2007). A Caution Regarding Rules of Thumb for Variance Inflation Factors. *Quality & Quantity, 41*, 673-690.

OECD (2012) Equity and Quality in Education: Supporting disadvantaged students and schools. OECD Publishing.

Otunuku, M. a., & Brown, G. T. L. (2007). Tongan Students' Attitudes towards Their Subjects in New Zealand Relative to Their Academic Achievement. *Asia Pacific Education Review, 8*(1), 117-128.

Owoyele, J. W., & Olagunju, O. P. (2010). Socio-economic background and the relative efficacy of self drills on factual recall and student's achievement in English language in senior secondary schools in Nigeria. *Academic Leadership (15337812), 8*(1), 1-7.

Pan, D., Rudo, Z., & Smith-Hansen, L. (2002). *Resource Allocation and Student Performance Improvements in 12 Districts in the Southwest Region*.

Pan, D., Rudo, Z. H., Schneider, C. L., & Smith-Hansen, L. (2003). *Examination of Resource Allocation in Education: Connecting Spending to Student Performance*. Southwest Educational Development Laboratory Publication, Austin T. X.: Southwest Educational Development Laboratory.

Peddie, R. (1992). *Beyond the norm? An introduction to standards-based assessment*. Wellington, New Zealand: New Zealand Qualifications Authority.

Perez, M., & Socias, M. (2008). Highly Successful Schools: What Do They Do Differently and at What Cost? *Education Finance and Policy, 3*(1), 109-129.

Perry, L., & McConney, A. (2010). School socio-Economic Composition and Student Outcomes in Australia: Implications for Educational Policy. *Australian Journal of Education, 54*(1), 72-85.

Picot, B. (1988). *Administering for excellence: Effective administration in education*. Wellington, New Zealand: Taskforce to Review Education Administration.

Picus, L. O. (2000). Student-Level Finance Data: Wave of the Future? (cover story). *Clearing House, 74*(2), 75-80.

Putwain, D. W. (2008). Test anxiety and GCSE performance: the effect of gender and socio-economic background. *Educational Psychology in Practice, 24*(4), 319-334.

Rangel, C., & Lleras, C. (2010). Educational Inequality in Colombia: Family Background, School Quality and Student Achievement in Cartagena. *International Studies in Sociology of Education, 20*(4), 291-317.

Rector, L. D. (2011). *High Schools and High Stakes Testing in California: Size and Income Do Matter*: Online Submission.(ERIC Document Reproduction Service No. ED 515798).

Ross, K. N., & Levačić, R. (Eds.). (1999). *Needs-Based Resource Allocation in Education via formula funding of schools*. Paris: International Institute for Educational Planing, UNESCO.

Rubie-Davies, C., Hattie, J. A., & Hamilton, R. (2006). Expecting the best for students: Teacher expectations and academic outcomes. *British Journal of Educational Psychology, 76*(3), 429-444.

Rumberger, R. W. (2009). *Comment on book cover "The Money Myth: School Resources, Outcomes, and Equity" by Norton Grubb*. Santa Barbara: University of California.

Salmond, C., Crampton, P., & Atkinson, J. (2007). *NZDep2006 Index of Deprivation User's Manual*. Wellington: Department of Public Health, University of Otago.

Sammons, P. (1995). Continuity of School Effects: A Longitudinal Analysis of Primary and Secondary School Effects on GCSE Performance. *School Effectiveness and School Improvement, 6*(4), 285-307.

Satherley, P. (2006). *The big picture: Student outcomes overview 2001-2005*. Wellington, New Zealand: Ministry of Education.

Shea, C. (1998). Do smaller classes mean better schools? Economists aren't so sure. *Chronicle of Higher Education, 44*(30), A15.

Snook, I., & O'Neill, J. (2010). Social Class and Educational Achievement: Beyond Ideology. *New Zealand Journal of Educational Studies, 45*(2), 3-18.

Steele, F., Vignoles, A., & Jenkins, A. (2007). The Effect of school resources on pupil attainment: A multilevel simultaneous equation modelling approach. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 170*(3), 801-824.

Strachan, J. (2001). Assessment in Change: Some Reflections on the Local and International Background to the National Certificate of Educational Achievement (NCEA). *New Zealand Annual Review of Education*, *11*, 245-273.

