CHAPTER X: DETERMINANTS OF STUDENT PERFORMANCE IN THE SLC EXAMINATIONS: EVIDENCE FROM SURVEY *

1. INTRODUCTION

High student failure rates in SLC examinations and disparities in performance are two national issues that raise discussion in the Nepali news media and other public forums every year before and after the SLC examinations (Onta, 2005). The SLC examinations have been routinely criticized for their lack of technical quality, the way exam papers are, and the way examinations are administrated under varying conditions in different centers and parts of the country. While these discussions have raised issues of critical relevance, they are often based on anecdotal evidence rather than rigorous analysis. Some of the studies conducted so far purporting to identify shortcomings (CERID, 1996), suggest that the lack of properly trained test developers and insufficient emphasis on testing the analytical and problem solving skills of students has resulted in test questions that are weak in terms of reliability and validity, and the examinations tend to test the ability to recall rather than the ability to creatively apply the knowledge students have acquired to analyze and solve problems. These studies also point out that one factor affecting the results, is the exam marking process. In the main, these studies have tended to be piecemeal in nature, focusing mainly on narrow sets of factors that might potentially influence the performance of students in the SLC examinations and on describing the factors without necessarily establishing the link between these factors and student performance. Hence, they have not helped much in providing a complete understanding of the underlying reasons that lead to the enormous wastage in the secondary education. While the poor quality of test papers and grading practices might partially explain the poor performance of some students, for example, they do not explain why some students perform better than others even though, they face the same quality test papers and grading practices. Similarly, the quality of school infrastructure might partly explain the performance gap between students from different schools, but not the differences in performance between students from the same school.

There are, clearly, a host of socio-economic, cultural, and institutional factors that could be contributing, either individually or collectively, to the persistently high failure rates in the SLC examinations. Hence only a comprehensive research study that simultaneously looks at a broad set of potential performance determinants can provide an in-depth understanding of the reasons behind the poor student performance in the SLC examinations. A study to determine the various factors that influence student performance in the SLC examinations was carried out under the SLC Study. This study 'Determinants of Student Performance in the SLC Examinations' is a serious attempt in this direction. It is expected that an in-depth understanding of the determinants of student performance in the SLC examinations will be very valuable for both policymakers and researchers in developing viable and effective solutions to the existing problems in the secondary school education of Nepal. The insights from a study like this should

* This chapter is based on the report 'Determinants of Student Performance in the SLC Exams: Evidence from Survey', prepared by Dr. Saurav Dev Bhatta for the SLC Study team.

help policymakers in making evidence-based decisions that make the most difference. This study is significant from an academic perspective as well.

The main objective of the study 'Determinants of Student Performance in the SLC Examinations' was to determine the various factors that influence student performance in the SLC examinations. More specifically, it attempted to answer why some students perform better than others in the SLC examinations by analyzing the relationship between a host of potential determinants of performance and student performance using data collected through a nationwide survey of schools and students. Although there are many potential factors that could influence student performance in SLC examinations, not all such factors are relevant from a policy perspective. The focus in this study was, therefore on factors that are amenable to manipulation through Government intervention. In particular, the analysis carefully looked into the relationship between school resources and student performance and identified resources that are especially relevant for improving student performance.

2. THEORETICAL FRAMEWORK

Most studies on the determinants of student performance recognize that there are a variety of school and non-school factors that could potentially affect student outcomes. Their emphasis on particular sets of factors, however, is different depending on the research tradition being followed. Studies using educational production functions focus on the relationship between resource inputs and student outcomes while often treating the school as a black box. School effectiveness research, on the other hand, focuses on "breaking open" the black box and studying the internal school processes as well. But this second line of research has largely neglected to adequately account for the role of school resources in determining student performance (Levacic and Vignoles, 2002). 'Determinants of Student Performance in the SLC Examinations' tries to integrate elements of both research traditions by using augmented education production functions that incorporate a number of variables emphasized in the school effectiveness framework.

The basic model linking student outcomes with various determinants of outcomes in school effectiveness research is given in Figure 1.[1] It says that school inputs, teacher inputs, student inputs, and family inputs along with the national, community, and school contexts act through the school process to determine student outcomes. The context can also have a direct impact on outcomes and various inputs, while inputs can themselves be altered as a result of feedback from the school process.[2] Within this framework, school context represents a variety of contextual variables including the school governance structure and socio-economic characteristics of the student body. The socio-economic characteristics of the local community are represented by the community context and both school and community contexts are nested in the national context. Student inputs represent not just the effort a student puts into the learning process, but also her prior knowledge and other characteristics. The socio-economic characteristics of the student's family and their inputs into the student's academic life are included among the family inputs.

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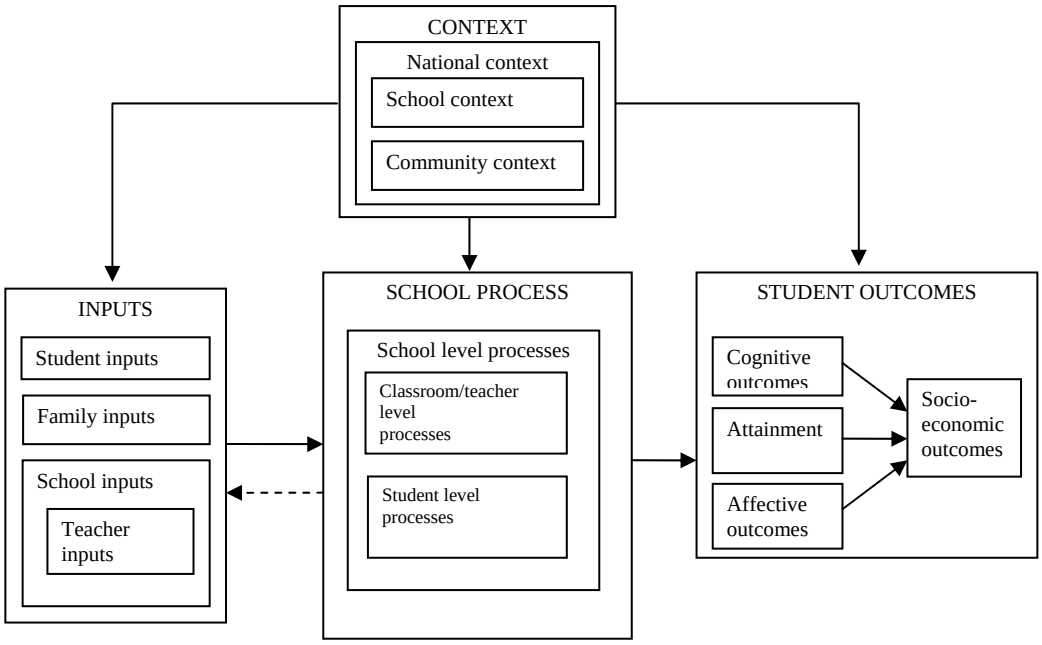
[1] The model presented in Figure 1.1draws from the models used by Scheerens (2004), Levacic and Vignoles (2002), and Ridker (1997).

