INTER SECTORAL STUDY ON EDUCATION & HEALTH

FINAL REPORT

Health for Education:

A study of non-school determinants of learning achievement of Grade 4 students in Sri Lanka

NATIONAL EDUCATION COMMISSION
Sri Lanka

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Health for Education:

A study of non-school determinants of learning achievement of Grade 4 students in Sri Lanka

Nilanthi de Silva
Lal Perera
Neranjana Gunetilleke
RO Thattil

NATIONAL EDUCATION COMMISSION
223C, NAWALA ROAD, NARAHENPITA, COLOMBO, SRI LANKA.

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RESEARCH TEAM

Education

Late Prof S Rupesinghe
(Team Leader and Education Specialist, Nov 2002 – Nov 2003)
Faculty of Education, University of Colombo
Prof Lal Perera
(Education Specialist, Nov 2003 onwards)
Faculty of Education, University of Colombo
Mr AA Navaratne
National Education Research and Evaluation Centre, Faculty of Education, University of Colombo
Dr M Karunanithy
Faculty of Education, University of Colombo

Health

Prof Nilanthi de Silva
(Health Specialist, and Team Leader from Nov 2003 onwards)
Faculty of Medicine, University of Kelaniya
Dr A Pathmeswaran
Faculty of Medicine, University of Kelaniya
Dr Aswini Fernando
Faculty of Medicine, University of Kelaniya
Dr Renuka Jayatissa
Medical Research Institute
Dr Sagarika Samarasinghe
Medical Research Institute

Economics

Ms Neranjana Gunetilleke (Economics Specialist)
Centre for Poverty Analysis

Statistics

Prof RO Thattil (Statistics Specialist)
Postgraduate Institute of Agriculture, University of Peradeniya
Dr Ranjith Premalal de Silva
Faculty of Agriculture, University of Peradeniya
Dr A Samita
Faculty of Agriculture, University of Peradeniya

Coordinator

Mr. Anura Hettiarachchi, National Education Commission

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EXECUTIVE SUMMARY

Background

The Inter Sectoral Study on Education and Health was carried out to understand the relative importance of factors other than the school, such as health, nutritional status and other personal characteristics of children, and their home background in determining the level of achievement of primary school students in Sri Lanka. It builds on a study on 'National Assessment of Achievement of Grade 4 pupils in Sri Lanka' conducted by the National Education Research and Evaluation Center (NEREC) of the Faculty of Education, University of Colombo, using a nationally representative sub-sample of children who sat for the NEREC tests in First Language (Sinhala or Tamil), Mathematics and Second Language (English).

Study design and data collection

The NEREC tests were administered in March 2003 to 16,383 children registered in Grade 5 in 2003, in 939 schools. A maximum of 20 children were selected from one school. From this sample, a sub-sample of 2,731 children were selected for this study. The sub-sample was drawn from 144 schools, of which 140 were state schools and 4 were private. Sampling was stratified by province and functional school type (Education Ministry categorization), and included private schools following the national curriculum. Boys comprised 53.7% of the sub sample. Survey teams from the Medical Research Institute visited all 144 schools during the period May – September 2003 and physically examined the selected children to assess health factors that could affect their learning abilities. In June – July 2003, trained enumerators also visited the households of the selected children and their schools and completed two sets of questionnaires, one relating to the household and the other to the school.

Profile of the Study Sample

Health Survey Results

In order to understand the importance of health and nutritional status, several indicators were assessed: stunting as indicated by low height-for-age Z score; excessive thinness as indicated by low Body Mass Index; anaemia as indicated by low haemoglobin levels in fingerprick blood; Bitot's spots and goiter as clinical evidence of Vitamin A and iodine deficiency, respectively; eye examination for evidence of

shortsightedness; faecal examination for evidence of intestinal worm infections; and a history of malaria; frequent illness that disrupted schooling, or deafness, as reported by the child's parents.

The health survey results indicated that at a national level, 15.5% of children were stunted; 52.6% were excessively thin; 12.1% were anaemic; 0.3% had Bitot's spots; 3.0% had goitre; 4.6% were shortsighted; and 6.9% had worm infections. 1.3% were reported to have hearing difficulties; 6.4% had a lifetime history of malaria; and 15.4% were reported to suffer from frequent illness that caused them to miss school on at least 3 – 5 days each month. The most commonly cited illnesses were fevers and asthma (wheezing). These rates are generally consistent with rates reported in previous Sri Lankan studies. They are relatively low when compared with those in most other developing countries, but higher than those seen in developed countries.

Prevalence rates of stunting, anaemia, worm infections and a history of malaria were higher in the Northern and Eastern Provinces than in the rest of the country. Prevalence rates for all the conditions assessed (except for shortsightedness) were on average, higher among children attending state schools, when compared with private schools. There were no significant differences between prevalence rates in boys and girls in any of the conditions, except goiter, which was more common among girls.

Household and School Survey Results

The household survey results showed that 6.4% of children did not have their mothers living with them, mainly because the mother was working overseas. Almost 15% of the children did not have their fathers living with them and this was mainly because the father was working in another part of the country.

The large majority of children attended school regularly: only 18.2% had attendance rates below 80%. Attendance rates were slightly higher among girls when compared with boys. About half the children (53%) were reported to spend over 6 hours each week in studying at home during term-time. Almost one third (32.3%) spent over 6 hours each week at extra tuition classes outside school; only 26.5% did not attend any tuition classes. 39.4% of the children did not spend any time at all on reading as a leisure activity. Only 18.8% spent more than 3 hours each week on reading, whereas

59.1% of children spent more than 3 hours a week on watching television. Boys spent more time at play, at supervised sports, and on watching TV, whereas girls spent significantly more time on studying, reading for leisure and in carrying out household tasks.

Of the 2,473 children with regard to whom data was available on the ethnic group of both parents, 2,447 (98.9%) had parents who were of the same ethnic group. All (except 2) children of Sinhala parentage were studying in the Sinhala medium at school, compared to 95.8% of children of Tamil parentage and 90.4% of children of Moor / Malay parentage who were in Tamil medium schools. There were no statistically significant differences in the male: female ratio within the different ethnic groups.

The households surveyed represented a cross section of income groups in the country; 55% of the households surveyed had an income less than Rs. 7,000 per month while 13% had incomes in excess of Rs. 15,000. This is a close representation of the household income distribution in Sri Lanka. Household size varied from 2 to 12 members, with a mean of 5.1. According to per capita monthly income (calculated from annual income and household size) 53.6% of the children were from households below the 2002 National Poverty Line of Rs 1,423.00. Among children for whom data on education-related expenditure was available, 66.0 % of parents spent 5% or less of their household income on items related to the child's education, while 91.2% spent 10% or less. Total education-related expenditure showed a strong positive correlation with total household income. Poor households spent a significantly higher percentage of household income on the child's education than non-poor households.

With regard to the education level of parents, the survey results showed that while less than 1% of parents had received no education at all, 40% of fathers and 32% of mothers had completed less than 8 years of education. 21% of fathers and 23% of mothers had studied up to G.C.E A/L or more. The situation pertaining to private schools, however, was very different from that in state schools. In private schools 85% of the fathers and 78% of the mothers had studied up to A/L or more, and there was a greater concentration of professionally qualified parents. The commonest occupations of the fathers in the sample surveyed were in wage labour (26%) and in

the agricultural and fishing sectors (21%). The occupation patterns of the mothers clearly pointed to a majority who work within the home (66%). Of those in a primary occupation away from the home, the largest percentage was in salaried employment (professional and other salaried 16%).

A little less than half of all households (44.5%) had up to 10 books, other than school books, that the child could read while about one third (35.1%) of households did not have any suitable books at all. Availability of books at home was significantly positively correlated with household income and parental education.

With regards to interaction between parents and school, almost half of all respondents (46%) said that they discussed the child's progress with the class teacher only on days designated for parent-teacher meetings. However, about one-fourth (26%) said that they also meet the teacher regularly on other days to discuss the child's progress. The majority of respondents (65.8%) said that they discuss schoolwork with the child on a daily basis; while 32.9% said they did so only occasionally. Again, only about 1% said they never discussed schoolwork with the child. About two-thirds of children (68.8%) received regular help with homework from their mothers, but only about one-fourth (23.9%) had help from their fathers. About 20% of children never received any help with homework from their fathers, and about 10% never received help from their mothers. Mothers and fathers who had passed at least the GCE O level examination were significantly more likely to assist the child with homework (sometimes or regularly), than those who had not. Neither the frequency of parental assistance with homework (both mother and father) nor the percentage of household income spent on education-related expenses for the child differed significantly according to the sex of the child.

Interaction between health and household status

Thus far, factors such as the child's health, other personal characteristics, the learning environment at home, household income and parental education were treated as independent variables. However, the characteristics of the study sample discussed above indicate that there are strong associations between some variables, in particular child health indicators, household income and parental education.

The prevalence rates of stunting, excessive thinness, anaemia, intestinal worm infections, and hearing defects were much more common among children from poor households than among the non-poor households. All these conditions were also significantly associated with lower levels of parental education. In contrast, there was no difference in the prevalence of shortsightedness among children from poor households, and non-poor households, nor was there any association between reported defects in eyesight and household income or parental education.

A positive history of malaria was also associated with household poverty. An association was present between maternal and paternal education, and a past history of malaria, but this was barely statistically significant. Children from poor households were also more likely to suffer from frequent illness than children from non-poor households. Children of mothers with no O' levels were also more likely to suffer from frequent illness than children of better-educated mothers; the pattern was similar with paternal education.

Determinants of learning achievement

This study attempts to understand what determines learning achievement. For purposes of this study, "learning achievement" was defined as achieving a score of at least 80% in each of the NEREC tests (considered as having attained mastery of the subject). There was a wide variation in achievement rates between subjects: 48.5% attained mastery level in Sinhala, and 42.3% attained mastery in Mathematics; but only 25.6% did so in Tamil; and 15.0% in English. There was a very high degree of correlation between scores in different subjects, i.e., children who had high scores in one subject tended to have high scores in other subjects as well.

In carrying out the statistical analysis, simple bivariate correlations between the dependent variables (test scores in the First Language, i.e. Sinhala / Tamil), and Mathematics and the main independent variables relating to the children's health status and home environment, were first examined, as described above. This was done in order to identify variables to be included in the next stage of analysis, multivariate regression. The final analysis that examined the interrelationships between learning achievement, the children's health, personal characteristics, household environment,

and school, was based on multivariate analysis using logistic regression with these key variables.

The two models (one for First Language and the other for Mathematics) were built up in several stages, in order to assess the contribution of groups of variables in explaining the observed variation in learning outcome. Variables relating to the child were added first, then the household, and finally the school. Thus, the child's sex and birth order were included first in the model, and then variables relating to health and nutritional status were added, followed by those relating to the child's behaviour (school attendance and time spent on various activities after school). In the 4th stage, variables relating to the household environment were added: ethnic group; the presence of the child's mother in the household; assistance with schoolwork at home; level of parental education; and household per capita income. Finally the school was included as a variable in order to correct for the effect of the school environment in determining learning outcome.

The final findings can be summarized as:

1. The school environment is the main determinant of learning achievement, with regard to both first language and mathematics, overshadowing all other factors.
2. However, the socio-economic context in which the child lives, and his / her personal characteristics are also important determinants of learning achievement.
3. Health factors are critical variables that are associated with both learning achievement and the socio-economic context.

Determinants of successful learning outcome in First Language

The final model constructed in this manner was able to explain 52% of the variation in achieving mastery of the First Language, i.e. Sinhala or Tamil. The most important single explanatory variable is the school (about 17%). Personal attributes (gender, birth order, school attendance, after school activities) together explain a similar proportion of the variation. Household variables explain about 12% of the variation, while health and nutrition explains about 6%.

With regard to health:

- Poor nutritional status as indicated by stunting of growth, anaemia, worm infections, malaria and frequent illness are all associated with poor outcome.
- However, when the health variables were controlled for the socio-economic characteristics of the household, all except frequent illness, were found to be no longer significant. This is probably because all of the health variables included were significantly associated with parental educational levels and household income. Hence, the initially observed association between mastery of first language and the health variables of stunting, anaemia and STH infection, is driven by household factors, rather than an independent cause-and-effect relationship.
- Frequent illness that caused a child to miss school on a regular basis, remained an independent predictor of learning outcome with regard to mastery of first language, even after correcting for parental education and household income.
- However, when the school environment was also brought into the equation, none of the health variables remained as significant predictors of learning achievement.

In terms of personal characteristics of the child and the socio-economic environment of the household:

- Parental education appears to be the most important predictor of achievement, with children of parents who were educated beyond the Ordinary Level being 4 – 5 times more likely to achieve mastery, when compared with children of less educated parents.
- Apart from the deleterious effect of frequent illness causing absenteeism, regular school attendance was one of the most significant predictors of learning outcome, such that even after inclusion of household socio-economic variables, and the school, children who had over 80% attendance during the previous year were almost 4 times as likely to attain success compared with those who had less than 80% attendance.
- Gender is a significant predictor of success, such that after controlling for household and school characteristics, girls were over twice as likely as boys to attain mastery of the First Language. Going against popular belief, the study

shows that this prevalence of higher achievement by girls cannot be attributed to differences in time spent on studying and playing after school.

- In terms of medium of instruction and ethnic group, children of Sinhala parents are significantly more likely to achieve mastery of the first language than children of Tamil, or Muslim and Malay parents.
- Reading for leisure was also found to be a predictor of achievement in First Language, even after correction for sex, household socio-economic status, and school, so that children who spent any time at all on reading for leisure were 1.4 times as likely to gain mastery in First Language than children who did not read at all.
- Similarly children who spent at least 3 hours a week on extra tuition classes were 1.4 times more likely to achieve mastery than those who did not.

Determinants of successful learning outcome in Mathematics

The model developed for predicting mastery of Mathematics explained 46.8% of the variation in learning outcome, a little less than that for First Language. As in the other model, in this too, the school was the single most important explanatory variable, accounting for about 16% of the variation. Personal attributes explain about 13% of the variation, while household variables explain about 10% and health variables explain about 7% of the variation.

As with the model for First Language, variables that predict mastery of Mathematics include gender, school attendance, attending tuition classes, parental education and the school.

Differences observed were:

- Soil transmitted helminth infections, and poor nutritional status, as indicated by excessive thinness, remained significant predictors of learning achievement in Mathematics after controlling for household characteristics as well as the school. Moreover, frequent illness was not a significant contributor to achievement in Mathematics.
- Reading for leisure and ethnicity were not significant determinants of learning achievement in mathematics as they were for achievement in Sinhala / Tamil as first language.

It is clear therefore, that while the main determinants of successful outcome are common to both first language and mathematics, there are also some significant differences.

Recommendations

Given the overpowering impact of the school variable on achievement, the need to raise the standard of schools cannot be underestimated or ignored. In terms of learning and achievement the study shows that high quality schools can compensate to a large degree for both home socio-economic weakness as well as health deficits.

As this study has concentrated on health as a determinant of learning achievement in primary schoolchildren, the recommendations are also focused on issues dealing with the **health** of primary schoolchildren.

- A significant proportion of Sri Lankan children suffer from stunting of linear growth, and excessive thinness, as well as from nutritional anaemia. Because of the observed effect of nutritional deficits on learning achievement, and considering that all children have the right to good health, there is a need to provide nutritional supplementation for children at risk of these nutritional deficits. Such children are mostly from low income families.

- Children in the Northern, Eastern and Western Provinces, particularly those from low-income families are also more likely to be infected with any one of soil-transmitted helminths. Ensuring regular provision of anthelmintic treatment for children in these provinces (particularly targeting children from low-income families) through the school medical inspections programme will be a highly cost-effective means of eliminating these worm infections.

- Many children in some provinces had experienced at least one attack of malaria during their lifetimes, an association between malaria and poor learning outcome was observed. However, specific measures aimed at reducing the incidence of malaria may be unnecessary, given the current low level of malaria transmission.

- Improving nutritional status through supplementary feeding programmes, and regular de-worming will improve the general well-being of children, and may also reduce the occurrence of frequent minor illnesses (fevers, diarrhoeas) that cause children to miss school.

- A significant proportion of children also appear to suffer from shortsightedness. Although the results of this study did not find any relationship between learning achievement and the occurrence of shortsightedness, it would still be advisable to screen all schoolchildren, and provide corrective eyeglasses to those with defective eyesight.

A few **recommendations that are not directly related to health** also arise from the findings of this study.

- In terms of improving learning achievement, the importance of regular school attendance cannot be overemphasized. Parents need to be educated regarding this, so that they ensure that children do not stay away from school unless they are ill. Reasons for absenteeism need to be explored further, and remedial measures that address these reasons and improve school attendance are very likely to have a strong impact on improving learning outcome.

- Special attention should be paid to boys, and children of parents with a low level of educational achievement. Educational strategies that focus on encouraging these children to master the desired learning outcomes at each stage of primary school are very likely to improve achievement levels.

- Encouraging children to read during their leisure time will improve mastery of language skills. Although this may seem an over-simplistic re-iteration of a well-known fact, the results of this study showed that who read regularly during their leisure hours, and even spent just a few minutes on this each day, did better in mastering their first language. Special attention needs to be focused on Tamil students in this regard.

- Efforts should be made to identify the reasons why attendance of extra tuition classes after school improved performance in both first language and mathematics. It may then become possible to draw on these findings and improve learning activities in school.

CHAPTER 1.
BACKGROUND

Primary education reforms were implemented in Sri Lanka in the late 1990s, taking forward the child-centred, activity-based curriculum introduced in the 1970s. The reforms were first implemented in Grade 1 in schools in the Gampaha District, and introduced island wide in 1999. The curriculum framework was designed in 1997, syllabuses based on competencies, teacher guides, readers and workbooks were developed, printed and distributed to schools year by year, teachers trained and officers oriented to the changes. The reforms reached grade 5, the final year in primary school, in 2003. Infrastructure developments to improve the class room learning environment for activities and physical facilities were undertaken according to specified norms, for three Key Stages: Key Stage 1 in Grades 1 and 2; Key Stage 2 in Grades 3 and 4; Key Stage 3 in Grade 5.

During the period 2002 – 3, the National Educational Research and Evaluation Centre (NEREC) standardised a series of tests that could be used to assess competencies to be achieved at the end of Key Stage 2 (Grade 4). These included the First Language (Sinhala or Tamil), Second Language (English) and Mathematics. These tests were administered to a nation-wide sample of some 16,000 children in March 2003, to examine patterns in achievement levels of students, and the background factors influencing student achievement (Perera *et al*, 2004).

1.1 STUDY RATIONALE

The Inter-Sectoral Study of Education and Health (ISSEH) was commissioned by the National Education Commission (NEC) to build on the results of the NEREC study. The objective of this study is to further explore the non-school factors that determine the level of achievements of students who completed Key Stage 2 (Grade 4). In the NEREC study, factors that could affect a child's learning achievements were viewed in very broad terms as those concerning the learning environment at school and the environment at home. The Inter-Sectoral Study extended the focus to include the health and nutritional status of the child as a special study component. As such, the Inter-Sectoral study adds the dimension of relationship between the child's health – often influenced by the home environment – and achievement in school. As the

conceptual framework presented in Figure 1.1 indicates, learning achievement was viewed as an outcome influenced by complex set of interactive factors relating to the child, the child's family and the school attended by the child. The major emphasis of this study was on determining the extent to which these factors, especially those relating to the child and the family, affect learning achievements.

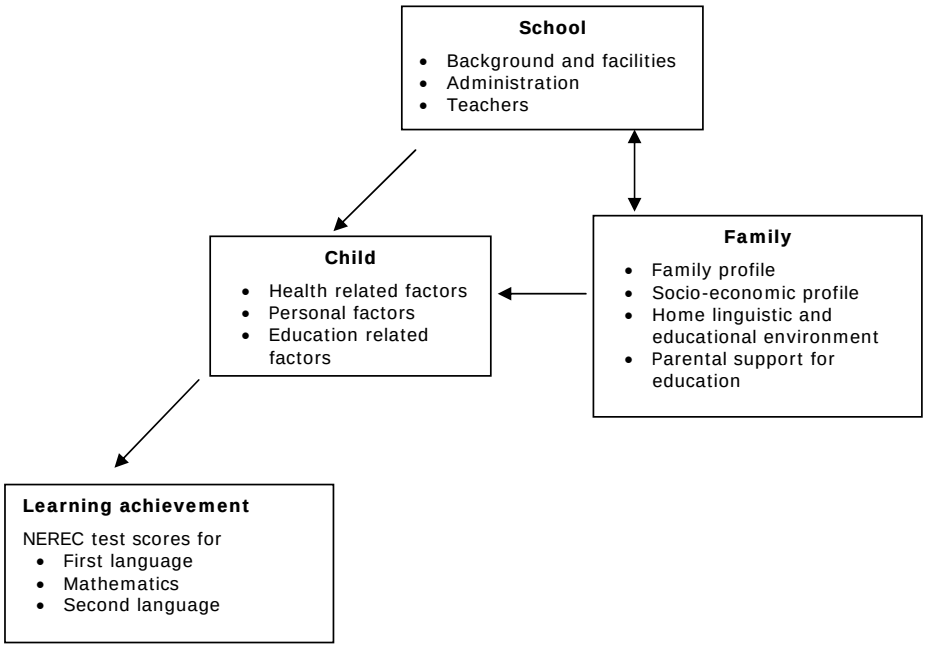


Figure 1.1 Conceptual framework of the study

1.2 SIGNIFICANCE OF THE STUDY

Many of the research studies carried out in Sri Lanka during the last two decades in the area of learning achievement of primary school students have emphasized the social and school-related factors that influence learning achievement. For example, the Learning Achievement Studies repeatedly carried out by the National Institute of Education (NIE) on students in Grades 3 and 4, the study carried out by Kariyawasam in relation to students in Grades 3, 4 and 5, and the Baseline Survey carried out by the NIE in collaboration with UNICEF in relation to students in Grades 2, 3, 4 and 5, have all basically drawn attention to the social and school related factors that cause disparities in student achievement (Navaratne 1995, Navaratne, 1998). The NEREC study of student learning in Grade 4 also emphasizes the interrelationship between student achievement and background factors (Perera *et al* 2004).

In such a context, the present study stands out because it focuses explicitly on the interrelationship between learning achievement and child health. While it is well known that in most developing countries, school-aged children suffer from malnutrition and a variety of different health problems that could affect learning abilities, there has not been a systematic study of this relationship in the Sri Lankan context. This study thus provides an opportunity to make recommendations regarding these problems, in order to improve children's performance in school. It also paves the way for inter-ministerial programmes that could be launched by Ministries such as the Ministry of Education, the Ministry of Health, the Ministry of Food, and the Ministry of Social Services etc to address these issues.

Against this background, the overall aim of the study was to explore the inter relationship between the health, nutritional status and other personal attributes of the child, while taking into consideration the child's home environment and the school, in determining the level of learning achievement of Grade 4 students. Based on the literature reviews[1] which are summarized in the next chapter, specific objectives were identified as follows:

1. To identify the following characteristics of a nationally representative sample of primary school children
    a. Health, nutritional factors and personal attributes that affect learning
    b. Socio-economic background and learning environment at home
    c. Learning environment at school
    d. Learning achievements at end of Grade 4 of the new national curriculum
2. To examine the nature of the interrelationship between these 4 sets of factors
3. To determine the extent to which each of the first three sets of factors (health, nutrition, personal attributes, socio-economic and learning environment at home, school environment) impact on the fourth set of factors (learning achievement).

The study and the resultant report followed this rationale.

[1] At the commencement of the study the team carried out three literature reviews focusing on health factors, school factors and socio-economic factors.

CHAPTER 2.
REVIEW OF LITERATURE

The preparatory phase of the study looked in detail at the status of current knowledge with regard to the study's focus areas. This took the form of three literature reviews on:

1. Health and nutritional status and learning achievement
2. Household socio-economic environment and learning achievement
3. The school environment and learning achievement

This chapter summarizes the findings of these literature reviews.