Taylor, R. M. (2008). *Teachers' Conflicting Responses to Change: An Evaluation of the Implementation of Senior Social Studies for the NCEA, 2002-2006.* Massey University, Palmerston North.

United States Department of Education. (1983). A Nation at Risk: The imperative for Educational Reforms. *The Elementary School Journal, 84*(2), 112-130.

Wilkinson, I. A. G. (1998). Dealing with diversity: Achievement gaps in reading literacy among New Zealand students. *Reading Research Quarterly, 33*(2), 144-167.

Womack, S. T. (2000). *The Relationship between Resources and Academic Achievement*. ERIC Document Reproduction Service No. 456498.

Wylie, C. (1994). *Self-managing schools in New Zealand: The fifth year*. Wellington, New Zealand: New Zealand Council for Educational Research.

Appendix 1. Comparison between OLS and HLM methods: Models with proportion of administration expenditure

		OLS method				HLM with raw SES variable				HLM with grand centered SES variable				Comparison between HLM with raw SES variable and OLS			Comparison between HLM with grand centering SES variable and OLS		
		β	Effect size	SE	Sig.	β	Effect size	SE	Sig.	β	Effect size	SE	Sig.	Consistency in sign of *b* coefficient	Difference in effect sizes	Consistency in significance level	Consistency in sign of B coefficient	Difference in effect sizes	Consistency in significance level
Low decile schools	Student SES	1.1	0.0	0.0	0.00	1.1	0.0	0.0	0.00	1.1	0.0	0.0	0.00	✓	-0.01	✓	✓	-0.01	✓
	Female student	1.7	0.3	0.0	0.00	1.9	0.3	0.1	0.00	1.9	0.3	0.1	0.00	✓	-0.07	✓	✓	-0.07	✓
	Foreign student	0.9	-0.1	0.3	0.69	0.8	-0.1	0.4	0.61	0.8	-0.1	0.4	0.61	✓	0.03	✓	✓	0.03	✓
	Asian	1.0	-0.0	0.1	0.72	1.0	-0.0	0.1	0.74	1.0	-0.0	0.1	0.74	✓	0.00	✓	✓	0.00	✓
	Maori	0.5	-0.4	0.1	0.00	0.4	-0.5	0.1	0.00	0.4	-0.5	0.1	0.00	✓	0.09	✓	✓	0.09	✓
	Pacific Islander	0.3	-0.6	0.1	0.00	0.3	-0.8	0.1	0.00	0.3	-0.8	0.1	0.00	✓	0.15	✓	✓	0.15	✓
	Other ethnic student	0.8	-0.1	0.2	0.28	0.8	-0.1	0.2	0.29	0.8	-0.1	0.2	0.29	✓	0.02	✓	✓	0.02	✓
	State school	0.5	-0.4	0.1	0.00	0.4	-0.5	0.1	0.00	0.4	-0.5	0.1	0.00	✓	0.10	✓	✓	0.10	✓
	Girls school only	1.5	0.2	0.1	0.00	1.6	0.3	0.1	0.00	1.6	0.3	0.1	0.00	✓	-0.05	✓	✓	-0.05	✓
	Boys school only	1.0	-0.0	0.1	0.82	1.0	-0.0	0.2	0.94	1.0	-0.0	0.2	0.94	✓	-0.01	✓	✓	-0.01	✓
	Administration expenditure	1.0	-0.0	0.0	0.84	1.0	-0.0	0.0	0.51	1.0	-0.0	0.0	0.51	✓	0.00	✓	✓	0.00	✓