[2] Although not shown here, student outcomes can also have a feedback effect on inputs, school context, and school processes. This reverse relationship will not be studied in this report.

School inputs refer primarily to school expenditure and physical plus human resources of the school, while teacher inputs represent the qualifications and characteristics of the teachers. School processes are grouped into three categories: school-level processes which deal with the overall school environment and administrative structure, classroom/teacher level processes which focus on instructional approaches and teaching quality, and student level processes reflecting the learning approach of the student. It is assumed that the school-level conditions can enhance the effectiveness enhancing conditions at the classroom/teacher level and student level (Scheerens, 2004).

Four categories of student outcomes are identified in Figure 1. The first category—cognitive outcomes—refers to academic achievement and is typically measured using test scores. A related, though different, group of outcomes is attainment. The duration of school enrollment, the highest Grade achieved, and academic qualifications are the important outcomes in this category.[3] Affective outcomes, on the other hand, refer to social skills, behaviors, and attitudes towards learning. These three types of outcomes, which may be viewed as proximal outcomes, largely determine the status of the student in the world of work. Hence, Figure 1 shows arrows leading from the first three outcomes to the fourth outcome category, namely, socioeconomic outcomes. Work skills, employment status, and earnings are some of the indicators of socio-economic or post-school outcomes. This model assumes that the school process, which is affected by both inputs and context variables, has an impact on all four types of student outcomes.

Figure 1: Determinants of Student Outcomes in the School Effectiveness Framework



[3] It might be pointed out that while academic achievement can be used as an indicator of the quality of education, attainment is only an indicator of quantity.

Traditional educational production function-based studies, while largely consistent with the school effectiveness framework presented in Figure 1, typically do not include school level and classroom/teacher level process variables among the determinants of student outcome (Levacic and Vignoles, 2002). The augmented educational production function used in the current study attempts to overcome this limitation by incorporating key variables from most of the different boxes depicted in the figure. In the economics field, a production function is basically a mathematical expression of an input-output relationship showing the maximum amount of output that can be obtained from a given set of inputs. Similarly, an educational production function models educational outcomes as a function of different categories of explanatory variables under the assumption that the resources represented by the explanatory variables are being used efficiently.

While the school effectiveness framework in Figure 1 is quite comprehensive in its inclusion of determinants of student outcomes, it could nevertheless be criticized for not including aspects related to the technical processes involved in the exam and the quality of test items. Similarly, when it comes to exam marking, inadequate training or negligence on the part of the graders and the resulting unreliability in marking can also influence the scores of students. But since all the students taking the exam in any particular year face the same exam quality issues and exam marking conditions, the *differences* in performance across students cannot be attributed to these factors. Furthermore, the impact of marking unreliability on individual exam scores can go in both directions—it can either help or hurt the student. In other words, there is no systematic relationship between marking unreliability and exam outcomes. Hence, neither of these two factors—test quality and marking practices—is included as a determinant of student outcome in the above framework. But since these factors can have an impact on the entire batch of students taking the examinations in any particular year, they have been indirectly accounted for in this study by including the exam year as one of the context variables. Cultural and gender biases in question content and wording can also have a differential impact on student performance between genders and across ethnic groups. This type of relational analysis, however, is beyond the scope of the current study.

The relationship between student outcomes (the dependent variable) and the different sets of performance determinants (the explanatory variables) are analyzed using student-level data.

3. VARIABLES USED IN THE STUDY

Dependent Variable

The dependent variable in this study is student outcome. The specific indicators of performance used in this study are as follows: (a) *SLC score*: aggregate average score, as well as subject-wise scores of the student in her most recent SLC examinations; (b) *SLC pass/fail status*: whether or not the student passed the SLC examinations. The rationale behind using these two different types of indicators is that while the first indicator allows us to analyze the relationship between SLC scores and the determinants of performance, the second enables us to understand how changes in the determinants are associated with the *probability* of passing the SLC examinations.

Explanatory Variables

The determinants of performance can be grouped into three broad categories—context variables, inputs, and school process variables. For details on these categories, please refer to

Annexes 9, 10, 11, 12 and 13 of Chapter X of this report and 'Determinants of Student Performance in the SLC Examinations'

4. SURVEY METHODOLOGY

The data were gathered through a nationwide survey of families schools students, head teachers , and teachers, divided into four components: (i) questionnaire design, (ii) sample design, (iii) field work, and (iv) data entry and management.

For details, please refer to the study report 'Determinants of Student Performance in the SLC Examinations'.

4.1 Sampling

Recognizing the magnitude of the task, the terms of reference for this study proposed a sample size that was adequately large for the purpose at hand. More specifically, it recommended that the survey cover approximately 450 schools and 22,500 students, i.e., around 10% of the secondary schools in the country and 50 students (on average) from each of the sample schools. In order to ensure the representativeness of the sample while making the survey practically feasible, a multi-stage, stratified random sampling approach was used to select schools and students. The representativeness of the sample was also enhanced by including SLC students from multiple years in the sample. But keeping in mind the increasing difficulty of tracing students the further back in time we went, the sample was limited to the SLC batches of 2002, 2003, and 2004. Fifty percent of the sample (11,250 students) consisted of students from the 2004 batch and the remaining sample was split equally between the years 2003 and 2004.

The first step in the design involved developing a scheme for grouping the schools into collectively exhaustive and mutually exclusive categories—or strata—such that each category would be relatively homogenous and the samples taken from these categories would be representative of the larger population of schools in terms of both performance and the major determinants of performance[4]. Details of the stratification scheme and the allocation of schools across the different strata are provided in the following two subsections. In the next step, the sample of 450 schools was selected through a two-stage sampling process where the selection of districts within each stratum took place in the first stage followed by the selection of schools within each sample district in the second stage. The final step involved specifying the number of students that should be selected from each school and selecting the sample students in these schools. It should be pointed out that while the selection of schools and determination of student sample size for each school was done by the Team in Kathmandu, the selection of students in each school was done by the field researchers themselves according to specific guidelines provided by the Team.