2.1 HEALTH AND NUTRITIONAL STATUS AND LEARNING ACHIEVEMENT[2]

Good health is important for education. Children need to be in good health so that they are able to attend school regularly to take full advantage of the opportunities provided by schools. Several studies, many of them conducted in developing countries, have shown that chronic ill health due to conditions such as poor nutrition, iron deficiency, malaria, and soil-transmitted helminth infections[3] affect academic performance and mental ability of pupils (Fernando et al, 2003, Grantham-McGregor 1995, Grantham-McGregor & Ani 2001, Halterman et al, 2001, Wachs 1995, Watkins & Pollitt 1997). These are all conditions that can affect large proportions of a given population, particularly in developing countries with widespread poverty. Malaria and worm infections are also much more common in tropical countries such as Sri Lanka, because a warm climate is generally conducive to spread of disease.

[2] This section summarizes the discussion provided in 'Impact of health and nutrition on learning achievement in primary school: Sri Lanka situation analysis', NEC 2003, prepared as a background paper for this study.

[3] The term 'soil-transmitted helminths' refers to worms that parasitize the intestines, and are spread by contamination of soil with faeces of infected persons. The most common of these are the common round worm (*Ascaris lumbricoides*), the hookworms (*Necator americanus* and *Ancylostoma duodenale*) and whipworm (*Trichuris trichiura*).

Malnutrition

Extensive review of the Sri Lankan medical literature showed that under-nutrition, as indicated by stunting, wasting and underweight, continues to be a significant problem among primary school children in all parts of the country (DCS 2001, Jayatissa 2002). Outside the Northern and Eastern Provinces, the problem is worst in the estate sector and the less developed rural areas, and least in Colombo and other urban areas. Despite the frequency of the problem, the effect of under-nutrition on learning has been examined in only study carried out in Sri Lanka. This study found that 6 – 8 year old children who were chronically malnourished (stunted) scored significantly less than normal children in educational achievement tests on language and arithmetic (Rajapaksa & Fernando, 1988).

However, it should be noted that there is no conclusive proof (from local or international studies) that malnutrition *per se* impairs behavioural development and mental function in children. The reason for this is essentially methodological. The most persistent risks cluster in the lower socio-economic status segments of the population and it is very difficult to separate effects produced by malnutrition from those which are a consequence of other adverse circumstances which surround the malnourished child. Children who are malnourished tend to live in poorer housing, the quality of education is low and their health is compromised by various environmental factors (Connolly & Kvalsvig, 1993).

Anaemia

Anaemia is also a common problem that affects the health of primary school children in all parts of Sri Lanka (Jayatissa 2002, Mudalige & Nestel 1996). The main causative factor is probably dietary inadequacy of iron, since other possible causative factors such as hookworm infection and malaria are now largely controlled in much of the country. Iron-deficiency anaemia has been linked with impaired attentiveness, poor coordination, and poor school performance but there is little to indicate the nature of the causal processes that connect the two. Whether the behavioural effects are primarily attributable to anaemia or to alterations in brain iron metabolism affecting neurotransmitter activity and, via this route, attention and other cognitive process, is still unclear.

Malaria

About one-fifth of Sri Lanka's population live in areas that may be considered malarious, but the incidence of this infection has declined drastically in the recent past due to improved control measures. According to data from the national malaria control campaign records, the malaria risk was highest for children aged 5 – 10 years in the Monaragala and Puttalam Districts. This was excluding the Northern and Eastern Provinces for which age-wise data was not available. Repeated malaria infections may have a detrimental effect on the nutritional status of the child and may give rise to chronic anaemia, which together with poor nutritional status, may have an impact on the cognitive performance of the school child. It is possible that malaria parasitaemia may affect cognitive function and hinder children's ability to learn in school. Studies done in Sri Lanka have shown that the cognitive performance of children with malaria was poorer than children with non-malarial fever and healthy controls both at the time of presentation and at 2-4 weeks later, and that both mathematics and language performance were dependent on the number of malaria attacks experienced in the past (Fernando *et al*, 2003).

Soil-transmitted helminth infections

Soil-transmitted helminth infections were extremely common in Sri Lanka in the past, but no nation-wide survey has been carried out for almost a century (de Silva 2005). The literature review indicated that recent data were of very patchy distribution: these suggest that worm infections are now a significant problem mainly in the estate sector of the Wet Zone and the Hill Country, and in the urban slum areas of the Wet Zone.

Several studies (all done outside Sri Lanka) have shown an association between parasitic helminth infection rates in children and poor cognitive performance and absenteeism from school. Moreover, improvement in educational achievement of infected children has been observed following anthelmintic treatment, indicating that the infection *per se*, rather than associated sociological factors were responsible for impaired learning (Kvalsvig *et al.* 1991, Nokes & Bundy, 1994, Watkins & Pollitt, 1997).

Other health conditions

Other factors, which do not usually reach the same levels of frequency as the conditions discussed above, but which may also affect learning, include deficiency of

iodine, and Vitamin A, defective visual acuity and impaired hearing, as well as conditions like childhood asthma, neuro-developmental disorders of childhood, psychological problems.

Currently available data on the indicators of iodine deficiency in Sri Lanka offer conflicting evidence regarding the extent of the problem (MRI, 2001). Goitre rates appear to indicate that iodine deficiency is still a significant problem in much of the country, but urinary iodine levels appear to indicate that there is no serious deficiency in the dietary intake of iodine. The data suggest that the aetiology of goitre in Sri Lanka is complex and that a significant proportion may not be due to deficiency in the intake of iodine.

About 5 – 10% of schoolchildren suffer undiagnosed eye defects, some of it relating to visual defects, others to Vitamin A deficiency (Pathinayake 1992). Very little data is available on the prevalence of hearing impairment in schoolchildren. The rates recorded at school medical inspections were less than 1% but the only independent study regarding this found a prevalence of 19% (Edussuriya 1994). There are no national data with regard to prevalence of asthma, neuro-developmental disorders and psychological disorders.

Apart from chronic, long-term conditions, frequent, short episodes of ill health which leads to absenteeism from school may also have a negative impact on school performance. Significant negative correlations between absenteeism and both arithmetic and verbal performance in girls and boys in grades five and six have been described (Ohlund & Ericsson 1994).

From the existing international and Sri Lankan literature, the following key variables were identified for analysis through the ISSEH study:

- under-nutrition
- frequent illness
- iron-deficiency anaemia
- deficiency of iodine
- deficiency of Vitamin A

- soil-transmitted helminth infections
- malaria
- visual acuity and hearing,

In summary, the literature review showed that many of the health factors that have been linked with poor performance in school are known to occur among primary school children in Sri Lanka to a greater or lesser extent. However, evidence explicitly linking learning achievement to health conditions is only available regarding two health conditions (under-nutrition and malaria) and the relationship between a range of other likely health conditions and learning achievement has not been adequately studied in the Sri Lankan context. Moreover, no single study published to date has examined the relative impact of health conditions in the context of the full spectrum of other determinants, such as the child's household and school environment, on learning achievement.

2.2 HOUSEHOLD SOCIO-ECONOMIC ENVIRONMENT AND LEARNING ACHIEVEMENT[4]

While the impact of education on personal and household socio-economic advancement has been extensively studied and the positive link accepted, the opposite relationship between the child's socio-economic environment and learning achievement, has not received adequate research attention in Sri Lanka. Of the existing knowledge on the impact of household socio-economic environment on primary school achievement, a large proportion is based on studies by educationalists. The findings point to two key variables that are strongly inter-related: parental involvement and the socio-economic status of the household.

Parental involvement refers to the parents' contribution to the educational endeavours of the child. This includes activities that are directly related to education as well as those indirectly related. The expectations of the parents towards the child's education and the time spent with the child are prime methods by which the child is oriented towards educational achievement.

[4] This section summaries the discussion provided in 'Impact of Household Socio-Economic Status on Student Achievement: A Literature Review', CEPA, 2003, prepared as a background paper for this study.

Socio-economic status of the household refers primarily to the asset and resource base available to the child via the family unit or household. While the material resources available for the child's education is directly effected by the economic status of the household, studies have clearly shown that factors effecting parental involvement can also be directly linked to their economic status. Parents who are economically constrained are frequently faced with the inability to devote sufficient time and energy needed to facilitate the education process. In addition there is a high level of uncertainty regarding the potential for their children to complete their education. Such constraints manifest themselves as low expectations, which in turn lead to low aspirations and achievements by the students.

A critical factor that comes out when analysing the literature on socio-economic indicators is the strong inter-relationship between parental education, occupation and household income. The education levels of the parent are linked to the type of occupation, which is in turn linked to income levels.

In addition the literature explores special issues that are relevant to the achievement levels of students from low-income households:

Low income groups access low quality schools: The greater propensity for students from low income households, to attend lower quality schools thus aggravating the unfavourable impacts of the household environment on the child's learning, has been considered in a number of studies. This is particularly true of primary school children as they are more likely to access school in the vicinity of their homes. According to a report by Sri Lanka to the 1990 World Conference on Education for All, "for those children living in the lower income areas of the country, school facilities are far below acceptable standards. Despite the introduction of several programs intended to remedy this problem, such schools continue to lack basic physical facilities... Catering to the most socially and economically disadvantaged families, these schools record the highest incidence of non-attendance and drop-out."

Absenteeism and dropouts: This is an issue that is hidden in the high primary school enrolment figures in Sri Lanka. While the drop out rate in Sri Lanka (averaging 3%) is lower than the South Asian and Developing Country averages, it is

still unacceptably high. When considering the drop out trends in Sri Lanka it is evident that the worse levels are at the secondary school level rather than the primary school level. Looking at the factors that precipitate dropping out, it is evident that income related factors are the main trigger. Data from the Central Bank show that the primary reason for students staying away from school is the inability of parents to meet the ancillary expenses of schooling despite its free provision by the state. While this is a direct reflection of the household's economic conditions it is important to note that the relatively few children drop out of school to take part in income generating activities. However, absenteeism from school is more likely to be linked with the economic production cycle of the household, especially in the case of poorer households.

Access to private tuition: While the literature is divided on the significance of private tuition on achievement of primary school students, it is accepted that students from higher income households have greater access to better quality private tuition. This view is substantiated to a degree by the Central Bank findings which show that a greater percentage of urban students attend private tuition than those from the relatively poor sectors of rural and estate.

Reflecting the literature discussed above, three key variables were identified for the ISSEH study as follows:

- Educational levels of parents: Years of formal education and areas of study of both the mother and father.
- Occupation of parents: Primarily father's occupation, which is generally divided into four or five groups, with professional and managerial being at the top and unskilled or manual workers at the bottom.
- Household income: Analysed based on income deciles or poverty line.

The overall findings from the literature point to a strong positive co-relation between each of the above variables and student achievement in Sri Lanka. However, while individual variables have a positive correlation, it is clearly shown that the impact is strongest in households that fare well in all three areas. This is especially true at the primary school level when the child is strongly linked to the home environment. Issues arising from these variables that have been explored in the literature include the

tradition of learning within a family, language development due to parental influence, role of parental expectations, ability of parents and the opportunities open to them to create a sound learning environment within the home.

2.3 THE SCHOOL ENVIRONMENT AND LEARNING ACHIEVEMENT

Of the three sub-sectors that this study seeks to bring together, this is the sector that has been most studied and led to policy reform. Considerable amount of the research has been carried out by educationalists and at times requested as a direct input to policy reform.

2.3.1 School learning environment

The classroom is a contrived environment to which parents send their children to receive an education. Therefore the responsibility of the school is to present a situation conducive to learning. The school environment should be able to motivate students and tap the potential of students. Learning has been defined as an ‘excavation of the treasures hidden within an individual’. Therefore the school environment should provide all required conditions to enhance the attempt in exploring the competencies and abilities hidden in each individual, which are identified as ‘latent traits’ by educational psychologists.

The school environment comprises of three components. These are the physical environment, the human environment, and the school culture, which results from the physical and human environments. To make the environment conducive for learning, there should be a smooth interaction among all three components. It is sometimes evident that even with high provision of physical and human resources, some schools find difficulties in achieving their expected objectives and goals. School culture plays a major role in this regard. Also, the school environment has a major impact on teacher activities. The well-organised school environment fosters interest and motivates teachers engage themselves in teaching and other extra-curricular activities. The availability of physical and human resources alone is not sufficient to motivate teachers and students to successfully reach achievement targets. A sound and strong integration of these three factors is necessary to make a good school environment.

2.3.2 Factors comprising the school environment and their interactions

The school environment comprises of the three components identified above, namely, human, physical and cultural factors. The physical factors include school buildings, laboratories, libraries, infrastructure facilities, flora and fauna. These factors should be adequate and also arranged systematically. They should be of good quality and of adequate quantity. Special mention has to be made of the school garden. It should be well-planned and managed to provide a pleasant environment to the learner. The school garden should be organized in such a manner to provide opportunities for the teacher to make use of it in their teaching. It should also provide a pleasant and natural environment for the learner to make his learning enjoyable and productive.

The human environment consists of students, teachers, principal, deputy principals, sectional heads, grade coordinators, subject coordinators, clerical staff, non-academic staff, parents and well-wishers. Of these, the students are the most important component. All the other components should work for the well-being and excellence in achievement of the students. This includes the development of cognitive abilities and psychomotor skills, as well as affective traits and social skills of the students, which are essential for balanced personality development. Teachers and other personnel, who fall into the category of human resources should be well-informed, trained and managed to assure optimal development of students.

Based on the literature, the following school related variables are identified for the ISSEH study:

- location, infrastructure and facilities
- the size of the student population,
- characteristics of the administrative head and its teachers.

The school culture is a by-product of the interaction between the physical and human environment. Schools have their own vision, objectives, traditions and conventions. They provide a culture that is unique to the school, which supports the development of the student. It is a means of establishing school identity. The principal and other staff members of the school play a key role in moulding the culture and identity of a school. They should be woven together by the conventions and traditions of the

school. If a school works towards achieving high targets in students, it is a positive sign of the school culture. Commitment and willingness to work, as well as loyalty and devotion of the staff members are signs of a good school culture.

2.4 DEFINING LEARNING ACHIEVEMENT

The above discussion covers the three main areas from which independent variables are drawn to predict learning achievement of primary school children in Sri Lanka. The dependent variable – learning achievement – can also be defined and measured in many ways.

According to the literature, learning is a permanent behavioural change that takes place in students as a result of the experiences they gather inside and outside the classroom. Learning achievements include changes in cognitive abilities, affective traits, psychomotor skills and social skills. They are the desired and essential learning outcomes stated in the curriculum.

Some of these changes are observable and measurable. In Sri Lanka, the practice is to have different kinds of written tests to assess the level of student achievement in cognitive abilities. The measurement of other skills and traits is given less emphasis in the system. More importance has been given to written type tests, and less to the measurement of attitudes, skills and interests etc.

Accordingly, learning achievement is captured in this study through three variables:

1. NEREC administered test scores for First Language (Sinhala or Tamil)
2. NEREC administered test scores for Mathematics
3. NEREC administered test scores for Second Language (English)

The first two tests were constructed as measures of the level of achievement in the essential skills of literacy and numeracy respectively, while the third was designed to evaluate mastery of the children's second language, English.

2.5 DECIDING THE AREAS OF FOCUS

The overall aim of the study was to explore inter relationships between the health, nutritional status and other personal attributes of the child, the child's home environment and the school in determining the level of learning achievement of Grade 4 students. Based on the findings of the literature reviews, which were completed in 2002, the study team decided to focus on the following aspects:

1. Students' health and nutrition known to affect learning, and likely to be important in Sri Lanka: these included under-nutrition, anaemia, soil-transmitted helminth infections, malaria, visual acuity, hearing, frequent illness, and deficiency of iodine and Vitamin A. Other conditions such as asthma, neuro-psychiatric and psychological disorders were not included because of difficulties in carrying out such assessments in the required sample size
2. Student characteristics that are likely to affect learning: these included sex, birth order, school attendance rate, and after-school activities
3. Household socio-economic environment: the main factors to be assessed included parental education, household income, expenditure on children's education, and the learning environment provided for the child.
4. School environment: these included background factors relating to the school such as location, infrastructure and facilities as well as the size of the student population, characteristics of the administrative head and its teachers.

CHAPTER 3.
STUDY DESIGN AND DATA COLLECTION

This chapter provides a summary of the study design and details of the data collection process.

3.1 SELECTION OF STUDY SAMPLE

As mentioned in the introduction, the children included in this study constituted a sub-sample of the NEREC study of 'National assessment of achievement of Grade 4 pupils in Sri Lanka' (Perera *et al* 2004). The NEREC study had a sample of 16 383 students selected from 939 schools, and was designed to cover all 9 provinces, 25 districts, and 92 educational zones in the country. The minimum cluster size selected from each school was 20. Where a school did not have 20 students in the relevant grade, two such small schools that had 10 – 19 students in the grade were selected together, to make a 'pseudo-school'. As a result, schools that had less than 10 students in Grade 4 in the year 2002 were not considered for inclusion in the sample.

For the Inter-Sectoral study, a smaller sample was selected from within the NEREC sample, using multi-stage stratification.

Stage 1: Stratification by provincial level, with representation of all 9 provinces

Stage 2: Stratification by the 4 types of school recognised by the Ministry of Education

Stage 3: For each type, state schools from rural, urban and estate areas were randomly selected on a proportional basis, the number of schools from each type being approximately proportional to the size of population

Stage 4: For each school selected, all 20 children included in the NEREC study were included in the Inter-Sectoral study

School types in state sector:

- **Type 1AB** – classes from Grade 1 to GCE Advanced Level, including science stream classes
- **Type 1C** – Grade 1 to GCE Advanced Level, Arts or Commerce stream classes only
- **Type 2** – Grade 1 to GCE Ordinary Level only
- **Type 3** –Grades 1 to 5 or 1 to 8 only

The targeted sample of schools is shown in Table 3.1. It was estimated that the 139 state schools thus sampled would constitute 1.5% of the state schools with Grade 4 classes, while the sample of 2 780 children would constitute 0.8% of the school children in Grade 4 in 2002. The sampling procedure did not involve stratification for

sex or medium of instruction on the assumption that random sampling would ensure suitably representative numbers for both variables.

Four privately run, fee-levying schools which followed the same curriculum as the state schools, and which consented to take part in the study were also included. These comprised three schools from the Western Province (one boys-only school and two girls-only schools) and one boys-only school in the Central Province. The same minimum cluster size was used for each of these schools.

Table 3.1 Targeted sample number of schools by province and school type

Province	*Type 1AB*	*Type 1C*	*Type 2*	*Type 3*	*Private*	*Total*
Western	4	4	5	4	2	19
Southern	4	5	4	3	0	16
Central	3	4	5	4	2	18
North Western	3	4	5	3	0	15
North Central	3	4	5	3	0	15
Sabaragamuwa	3	4	5	3	0	15
Uva	3	4	5	3	0	15
Northern	3	4	5	3	0	15
Eastern	3	4	5	3	0	15
Total	29	37	44	29	4	143

3.2 COLLECTION OF DATA

After the study sample was selected, data was collected through three main instruments - a health survey, a household questionnaire and a school questionnaire - as described below.

3.2.1 Health survey

The health survey was carried out during the period June – September 2003, by staff of the Medical Research Institute, Colombo. The field staff worked in five teams, each consisting of two Public Health Inspectors (PHIs) and a microscopist. The PHIs were trained and experienced in the assessment of nutritional status, while the microscopists were trained in faecal examination for intestinal nematode eggs. Informed, written consent was obtained from each child's parent / guardian for examination of the child, and particularly for taking a blood sample. The children were examined in a suitable room within the school premises.

Physical anthropometry

Height was measured in cm to the nearest decimal, using an anthropometric rod. Weight was measured in kg to the nearest decimal, using an electronic weighing scale from Seca®. Two indices were calculated for assessment of nutritional status: height-for-age Z-score (HAZ) and body mass index (BMI). Low height-for-age is considered an indicator of stunting ('shortness') which is frequently associated with poor overall economic conditions and / or repeated exposure to adverse conditions (WHO 1995). Calculations were done using the ANTHRO software package with WHO / NCHS references for classification of nutritional status. Z-scores (standard deviation units) are useful because they have the statistical property of being normally distributed, thus allowing calculation of a meaningful average and standard deviation for a population. HAZ is calculated as follows:

$$\text{Z-score} = \frac{\text{(observed value) – (median reference value)}}{\text{Standard deviation of reference population}}$$

Children with HAZ scores below –2.0 SD were considered stunted.

Because the study sample comprised of children in the early adolescent age group, BMI was used as an indicator of 'thinness' rather than the weight-for-height Z-score, which is commonly used for younger children (WHO, 1995). BMI is calculated as follows:

$$\text{BMI} = \frac{\text{weight (in kg)}}{[\text{Height (in m)}]^2}$$

As recommended by the WHO, children who had a BMI-for-age below the 5th centile of the NCHS reference population were categorized as 'thin' and those above the 85th centile of the same reference population were categorized as 'at risk of overweight'. These cut-off values are as indicated in Table 3.2:

Table 3.2. Body Mass Indices of NCHS reference population

Age (years)	*Boys*		*Girls*	
	5th centile	85th centile	5th centile	85th centile
9	14.03	18.85	13.87	19.19
10	14.42	19.60	14.23	20.19
11	14.83	20.35	14.60	21.18
12	15.24	21.12	14.98	22.17
13	15.73	21.93	15.36	23.08
14	16.18	22.77	15.67	23.88
15	16.59	23.63	16.01	24.29

From WHO 1995

Anaemia

Haemoglobin levels were measured in g / dl, using 10 µl of fingerprick blood and a HemoCue® meter, for diagnosis of anaemia. Sterile disposable lancets were used for drawing blood and all sterile precautions were followed in doing this. Children living at an altitude of less than 1000 m, with haemoglobin levels below 11.5 g / dl of blood, were considered to be anaemic. As recommended by the WHO (2001), the cut-off point for children at altitudes between 1000 – 1500 m was 11.7 g / dl; and for 1500 – 2000 m, it was 12.0 g / dl. There were no children living at altitudes higher than 2000 m.

Visual acuity

Visual acuity was examined using a Snellen's chart with numerals, at a distance of 6 m, for evidence of myopia. Where children had previously been found to have defective eyesight and were wearing corrective eyeglasses, testing was done with the glasses on. A child who had 6/6 or 6/9 vision in the better eye was considered to have normal visual acuity (Polnay & Hull 1985).

Bitot's spots and goitre

Both eyes were examined for the presence of Bitot's spots as clinical evidence of Vitamin A deficiency. Each child was examined using the standard technique recommended by the WHO for evidence of goitre, and recorded as a visibly or palpably enlarged thyroid gland (WHO 1994).

Soil transmitted helminth infections

Faecal samples provided by the children were examined microscopically for roundworm, whipworm and hookworm eggs. All samples were examined on the day of collection, in the field. Quantification of infection was done using the modified Kato-Katz method as recommended by the WHO (Montresor *et al*, 2002). Kits were from Vestergaard-Frandsen, India, with templates delivering 41.7 mg of faeces.

Ethical considerations

Ethical approval for the study was obtained from the Ethical Review Committee of the Faculty of Medicine, University of Kelaniya. Children who were found to have Bitot's spots, a goitre, myopia, or haemoglobin levels below 11.5 g / dl were referred

to the nearest Medical Officer of Health or District Medical Officer for further assessment and follow-up. In schools where any child was found to be infected with any one of the three nematodes, all children were offered treatment with single dose mebendazole (500 mg, from the State Pharmaceutical Manufacturing Corporation of Sri Lanka).

3.2.2 Assessment of home environment

Data pertaining to the selected child's home background were recorded on the Household Questionnaire by trained household enumerators. The interview was carried out at home, with the mother, or in the mother's absence, any other person who was responsible for the day-to-day wellbeing of the child. In the case of children living away from home, the questionnaire was completed by interviewing the guardian.