	Total per student expenditure	1.0	-0.0	0.0	0.82	1.0	-0.0	0.0	0.96	1.0	-0.0	0.0	0.96	✓	-0.00	✓	✓	-0.00	✓
Medium decile schools	Student SES	1.1	0.0	0.0	0.00	1.1	0.0	0.0	0.00	1.1	0.1	0.0	0.00	✓	0.01	✓	✓	-0.01	✓
	Female student	1.8	0.3	0.0	0.00	1.9	0.3	0.1	0.00	2.1	0.4	0.0	0.00	✓	-0.04	✓	✓	-0.09	✓
	Foreign student	0.8	-0.1	0.1	0.02	0.8	-0.1	0.4	0.61	0.7	-0.2	0.1	0.02	✓	-0.05		✓	0.04	✓
	Asian	1.4	0.2	0.0	0.00	1.0	-0.0	0.1	0.74	1.6	0.3	0.1	0.00		0.22		✓	-0.06	✓
	Maori	0.4	-0.5	0.0	0.00	0.4	-0.5	0.1	0.00	0.3	-0.6	0.0	0.00	✓	0.01	✓	✓	0.14	✓
	Pacific Islander	0.3	-0.6	0.1	0.00	0.3	-0.8	0.1	0.00	0.2	-0.8	0.1	0.00	✓	0.15	✓	✓	0.16	✓
	Other ethnic student	0.5	-0.4	0.1	0.00	0.8	-0.1	0.2	0.29	0.4	-0.5	0.1	0.00	✓	-0.30		✓	0.11	✓
	State school	0.5	-0.4	0.1	0.00	0.4	-0.5	0.1	0.00	0.4	-0.5	0.1	0.00	✓	0.08	✓	✓	0.10	✓
	Girls school only	1.3	0.2	0.0	0.00	1.6	0.3	0.1	0.00	1.4	0.2	0.0	0.00	✓	-0.11	✓	✓	-0.03	✓
	Boys school only	1.2	0.1	0.0	0.00	1.0	-0.0	0.2	0.94	1.2	0.1	0.1	0.00		0.10		✓	-0.02	✓
	Administration expenditure	1.0	-0.0	0.0	0.00	1.0	-0.0	0.0	0.51	1.0	-0.0	0.0	0.00	✓	-0.01		✓	0.00	✓
	Total per student expenditure	1.0	-0.0	0.0	0.00	1.0	-0.0	0.0	0.96	1.0	-0.0	0.0	0.00	✓	-0.00		✓	0.00	✓
High decile schools	Student SES	1.1	0.0	0.0	0.00	1.1	0.1	0.0	0.00	1.1	0.1	0.0	0.00	✓	-0.02	✓	✓	-0.02	✓
	Female student	1.8	0.3	0.0	0.00	2.4	0.5	0.1	0.00	2.4	0.5	0.1	0.00	✓	-0.14	✓	✓	-0.14	✓
	Foreign student	0.4	-0.5	0.1	0.00	0.3	-0.6	0.2	0.00	0.3	-0.6	0.2	0.00	✓	0.16	✓	✓	0.16	✓
	Asian	1.4	0.2	0.1	0.00	1.6	0.3	0.1	0.00	1.6	0.3	0.1	0.00	✓	-0.07	✓	✓	-0.07	✓
	Maori	0.4	-0.5	0.1	0.00	0.3	-0.7	0.1	0.00	0.3	-0.7	0.1	0.00	✓	0.22	✓	✓	0.22	✓
	Pacific Islander	0.3	-0.7	0.1	0.00	0.2	-1.0	0.1	0.00	0.2	-1.0	0.1	0.00	✓	0.29	✓	✓	0.29	✓
	Other ethnic student	0.7	-0.2	0.1	0.00	0.6	-0.3	0.1	0.00	0.6	-0.3	0.1	0.00	✓	0.08	✓	✓	0.08	✓
	State school	0.6	-0.3	0.1	0.00	0.5	-0.4	0.1	0.00	0.5	-0.4	0.1	0.00	✓	0.11	✓	✓	0.11	✓
	Girls school only	1.8	0.3	0.1	0.00	2.1	0.4	0.1	0.00	2.1	0.4	0.1	0.00	✓	-0.09	✓	✓	-0.09	✓
	Boys school only	1.1	0.1	0.1	0.18	1.2	0.1	0.1	0.14	1.2	0.1	0.1	0.14	✓	-0.03	✓	✓	-0.03	✓
	Administration expenditure	1.0	-0.0	0.0	0.35	1.0	-0.0	0.0	0.84	1.0	-0.0	0.0	0.84	✓	-0.00	✓	✓	-0.00	✓
	Total per student expenditure	1.0	-0.0	0.0	0.01	1.0	-0.0	0.0	0.00	1.0	-0.0	0.0	0.00	✓	0.00	✓	✓	0.00	