[4] The sample design adopted in this study follows the general approach used in household income/consumption surveys where the basic sampling frame consists of households rather than individuals. The idea is to treat schools as "households," students as "family members", and use available lists of schools as the sampling frame from which the sample of schools is selected. SLC class size in this design is equivalent to household size in income/consumption surveys and therefore plays a crucial role in the selection of students.

For details on the Stratification Scheme, see the report 'Determinants of Student Performance in the SLC Exam'.

Selecting Sample Schools

A two-stage approach was taken to select the sample of schools. In the first stage, districts were randomly selected from each eco-development region according to the scheme presented in Table 1.

Table 1. District Selection Scheme

Number of Districts in Region	Sample Selection Rule
3 or fewer	Select 1 district
4 to 7	Select 2 districts
8 to 10	Select 3 districts
11 or greater	Select 4 districts

In the case of Kathmandu Valley, however, two districts were selected to account for the disproportionately large number of schools in this region. The 28 sample districts selected through this process are shown in Table 2 and the map in the following page.

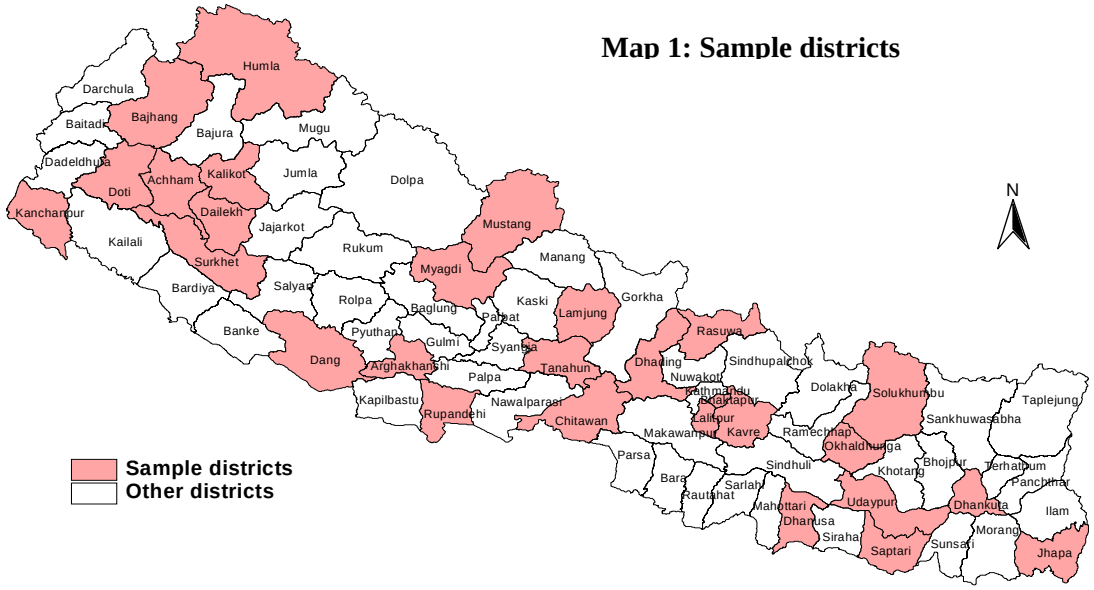
Table 2. Sample Districts in Each Geographical Stratum

	Ecological Region		
Development region	Tarai	Hill	Mountain
Eastern	Jhapa, Saptari	Dhankuta, Okhaldhunga , Udayapur	Solukhumbu
Central (no K. V.)	Dhanusha, Chitwan	Dhading, Kavre	Rasuwa
Western	Rupandehi	Arghakhanchi, Lamjung, Myagdi, Tanahun	Mustang
Mid-Western	Dang	Dailekh, Surkhet	Humla, Kalikot
Far-Western	Kanchanpur	Achham, Doti	Bajhang
Kathmandu Valley		Bhaktapur, Lalitpur	

Once the districts in each geographical stratum were selected, all the schools in the sample districts were listed and grouped by school type and school size. Based on this grouping, the proportion of each type and size of school in the sample districts was determined. Finally, for each geographical stratum, the total sample schools were allocated across the sample districts according to the computed proportions.

The actual selection of schools in each district is the last step of the school selection procedure. This is done by listing the schools in each type and SLC class size category in the district and randomly selecting the desired number of schools from each category. The number of sample schools in each district is given in Annex 8.

Map 1: Sample districts



Selecting Students within Schools

According to the modified sample frame, there were a total of 16,368 regular SLC students[5] who appeared in the 2004 examinations from the sample schools. Hence, selecting 11,250 students from the 2004 batch meant selecting 68.7% of the SLC candidates for that year[6]. The number of SLC students from 2004 that should be selected from each sample school was obtained by multiplying the school's 2004 SLC class size by this percentage. The required sample size for each of the earlier two years was simply half the number computed for 2004.

The selection of individual students was done in the field itself. The sample selection process in each school began with the compilation of separate lists of SLC candidates for the three years of interest. As some of the students taking the SLC examinations were repeat or "exempted" students, the lists for the three years were first compared to eliminate double listing of students. For example, if a student who took the SLC examinations in 2002 was listed in 2003 as well, the entry in the earlier year was deleted. The student lists for 2003 and 2004 were compared and modified in a similar manner. As a last check, the modified lists for 2002 and 2004 were compared to eliminate double counting of repeat students who might have waited a year before sitting for the examinations again. And students who were listed as absent in the school's SLC roster were also removed from the lists. Before the lists were finalized, however, it was necessary

[5] The ideal sampling frame would have included information on not just the "regular" SLC students, but also on the number of repeat or "exempted" students. But information on "exempted" students in each school was not available in the school-level dataset provided by the OCE.

[6] This fraction is known as the sampling fraction or deflating factor.

to delete the names of those students with whom it would simply be impossible to meet for an interview.