The household questionnaire also had 5 parts:

Section 1: Identification data

Section 2: Household profile

Section 3: Home learning environment

Section 4: Health and nutrition

Section 5: Socio-economic status of household

The household profile (Section 2) recorded information on all members of the household in which the child lived; each person's relationship to the child, his/ her gender, age, religion, race, level of education and employment.

Section 3 covered information regarding the home learning environment: the relationship of the child with each parent; facilities for study and play; travel to school; classes attended after school; use of libraries; TV viewing; family trips and events; supervision of, and assistance with school homework; relationships with the child's friends parents; parental expectations regarding the child; attitudes to education; selection of the school attended by this child; and any factors obstructing school attendance.

In Section 4, information was sought regarding the child's general health; any past history of malaria or worm infections; problems regarding visual acuity, hearing or any other physical or mental disability; diet, eating habits and other health-related habits.

In the final section (socio-economic status of household), information was sought regarding housing; ownership of assets; household access to services; livelihood, income and expenditure, with special focus on expenditure relating to health and education; credit and savings history; vulnerability and coping strategies; and socio-cultural variables.

3.2.3 Assessment of school environment

Data pertaining to the school environment were recorded on the School Questionnaire, by trained enumerators who also had several years experience in the education sector. The questionnaire consisted of 5 parts:

Section 1: Background information regarding the school

Section 2: Information regarding the Administrative Head (Principal / Deputy Principal / Sectional Head)

Section 3: Information regarding Grade 4 teachers

Section 4: Information specific to student

Section 5: Classroom observation schedule

Sections 1 and 2 were completed by interviewing the administrative head of the primary school: Principal or Deputy Principal, or in the case of large schools, the Sectional Head. Data regarding the location and type of school, the community served by the school, the distance from the school to basic facilities, school enrolment, number of teachers and the leave taken by them, the facilities available in the school, its supply of texts, teacher guides, and quality inputs, were recorded in Section 1.

Section 2 contained information regarding the interviewee: gender, educational and professional qualifications and nature of appointment, years of service, residence and travel to work, leave taken in 2002, and involvement in monitoring of teaching-learning activities, as well membership in, and participation in meetings of statutory school bodies.

The school enumerator also interviewed at least 3 (preferably 5) teachers who had been deployed in teaching the selected students when they were in Grade 4 in 2002. Thus, 3 – 5 copies of Section 3 were completed for each school. This section contained details of the teacher's gender, professional and educational qualifications, and nature of appointment, years of service, residence and travel to work, meetings with relevant officers and parents, extra classes conducted after school hours in 2002,

action taken regarding students with special needs, reporting of students' progress to parents.

One copy of Section 4 was completed by the enumerator for each child included in the study (i.e. up to 20 copies per school). This Section covered information obtained by examining the previous year's school records, including the child's age, sex, school attendance in 2002, School Based Assessments in the First Language (Sinhala / Tamil), Mathematics and Environmental Sciences, as well as information regarding teacher's observations regarding special abilities and behaviour in school. Information regarding the child's favourite subjects, sports, hobbies, manner of spending time after school, pre-school attendance, and the language spoken at home were elicited in a direct interview with the child.

One copy of Section 5 (Classroom Observation Schedule) was completed for each teacher included in the study. This was done by the school enumerator who sat in during the relevant teacher's classroom sessions on one day, and completed the schedule while observing his / her teaching practices. The schedule included observations on teacher preparation, methods of teaching, use of physical resources, use of learning methods, awareness of students with learning difficulties, classroom instructions, evaluation of pupils, diagnosis and remedial action for students with learning difficulties, attention to security and safety of pupils, and general teacher interest and pleasantness. The minimum possible score was 0 and the maximum was 84.

3.2.4 Questionnaire construction and enumerators

Questionnaires were constructed in English by the research team and translated into Sinhala and Tamil. Questionnaires were placed for review before a group of experts and stakeholders at the Study Inception Workshop held in February 2003, and revised according to the expert recommendations.

Pilot study

The translated questionnaires were field tested through a pilot study conducted on a national sample of 18 schools (2 schools from each province) during the period 20 March – 4 April 2003. During this pilot study, 18 school principals, 54 teachers, 90 students and 90 parents were interviewed. Questionnaires were revised with insights gained from the feedback sessions with the enumerators. The research team monitored

the pilot study by visiting some of the schools and households included in the sample along with the supervisors appointed by the firm that carried out the fieldwork.

Enumerators

A total of 67 enumerators were deployed by the firm appointed to carry out the fieldwork. The enumerators completed the School and Household Questionnaires during the period May – July 2003, working in teams of three (one school enumerator and two household enumerators). Each team worked in their home province and was designated to cover specific schools and households according to their first language, and the language spoken by the majority of children in the assigned schools.

The school enumerators (who were designated team leaders) were all persons with extensive experience in state sector primary education. All enumerators were provided with an instruction manual regarding completion of the two sets of questionnaires, and trained at a two-day workshop prior to fieldwork. Some of the enumerators participated in the pilot study, and were thus involved in questionnaire development.

Monitoring of fieldwork was carried out by officers of the National Education Commission, the research team, and by supervisors employed by the consultancy firm.

3.2.5 Measurement of learning achievement

Test papers designed to assess learning achievement in the First Language (Sinhala / Tamil), Second Language (English) and Mathematics, at the end of Key Stage 2 (Grade 4) were constructed and piloted by NEREC as part of their study on 'National Assessment of Achievement of Grade 4 Pupils in Sri Lanka' (Perera *et al* 2004).

Each of the tests on Sinhala, Tamil and English had 10 questions on vocabulary, 11 on comprehension, 10 on syntax and 9 on writing. The Mathematics test had 12 questions on concepts, 15 on procedures and 13 on problem solving. Students were given 45 minutes each to complete the tests in their first language and in English; and 60 minutes for the Mathematics test. Each subject was pre-tested thrice. The first pre-test, which had 400 items, focussed on content. The 2nd pre-test was with 80 items, and focussed on language. The final 40 items were pre-tested on the final occasion.

These tests were administered to the student sample on 8 March 2003 by their teachers, under the supervision of an Education Ministry official. The completed test

papers were scored by NEREC staff, and the marks obtained by each child were passed on for use in this Inter Sectoral Study, along with the pupil's name, identification code and other details pertaining to the school.

3.3 DATA ENTRY AND STATISTICAL ANALYSIS

3.3.1 Design and development of database structure

A detailed study was conducted on the types of questions and the nature of answers found in the completed questionnaire in order to choose a suitable software and structure for the database. MS Access was found to be the best software for the database due to its availability, simplicity of database construction, multi-user environment, the strong data export and analytical functionality. Accordingly, the database was designed and developed in MS Access.

The database consists of two sections namely, School Questionnaire and Household Questionnaire. The School Questionnaire section holds 6 tables: School Background and Principal, Teachers, Students, Marks, Health Data, and Faecal Test Data. The Household Questionnaire section holds 34 tables, namely, Sections 123 (Identification data, Household Profile, Home Learning Environment), Section 4 (Child's Health Profile), Section 5 (Socio Economic Status of Household), and 31 tables for data that have more than one dataset for each student.

All the tables are linked together as shown in Figure 3.1. Three types of identity numbers are used; School ID (8-digit), Teacher ID (5-digit start with 'T'), and Student ID (5-digit start with 'PU') are used to link the tables. The School Background and Principal table is linked with Teachers and Students tables by School ID, using one to many relationships. The Student table is linked with all the other tables by Student ID, using one to one relationships. To facilitate the data entry process, data entry forms were prepared as interfaces between the data and data tables. The data entry forms were designed in such a way that these forms resemble the order of questions and the appearance of the questionnaires. These forms were strengthened with dropdown lists, combo boxes, list boxes, tick boxes so that the data entry process is fast and accurate. Figure 3.2 illustrates the database forms and tables and the data flow to each table.

Table 3.3: Number of records in each table in database

Table Name	Number of Records
School Background and Principal	144
Teachers	361
Students	2731
Marks	2731
Health Data	2731
Faecal Test Data	2731
Section 123	2731
Section 4	2731
Section 5	2731
Other 31 tables	Different Numbers

Figure 3.1 Relationships between database tables

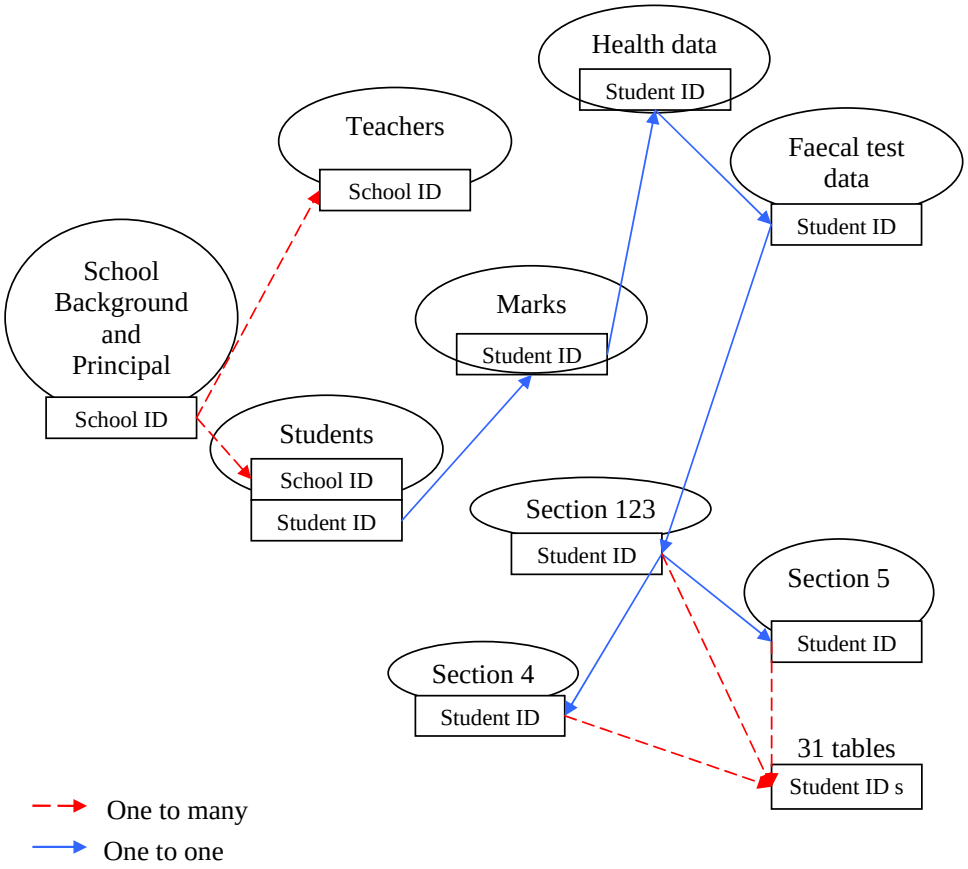
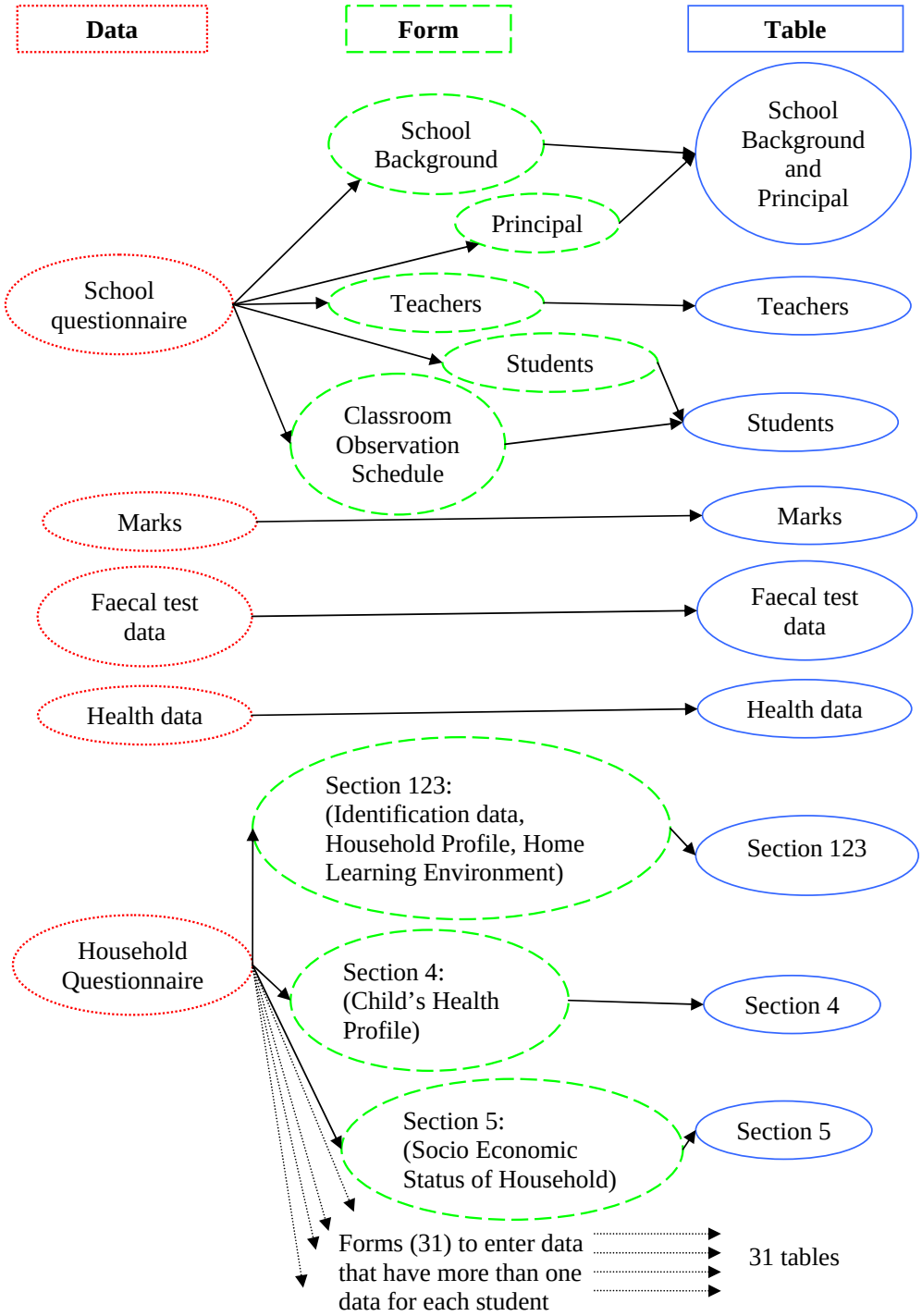


Figure 3.2 Database forms and tables and the data flow



Data entry was performed by a group of ten graduates who were given one week training prior to commencement. The data entry was completed during the period July – October 2003. The entire database was checked through a second round data verification process. Table 3.3 shows the number of data records in each table.

3.3.2 Data analysis

The dependent variable was the set of marks scored for First Language, Mathematics and English, in the NEREC Achievement tests. The independent variables consisted of health, personal, household, socio-economic and school variables.

The statistical analysis was carried out in several stages.

1. For each variable, a simple tabulation of data based on provinces was performed and univariate descriptive statistics such as mean, standard deviation were calculated. These results are presented in Chapter 4.
2. Where necessary, cross tabulation between variables were carried out for verification purposes. Cross tabulations with variables related to the child and the child's household socio-economic environment, were also carried out in order to establish the extent of associations between the two. These are also presented in Chapter 4.
3. Simple bivariate correlation of the dependent variables (test scores in First Language, Mathematics and English) and the main independent variables relating to the children's health and nutritional status and their home environment. This was done in order to identify variables to be included in the next stage of analysis, multivariate analysis. The results of these bivariate correlations are presented in Chapter 5.
4. Multivariate analysis using logistic regression was carried out with key variables that were found to be significantly associated with learning achievement in the previous bivariate analyses. Successful outcome in learning was deemed to be achievement of a test score indicative of mastery (i.e., 80% or more) of either or both First Language (Sinhala or Tamil) and Mathematics. English was not included in this part of the analysis because the proportion of children achieving mastery was very low, thereby rendering the method of statistical analysis invalid. The results of this multivariate analysis are presented in Chapter 6.

3.4 LIMITATIONS OF THE STUDY

Before discussing the results of the study, the following limitations are noted by the study team.

1. The present study was carried out with the main objective of establishing the relationship between the learning achievements at the end of Grade 4 in the new primary school curriculum, and the factors that could influence these learning achievements. Learning achievements were principally measured by the NEREC test, which was designed and administered as part of a separate, independently commissioned study. The test was actually administered after the target population had gone through an additional school term after completing Key Stage 2. Furthermore, administration of the School and Household Questionnaires that were designed and constructed for the Inter-Sectoral Study were administered 2 – 3 months after the achievement test was conducted. Due to various administrative problems, and extensive flooding due to monsoon rains in 3 provinces in May 2003, final completion of the health survey took place approximately 6 months after administration of the NEREC test. It is possible that this relative lack of close synchrony between the various components of the study may have affected the findings.

2. The techniques used for assessment of nutritional and health status were necessarily limited to those that could be used in the field, and were not excessively expensive. This meant that assessment of some conditions (e.g. deficiency of Vitamin A and iodine, hearing defects) was performed only by clinical examination (e.g. for Bitot's spots, and goiter), or by questioning the parents (e.g. hearing). This may have resulted in some degree of underestimation of the true levels of the relevant conditions.

3. While privately owned and managed schools which follow the state curriculum were included in the sample, it was not possible to follow the same sampling and data collection method as for government schools. In the case of sampling, the fact that very few such private schools exist in Sri Lanka (only

26 in the country) and almost all have Type 1AB characteristics meant that there was no room for selection nor representation across types of schools. However, as it was felt that private schools should be included in the study, three private schools in the Western Province and one in the Central Province were studied. In the case of data collection, one private school agreed to participate only on the condition that the achievement test was administered by the school, without the presence of the study team. One school refused to allow the study team access to the student's households for administering the household questionnaire. Hence, the achievement test was administered in a way that was comparable with the state schools only in 3 private schools and the household data is also available only for 3 private schools. Compliance in providing the faecal samples required for the health survey was also much lower in all the private schools than in the state schools, but compliance with other health measurements was comparable.

CHAPTER 4.
PROFILE OF STUDY SAMPLE

This chapter briefly sets out a profile of the sample covered by the study in order to provide insight into the nature of the information base prior to exploring the inter relationships between non-school factors and learning achievement. The profiling would also enable a general comparison with the larger national population.

4.1 OVERVIEW

The survey covered 2731 children, with a mean age of 9.6 years (range 9 – 15 years, SD 0.6 years). Their distribution by province and sex is shown in Table 4.1.

Table 4.1. Distribution of study sample by province, school type and sex

Province	Males		Females		Total
	n	%	n	%	
Central	112	40.6	164	59.4	276
Eastern	138	50.7	134	49.3	272
North Central	131	49.1	136	50.9	267
North Western	188	67.9	89	32.1	277
Northern	157	58.4	112	41.6	269
Sabaragamuwa	137	54.2	116	45.8	253
Southern	162	57.4	120	42.6	282
Uva	137	51.1	131	48.9	268
Western	153	51.2	146	48.8	299
Private schools	36	55.4	29	44.6	65
Sri Lanka	**1351**	**53.4**	**1177**	**46.6**	**2528**

The school was the second level of stratification following the provinces. A total of 144 schools were included in the study sample, instead of the targeted 143, because the small student population in one state school had to be supplemented with that of another school of similar type in the same province. Because of refusal to participate in the study, one of the two private schools initially selected from the Central Province was replaced by another in the Western Province. Thus the four private schools included three from the Western Province and one from the Central Province.

Representing the national spread, two thirds of the children (n = 1834, 67.2%) were in Sinhala medium classes, while the rest (32.8%) were in the Tamil medium.

Considering the location of schools in the study sample within the community, the majority of Type 1AB schools (63.6%) and all four private schools were located in Municipal Council or Urban Council Areas, whereas most schools of Types 1C, 2 and 3 were located within Pradeshiya Sabha areas (68.4, 71.8 and 61.5%, respectively). Overall, 41.4% of the schools were located within a Municipal or Urban Council area.

4.2 HEALTH

As the primary area of interest of this study, this section provides the health profile of the study sample, on indicators such as nutritional status and the incidence of anaemia, vitamin A and iodine deficiency, defects in eyesight and hearing, soil-transmitted helminth infections, malaria and frequent illnesses.

4.2.1 Nutritional status

Two indices were calculated for assessment of nutritional status: height-for-age Z-score (HAZ) and body mass index (BMI).

The national prevalence of stunting among children in state schools was 15.5%; it ranged from 12.0% in the North Western Province to 20.2% in the Eastern Province (see Figure 4.1). None of the children attending private schools were stunted. The differences between boys and girls were not statistically significant, except in the North Central Province, where more boys were stunted than girls. The overall national level of stunting is similar to that found among under-fives in the national Demographic and Health Survey of 2000, but somewhat less than the prevalence of 22.6% found in a study of 15,120 schoolchildren (aged 5 – 14 years) carried out by the MRI in 23 districts in 2001-2003.

> ***'Stunting'*** is a term used to indicate abnormally low height-for-age. It reflects a process of failure to reach linear growth potential as a result of sub-optimal health and / or nutritional conditions.

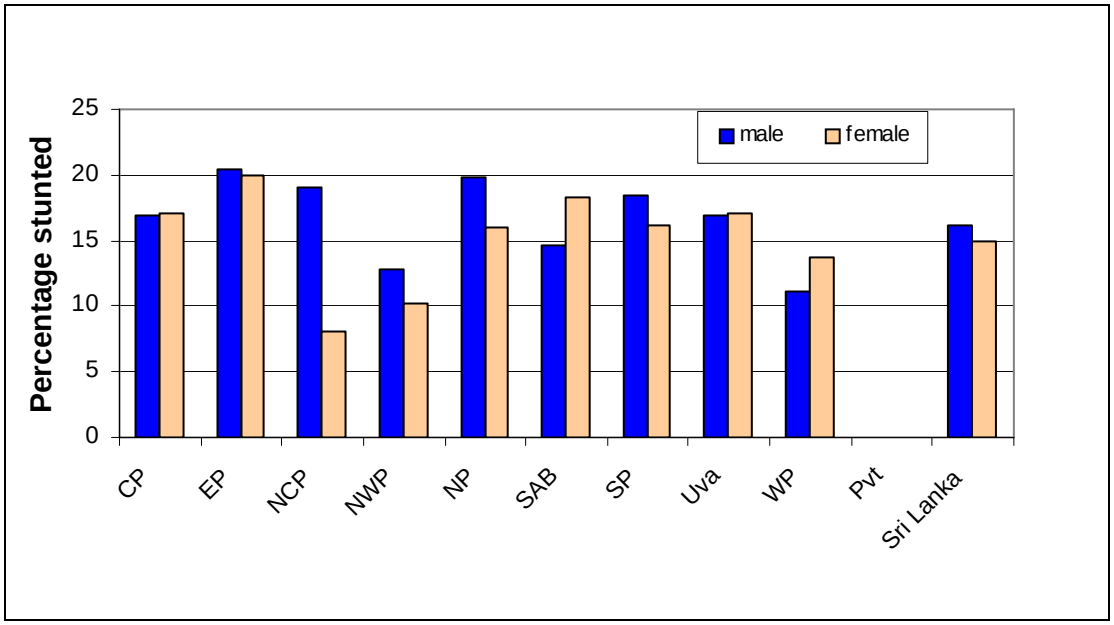


Figure 4.1. Prevalence of stunting by province and sex

About half of those attending state schools (52.6%), fell into the category 'thin', as indicated by their Body Mass Index (see Figure 4.2). Again, the differences between boys and girls were not statistically significant except in one province, Uva, where significantly more boys than girls were 'thin'. In the four private schools, the proportion of 'thin' children was only 16.9%. In the same schools, 21.5% of children were 'overweight'. The national average prevalence of overweight was 3.1%. The high rates of excessive thinness could mean that the cut-off values used here are inappropriate for Sri Lankan children. However, it is also possible that these very high rates of excessive thinness are a result of late maturation, with a delay in the growth spurt in Sri Lankan children when compared to the US reference population. This latter view is supported by the much lower prevalence of thinness among children in private schools, who probably have an early growth spurt like US children. This would indicate that Sri Lankan children have the same genetic potential to grow as US children and therefore, using a US reference population is acceptable.