Given that the vast majority of SLC candidates fail the examinations, randomly drawing a sample of students directly from the above lists could potentially result in an overrepresentation of poor performance students. Hence, the students in each of the three final lists were grouped into three categories—good, fair, and poor—according to their SLC performance, and samples were selected separately from each of these categories. The "good" and "fair" categories included students who passed in the first and second divisions, respectively. Students who either failed or passed in the third division were placed in the "poor" category. Multiplying each year's required sample size by the proportion of total students in each category yielded the number of students that needed to be selected from each performance category for that year. Finally, the required number of students in each performance category was selected by first sorting the students within each category by their first names and proceeding down the sorted list sequentially.[7]

Selection of Teachers and Families

As indicated in the questionnaire design section, the respondents in this survey also included families, teachers, and head teachers of the SLC candidates. Ideally, the family of each SLC candidate in the sample should be interviewed. Because of time and resource limitations, however, it was decided that the number of families in the sample would be limited to 25% of the student sample (approximately 5,625 families). The families were selected from the list of the sample students according to the proportions of sample students in the various performance categories.

The number of secondary school teachers differs widely from school to school. And since there was no information on the number of teachers in the available sample frame, it was not practical to specify, beforehand, the number of teachers that should be sampled from each school. Rather, the field researchers were instructed to interview all the secondary school teachers in each school so long as the number did not exceed twelve. If there were more than twelve teachers in the school, then the twelve teachers that were selected should represent as many subjects as possible. Using this procedure, a total of 2,406 teachers were interviewed in the survey. The number of head teachers surveyed was, naturally, equal to the number of schools in the sample.

4.2 Fieldwork

Three categories of field researchers were invited to participate in the survey: field coordinators, assistant field researchers, and junior field researchers. A total of 174 field researchers (73 field coordinators and 101 assistant field researchers) were recruited in Kathmandu through this process. Another 277 junior field researchers were recruited locally by the field coordinators in the different districts. A training program was organized to thoroughly familiarize the field researchers with the study and instruments and give them all the information necessary for conducting the survey in a reliable and efficient manner. The training included sessions where

[7] This is a valid random selection approach since performance, ethnicity, gender, and most other variables of interest to this research are unrelated to the first names of students. Sorting the students by last name, on the other hand, would lump students of specific ethnicities together and increase the chances of excluding certain groups.

the participants were introduced to the basics of FGDs and required to practice conducting FGDs in small groups.

Fieldwork took place in two phases. The first phase involved surveying schools in only a few districts to gather first-hand knowledge of the reality in the field. This experience enabled the team to determine whether or not it would be feasible to conduct the second phase of the survey in the remaining sample districts. Accordingly, 70 schools in eight remote and/or conflict-prone districts across the nation were surveyed between September 15, 2004 and October 14, 2004. The feedback obtained from the first phase survey was very encouraging. In spite of the tense political situation, the field researchers were able to successfully complete the survey in seven of the districts within three weeks.

4.3 Data Entry and Management

The data entry task was contracted out to a professional data entry company through a competitive bidding process. A major task preceding data entry was the coding of open-ended questions. Before the questions could be coded, however, the lead researchers had to develop codes for the answers to these questions. After all the open-ended questions had been coded, the questionnaires were sent to the data entry company. The data were entered using a custom-made data entry software developed by the Team's data manager in close consultation with the SLC Study Team's lead researchers. The company's data entry team consisted of 50 entry operators, one system administrator, one database manager, and six quality control operators. Before beginning with the data entry, the SLC Study Team's data manager conducted a one-day training workshop for the entry operators to thoroughly familiarize them with the data entry software and point out potential errors they could make.

5. OVERVIEW OF STUDENT PERFORMANCE IN THE SAMPLE

This section presents an overview of the SLC performance of students in our sample. Beginning with a discussion of the average performance for the entire sample, it goes on to analyze the differences in student performance across some key variables. As mentioned earlier, the survey was able to gather data on approximately 88% (19,896) of the 22,500 students in the proposed sample. But the records of 914 respondents had to be dropped because of missing student performance information—the most important variable in our study—thereby leaving only 18,982 student records in the dataset.[8] The discussion below deals with the performance of these 18,982 students.

5.1 SLC Performance of the Entire Sample

Table 3 summarizes the SLC performance of all the students in the sample. It may be noted that that pass rate of 51% in the sample is somewhat higher than the pass rates computed using data

[8] Thus the effective response rate for the survey was 84%. It should, however, be clarified that while the dataset includes the SLC scores for 18,982 students, many of the other variables in the dataset have missing observations.

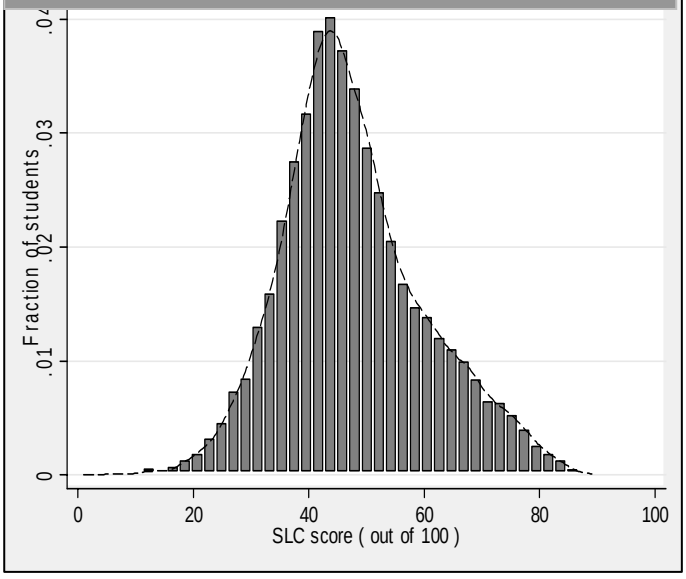
from the OCE (see Bhatta, 2004).[9] Hence, the student sample in this study appears to be slightly biased in favor of successful SLC candidates. But this bias should not have a significant effect on the results of the regressions in the next chapter since the multitude of explanatory variables included in the model account for most of the major factors affecting student performance.

Table 3. SLC Results for Sample Students, 2002-2004

	SLC Year			
	2002	2003	2004	Total
Total SLC candidates	3,553	4,696	10,733	18,982
Total SLC candidates (%)	100	100	100	100
Students who failed (%)	47.65	48.74	48.77	48.56
Students who passed (%)	52.35	51.26	51.23	51.44
Third division (%)	4.98	5.62	6.50	6.00
Second division (%)	28.45	28.13	28.29	28.28
First division (%)	18.91	17.5	16.44	17.16
Average score (out of 100)	48.30	48.09	47.65	47.88
Public school candidates (%)	76.98	77.04	80.58	79.03
Private school candidates (%)	23.02	22.96	19.42	20.97

Number of schools in sample: 432

Figure 2. Distribution of SLC Scores among Sample Students



Another interesting piece of information in Table 3 is the distribution of successful SLC students over the different pass categories. The figures indicate that among the successful candidates, only a small minority (12%) passed in the third division. Most of those who passed secured either first or second division scores. And although not shown in this table, 72% of the first division students were from private schools whereas only 5% of the third division holders were private school students. Considering that approximately 79% of the sample students are from public schools,10 the low percentage of high performing students in public schools is an alarming indication of the academic plight of the majority of Nepali youth.

[9] For example, the SLC pass rate computed using OCE data for 2004 is 46%.The OCE figures should be viewed as the true values since they have been computed using SLC performance data for *all* the students taking the SLC exams. The deviations of the sample pass percentages from the OCE results are probably due to the difficulties faced by the field researchers in locating students who had failed the SLC exams.

[10] This percentage is virtually identical to the percentage of public school students computed using OCE data (see Bhatta 2004).

Recall that study on Student Performance uses two indicators of student performance, namely, the pass/fail status of the student and the average score secured by the student in the SLC examinations. The above discussion focused only on the first indicator. The rest of the chapter will focus primarily on the second indicator—the average SLC score for the students in the sample. Table 3 shows that the average score for the sample is only 48 out of 100, a figure that cannot be considered encouraging even when we account for the fact that examiners have traditionally tended put an implicit cap on the maximum score in some of the SLC subjects.

Although the sample's average score gives an indication of the performance of the sample students, it does not give any information about how performance varies across students. It is, therefore, instructive to look also at the distribution of SLC scores among the sample students. The frequency histogram in Figure 2 shows the fraction of students (Y axis) that falls under different score categories (X axis). It shows that a large number of students have scores between 40 and 50, and the rest of the scores are distributed almost symmetrically around this range. Clearly, there is a very small percentage of students with scores in the higher ranges. [11]

5.2 Differences in Student Performance across School Types, Genders, and Ethnic Groups

In order to gain a better understanding of how SLC performance varies across students, it is useful to categorize students into different groups, study the performances of the different groups separately, and look at the performance differences across these groups. This section discusses the differences in student performance across school types, genders, and ethnicities.

As mentioned earlier, approximately 79% of the students in the sample are from public schools. It is, therefore, likely that the results seen in earlier are dominated by the performances of public school students. Table 4 presents the average scores and pass rates for public and private schools separately.

Table 4. Mean SLC Scores and Pass Rates by Gender and School Type

Label	% of students	Mean score	CV of score	Pass rate (%)
Total	100.00	47.880	0.260	51.44
Public	79.03	44.156	0.221	41.74
Private	20.97	61.914	0.185	88.02
Difference (Pvt.-Pub)	-58.06	17.758*	-0.036	46.27
Critical difference		0.354		
Female	44.77	46.228	0.258	45.81
Male	55.23	49.218	0.258	56.01
Difference (M - F)	10.46	2.990*	0.000	10.20
Critical Difference		0.354		

*Statistically significant at the 5% level.

As might be expected, the pass rate for private schools (88%) is much higher than the pass rate for public schools (42%). Similarly, the average score for private schools is 18 points higher than that for public schools and the difference in scores is statistically significant at the 5% level.[12] Another

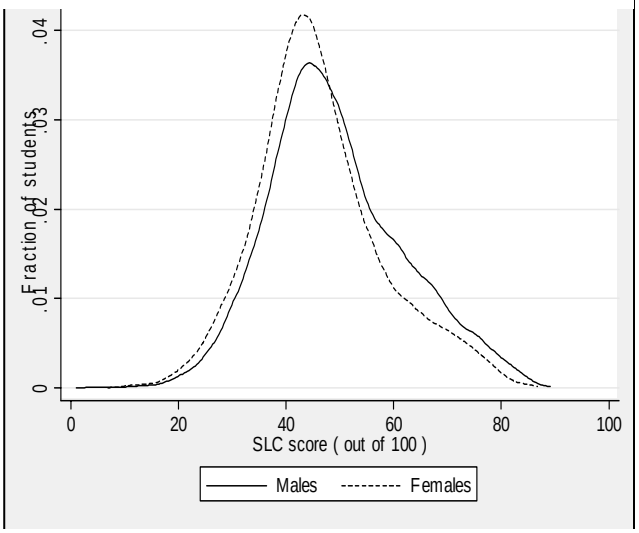
[11] It turns out that around 50% of the students scored between 39 and 55, and less than 1% scored over 80.

[12] Note that the table also presents the "critical difference" in scores. The difference in scores is considered statistically significant, if it is greater, in absolute terms, than the critical difference. If a result is statistically significant, it means that the result holds not just for the particular sample at hand, but for the population as a whole. For example, the private-public difference in scores is statistically significant since it is greater than the corresponding critical difference.

interesting observation can be made from the figures in the fourth column of the table. The coefficient of variation (CV) is an indicator of the dispersion of data points. Hence, the numerical values in the fourth column show the extent to which SLC scores vary across students. The higher CV for public schools compared to private schools, therefore, indicates that there is a greater variation in performance among public school students than among private school students.

Table 4 also presents information on the gender gap in SLC participation and performance. As shown in the table, the SLC candidates in the sample consist of 55% males and 45% females. And while 56% of the male candidates passed the SLC examinations, the pass rate for females is around ten percentage points lower at 46%. Interestingly, although the absolute difference in average SLC scores between males and females is relatively small (three points), it is statistically significant at the 5% level. Also note from the CV column that the variation in SLC scores among females is very similar to the variation among males.

Figure 3. Distribution of SLC Scores – Male vs Female Students



The distributions of SLC scores for males and females are shown in Figure 3. Although the locations of the two curves are not drastically different from each other as in the case of private versus public schools, the distribution for males is clearly to the right of the distribution for females. Again, this indicates that males generally have higher scores than females and that the percentage of males in any high score range is always higher than the percentage for females. Finally, observe that the shapes of the two distributions are very similar, providing visual evidence of the similarly in CV values between males and females.