Body Mass Index (BMI)

BMI is calculated by dividing weight (in kg) by the square of height (in m). In older children nearing adolescence, it is used with age and sex dependent cut-offs derived from a reference population to define excessive thinness or overweight.

There was a statistically significant association between thinness and stunting: the prevalence of stunting among excessively thin children was 68.1% whereas only 31.9% of children with normal BMI were stunted, and none of the children categorized as overweight or obese were stunted (chi-square = 54.1, p<0.001)

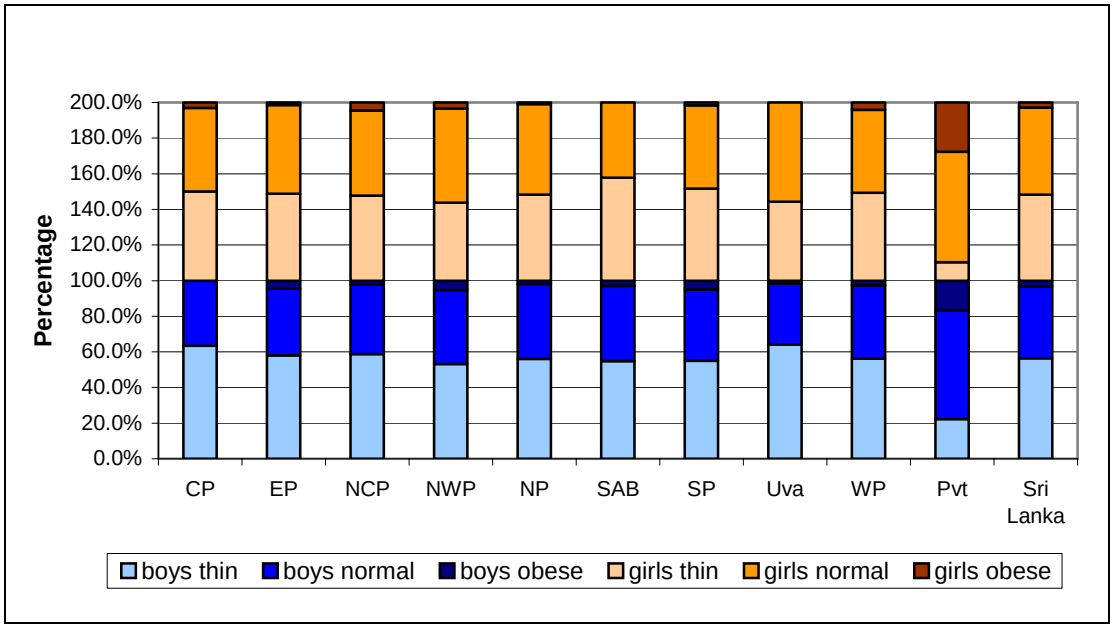


Figure 4.2. Prevalence of excessive thinness and overweight by province and sex

4.2.2 Anaemia

The national prevalence of anaemia was 12.1%; ranging from 6.3% in the Central Province to 28.3% in the Northern Province (see Figure 4.3). The difference in the prevalence of anaemia in girls and boys was not statistically significant except in Uva, where significantly more girls than boys were anaemic. Prevalence in private schools was minimal, at 2.4%. The national prevalence of anaemia found in this study is somewhat less than the 20.7% found in a survey conducted by the MRI. This study covered 2,438 children of a comparable age group (5 – 11 year olds), in 7 of the 9 provinces of Sri Lanka in 2001. However, the prevalence of anaemia has been declining in general.

> ***Anaemia*** occurs when blood haemoglobin (Hb) levels fall below a level defined on the basis of age, sex and altitude of the living environment. Iron deficiency is the most common cause of anaemia.

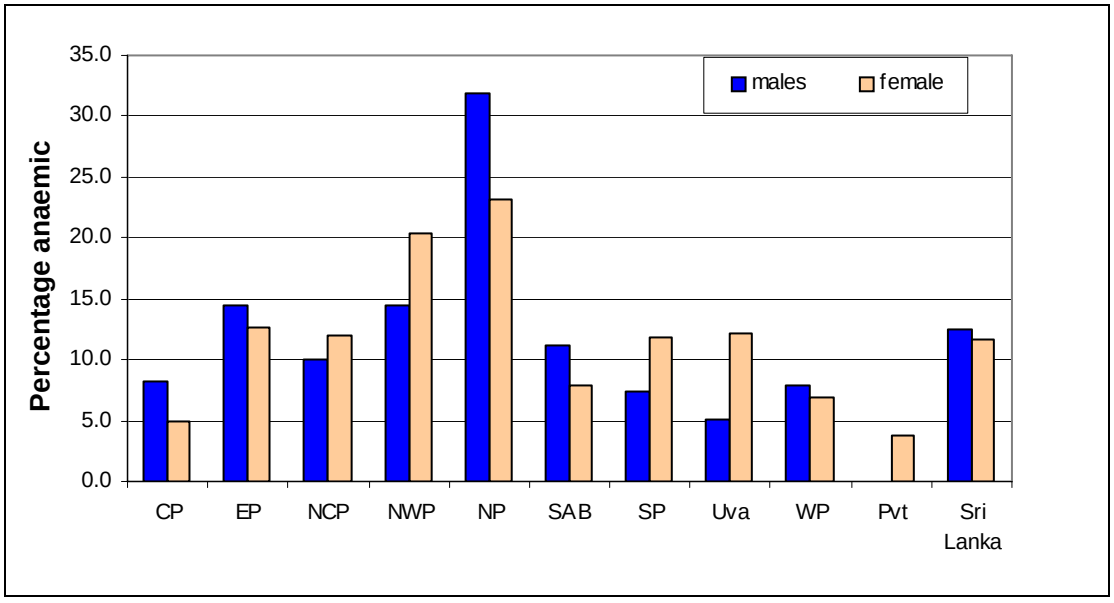


Figure 4.3. Prevalence of anaemia by province and sex

4.2.3 Vitamin A and iodine deficiency

The prevalence of clinically obvious Vitamin A deficiency, as indicated by the presence of Bitot's spots on the conjunctiva of the eyes, was low. Overall, only 0.3% of the children had Bitot's spots (0.4% of boys and 0.2% of girls). The overall prevalence of visible or palpable enlargement of the thyroid gland was also low (3%). The prevalence rate among girls was significantly higher than among boys (57/1176, 4.8% vs 23/1351, 1.7%, chi-square=20.3, $p<0.001$).

4.2.4 Defects in eyesight and hearing

The prevalence of shortsightedness in the state schools ranged from 2.8% in Sabaragamuwa to 7.1% in the North Central Province. It was 7.7% in the private schools, and the national average was 4.6%. Again, there was no significant difference between boys and girls, except in the private schools, where more boys than girls were found to be shortsighted. When the principal care-giver was questioned regarding the presence of any problems with eyesight in child, 3.6% answered positively. However, only 31.1% of these children were actually found to be shortsighted on testing. On the other hand, of those who were found to be

> ***Shortsightedness*** was tested at a distance of 6 m, using a standard Snellen's chart with numerals. Children who had already been found to have defective vision were tested with their glasses on.

shortsighted on testing, only 24.6% were suspected by their parents to have defective eyesight.

Parents of 34 children (1.3%) complained of defective hearing in the child. However, there was no means of objective verification of this complaint, since it is difficult to test hearing in a field situation. Among these 34 children, the parents of 8 (23.5%) also complained of frequent illness in the child, whereas only 393/2641 (14.9%) of children who were not suspected of deafness were frequently ill. This difference however, was not statistically significant.

4.2.5 Soil-transmitted helminth infections and malaria

As shown in Figure 4.4, the national prevalence of the soil-transmitted helminth infections [roundworm (*Ascaris lumbricoides)*, whipworm *(Trichuris trichiura)* and hookworm (*Necator americanus*)], was less than 5% each, with a cumulative prevalence of 6.9% for all three infections; there were no differences between prevalence in boys and girls.

According to information gathered from the children's caregivers, 9% had passed worms at some time in their lives. Virtually all children (96% islandwide) had been given some form of anthelmintic treatment during the year prior to interview.

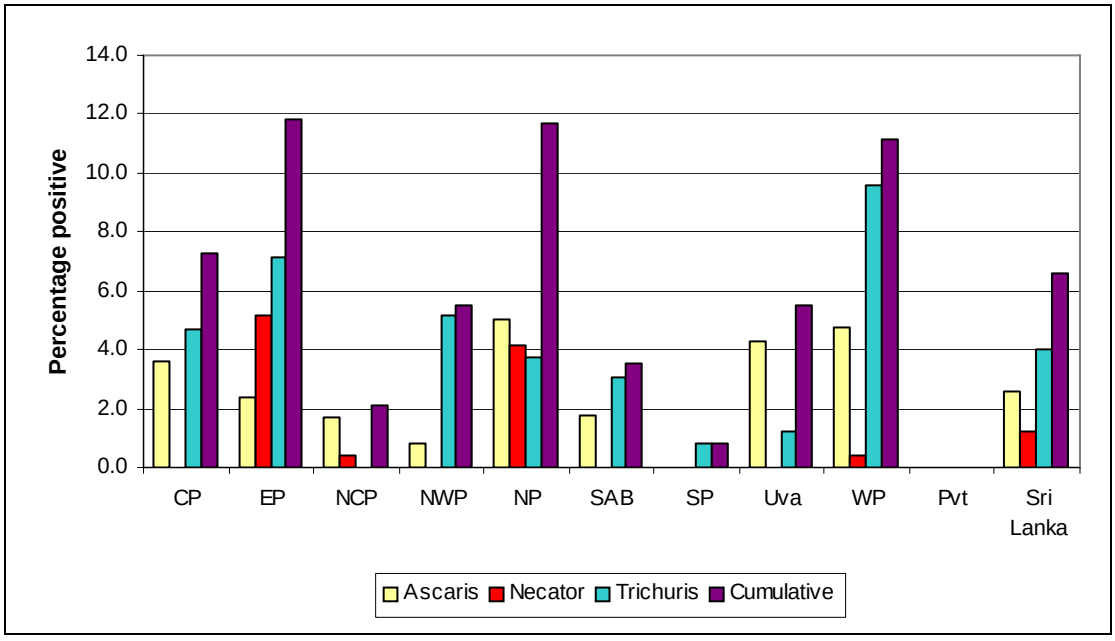


Figure 4.4. Prevalence of soil-transmitted helminth infections by province

During the household survey, parents were specifically asked whether the child had ever had malaria. As expected from knowledge of the current distribution of endemic malaria in Sri Lanka, there were marked regional differences in the answer to this question. Only 1% of children in the Central, Sabaragamuwa and Western Provinces (which are largely non-endemic) had ever had malaria, whereas in the Northern Province, 28% of the children were reported to have had experienced malaria at some time in their lives. Overall, only 6.4% of children had a lifetime history of malaria.

The prevalences of geohelminth infections and malaria, often a major problem among school children in other developing countries, are low. It is possible that the prevalence of geohelminths is somewhat of an underestimate, particularly with regard to the Eastern Province. Household interviews with parents in this province were held some days before medical examination of the children, because of logistic difficulties. The medical survey team then found that many of the children had been given anthelmintics by their parents soon after the household interview. However, since the vast majority of children appear to be given anthelmintics regularly anyway, it is unlikely that the degree of underestimation is of much significance.

4.2.6 Frequent illness

In the state schools, the proportion of children reported by their parents to have missed school frequently (>1 day a week or 3 – 5 days a month) during the preceding year because of illness, ranged from 10.0% in the Central Province to 20% in the Northern Province, with an average of 15.4%, and no significant differences between boys and girls. In the private schools, this proportion was only 3.5%. The most commonly cited illnesses were fevers and asthma (or wheezing).

4.3 PERSONAL CHARACTERISTICS

The following section provides a profile of the sample in relation to personal characteristics of the student such as sex, birth order, school attendance and activities after-school hours.

4.3.1 Sex and birth order

The study sample had a slight preponderance of boys (1468 boys vs. 1263 girls), resulting in a male: female ratio of 1: 0.9. Information on birth order was available for

2436 children: 39.5% were the eldest, while 28.7% were the second eldest and 18.8% were the third in the family. A total of 1558 children had older siblings.

4.3.2 School attendance

School was held on an average of 191 days in 2002, and 18.2% of children had less than 80% attendance (see Figure 4.5). The school attendance rate of girls was slightly higher than that of boys (87.1% vs 85.8%; this difference was statistically significant (t statistic = 2.5, p=0.01).

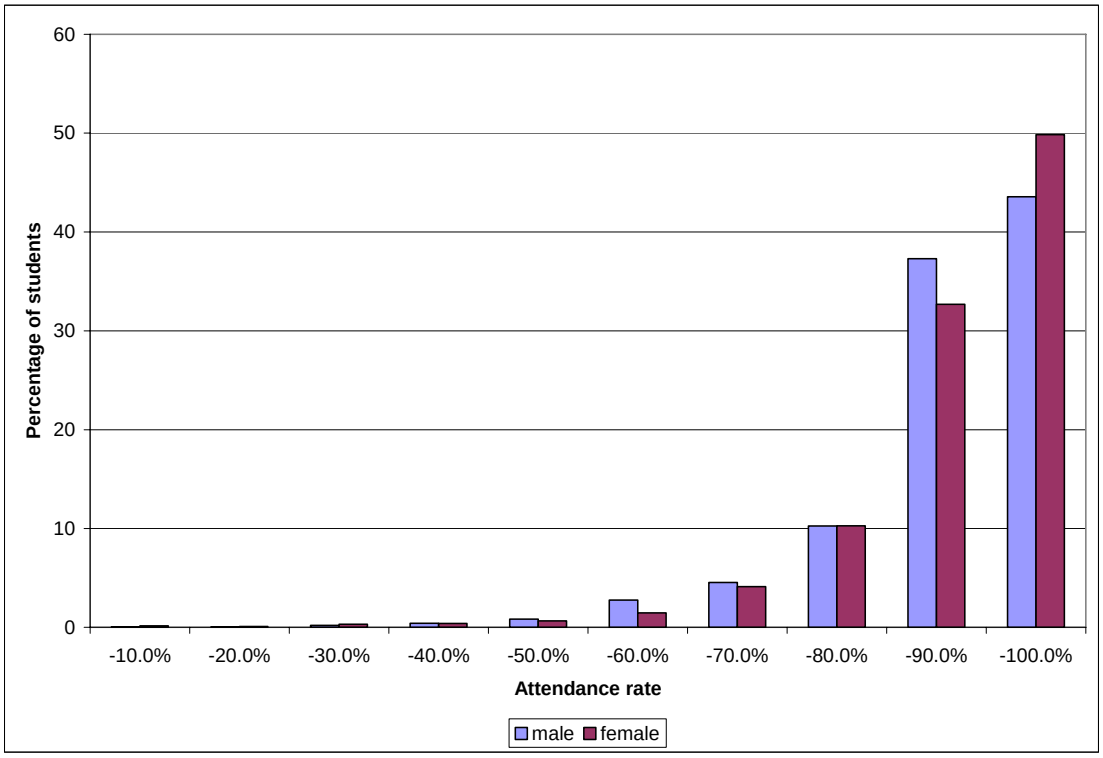


Figure 4.5. School attendance rates among boys and girls

4.3.3 Activities after school hours

As shown in Figure 4.6, about half (n=1373, 53%) of the children were reported to spend more than 6 hours per week studying at home during term-time; another 28.3 % spent 3 – 6 hours each week. About one third (n=838, 32.3%) of the children spent more than 6 hours each week at extra classes outside school (tuition classes) and another 24.0 % spent 3 – 6 hours at tuition classes. Only 26.5 % of children did not attend any extra classes. As Figure 4.7 shows, 39.4% of the children did not spend any time reading for leisure; another 40.7% spent less than 3 hours a week. Thus only

18.8% of children spent more than 3 hours a week on reading for leisure. 59.1% of children spent more than 3 hours a week watching television.

There were statistically significant differences in the time spent by boys and girls on some activities (Mann-Whitney U test). Boys spent significantly more time than girls on playing, on supervised sports, and on watching TV, whereas girls spent significantly more time on studying, on reading for leisure and in carrying out household tasks. There were no statistically significant differences between boys and girls in time spent on tuition classes after school, on aesthetic activities, on listening to the radio, and in engaging in paid or unpaid economic activities.

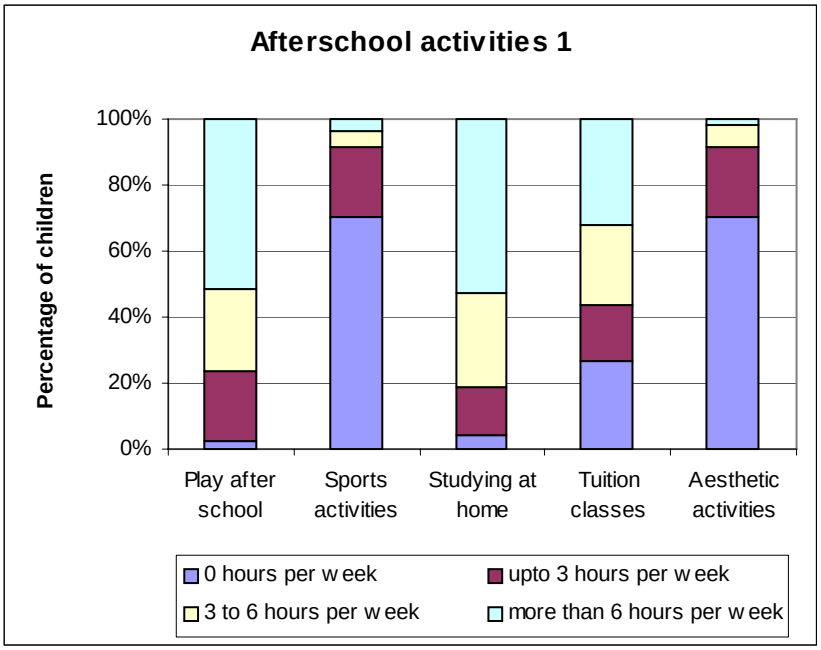


Figure 4.6. Time spent on play, supervised sports, studying, tuition classes and aesthetic activities

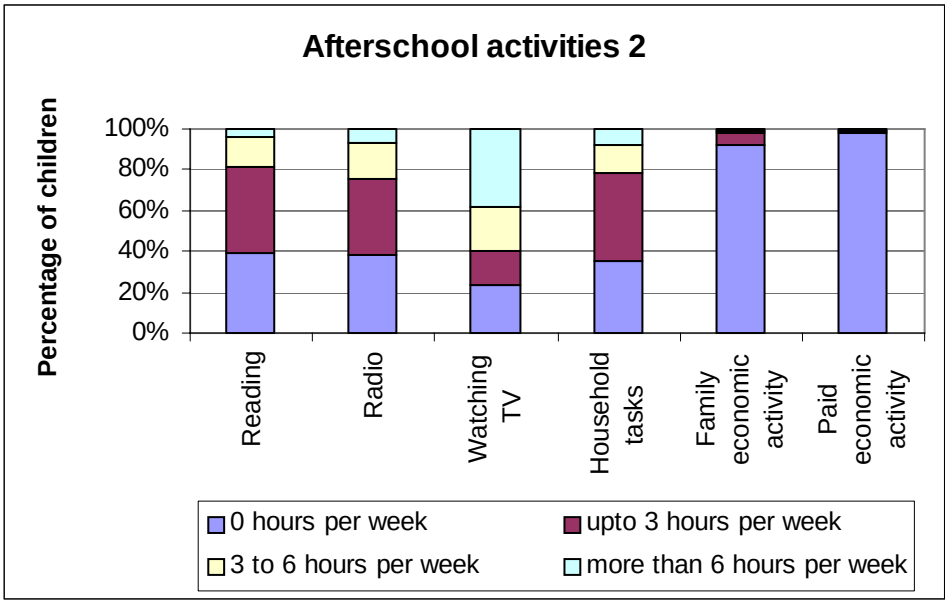


Figure 4.7. Time spent on reading for leisure, listening to radio, watching television, household tasks, family's economic activities, and other paid economic activities

4.4 HOUSEHOLD ENVIRONMENT

This section provides a profile of the household environment of the study sample, as shown by indicators such as household income, Expenditure on education, parental education, parental occupation, ethnic background and the learning environment in the household.

The sample from which the household analysis is carried out in this study is marginally smaller than the total student sample, because the households used in the analysis were restricted to those where the household interviews confirmed that the child lived with his/her own family when attending school (n=2592, 95% of the total sample). Among the children who resided at home, 6.4% did not have their mothers living with them, mainly because the mother had gone to work overseas (n=97, 3.7%). Almost 15% of the children did not have their fathers living with them but in this instance, it was mainly because the father was working in another part of the country.

4.4.1 Household income

The households surveyed cut across the income groups in the country; 55% of the households surveyed had an income less than Rs. 7000 per month while 13% had incomes in excess of Rs. 15,000. This is a close representation of the household

income groups in Sri Lanka. The estimated monthly household income category showed a very close correlation with monthly household income estimates derived from data provided by householders on the actual amount of annual household income from the principal income sources for the household (Spearman's rho=000.967, n=2481, p<0.001).

Household size varied from 2 to 12 members, with a mean of 5.1 (SD 1.4). Per capita monthly income was calculated, based on the data provided on annual income and household size. According to per capita monthly income, 53.6% of the children were from households below the National Poverty Line of Rs 1,423.00.

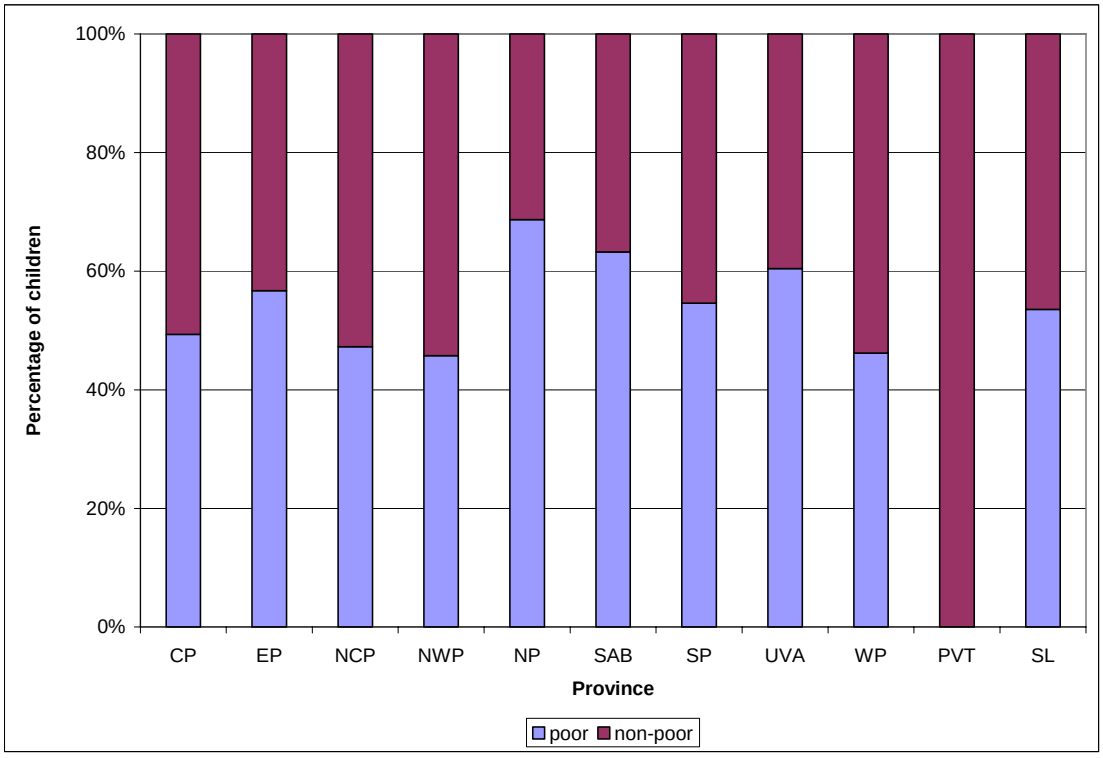


Figure 4.8. Proportion of poor and non-poor households by province

4.4.2 Expenditure on education

The itemized list of expenditure on the child's education included those related to curricular expenses (school fees, facilities fees, exercise books and stationery, boarding fees, school uniforms, shoes, equipment, and subject-related supplementary books etc); co-curricular expenses (library fees, other contributions to school,

education trips etc); extra-curricular expenses (aesthetic studies, sports fees and equipment etc); fees for tuition classes; and travel expenses.