The disparity in performance across ethnic groups is another important dimension of the existing disparities in SLC performance. Table 5 summarizes the mean SLC scores and pass rates for the six different ethnic groups. First, observe that the sample is completely dominated by Brahmans,[13] Chhettris, and Newars—the three socio-economically and politically dominant groups in Nepal. Brahmans and Newars, in particular, are highly over-represented in the sample, while Dalits—the most oppressed and marginalized people in the country—are highly underrepresented. For example, although Brahmans comprise only 13% of the national population (Dahal 2003), the percentage of Brahman SLC candidates is over 34%. Similarly, the percentage of Newar SLC candidates in the sample is also more than two times their percentage in the national population, while that of Dalits is less than one-fourth their representation in the national population.

Newars are distinctly ahead of the rest of population in terms of pass rate. The second and third highest pass rates are for Brahmans and Chhetris, respectively. This is an interesting finding considering that Brahmans are generally viewed as the dominant ethnic group, especially in the

[13] Unless stated otherwise, the term "Brahmans" refers to Hill Brahmans only.

area of academics. And as might be expected, the socio-economically disadvantaged Dalits have the lowest pass rate. Janjatis and Others have the second and third lowest pass rates, respectively.

Table 5. Mean SLC Scores and Pass Rates for Different Ethnic Groups

Ethnicity	No. of Students	% of students	Mean Score	CV of Score	Pass Rate (%)
Brahman	6,509	34.29	48.331	0.234	52.44
Chhettri	3,896	20.52	47.320	0.245	49.44
Newar	2,546	13.41	54.998	0.252	70.07
Janjati	2,768	14.58	45.052	0.259	43.93
Dalit	439	2.31	43.692	0.235	39.41
Others	2,824	14.88	44.616	0.292	44.37
Total	18,982	100.00	47.880	0.260	51.44

Note: The term "Brahman" denotes Hill Brahman only.

Newars are distinctly ahead of the rest of population in terms of pass rate. The second and third highest pass rates are for Brahmans and Chhetris, respectively. This is an interesting finding considering that Brahmans are generally viewed as the dominant ethnic group, especially in the area of academics. And as might be expected, the socio-economically disadvantaged Dalits have the lowest pass rate. Janjatis and Others have the second and third lowest pass rates, respectively.

Table 6. Pairwise Comparison of SLC Scores between Different Ethnic Groups

(Mean Score)	(48.33)	(47.32)	(54.99)	(45.05)	(43.69)
Ethinicity	Brahman	Chhetri	Newar	Janjati	**Dalit**
(47.32)	-1.0107*				
Chhettri	0.47762				
(54.99)	6.6673*	7.678*			
Newar	0.55117	0.6009			
(45.05)	-3.2784*	-2.2677*	-9.9457*		
Janjati	0.53505	0.58614	0.64748		
(43.69)	-4.6391*	-3.6283*	-11.306*	-1.3607*	
Dalit	1.1627	1.1871	1.2185	1.2113	
(44.61)	-3.7144*	-2.7037*	-10.382*	-0.43597	0.9247
Others	0.53131	0.58273	0.6444	0.63066	1.2097

*Statistically significant at the 5% level.
Note : In each cell, the top figure shows the difference in mean scores (row-column) and the bottom figure shows the critical difference

The average SLC scores for the different ethnic groups also exhibit the same pattern except that now the performance of Janjatis is better than that of Others.[14] Before discussing the differences

[14] The student's mother tongue is another related variable that could influence her SLC performance. Data indicate that the average score of students whose mother tongue is Nepali (48.3) is approximately 1.5 points higher than that of non-native Nepali speakers with the difference statistically significant at the 5% level.

in SLC scores among the various ethnic groups, it is worthwile to point out that the CV of score is the lowest for Brahmans, which indicates that the scores vary the least among members of this ethnic group. Setting aside the Others group, which does not really represent a single ethnicity, the group with the largest variation in performance is the Newars. Hence, while Newars have the best scores on average, their intra-group performance variation is also the greatest. The differences in SLC scores among the different ethnic groups are presented in Table 6. The pairwise comparisons shown in the table indicate that there are statistically significant differences among all pairs of ethnic groups except for the following pairs: Dalits and Others, and Janjatis and Others. And the difference is the greatest between Newars and Dalits.

Figure 4. Distribution of SLC Scores: Hill Brahmans vs Dalits

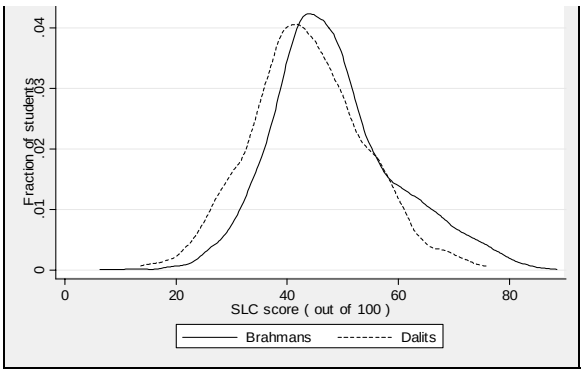
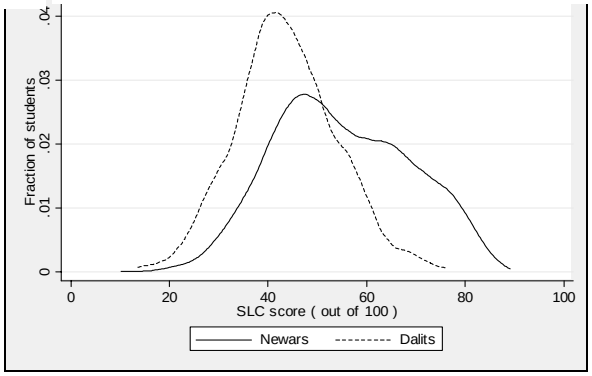


Figure 5. Distribution of SLC Scores: Newars vs Dalits



Figures 4 and 5 compare the distribution of scores for Dalits with those of Brahmans and Newars, respectively. In each case, the curve for Dalits is clearly to the left of the other ethnic group. Hence, not only is the average performance of Dalits generally lower, but the percentage of Dalit students in any high score range is always lower than the percentages for the other two groups. The graphs also indicate that the difference in the percentage of students in the higher score ranges is particularly high when Dalits are compared with Newars. Also note that the shorter and fatter shape of the distribution for Newars provides further evidence of the larger variation in performance among members of this group.

5.3 Differences in Student Performance across Space

Past research (Bhatta, 2004) and summary data published by OCE (OCE, 2002) indicate that there are notable differences in SLC performance across space, namely across the various ecological, development, and eco-development regions of Nepal. This section describes the performance differences across these spatial units in our sample. In addition, it also analyzes the differences in performance between district headquarters and the periphery, and between bazaar areas and eslewhere. In the discussion that follows, note that Kathmandu Valley is treated separately in recognition of its distinctly higher economic status compared to other regions.