Among 2490 children for whom data on education-related expenditure was available, 66.0 % of parents spent 5% or less of their household income on items related to the child's education, while 91.2% spent 10% or less. Total education-related expenditure showed a strong positive correlation with total household income (Spearman's rho = 0.536, $p<0.001$), but there was a statistically significant, negative correlation between total household income and the percentage spent on education (Spearman's rho = -0.165, $p<0.001$). Poor households (per capita monthly income < Rs 1423) spent a significantly higher percentage of household income on the child's education than non-poor households (Mann-Whitney U test, $p=0.011$).

4.4.3 Parental education

Less than 1% of parents have received no education, while 40% of the fathers and 32% of the mothers had completed less than 8 years of education. 21% of the fathers and 23% of the mothers had studied up to G.C.E A/L or more.

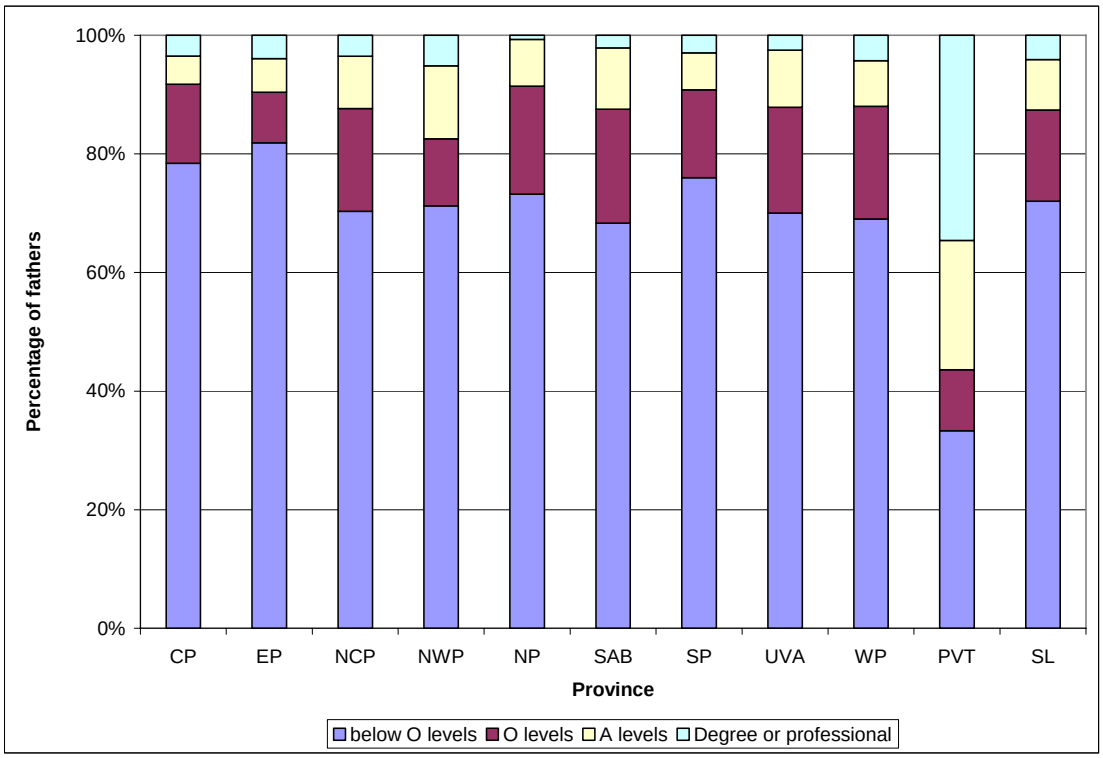


Figure 4.9. Educational levels of fathers by province

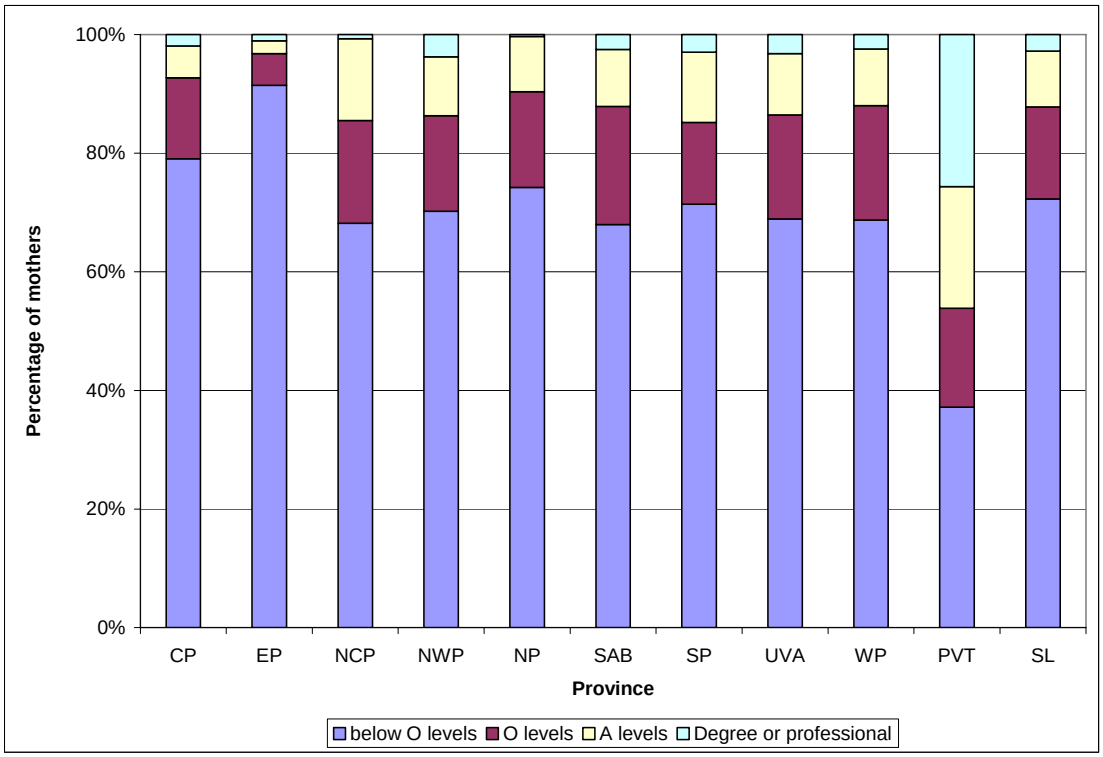


Figure 4.10. Educational levels of mothers by province

The situation of the private schools however, was very different from all types of state schools. While 85% of the fathers and 78% of the mothers had studied up to A/L or more, there was a greater concentration of professionally qualified parents.

The boys in the study sample tended to be from households with slightly higher income than the girls (see Figure 4.11), and also to have higher levels of parental education (Figure 4.12); although the differences were small, they were statistically significant.

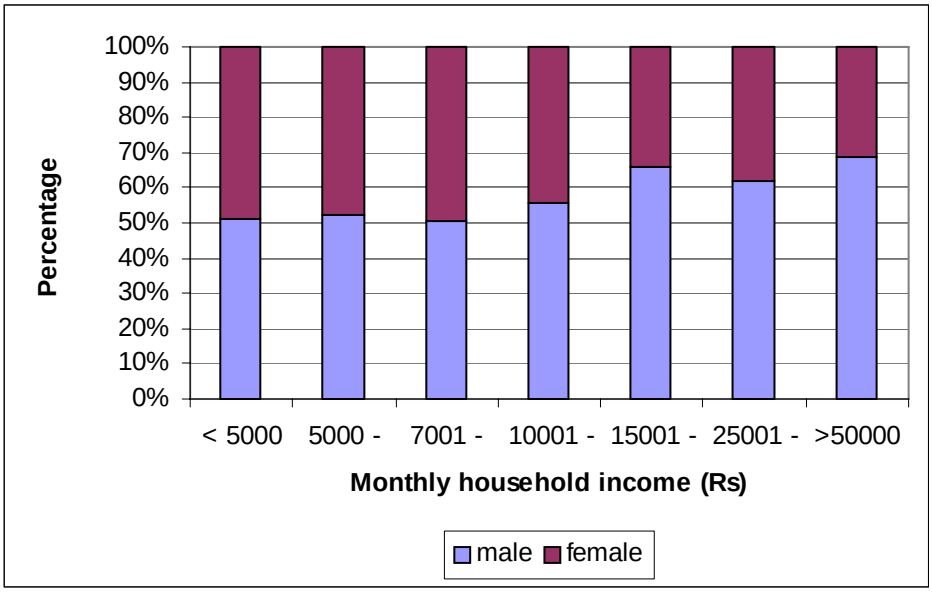


Figure 4.11. Monthly household income of boys and girls in study sample

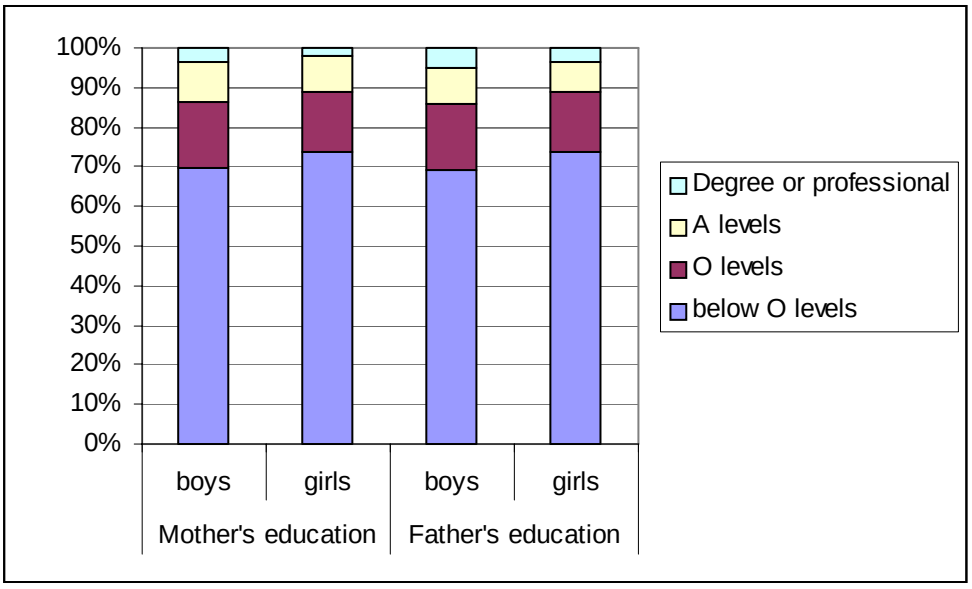


Figure 4.12. Highest educational attainment of parents of boys and girls in study sample

4.4.4 Parental occupation

According to the literature survey, primary occupation of the parents is the next most influential variable in terms of home environment. The commonest occupations of the fathers in the sample surveyed were in wage labour (26%) and in the agricultural and fishing sector (21%) (see Figure 4.13).

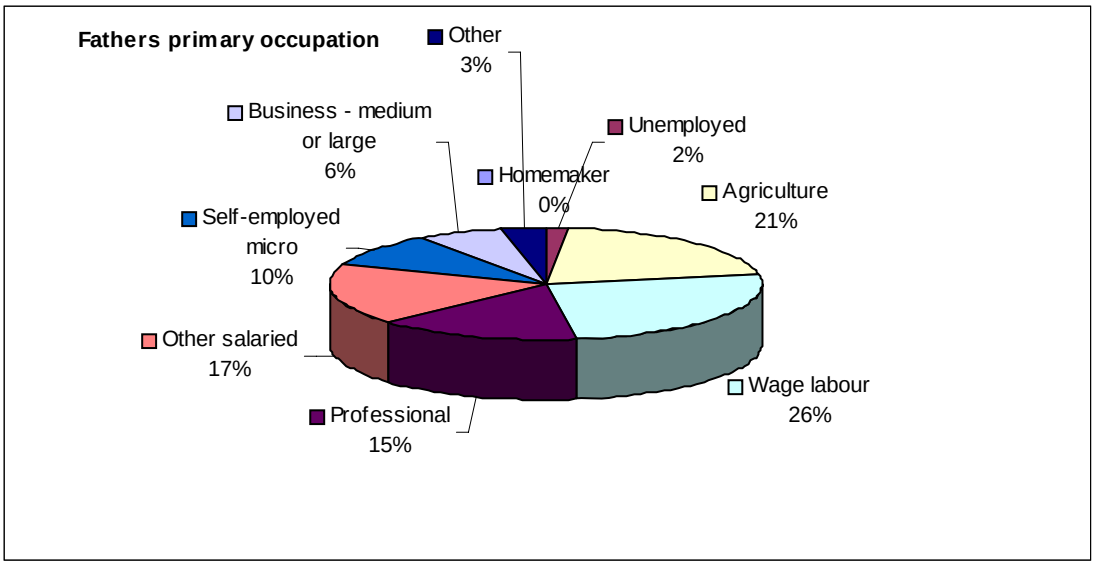


Figure 4.13 Fathers' primary occupation

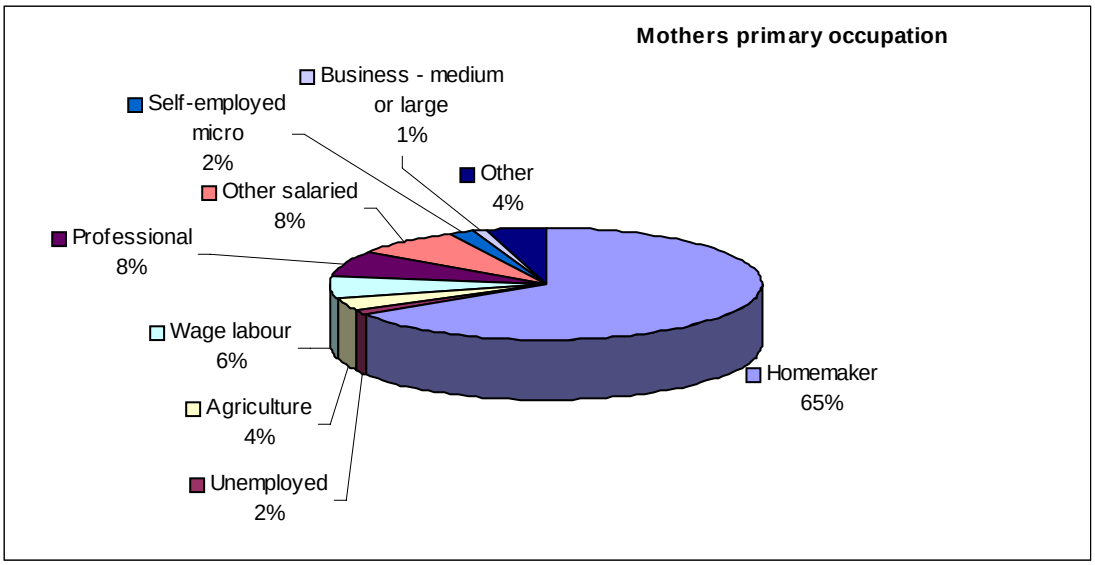


Figure 4.14 Mothers' primary occupation

The occupation patterns of the mothers clearly pointed to a majority who work within the home (66%, see Figure 4.14). Of those in a primary occupation away from the home, the largest percentage was in salaried employment (professional and other salaried 16%). However, it must be noted that a large percentage of women would be stating 'housewife' as the primary occupation while simultaneously having a secondary occupation.

4.4.5 Ethnic background

Data regarding the ethnic group was not supplied with regard to 25 mothers and 108 fathers. Of the 2473 children, with regard to whom data was available on the ethnic group of both parents, 2447 (98.9%) had parents who were of the same ethnic group. Figure 4.13 shows the distribution of these groups. All (except 2) children of Sinhala parentage were studying in the Sinhala medium at school, whereas 95.8% of children of Tamil parentage and 90.4% of children of Moor / Malay parentage were in Tamil medium schools.

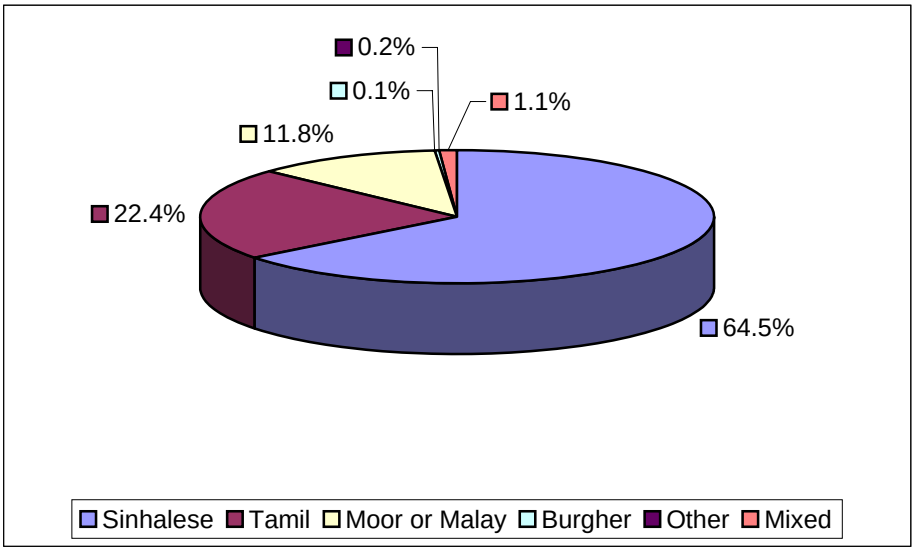


Figure 4.15. Representation of ethnic groups in study sample

There were no statistically significant differences in the male: female ratio within the different ethnic groups.

4.4.6 Learning environment in household

A little less than half of all households (44.5%) had up to 10 books in the house, that the child could read, apart from schoolbooks. However, about one third (35.1%) of households did not have any suitable books at all. Availability of books at home was significantly positively correlated with household income and parental education (paternal education more than maternal). At least one member of the household was a library member only in 12.1% of all households. Library membership also showed a significant, positive correlation with parental education and household income. However, the strength of the correlation was less than that with the number of children's books in the household.

With regards to the interaction between parents and school, almost half of all respondents (46%) said that they discuss the child's progress with the class teacher only on days designated for parent-teacher meetings. However, about one-fourth (26%) said that they also meet the teacher regularly on other days to discuss the child's progress. Another one-fourth said that they meet the teacher occasionally, but only 1% said that they never discuss the child's progress with the teacher. The majority of respondents (65.8%) said that they discuss schoolwork with the child on a daily basis; while 32.9% said they did so occasionally. Again, only about 1% said they never discuss schoolwork with the child.

About two-thirds of the children (68.8%) received regular help with homework from their mothers, but only about one-fourth of the children (23.9%) did so from their fathers. About 20% of children never received any help with homework from their fathers, and about 10% never received help from their mothers. Mothers who had passed at least the GCE O level examination were significantly more likely to assist the child with homework (sometimes or regularly), than those who had not (97.4% vs 81.8%, chi-square = 104.5, $p<0.001$). The same pattern was evident with fathers (89.5% vs 67.5%, chi-square = 119.4, $p<0.001$).

With regard to the manner in which children spent their time after school, when data was disaggregated according to income, the differences between boys and girls remained the same in poor households (per capita monthly income less than Rs 1423), except for time spent on watching TV, which did not differ significantly between girls and boys. In non-poor households, significant differences between boys and girls

remained evident only in time spent on playing, and in supervised sports. This implies that irrespective of economic status, boys spend more time than girls on playing and sports, whereas in poorer households only, girls spend more time on studying, reading for leisure, and household tasks.

The frequency of parental assistance with homework (both mother and father) did not differ significantly according to the sex of the child, nor did the percentage of household income spent on education-related expenses for the child.

4.5 SUMMARY OF HEALTH AND HOUSEHOLD PROFILE

To conclude, it would appear from the sample profile that the national prevalence of stunting is moderately high (15.5%). A large proportion of children (52.6%) are excessively thin, while a few (3.1%) are overweight. The national prevalence of anaemia is also moderately high (12.1%), but the prevalence of clinically obvious Vitamin A deficiency and iodine deficiency is low. The prevalence of soil-transmitted helminth infections is also relatively low (6.9%). About 5% of all children were shortsighted. Among children on whom anthropometry, haemoglobin and faecal examinations were all done, 64.6% were excessively thin, stunted, anaemic or infected with worms. A much higher proportion of children in the Northern and Eastern Provinces had health problems when compared to the other provinces.

Summarizing the sample in relation to the three household variables – parental income, education and occupation - identified as being the most influential for achievement shows a good representation of the national spread. The households in the study sample cuts across the income distribution groups of households in SL. However, the representation of students from households below the poverty line is higher than the Sri Lankan average. Parental education levels are high with less than 1% of parents falling into the 'no education' category. In terms of occupation, over 50% of fathers were occupied in wage labour and in the agricultural and fishing sectors. The occupation patterns of the mothers clearly pointed to a majority who work within the home the largest percentage of those who declared an alternative primary occupation was in salaried employment.

The next chapter will explore the factors that affect the achievement levels of the population profiled in this chapter with health of the child as the central focus.

CHAPTER 5.
LEARNING ACHIEVEMENT AND ITS ASSOCIATIONS

This chapter explores the relationship between learning achievement and non-school factors by analyzing the associations with learning achievement among the study sample in relation to other factors such as children's health status and home environment. The analysis was carried out in two stages; in the first stage discussed in greater detail below, simple bivariate correlations were done with the dependent variables (learning achievement as shown by test scores in first language – ie, Sinhala / Tamil, Mathematics and English) and the main independent variables relating to child health, personal characteristics and household environment, Based on these correlations, multivariate regressions were constructed in stage two of the analysis, the results of which are discussed in greater detail in Chapter 6.

5.1 DEPENDENT VARIABLES: TEST SCORES

As mentioned before, learning achievement in this study is measured in terms of NEREC administered test scores in Sinhala /Tamil, Mathematics and English. The tests were scored out of 100 marks in each subject.

The distribution of scores in each subject among the study sample is shown in Figure 5.1, while the percentage achieving mastery (i.e. scores of 80% or above) is shown in Table 5.1. It should be noted that the test scores do not follow a normal distribution, especially for Sinhala and Mathematics[1]. Because of this non-normal distribution, all statistical analyses were carried out using tools that did not require a normal distribution of the data set.

[1] Details of patterns and trends in student achievement in relation to identified variables and previous levels of achievement are discussed in the report presented by NEREC (Perera et al, 2004).

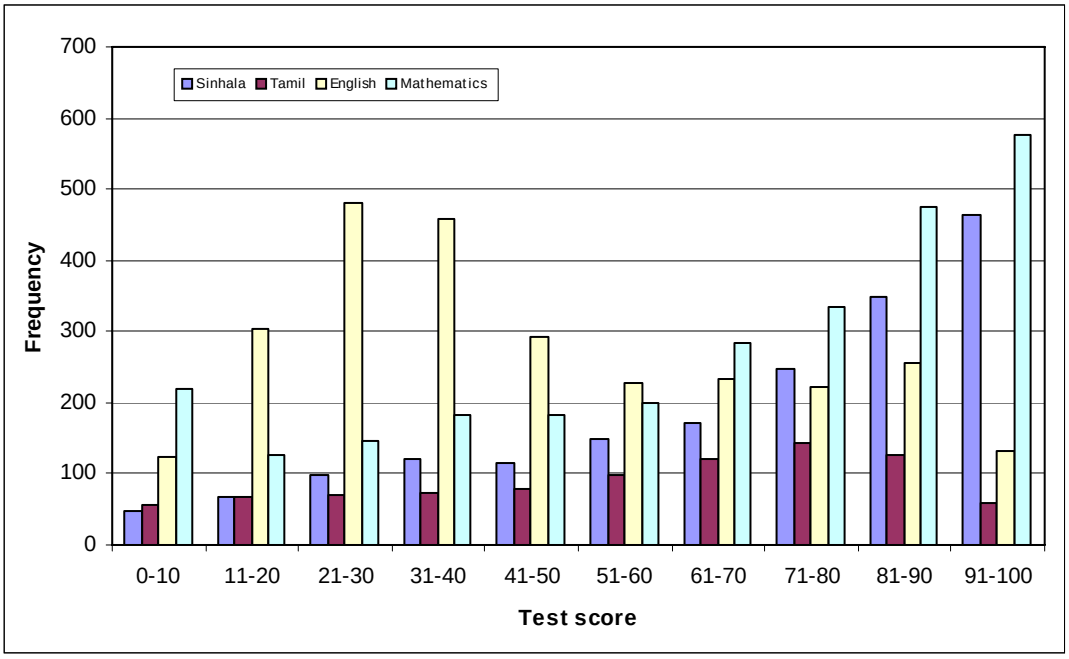


Figure 5.1 Distribution of NEREC test scores

As shown in Table 5.1, less than 50% of students achieved mastery in any one subject. Within this, the highest level of achievement is in Sinhala as a first language where 48% of students had achieved mastery, followed by Mathematics. Only one fourth achieved mastery of Tamil as a first language while even fewer had achieved mastery of English as a second language.

Table 5.1. Summary statistics of national performance in NEREC tests

Subject	Number of students	Percentage achieving mastery
First Language: Sinhala	1834	48.6
First Language: Tamil	897	25.6
Mathematics	2731	42.3
English	2731	15.0

Table 5.2 shows that there was a very high degree of correlation between scores in different subjects, i.e., children who had high scores in one subject tended to have high scores in other subjects as well. This was particularly true in relation to test scores in first language (Sinhala/Tamil) and Mathematics. Relationship of English with achievement in other subjects was relatively weak.

Table 5.2. Correlation between test scores (Spearman's rank correlation test)

		Sinhala	*Tamil*	*English*	*Maths*
Sinhala	Correlation Coefficient	1.000	.	.793(**)	.836(**)
	Sig. (2-tailed)	.	.	.000	.000
	N	1834	0	1834	1834
Tamil	Correlation Coefficient	.	1.000	.733(**)	.857(**)
	Sig. (2-tailed)	.	.	.000	.000
	N	0	897	897	897
English	Correlation Coefficient	.793(**)	.733(**)	1.000	.766(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	1834	897	2731	2731
Maths	Correlation Coefficient	.836(**)	.857(**)	.766(**)	1.000
	Sig. (2-tailed)	.000	.000	.000	.
	N	1834	897	2731	2731

** Correlation is significant at the 0.01 level (2-tailed)

5.2 TEST SCORES IN RELATION TO HEALTH STATUS

This section provides the summary results of bivariate analysis between test scores and health indicators such as nutritional status and incidence of anaemia, soil-transmitted helminth infections and malaria.

Nutritional status

Test scores in all subjects showed a statistically significant, positive correlation with height for age Z (HAZ) scores, with correlation coefficients (Spearman's rho) ranging from 0.196 to 0.258. Children who were stunted (HAZ <=-2.0) had significantly lower mean test scores in all subjects, when compared with those who were not stunted (see Figure 5.2).

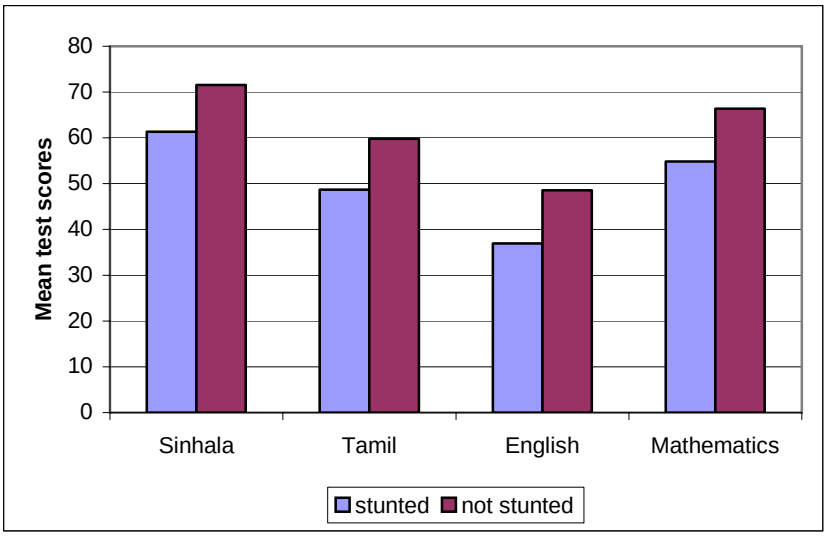


Figure 5.2. Mean test scores according to presence of stunting

Test scores in all subjects also showed a statistically significant, positive correlation with BMI. The correlation coefficients (Spearman's rho) were however, lower than with HAZ scores, ranging from 0.089 for Tamil to 0.142 for English. Mean test scores after categorization according to sex- and age-related cut-off levels are shown in Figure 5.3.

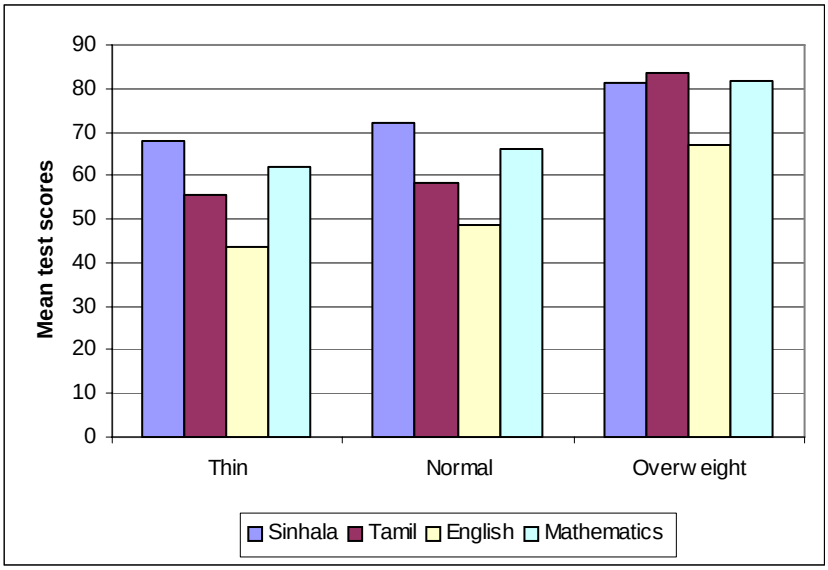


Figure 5.3. Mean test scores according to degree of thinness

Anaemia

Haemoglobin levels measured on finger prick blood, also showed a statistically significant positive correlation with test scores in all subjects. Correlation co-

efficients (Spearmans' rho) ranged from 0.071 for Sinhala to 0.116 for English. When children were categorized as anaemic or non-anaemic, using altitude adjusted cut-off levels, children who were anaemic were found to have significantly lower scores in all subjects.

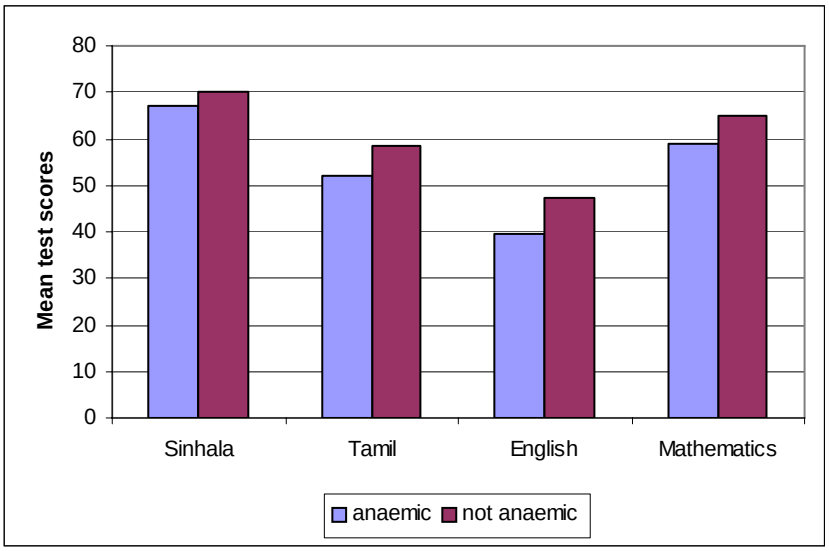


Figure 5.4. Mean test scores according to presence of anaemia

Soil-transmitted helminth infections and malaria

In general, test scores in all subjects had a negative correlation with increasing intensity of infection with all three soil-transmitted helminth infections, as shown in Table 5.3. Roundworm egg counts showed statistically significant, negative correlations with all test scores, but hookworm egg counts showed statistically significant correlation with only Tamil, English and Mathematics. Whipworm egg counts showed no statistically significant correlation with Tamil scores. Children who were infected with any one or more of the three worms had lower mean scores in all subjects than children who were free of infection (Figure 5.5)

Children who had a past history of malaria had lower mean scores in all subjects (Figure 5.6). The differences were statistically significant for Sinhala, English and Mathematics, but not Tamil.

Table 5.3. Correlation between test scores and egg counts (Spearman's rank test)

Subject		Intensity of infection		
		Roundworm	**Hookworm**	**Whipworm**
Sinhala	Correlation Coefficient	-.078(**)	-.049	-.123(**)
	Sig. (2-tailed)	.004	.069	.000
	N	1405	1405	1405
Tamil	Correlation Coefficient	-.125(**)	-.097(*)	-.075
	Sig. (2-tailed)	.001	.011	.052
	N	679	679	679
English	Correlation Coefficient	-.081(**)	-.074(**)	-.087(**)
	Sig. (2-tailed)	.000	.001	.000
	N	2084	2084	2084
Mathematics	Correlation Coefficient	-.107(**)	-.088(**)	-.144(**)
	Sig. (2-tailed)	.000	.000	.000
	N	2084	2084	2084

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

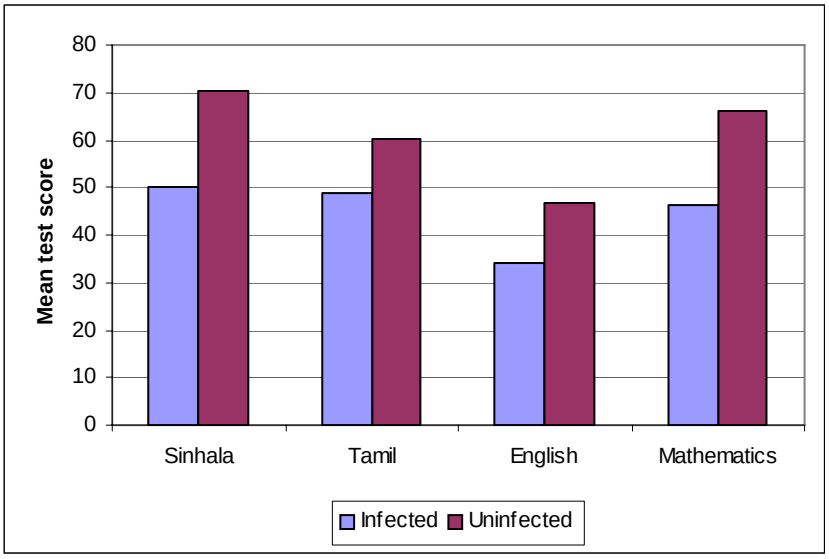


Figure 5.5. Mean test scores according to presence of infection with roundworm, hookworm or whipworm

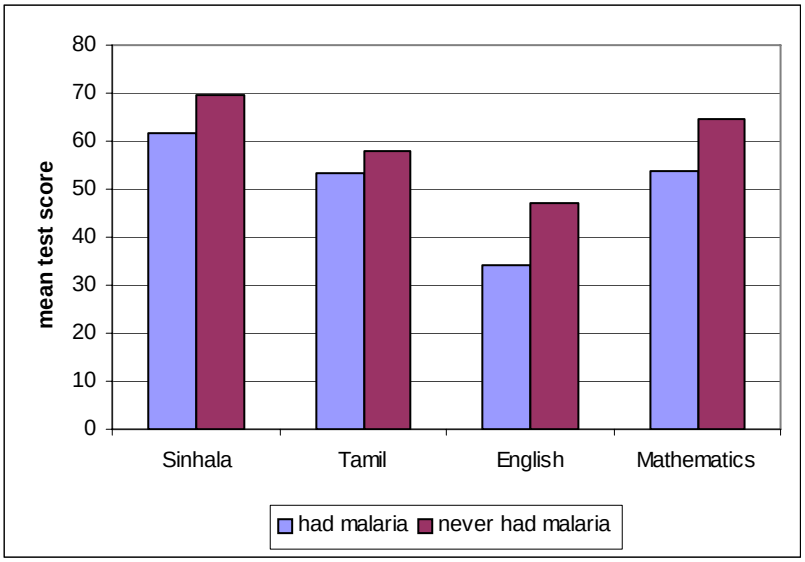


Figure 5.6. Mean test scores among children with a past history of malaria

Other health indicators

Children who were reported as being frequently ill (sufficiently ill to miss 4 or more days of school each month) had significantly lower test scores in all subjects (see Figure 5.7). Following the outlier pattern of first language Tamil, children who were reported to have hearing defects were also found to have significantly lower scores in Sinhala, Mathematics and English (Mann-Whitney U test, $p<0.05$), but not in Tamil. No correlation was evident between test scores and presence of Bitot's spots (indicative of Vitamin A deficiency), visible or palpable enlargement of the thyroid gland, or shortsightedness.

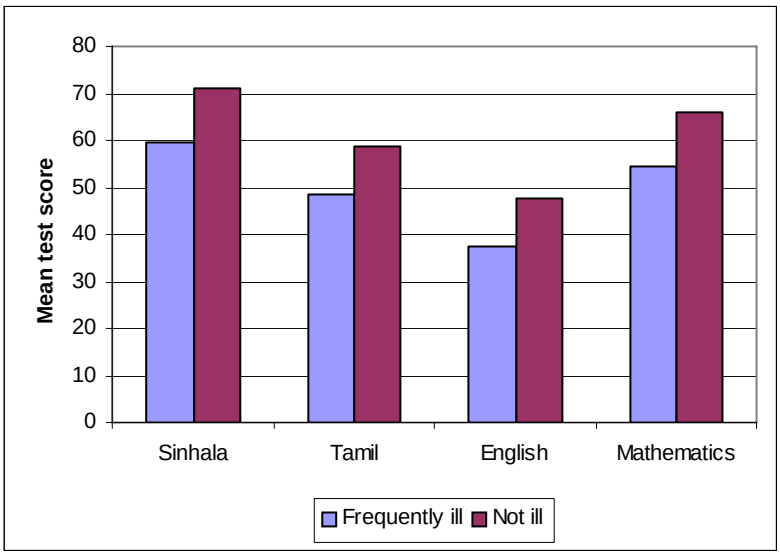


Figure 5.7. Mean test scores among children with frequent illness

From the above discussion, it can be concluded that significant negative correlations exist between all subjects that make up learning achievement and health conditions such as stunting, anaemia, roundworm infections and frequent illnesses. However, some health conditions such as malaria, hookworm infections and hearing defects, had significant negative correlations with learning achievement in Sinhala, English and Mathematics and not Tamil. A variety of different reasons may underlie these differences. Diagnosis of hearing defects was dependent on parental reporting, which may differ between communities. Hookworm egg counts were significantly negatively associated with Tamil, but not Sinhala, probably because hookworm was almost exclusively seen in the Northern and Eastern Provinces, which are largely Tamil-speaking. Whipworm egg counts were significantly negatively associated with Sinhala, but not Tamil scores, because whipworm was predominantly seen in the larger urban areas, which mainly have Sinhala- rather than Tamil-speaking populations. Children with a past history of malaria do have lower Tamil scores, but the difference is not statistically significant. However, the majority of children with a history of malaria were also from the North and East, where prevalence rates reached about 25%.

5.3 TEST SCORES IN RELATION TO PERSONAL CHARACTERISTICS

This section provides the summary results of bivariate analysis between test scores and personal characteristics of the child, such as sex and birth order, school attendance and activities after school hours.

Sex and birth order

Girls had significantly higher scores than boys in every subject (Mann-Whitney U test, $p<0.001$) in each (Figure 5.8), while test scores in all subjects showed a significant negative correlation with birth order, as shown in Figure 5.9. At each level of birth order, girls had higher mean test scores than boys.

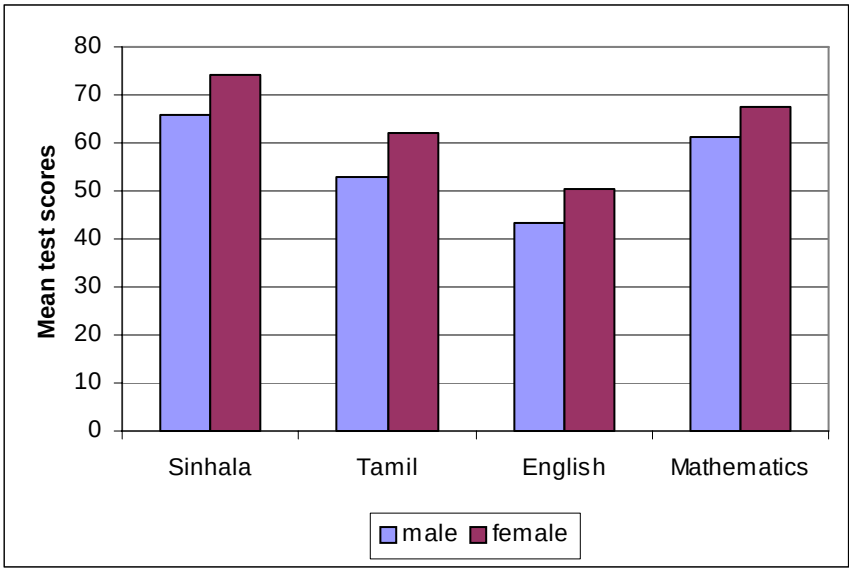


Figure 5.8. Mean test scores by sex of student

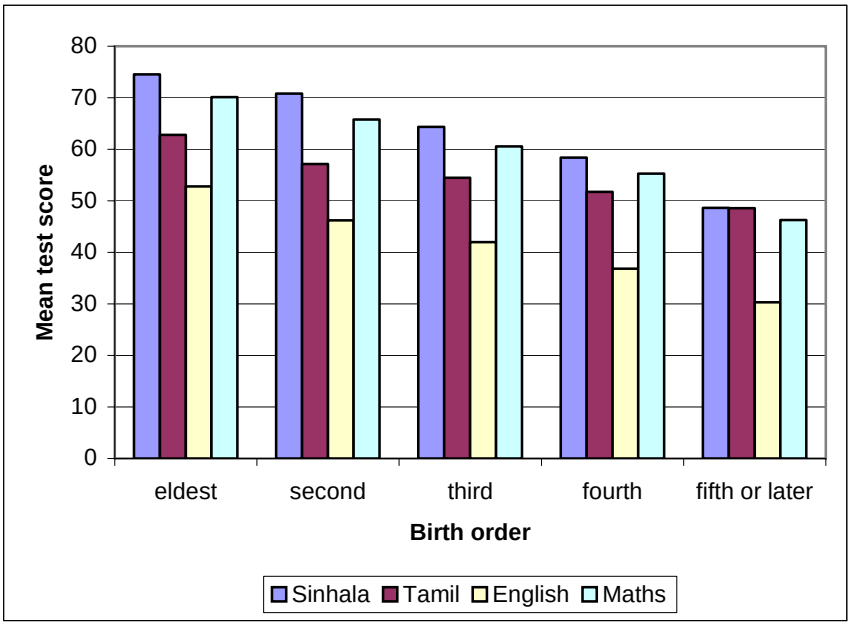


Figure 5.9. Mean test scores by birth order of child

School attendance

There was a significant positive correlation between the percentage of school days attended, and test scores in all subjects, with correlation coefficients ranging from 0.338 to 0.390 (Spearman's rho, $p < 0.01$ for all).

After school activities

With regard to the correlation between test scores and time spent on various activities after school hours during term time, the following showed consistent, significantly

positive correlations with all subjects: studying at home, attending extra tuition classes, engaging in aesthetic activities, reading for leisure, and watching television (see Table 5.4). Increasing time spent on play showed weak, but statistically significant, negative correlation with all test scores. Engagement in paid economic activity also showed a weak but statistically significant negative correlation with test scores in Sinhala and English. Increasing time spent on supervised sports activities showed a negative correlation with scores in Mathematics, but a positive correlation with scores in Sinhala and Tamil. The following activities showed no correlation with test scores: time spent listening to the radio, on household tasks, and in participating in economic activities undertaken by the family.

When data was disaggregated by sex, time spent studying after school remained significantly correlated with test scores among boys, but not among girls (except for Sinhala). Time spent on play was not significantly correlated with boys' test scores, but it remained significantly negatively related with girls' scores in English and Mathematics (Spearman's rho = -0.089, p=0.002 and rho= –0.063, p=0.030 respectively). Increasing time spent on tuition classes, aesthetic activities, reading for leisure, and watching TV remained significantly related to increasing test scores in all subjects except Tamil for both boys and girls (Spearman's rank test, $p<0.001$ for all).

Table 5.4. Correlations between test scores and time spent on activities after school (Spearman's rank test)

Activity		**Sinhala**	**Tamil**	**English**	**Maths**
Play	Correlation Coefficient	-.080(**)	-.087(*)	-.065(**)	-.040(*)
	Sig. (2-tailed)	.001	.011	.001	.040
	N	1743	849	2592	2592
Supervised sports	Correlation Coefficient	.087(**)	.123(**)	.018	-.071(**)
	Sig. (2-tailed)	.000	.000	.368	.000
	N	1743	849	2592	2592
Studying at home	Correlation Coefficient	.131(**)	.101(**)	.079(**)	.083(**)
	Sig. (2-tailed)	.000	.003	.000	.000
	N	1743	849	2592	2592
Tuition classes	Correlation Coefficient	.263(**)	.235(**)	.186(**)	.178(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	1743	849	2592	2592
Aesthetic activities	Correlation Coefficient	.223(**)	.106(**)	.183(**)	.149(**)
	Sig. (2-tailed)	.000	.002	.000	.000
	N	1743	849	2592	2592
Reading for leisure	Correlation Coefficient	.229(**)	.097(**)	.198(**)	.176(**)
	Sig. (2-tailed)	.000	.005	.000	.000
	N	1743	849	2592	2592
Watching TV	Correlation Coefficient	.168(**)	.113(**)	.232(**)	.207(**)
	Sig. (2-tailed)	.000	.001	.000	.000
	N	1743	849	2592	2592

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The above discussion shows that there was a significant positive correlation between learning achievement and personal characteristics such as gender (girls) and number of days of school attendance. Some after school activities such as studying, attending tuition classes and engaging in aesthetic activities, reading for leisure and watching TV also showed a positive correlation with learning achievement.