Table 7 presents the number and performance of students across the three ecological regions plus Kathmandu Valley. As might be expected, the sparsely populated Mountain region has the smallest percentage of SLC candidates. This is followed by Kathmandu Valley, which has a disproportionatly large percentage of candidates (13.4%) compared to its share of the national population (7.1%) (Pantha and Sharma, 2003). The ranking of the remaining two regions in

terms of the percentage of SLC candidates basically follows the population distribution pattern for the national population

Table 7. Mean SLC Scores and Pass Rates for Different Ecological Regions

Eco. Region	No. of Students	% of Students	Mean Score	CV of Score	Pass Rate (%)
Mountain	929	4.89	44.538	0.186	43.27
Hill	7,542	39.73	44.954	0.232	43.48
Tarai	7,974	42.01	47.453	0.259	50.41
Valley	2,537	13.37	59.142	0.226	81.36
Total	18,982	100	47.880	0.260	51.44

Observe that Kathmandu Valley is far ahead of the other regions in terms of pass rate. Compared to a pass rate of 81% for Kathmandu Valley, the pass rate in the next best performing region—the Tarai—is only 50%. Interestingly, there is very little difference in the pass rates between students from the Mountain region and the Hill region. The average SLC scores for the different regions also exhibit the same ranking, with Kathmandu Valley in lead with a distinctly higher score. But as shown in Table 8, the pairwise comparison of scores across the ecological regions reveals that the difference between the Hills and the Mountains is not statistically significant at the 5% level. It must be pointed out, however, that although these two regions have similar average scores, the CV of score is much higher for the Hill region. Clearly, the disparity in SLC scores among the students within the Hill region is much greater than the disparity within the mountain region.

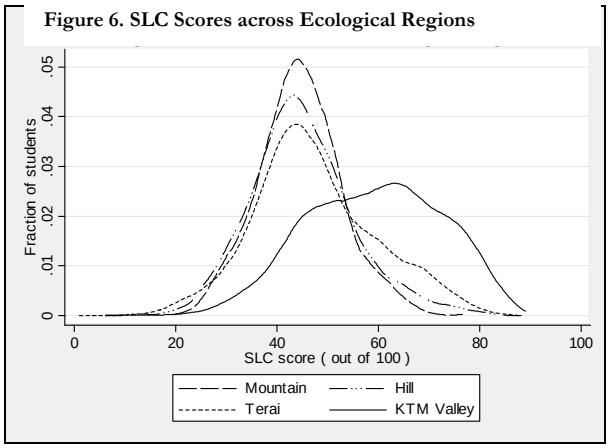
Table 9. Pairwise Comparison of Mean SLC Scores between Ecological Regions

(Mean Score)	(44.538)	(44.954)	(47.453)
Eco. Region	Mountain	Hill	Tarai
(44.954)	0.41504		
Hill	0.78836		
(47.453)	2.9145*	2.4995*	
Tarai	0.78601	0.36418	
(59.142)	14.604*	14.189*	11.689*
Valley	0.86947	0.52037	0.51681

*Statistically significant at the 5% level.
Note : In each cell, the top figure shows the difference in mean scores (row-column) and the bottom figure shows the critical difference.

Figure 6 shows the distributions of SLC scores in the three ecological regions and Kathmandu Valley. Notice that the curve for Kathmandu valley is similar in shape to the curve for Newars in Figure 7. This is not surprising considering that the majority of the Newars live in the Kathmandu Valley and constitute a major portion of the Valley's population. Futhermore, like the curve for Newars, the distribution for Kathmandu Valley is to the right of the other curves and is shorter and fatter in shape. The implications of these characteristics of the Valley curve are the same as those discussed earlier for Newars. As for the other regions, the distributions for the Mountains, Hills, and the Tarai get progressively shorter and fatter, confirming the increasing intra-regional variation in scores shown by the CV of score.

The SLC performance of students across the five development regions is presented in Table 9. It shows that the percentage of sample students increases progressively from west to east, with the Far Western region and Eastern region having the lowest and highest number of students. Again, this pattern is consistent with the distribution of population in the nation. In terms of pass rate, the Western Region—the region with the highest per capita income in the nation (CBS, 2004), shows the best SLC performance, and the region hit hardest by the Maoist insurgency, the Mid-Western Region, shows the worst performance. Surprisingly, the Far Western Region has a higher pass rate than the economically better-off Eastern Region.



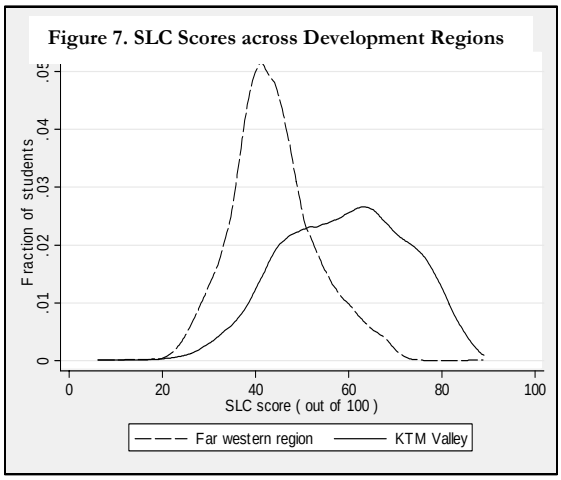


Table 9. Mean SLC Scores and Pass Rates for Different Development Regions

Dev. Region	No. Students	% of Students	Mean Score	CV of Score	Pass Rate (%)
Far West	1,203	6.34	43.913	0.210	43.47
Mid-West	1,436	7.57	44.828	0.251	35.17
West	4,457	23.48	48.617	0.213	54.25
Central	4,628	24.38	46.714	0.254	48.47
East	4,721	24.87	44.212	0.265	42.62
Valley	2,537	13.37	59.142	0.226	81.36
Total	18,982	100.00	47.880	0.260	51.44

Although the Western Region continues to rank at the top in terms of average SLC scores as well, the ranking of the remaining regions changes when this measure of performance is used. But the overall pattern of performance is clearer in this case—the two regions in the middle of the nation have high average scores, and the scores get progressively lower as we move further away from the middle. Furthermore, as can be seen from the pairwise comparison of scores in Table 10, the scores in the three "peripheral regions" (East, Mid-West and Far-West), are not significantly different from each other at the 5% level. But the score in each of these three regions is significantly different from the high-performing Central and Western Regions. Note that Kathmandu Valley, as usual, is a clear outlier in terms of both pass rate and average SLC score. The distributions of SLC scores in Kathmandu Valley and in the worst performing region (Far West) are presented in Figure 7. The implications of the differing shapes and locations of the two curves are again similar to the implications discussed earlier for the ecological regions.