5.4 TEST SCORES IN RELATION TO HOUSEHOLDS

This section provides the summary results of bivariate analysis between test scores and household indicators such as residence of parents with child, household income, parental education and the learning environment at home. As explained previously in Chapter 4, data used for this analysis is confined to children living at home during term time (n=2592).

Residence of parents with child

With regard to Sinhala, English and Mathematics, children who lived with their mothers had significantly higher test scores than those who did not (Mann-Whitney U test, $p<0.001$ for all three). The difference in Tamil test scores was not significant. In contrast, the father's residence at home with the child was not associated with statistically significant differences in any of the test scores.

Household income

We examined correlations between test scores and several indicators of economic status: the report monthly household income category; total annual household income; per capita monthly income (PCMI); PCMI categorized as multiples of the National Poverty Line.

Table 5.5. Test scores and indicators of economic status (Spearman's Rank Test)

		Reported income category	**Annual household income**	**Per capita monthly income**	**PCMI category[a]**
Sinhala	Correlation Coefficient	.362(**)	.360(**)	.403(**)	.388(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	1693	1674	1674	1674
Tamil	Correlation Coefficient	.256(**)	.241(**)	.272(**)	.286(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	826	833	833	833
English	Correlation Coefficient	.382(**)	.371(**)	.415(**)	.411(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2519	2507	2507	2507
Mathematics	Correlation Coefficient	.324(**)	.308(**)	.356(**)	.346(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2519	2507	2507	2507

[a] Per capita monthly income categorized as a multiple of national poverty line

** Correlation is significant at the 0.01 level (2-tailed).

All four indicators showed highly significant positive correlation with all subjects, but as Table 5.5 shows, the highest correlations were seen with per capita monthly income. Mean test scores for per capita monthly income, categorized as multiples of the National Poverty Line (Rs 1,423) are shown in Figure 5.10.

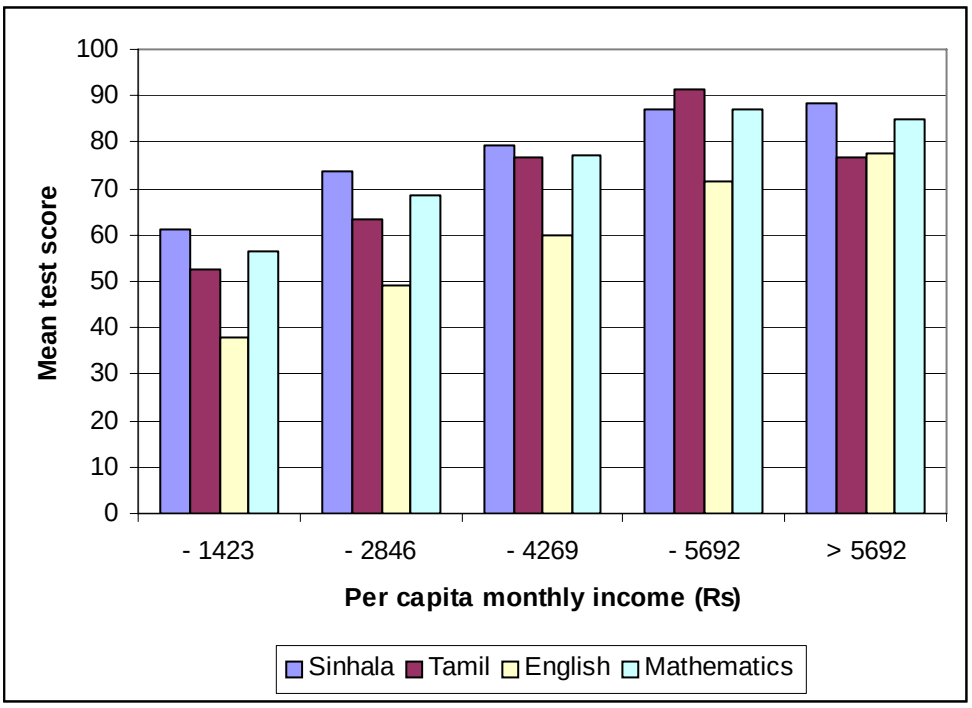


Figure 5.10. Mean test scores according to monthly income per household member

Parental education

Test scores also showed high statistically significant correlations with parental education, both when considered as the total years spent in education, and as the highest educational qualification attained by either parent (see Table 5.6). When test scores were correlated with the years spent in education, correlation coefficients were higher with paternal education than with maternal education for all subjects, whereas the correlation coefficients were very similar with regard to the highest educational attainment. It should be noted that data regarding years spent in education by parents was not available for 553 children, whereas data was more complete with regard to the highest educational attainment. Parental education (both father and mother) showed strong positive correlation with household income (Spearman's rho values ranging from 0.390 to 0.504, $p<0.01$).

Table 5.6. Correlation between test scores and parental education (Spearman's test)

		Years of education		Highest educational attainment	
		Mother	**Father**	**Mother**	**Father**
Sinhala	Correlation Coefficient	.444(**)	.521(**)	.463(**)	.457(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	1572	1526	1743	1743
Tamil	Correlation Coefficient	.226(**)	.301(**)	.229(**)	.248(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	486	457	849	849
English	Correlation Coefficient	.420(**)	.508(**)	.449(**)	.450(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2058	1983	2592	2592
Mathematics	Correlation Coefficient	.379(**)	.451(**)	.404(**)	.397(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2058	1983	2592	2592

** Correlation is significant at the 0.01 level (2-tailed).

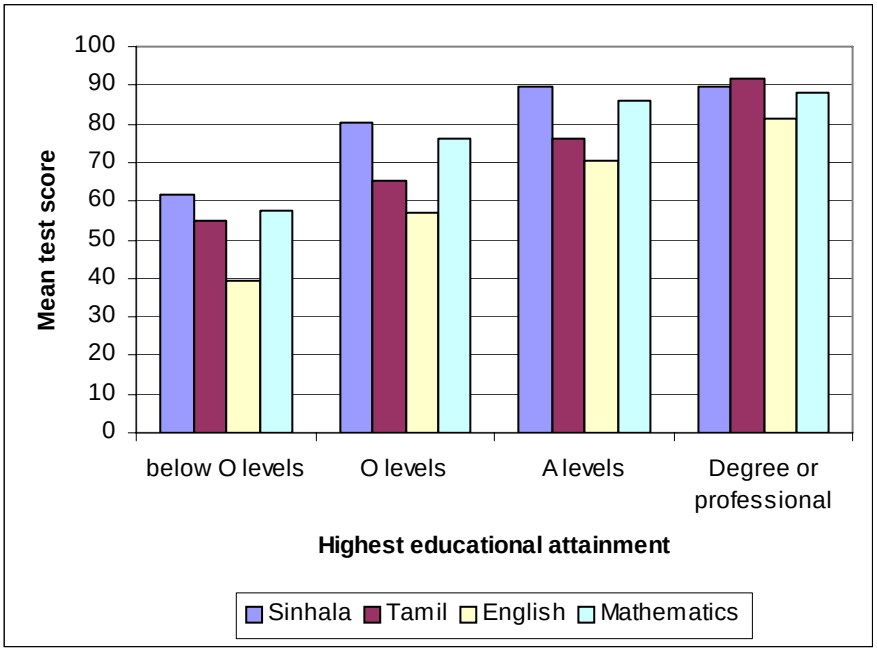


Figure 5.11. Mean test scores and highest educational attainment of mother

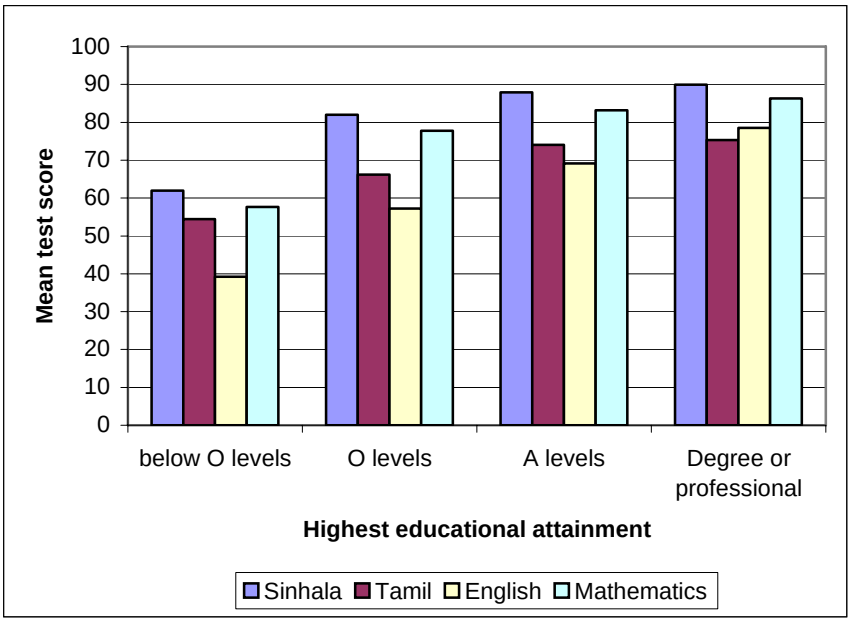


Figure 5.12. Mean test scores and highest educational attainment of father

Learning environment at home

All test scores showed a significant positive correlation with the number of books available at home that the child could read, apart from schoolbooks. Similarly, test scores in all subjects were significantly higher among children who were from households where at least one member of the household was a member of a library, compared with children from households where no one was a library-member.

As Table 5.7 shows, test scores in all subjects showed a positive correlation as parents showed more interest in the child's progress at school, as indicated by a higher frequency of discussions with class teacher, discussion of schoolwork with child, or assisting the child with homework assignments.

Table 5.7. Correlation between test scores and parental involvement in child's schoolwork (Spearman's rank test)

Subject		Discusses progress with class teacher	Discusses schoolwork with child	Mother helps with schoolwork	Father helps with schoolwork
Sinhala	Correlation Coefficient	.190(**)	.238(**)	.315(**)	.220(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	1741	1740	1719	1700
Tamil	Correlation Coefficient	.205(**)	.065	.081(*)	.048
	Sig. (2-tailed)	.000	.061	.044	.279
	N	844	841	621	503
English	Correlation Coefficient	.152(**)	.196(**)	.279(**)	.156(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2585	2581	2340	2203
Mathematics	Correlation Coefficient	.162(**)	.173(**)	.244(**)	.157(**)
	Sig. (2-tailed)	.000	.000	.000	.000
	N	2585	2581	2340	2203

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

As shown from the above discussion, there were significant correlations between learning achievement and household characteristics such as household income, parental education (both mother and father) and the learning environment at home in terms of availability of books and family members with library access.

Before going on to the discussion of the multivariate model of understanding learning achievement, the next section provides a brief discussion of the relationships between the independent variables discussed so far, namely, health status, personal characteristics and household environment.

5.5 ASSOCIATIONS BETWEEN CHILDREN'S HEALTH, PERSONAL CHARACTERISTICS AND HOUSEHOLD ENVIRONMENT

There was strong correlation between the children's health status and their household environment. The prevalence of stunting was much more common among children from poor households (per capita monthly income below the national poverty line) than among the non-poor households (19.2% vs. 12.4%, chi-square=20.8, p<0.001). It was also significantly associated with lower maternal education (18.4% prevalence among children of mothers with no O' levels, compared with 9.0% among children of mothers with at least O' levels (chi-square=32.7, p<0.001). A similar association was seen with paternal education (18.3% vs. 9.5%, chi-square=28.4, p<0.001).

As with stunting, the prevalence of excessive thinness was more common among children from poor households than from non-poor (57.3% vs 47.4%, chi-square=23.8, p<0.001). An association with parental education was also present: the prevalence of excessive thinness among children of mothers with no O levels was 54.6%, compared with 48.5% among those with at least the O' levels, (chi-square=7.3, p=0.007). The pattern was almost identical with regard to paternal education.

Anaemia was also more prevalent among children from households below the poverty line, when compared with those above the poverty line (14.6% vs. 9.6%, chi-square=13.3, p<0.001). The prevalence of anaemia among children of mothers with no O' levels was 13.3%, compared with 9.7% among those with at least the O' levels (chi-square=5.8, p=0.02), and the pattern was similar with regard to paternal education.

Children from poor households were significantly more likely to be infected with one or more worms than children from non-poor households (9.4% vs 3.9%, chi-square=23.4, p<0.001). Maternal education was very strongly associated with helminth infection (8.5% among children of mothers with no O'levels, compared with 1.5% among children of mothers with at least the O levels, chi-square=32.4, p<0.001); a similar pattern was also present with regard to paternal education.

A positive history of malaria was also associated with household poverty: 8.1% of children from poor households had a history of malaria, whereas only 4.4% of children from non-poor households had malaria (chi-square=14.8, p<0.001). An association was present between maternal and paternal education, and a past history of malaria, but this was barely statistically significant: chi-square=5.6, p=0.02 for maternal education and chi-square=4.0, p=0.04, for paternal education.

Again, children from poor households were more likely to suffer from frequent illness than children from non-poor households (17.8% vs 11.8%, chi-square=18.5, p<0.001). Children of mothers with no O' levels were also more likely to suffer from frequent illness than children of better-educated mothers (17.3% vs. 9.3%, chi-square=26.9, p<0.001); the pattern was similar with paternal education.

Of the health indicators, prevalence of shortsightedness among children was the only variable not associated with household poverty. Nor was there any association between reported defects in eyesight and household income or parental education. In contrast, reporting of hearing defects was significantly higher among poor households than in non-poor households 26/1388, 1.9% vs 8/1201, 0.7%, chi-square=7.2, p=0.007). This difference could be because shortsightedness is not usually affected by socio-economic conditions, whereas overcrowding and poor housing is often associated with an increased spread of upper respiratory tract infections among children, which could in turn increase the occurrence of middle ear infections, which can affect hearing if left untreated.

There was a significant negative correlation between birth order and household income, such that larger families were associated with lower per capita monthly income (Spearman's rho= - 0.235, p<0.001).

With regard to the manner in which children spent their afterschool hours, when data was disaggregated according to income, the differences between boys and girls remained the same in poor households (per capita monthly income less than Rs 1423), except for time spent on watching TV, which did not differ significantly between girls and boys. In non-poor households, significant differences between boys and girls remained evident only in time spent on playing, and in supervised sports. This implies

that irrespective of economic status, boys spend more time than girls on playing and sports, whereas in poorer households only, girls spend more time on studying, reading for leisure, and household tasks.

The frequency of parental assistance with homework (both mother and father) did not differ significantly according to the sex of the child, nor did the percentage of household income spent on education-related expenses for the child.

To conclude, it would appear from the sample profile discussed above that health status is associated with household poverty, with ill health among children more likely in poor households. In the next chapter, when discussing the relationship between learning achievement and health status, it is necessary to bear this link in mind and control for the effects of the household environment, when trying to understand the effects of ill health on learning.

CHAPTER 6.
INTERRELATIONSHIPS

This chapter presents the final results of the statistical analysis that examines the interrelationships between learning achievement and the child's health, while controlling for personal characteristics, household environment and the school.

In the multivariate analysis discussed below, logistic regression was carried out with key variables that were found to be significantly associated with learning achievement in the bivariate analyses described in Chapter 5. Logistic regression was used mainly because it enabled the construction of a model that focused on the desired learning outcome as a dichotomous variable, namely mastery of the relevant subjects (i.e. a test score of 80% or more), rather than test scores as a continuous variable. The model was constructed using only test scores for First Language (Sinhala or Tamil) and Mathematics. English was not included in this part of the analysis because the proportion of children achieving mastery was very low, thereby rendering the method of statistical analysis invalid. Children who were 11 years of age or above were excluded from the analysis, as were children who did not attend school while living at home during term.

6.1 CONSTRUCTION OF INTERSECTORAL MODEL

The multivariate model was constructed in several stages, in order to assess the extent to which each group of variables contributed towards explaining the observed variation in learning outcome, as indicated by the Nagelkerke R^2 [1] value of the model. When adding variables to the model, those relating to the child such as health and personal characteristics were added first, then household characteristics and finally the school, as described in greater detail below.

Stage 1

[1] R^2 is the coefficient of determination. It is the proportion of variation in the dependent (outcome) variable explained by the model.

In the first stage of this model, two basic variables relating to the child were included: sex and birth order. Birth order was categorized as eldest, second, third, and fourth-born or later.

Stage 2

In the next stage, seven dichotomous variables relating to health and nutritional status were added.

1. Presence / absence of stunting according to HAZ score
2. Presence / absence of excessive thinness according to BMI
3. Presence / absence of anaemia (altitude-adjusted)
4. Presence / absence of infection with any one or more major soil-transmitted helminth
5. Presence / absence of a history of malaria
6. Presence / absence of a reported hearing defect
7. Presence / absence of a history of frequent illness that prevents child from attending school

Stage 3

In the third stage, seven dichotomous variables relating to the child's behaviour in attending school and spending time after school were used. The cut-off levels for dichotomization were determined on the basis of the data described in Chapter 4:

1. School attendance: more than 80% of school days, or less
2. Time spent in play after school: more than 6 hours per week, during term time, or less
3. Time spent in studying at home: more than 6 hours per week, or less
4. Time spent in tuition classes after school: more than 3 hours per week, or less
5. Time spent in aesthetic activities after school: no time at all, or any time
6. Time spent in reading for leisure: no time at all, or any time
7. Time spent in watching TV: more than 3 hours per week, or less

Stage 4

In the fourth stage, five key variables relating to the child's household environment were added to the model:

1. Ethnic group of parents: Sinhala; Tamil; Muslim or Malay

2. Highest educational attainment of parents, categorized as follows: did not pass O' levels; passed O' levels only; passed A levels; university degree or professional qualifications. The level pertaining to the father or the mother, whichever was higher, was used here.
3. Per capita monthly income of household, categorized as multiples of the national poverty line. Thus category 1 comprised of children with per capita monthly income equal to, or less than Rs 1423; category 2, Rs 1424 – 2846; category 3, Rs 2847 – 4269; and category 4, Rs 4270 or more.
4. Residence of mother in same household as child; or not
5. Regular assistance (or not) from mother or father with the child's schoolwork

Stage 5

In the final stage, the school attended by the child was included in order to correct for the school environment

6.2 DETERMINANTS OF MASTERY OF FIRST LANGUAGE

Tables 6.1 shows the results of this multivariate analysis in relation to mastery of First Language (Sinhala or Tamil) at each stage of the analysis, and the odds ratio for each variable that was significant in predicting learning outcome.

As shown in Stage 2 of the model construction, the health indicators of stunting, anaemia, soil transmitted helminths, malaria and frequent illness were statistically significant variables in predicting learning achievement, even after controlling for gender and birth order. STH infection appears to be the strongest predictor of learning outcome from among the health variables, as indicated by an odds ratio of 3.8, compared with odds ratios ranging from 1.6 – 2.0 for the others. Thinness and deficient hearing, on the other hand, did not emerge as significant predictors of learning outcome at this stage, despite showing significant association in the previous bivariate analysis. This could be because of the associations between stunting and thinness, and between reported deafness and frequent illness.

Table 6.1 Model predicting mastery of First Language (Sinhala / Tamil)

	Odds Ratio for variable in stepwise logistic regression model (significance)				
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Nagelkerke R^2 for model	0.071	0.131	0.230	0.352	0.518
Gender (female vs male)	1.8	2.1	2.1	2.5	2.6
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Birth order (eldest vs fourth or later)	3.4	2.8	2.3	1.5	1.5
	(0.000)	(0.000)	(0.000)	(0.060)	(0.167)
Stunting (non-stunted vs stunted)		1.6	1.5	1.4	1.4
		(0.003)	(0.007)	(0.074)	(0.101)
Thinness (thin vs normal BMI)			Variable not in equation		
Anaemia (non-anaemic vs anaemic)		1.7	1.6	1.4	1.2
		(0.002)	(0.006)	(0.138)	(0.403)
STH infection (uninfected vs infected)		3.8	3.0	1.7	1.3
		(0.000)	(0.000)	(0.119)	(0.586)
Malaria (no malaria vs hx of malaria)		1.6	1.5	1.1	1.1
		(0.046)	(0.111)	(0.752)	(0.722)
Hearing (normal vs defective)			Variable not in equation		
Frequent illness (non-ill vs frequently ill)		2.0	1.7	1.5	1.5
		(0.000)	(0.001)	(0.039)	(0.088)
School attendance (> 80% vs < 80%)			4.3	3.8	3.9
			(0.000)	(0.000)	(0.000)
Play (< 6h / week vs > 6 h / week)			Variable not in equation		
Study (> 6h / week vs < 6 h / week)			Variable not in equation		
Tuition (> 3 h / week vs < 3 h / week)			1.5	1.4	1.6
			(0.000	(0.006)	(0.009)
Aesthetic activities (any time vs no time)			1.4	1.3	1.5
			(0.004)	(0.107)	(0.046)
Reading (any time vs no time)			1.5	1.4	2.0
			(0.000)	(0.012)	(0.000)
Watching TV (>3 h / wk vs < 3h / wk)			1.5	1.1	0.9
			(0.000)	(0.704)	(0.697)
Ethnic group (Sinhala vs Moor / Malay)				2.2	4.7
				(0.000)	(0.041)
Ethnic group (Tamil vs Moor / Malay)				1.1	0.8
				(0.797)	(0.815)
Parental education (category 4 vs 1)[a]				5.2	4.4
				(0.000)	(0.001)
Per capita monthly income (cat 4 vs 1)[b]				3.1	1.5
				(0.000)	(0.243)
Mother with child (residence vs non-residence)				Variable not in equation	
Homework (regular assistance from parents vs no regular assistance)				1.6	1.3
				(0.004)	(0.198)
School ID					+

[a] Parental education categories: 1=less than O'level; 2= O'level; 3=A'level; 4=Degree or professional
[b] Income categories: 1= < =Rs1423; 2=Rs1424 – 2846; 3=Rs 2847 – 4269; 4= >= Rs 4270

In Stage 3, when health variables were controlled for personal characteristics of the child (such as school attendance, activities after school hours such as attending tuition classes, engaging in aesthetic activities, reading for leisure and watching TV), the odds ratios for the health variables reduce, but remain statistically significant, except in the case of malaria. This may be because this last variable was based on reporting by parents, of a lifetime history of malaria, and as such, was not a very reliable indicator.

However, in Stage 4, when the health variables were also controlled for the household characteristics of the child, all health variables excluding frequent illnesses were no longer significant. This is probably because, as observed in Chapter 5 (section 5.5), all of the health variables included in the multivariate analysis were significantly associated with parental educational levels and household income. These results indicate that the initially observed association between mastery of first language and the health variables of stunting, anaemia and STH infection, is driven by household factors, rather than an independent cause-and-effect relationship. Frequent illness that causes a child to miss school regularly, remained an independent predictor of learning outcome with regard to mastery of first language, even after correcting for parental education and household income. However, when the school environment is also brought into the equation, none of the health variables remained as significant predictors of learning achievement.

Nevertheless, as indicated by the Nagelkerke R^2 value of 0.518, the final model which takes into account the home environment and school as well as variables directly related to the child, is able to explain over 50% of the variation in achieving mastery of the First Language, i.e. Sinhala or Tamil. In other words, gender, school attendance, activities after school hours such as attending tuition classes and reading, ethnicity, parental education and the school can explain over 50% of the variation in learning achievement in First Language across the study sample.

Of the different groups of variables that were examined in this model, those pertaining to the school environment and the household environment are the most important in determining learning outcome, as indicated by the increase in the Nagelkerke R^2 value

of the model at each stage of the stepwise logistic regression. Introduction of the household variables increased the R^2 value from 0.230 to 0.352, i.e., increasing the variation explained by the model by 12.2%; while introduction of the school as a variable into the model increased it by a further 16.6%.

Gender is a significant predictor of success, such that after controlling for household and school characteristics, girls are over twice as likely as boys to attain mastery of the First Language. In contrast, although birth order was also highly significantly associated with learning outcome in the bivariate analyses, as well as in the initial stages of the multivariate analysis, the association became non-significant after controlling for household characteristics. This is probably because it is a confounding variable that is associated with both parental education and family income.

Regular school attendance was one of the most significant predictors of learning outcome, such that even after inclusion of household socio-economic variables, and the school, children who had over 80% attendance during the previous year were almost 4 times as likely to attain success compared with those who had less than 80% attendance. This emphasizes the importance of regular school attendance (as against the absence of frequent illness which is only one contributory factor to lowering school attendance).

Of the six activities found to be significantly associated with learning outcome in the bivariate analyses, four (time spent in play after school, studying at home, reading for leisure, and watching television) also showed significant differences between the sexes, and could be considered to offer some explanation for the sex-related differences in language-based learning outcomes. However, time spent in play and in studying became non-significant in the logistic regression model when sex was included. This means that the higher success rates among girls in their First Language cannot be attributed to the fact that girls spent more time studying, and boys spent more time playing after school. Reading and watching TV remained independent predictors when sex was brought into the model, but with correction for household socio-economic status, it becomes clear that time spent in watching TV *per se* is not a truly independent predictor of learning outcome. On the other hand, reading for leisure remained an independent predictor for mastery of the First Language, even

after correction for sex, household socio-economic status, and school, so that children who spent any time at all on reading for leisure were 1.4 times as likely to gain mastery in First Language than children who did not read at all. Among the other variables relating to the child's behaviour, the only other variable that remained a significant predictor of success after correction for household and school environment was spending at least 3 hours a week on extra tuition classes: these children were 1.4 times more likely to achieve mastery than those who did not attend any tuition classes, or attended tuition classes for 3 hours or less each week.

Among the variables relating to the household, the level of parental education appears to be the most important predictor of learning outcome: children of parents who had a tertiary education were 4 – 5 times as likely to achieve mastery, when compared with children of parents who had not passed the GCE Ordinary Level examination. Household income is also a significant predictor of success, but this effect disappears when the school was brought into the model, perhaps because of the clustering of children of a similar income level within schools. In contrast, the effect of ethnic group on learning outcome (that children of Sinhala parents are significantly more likely to achieve mastery of the first language than children of Tamil, or Muslim and Malay parents) becomes even more marked with inclusion of the school in the model. This probably reflects the marked differences in mean test scores in First Language in the Sinhala-medium and Tamil-medium schools.

Of the variables relating to the home learning environment, the residence of the mother and the child in the same household was not a significant predictor of success, but children who had regular assistance from either the mother or the father with schoolwork were 1.5 time more likely to achieve mastery when compared with children who did not receive regular assistance. However, this effect also became non-significant when the school was brought into the model, again perhaps because of some clustering effect.

6.3 DETERMINANTS OF MASTERY OF MATHEMATICS

Tables 6.2 shows the results of this multivariate analysis in relation to mastery of Mathematics at each stage of the analysis, and the odds ratio for each variable that was significant in predicting learning outcome.

Table 6.2 Model predicting mastery of Mathematics

	Odds Ratio for variable in stepwise logistic regression model (significance)				
	Stage 1	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**
Nagelkerke R^2 for model	0.045	0.116	0.205	0.306	0.468
Gender (female vs male)	1.2	1.3	1.3	1.4	1.4
	(0.011)	(0.007)	(0.019)	(0.004)	(0.037)
Birth order (eldest vs fourth or later)	3.1	2.9	2.4	1.3	1.1
	(0.000)	(0.000)	(0.000)	(0.226)	(0.824)
Stunting (non-stunted vs stunted)	Variable not in equation				
Thinness (thin vs normal BMI)		1.2	1.2	1.2	1.3
		(0.046)	(0.055)	(0.072)	(0.030)
Anaemia (non-anaemic vs anaemic)		1.6	1.5	1.2	1.1
		(0.008)	(0.017)	(0.386)	(0.612)
STH infection (uninfected vs infected)		5.6	4.6	3.0	2.6
		(0.000)	(0.000)	(0.003)	(0.034)
Malaria (no malaria vs hx of malaria)		1.8	1.8	1.4	1.0
		(0.012)	(0.017)	(0.211)	(0.929)
Hearing (normal vs defective)	Variable not in equation				
Frequent illness (non-ill vs frequently ill)		1.9	1.6	1.4	1.4
		(0.000)	(0.003)	(0.064)	(0.130)
School attendance (> 80% vs < 80%)			3.9	3.5	3.6
			(0.000)	(0.000)	(0.000)
Play (< 6h / week vs > 6 h / week)	Variable not in equation				
Study (> 6h / week vs < 6 h / week)	Variable not in equation				
Tuition (> 3 h / week vs < 3 h / week)			1.4	1.4	1.6
			(0.002)	(0.018)	(0.005)
Aesthetic activities (any time vs no time)			1.5	1.3	1.3
			(0.001)	(0.054)	(0.101)
Reading (any time vs no time)			1.3	1.1	1.3
			(0.019	(0.586)	(0.120)
Watching TV (>3 h / wk vs < 3h / wk)			1.4	1.0	0.81
			(0.001)	(0.720)	(0.195)
Ethnic group (Sinhala vs Moor / Malay)				2.2	2.5
				(0.000)	(0.164)
Ethnic group (Tamil vs Moor / Malay)				1.3	1.7
				(0.369)	(0.625)
Parental education (category 4 vs 1)[a]				4.5	4.0
				(0.000)	(0.002)
Per capita monthly income (cat 4 vs 1)[b]				3.0	1.9
				(0.000)	(0.083)
Mother with child (residence vs non-residence)				Variable not in equation	
Homework (regular assistance from parents vs no regular assistance)				1.7	1.4
				(0.001)	(0.061)
School ID					

[a] Parental education categories: 1=less than O'level; 2= O'level; 3=A'level; 4=Degree or professional
[b] Income categories: 1= < =Rs1423; 2=Rs1424 – 2846; 3=Rs 2847 – 4269; 4= >= Rs 4270

The explanatory model predicting mastery of Mathematics is similar in many ways to that predicting mastery of First Language discussed above. As with the model for First Language, variables that predict mastery of Mathematics include gender, school attendance, attending tuition classes, parental education and the school.

As shown in stage 2 in Table 6.2 above, and similar to the model relating to mastery of First Language, the health variables of anaemia, soil transmitted helminths, malaria and frequent illnesses are significant predictors of mastery of Mathematics, when controlling only for gender and birth order of the child. However, unlike in the previous model, nutritional status is picked up by thinness rather than by stunting in this model. When controlling for household characteristics as well as the school however, soil transmitted helminth infections as well as excessive thinness remained significant predictors of learning achievement in Mathematics It is hard to explain why this may be so, except to observe that it is well known that determinants of learning outcome with regard to literacy and numeracy are different.

The above model also differs from that for First Language because reading for leisure and ethnicity are not significant determinants of learning achievement in mathematics. This is because of the nature of the subject – a child who reads is more likely to be proficient in his/her First Language. Given the significant contribution made by reading for leisure in first language achievement, the relative lack of non-academic children's newspapers and books in Tamil could be a strong contributor to the observed differences in achievement. Also, the ethnicity is linked to mastery of First Language as it determines whether Sinhala or Tamil is the child's First Language. Further, while school attendance remained significant, frequent illness was no longer significant. This probably reflects some inherent differences in the conditions necessary for the acquisition of mastery in the two types of skills.

In summary, the two models were used in this analysis to focus separately on first language and mathematics. A third model that looked at total achievement was carried out but abandoned due to lack of value addition.

To a large extent both models for first language and mathematics confirms existing knowledge on impact variables. It is clear that while some of learning determinants of first language and mathematics overlap, there are a few strong determinants that are relevant only to one model.

In both cases school remained a very strong determinant of achievement. Following the school, the determinants that play an important role in both mastery of first language and mathematics are parental education (particularly above the Ordinary Level), regular school attendance, gender (female), and more than 3 hours of tuition per week

Variables which are important determinants of first language but not of mathematics are: reading for leisure and ethnicity. None of the health variables remained independent predictors of successful outcome in first language after correction for individual behavioural factors, household socio-economic factors and school environment. However, two health variables remained independent predictors of achievement in mathematics: infection with any soil-transmitted helminth, and poor nutritional status as indicated by excessive thinness.

These findings lead to the position that interventions that seek to impact learning achievement can target both first language and mathematics by working with the determinants common to both models. For example, measures that target boys, and children who attend school irregularly, are likely to result in improved outcomes in both subjects. Interventions that seek to make a particular impact on either language skills or mathematics will have to pay additional attention to the variables that are unique to one model. It appears that regular deworming and nutritional supplements would be particularly beneficial in improving learning outcome in mathematics, while encouraging all children to read widely should improve first language skills. Particular focus should be on children studying in the Tamil medium.

CHAPTER 7.
SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY OF STUDY RESULTS

This study specifically sought to quantify the importance of health and related variables in the levels of educational achievements of primary school children. This was seen as a knowledge gap in Sri Lanka despite the fact that a vast body of knowledge exists on other contributing factors to primary school education. In an effort to take into account the complexities of factors influencing learning achievement, as well as to ensure that health variables were looked at in relative terms to other contributing variables, the study was designed as an inter-sectoral study which combined the school environment, the child's health and individual characteristics, as well as the socio-economic environment at home.

The final findings can be summarized as:

1. The school environment is the main determinant of learning achievement, with regard to both first language and mathematics, overshadowing all other factors.
2. However, the socio-economic context in which the child lives, and his / her personal characteristics are also important determinants of learning achievement.
3. Health factors are critical variables that are associated with both learning achievement and the socio-economic context.

Expanding on the above in terms of **determinants of achievement in First Language** (Sinhala / Tamil).

With regard to health:

- Poor nutritional status as indicated by stunting of growth, anaemia, worm infections, malaria and frequent illness are all associated with poor outcome.
- However, when the health variables were controlled for the socio-economic characteristics of the household, all except frequent illness, were found to be no longer significant. This is probably because all of the health variables

included were significantly associated with parental educational levels and household income. Hence, the initially observed association between mastery of first language and the health variables of stunting, anaemia and STH infection, is driven by household factors, rather than an independent cause-and-effect relationship.

- Frequent illness that caused a child to miss school on a regular basis, remained an independent predictor of learning outcome with regard to mastery of first language, even after correcting for parental education and household income.
- However, when the school environment was also brought into the equation, none of the health variables remained as significant predictors of learning achievement.

In terms of personal characteristics of the child and the socio-economic environment of the household:

- Parental education appears to be the most important predictor of achievement, with children of parents who were educated beyond the Ordinary Level being 4 – 5 times more likely to achieve mastery, when compared with children of less educated parents.
- Apart from the deleterious effect of frequent illness causing absenteeism, regular school attendance was one of the most significant predictors of learning outcome, such that even after inclusion of household socio-economic variables, and the school, children who had over 80% attendance during the previous year were almost 4 times as likely to attain success compared with those who had less than 80% attendance.
- Gender is a significant predictor of success, such that after controlling for household and school characteristics, girls were over twice as likely as boys to attain mastery of the First Language. Going against popular belief the study shows that this prevalence of higher achievement by girls cannot be attributed to differences in time spent on studying and playing after school.
- In terms of medium of instruction and ethnic group, children of Sinhala parents are significantly more likely to achieve mastery of the first language than children of Tamil, or Muslim and Malay parents.

- Reading for leisure was also found to be a predictor of achievement in First Language, even after correction for sex, household socio-economic status, and school, so that children who spent any time at all on reading for leisure were 1.4 times as likely to gain mastery in First Language than children who did not read at all.
- Similarly children who spent at least 3 hours a week on extra tuition classes were 1.4 times more likely to achieve mastery than those who did not.

The explanatory model predicting **mastery of Mathematics** is similar in many ways to that predicting mastery of first language discussed above. As with the model for First Language, variables that predict mastery of Mathematics include gender, school attendance, attending tuition classes, parental education and the school.

Differences observed were:

- Soil transmitted helminth infections, and poor nutritional status, as indicated by excessive thinness, remained significant predictors of learning achievement in Mathematics after controlling for household characteristics as well as the school. Moreover, frequent illness was not a significant contributor to achievement in Mathematics.
- Reading for leisure and ethnicity were not significant determinants of learning achievement in mathematics as they were for achievement in Sinhala / Tamil as first language.

It is clear therefore, that while the main determinants of successful outcome are common to both first language and mathematics, there are also some significant differences.

7.2 RECOMMENDATIONS

Given the overpowering impact of the school variable on achievement, the need to raise the standard to schools cannot be underestimated or ignored. In terms of learning and achievement the study shows that high quality schools can compensate to a large degree for both home socio-economic weakness as well as health deficits.

As this study has concentrated on health as a determinant of learning achievement in primary schoolchildren, the recommendations are also focused on issues dealing with the **health** of primary schoolchildren.

- A significant proportion of Sri Lankan children suffer from stunting of linear growth, and excessive thinness, as well as from nutritional anaemia. Because of the observed effect of nutritional deficits on learning achievement, and considering that all children have the right to good health, there is a need to provide nutritional supplementation for children at risk of these nutritional deficits. Such children are mostly from low income families.

- Children in the Northern, Eastern and Western Provinces, particularly those from low-income families are also more likely to be infected with any one of soil-transmitted helminths. Ensuring regular provision of anthelmintic treatment for children in these provinces (particularly targeting children from low-income families) through the school medical inspections programme will be a highly cost-effective means of eliminating these worm infections.

- Although many children in some provinces had experienced at least one attack of malaria during their lifetimes, and an association between malaria and poor learning outcome was observed, specific measures aimed at reducing the incidence of malaria may be unnecessary, given the current low level of malaria transmission.

- Improving nutritional status through supplementary feeding programmes, and regular de-worming will improve the general well-being of children, and may also reduce the occurrence of frequent minor illnesses (fevers, diarrhoeas) that cause children to miss school.

- A significant proportion of children also appear to suffer from shortsightedness. Although the results of this study did not find any relationship between learning achievement and the occurrence of shortsightedness, it would still be advisable to screen all schoolchildren, and provide corrective eyeglasses to those with defective eyesight.

A few **recommendations that are not directly related to health** also arise from the findings of this study.

- In terms of improving learning achievement, the importance of regular school attendance cannot be overemphasized. Parents need to be educated regarding this, so that they ensure that children do not stay away from school unless they are ill. Reasons for absenteeism need to be explored further, and remedial measures that address these reasons and improve school attendance are very likely to have a strong impact on improving learning outcome.

- Special attention should be paid to boys, and children of parents with a low level of educational achievement. Educational strategies that focus on encouraging these children to master the desired learning outcomes at each stage of primary school are very likely to improve achievement levels.

- Encouraging children to read during their leisure time will improve mastery of language skills. Although this may seem an over-simplistic re-iteration of a well-known fact, the results of this study showed that who read regularly during their leisure hours, and even spent just a few minutes on this each day, did better in mastering their first language.

- Efforts should be made to identify the reasons why attendance of extra tuition classes after school improved performance in both first language and mathematics. It may then become possible to draw on these findings and improve learning activities in school.

- The reasons for the marked difference in achievement of mastery of first language between students in Sinhala medium schools and Tamil medium schools also need to be explored further, so that appropriate remedial measures can be put into effect. The study findings indicate that greater access and usage of leisure reading in Tamil could have a positive impact on achievement.

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APPENDIX 1. LIST OF SCHOOLS IN STUDY SAMPLE

Province	Name of school	Education Zone
Central	K/Gampola Zahira College	Gampola
Central	K/Mahamaya Girls College	Kandy
Central	K/Sri Rahula College	Kandy
Central	K/Hagamuwa Maha Vidyalaya	Denuwara
Central	K/Handaganawa Maha Vidyalaya	Teldeniya
Central	K/Sarasavi Uyana Maha Vidyalaya	Kandy
Central	NE/Pundulu Oya Tamil Maha Vidyalaya	Kotmale
Central	K/Kahatapitiya Muslim Vidyalaya	Gampola
Central	K/Samudradevi Balika Vidyalaya	Wattegama
Central	NE/Hanguranketa CCV	Hanguranketa
Central	NE/Mahauva Tamil Vidyalaya	Walapane
Central	NE/Watawala Tamil Vidyalaya	Hatton
Central	K/Gemunupura Kanishta Vidyalaya	Gampola
Central	K/Kanishta Balika Vidyalaya	Gampola
Central	K/Paranagama Primary School	Wattegama
Central	NE/Glenuge Tamil Vidyalaya	Hatton
Central	Trinity College	Private school
Eastern	A/Al-Siraj MV	Akkaraipattu
Eastern	T/Muttur Central College	Muttur
Eastern	T/Sri Shanmuga Hindu Ladies Vidyalaya	Trincomalee
Eastern	A/Komari Methodist Mission TMV	Akkaraipattu
Eastern	B/Kannankudah MV	Batticaloa
Eastern	B/Meera BMV	Batticaloa
Eastern	T/Al-Hamra Muslim MV	Trincomalee
Eastern	B/Hiluriya Vidyalaya	Batticaloa
Eastern	A/Mavanagama MV	Dehiattakandiya
Eastern	Al-Ameen V	Muttur
Eastern	T/Kanniya Govt. Tamil Mixed School	Trincomalee
Eastern	T/St. Valanar V	Trincomalee
Eastern	B/Al-Hasanth V	Batticaloa
Eastern	B/Kaddaimunai V	Batticaloa
Eastern	A/Kalmunai RKM Girls V.	Kalmunai
North Central	A/Swarnapali BMV	Anuradapura
North Central	P/Bakamoona Mahasena MV	Hingurakgoda
North Central	A/Thalawa MV	Tambuttegama
North Central	A/Rathmale Tissa MV	Anuradapura
North Central	A/Walisinghe Harischandra MV	Anuradapura
North Central	A/Dambuluhalmilewa MV	Kekirawa
North Central	A/Gantiriyagama MV	Kekirawa
North Central	A/Pandukabhayapura V	Anuradapura
North Central	A/Wellaragama Vidyalaya	Galenbindunuwewa
North Central	A/Angunochchiya Vidyalaya	Kebithigollewa
North Central	A/Ethungama V	Kekirawa
North Central	P/Seevali Vidyalaya	Polonnaruwa
North Central	A/Nochchiyagama Primary V.	Anuradapura
North Central	P/Damminna Primary Vidyalaya	Dimbulagala
North Central	A/Thambuttegama Primary School	Tambuttegama
North Western	K/Maliyadeva College	Kurunegala
North Western	K/Sri Parakrama NS	Nikaweratiya
North Western	P/Zahira College	Puttalama
North Western	K/Rathnalankara MV	Giriulla

Province	Name of school	Education Zone
North Western	K/Ilukhena Gunananda MV	Kuliyapitiya
North Western	K/Kuliyapitiya RC Boys MV	Kuliyapitiya
North Western	P/Kandatodowewa MV	Puttalama
North Western	P/Gonawila KV	Chilaw
North Western	P/Merawala KV	Chilaw
North Western	K/Welgala KV	Ibbagamuwa
North Western	K/Subarathi KV	Kuliyapitiya
North Western	K/Kumbaloluwa JS	Kurunegala
North Western	P/Bishop Edmund Pieris Primary	Chilaw
North Western	P/Nainamadama PV	Chilaw
North Western	K/Wayamba Rajakeeya Primary	Kurunegala
Northern	J/Jaffna Central College	Jaffna
Northern	K/Vaddakachchi MV	Kilinochchi
Northern	J/American Mission College	Vadamarachchi
Northern	M/Adampan MMV	Madhu
Northern	J/Gnanasanyar College	Vadamarachchi
Northern	J/Pandateruppu Girls High School	Valikamam
Northern	V/Vavuniya Muslim MV	Vavuniya
Northern	J/ Kondavil Param Sothy Vidyalaya	Jaffna
Northern	J/St James Maha Vidyalaya	Jaffna
Northern	K/Jeyapuram GTMS	Kilinochchi
Northern	M/Sithy Vinayakar Hindu Junior School	Mannar
Northern	V/ Saivapragasa Ladies College	Vavuniya
Northern	J/Anaiparthy Methodist Mission Vidyalam	Jaffna
Northern	K/Chettiyakuruchchi GTM School	Kilinochchi
Northern	J/Mallagam Kanishta Vidyalaya	Valikamam
Sabaragamuwa	R/Jeilani Central College	Balangoda
Sabaragamuwa	K/Dudley Senanayake MV	Kegalle
Sabaragamuwa	R/Convent National School	Ratnapura
Sabaragamuwa	R/Madampe Vijaya MV	Embilipitiya
Sabaragamuwa	K/Ranwala Mahanaga MV	Kegalle
Sabaragamuwa	R/Batudegera MV	Ratnapura
Sabaragamuwa	R/Pathkoda BV	Ratnapura
Sabaragamuwa	R/ Talangama V.	Balangoda
Sabaragamuwa	K/Ruwanwella T V	Dehiowita
Sabaragamuwa	K/Dharmapala KV	Kegalle
Sabaragamuwa	K/Ratnapura Mihindu V	Ratnapura
Sabaragamuwa	R/Mahinda Vidyalaya	Ratnapura
Sabaragamuwa	R/Udagama KV	Balangoda
Sabaragamuwa	K/Kitulgala Boys Primary	Dehiowita
Sabaragamuwa	R/Wewila V.	Ratnapura
Southern	G/Sri Devananda MV	Ambalangoda
Southern	G/St. Aloysius College	Galle
Southern	M/Rahula College	Matara
Southern	G/Vidyaraja National School	Udugama
Southern	G/Aluthwala MV	Ambalangoda
Southern	G/Akmeemana MV	Galle
Southern	G/Paramananda MV	Galle
Southern	M/Belideniya MV	Matara
Southern	M/Thelijjawila Royal College	Matara
Southern	G/Sri Kalyanathissa KV	Ambalangoda
Southern	G/ Gamima KV	Elpitiya

Province	Name of school	Education Zone
Southern	H/Weerakele KV	Hambantota
Southern	H/Bowala KV	Walasmulla
Southern	H/Hambantota Vidyalaya	Hambantota
Southern	H/Wiharagala KV	Hambantota
Southern	M/Aparakke KV	Matara
Uva	B/Dharmaduta College	Badulla
Uva	B/Kudakusum Balika Maha Vidyalaya	Bandarawela
Uva	M/Sevanagala MV	Wellawaya
Uva	B/Sri Dhammananda MV	Badulla
Uva	B/Razik Fareed MMV	Bandarawela
Uva	B/Mapakadawewa MV	Mahiyangana
Uva	B/Keppitipola MV	Welimada
Uva	B/Kalaivani Tamil Vidyalaya	Badulla
Uva	B/Aislaby Tamil Vidyalaya	Bandarawela
Uva	M/Vipulananda Tamil KV	Moneragala
Uva	B/Yahalarawa Tamil Vidyalaya	Welimada
Uva	M/Kittulkote KV	Wellawaya
Uva	B/Saraswathi KV	Badulla
Uva	B/Valluvar Tamil Vidyalaya	Badulla
Uva	M/Mahanama KV	Moneragala
Western	C/Nalanda College	Colombo
Western	K/Zahira College	Kalutara
Western	K/Walagedera MV	Matugama
Western	C/Sri Jayawardanepura MV	Sri Jayewardenapura
Western	C/Anurudda Balika Vidyalaya	Colombo
Western	G/Weboda North Vidyadeepa MV	Kelaniya
Western	G/Burullapitiya MV	Minuwangoda
Western	C/St Mary's College, Kesbewa	Ratmalana
Western	C/Darusulaam Muslim BV	Colombo
Western	K/Mahawila KV	Horana
Western	K/Upadyaya KV	Kalutara
Western	G/Kandawala St. Joseph V.	Negombo
Western	C/Podujaya Vidyalaya, Kesbewa	Ratmalana
Western	G/Ovitigama Primary Vidyalaya	Gampaha
Western	K/Bombuwala Model Primary	Kalutara
Western	G/St. Annes Balika Primary School	Kelaniya
Western	G/Kattuwa Primary School-SLAF	Negombo
Western	Musaeus College	Private school
Western	St Bridget's Convent	Private school
Western	St Thomas College	Private school