Similarly, the SLC performances of students across the 15 eco-development regions plus Kathmandu Valley are summarized in Table 11. As this division of the nation is basically the intersection of the ecological and development regions, the distribution of sample students across the regions in Table 11 follows the patterns as shown earlier. More specifically, the percentage of sample students generally decreases from north (Mountains) to south (Tarai) and from west to east.

Table 10. Pairwise Comparisons of Mean SLC Scores between Development Regions

(Mean score)	(43.913)	(44.828)	(48.617)	(46.714)	(44.212)
Dev. Region	Far West	Mid-West	West	Central	East
(44.828)	.91474*				
Mid-West	0.8813				
(48.617)	4.7035*	3.7888*			
West	0.7326	0.6842			
(46.714)	2.8007*	1.886*	-1.9028*		
Central	0.72972	0.68111	0.47321		
(44.212)	0.29911	-0.61563	-4.4044*	-2.5016*	
East	0.72823	0.67952	0.47092	0.46642	
(59.142)	15.229*	14.314*	10.526*	12.428*	14.93*
Valley	0.78932	0.74462	0.56078	0.55701	0.55507

*Statistically significant at the 5% level.

Note : In each cell, the top figure shows the difference in mean scores (row-column) and the bottom figure shows the critical difference.

Table 11. Mean SLC Scores and Pass Rates for Different Eco-Development Regions

Eco. Development Region	No. of Students	% of Students	Mean Score	CV of Score	Pass Rate (%)
1. Far Western Mountain	269	1.42	45.868	0.182	62.45
2. Far Western Hills	437	2.30	41.666	0.200	34.32
3. Far Western Tarai	497	2.62	44.831	0.222	41.25
4. Mid-Western Mountain	113	0.60	42.352	0.167	18.58
5. Mid-Western Hills	740	3.90	41.534	0.209	25.95
6. Mid-Western Tarai	583	3.07	49.489	0.263	50.09
7. Western Mountain	32	0.17	53.320	0.145	68.75
8. Western Hills	3,187	16.79	47.317	0.211	53.00
9. Western Tarai	1,238	6.52	51.842	0.205	57.11
10. Central Mountain	363	1.91	45.157	0.177	41.05
11. Central Hills	1,869	9.85	45.827	0.243	44.57
12. Central Tarai	2,396	12.62	47.642	0.268	52.63
13. Eastern Mountain	152	0.80	40.485	0.180	27.63
14. Eastern Hills	1,309	6.90	40.983	0.244	31.70
15. Eastern Tarai	3,260	17.17	45.683	0.268	47.70
16. Kathmsndu Valley	2,537	13.37	59.142	0.226	81.36
Total	18,982	100.00	47.880	0.260	51.44

Before moving on to discuss the differences in performance across subjects, let us briefly look at how performance varies according to two other location factors—whether or not the sample school is in the district headquarters, and whether or not it has easy access to a permanent bazaar and motorable road. These community factors could have an impact on student performance, especially in the context of the ongoing conflict. Table 12 summarizes the performance of students for the different location types. First, observe that an overwhelming majority of the students (74%) live outside the district headquarters. And the pass rate of this majority is just 46%, around 10% below the 66% pass rate of the students living in the district headquarters. The average SLC scores in these two locations are also quite different. More

specifically, the average score of students from outside the district headquarters is 6.5 point lower than that of the district headquarters students. Furthermore, this difference is statistically significant at the 5% level.

Table 12. Mean SLC Scores and Pass Rates by Location

Location	No. of Students	% of Students	Mean Score	CV of Score	Pass Rate (%)
Total	18,982	100	47.880	0.260	51.44
Outside district headquarters	13,981	73.65	46.165	0.253	46.28
In district headquarters	5,001	26.35	52.672	0.251	65.89
Difference			6.5064*		
Critical Difference			0.39097		
Total	18,099	100	47.953	0.261	51.70
Not near bazaar & motorable road	6,299	34.8	43.769	0.220	41.48
Near bazaar & motorable road	11,800	65.2	50.187	0.265	57.15
Difference			6.4178*		
Critical Difference			0.37187		

*Statistically significant at the 5% level.

Note : In each cell, the top figure shows the difference in mean scores (row-column) and the bottom figure shows the critical difference.

One may recall that access to a permanent bazaar and motorable road is an indicator of urban amenities available in the area. Interestingly, over 65% of the students live in areas that have these minimum urban facilities. It must, however, be emphasized that these two characteristics alone are not adequate for categorizing an area as urbanized. There is clearly a very large difference in SLC pass rates (16%) between these two types of areas. The difference in average scores is also relatively large (around 6.4 points) and statistically significant at the 5% level. These results suggest that some of the inter-eco-development region differences in scores might partly be a consequence of the differences in urban amenities across these regions.

5.4 Student Performance in Different Subjects

This Study on Student Performance in SLC focuses mainly on student performance in the overall SLC examinations rather than on student performance in individual subjects. But it is not possible to gain a complete understanding of the determinants of SLC performance without looking at individual subjects as well. Based on summary statistics published by OCE (2002) in the past, it would be reasonable to conclude that the performance of students in the SLC examinations varies considerably across subjects. Qualitative evidence based on discussions with students and teachers, as well as quantitative evidence based on OCE data indicate that students have historically found some subjects (Mathematics, English, and Science) more challenging than others.

The pass rates and average SLC scores for the overall SLC examinations as well as for individual subjects are presented in rows 3-5 of Table 13. Note that, as expected, the pass rates for Mathematics, English, and Science are lower than the pass rates in other subjects. Interestingly, although the pass rates in Nepali and Social studies are relatively high, the average *scores* in these subjects are in the low range.

This can most likely be explained by the grading practices in these particular subjects—while exam markers have no problems giving passing scores to deserving students, they rarely assign scores above 90 even to the best students. Note that Mathematics is at the bottom of the list in

terms of both average score and pass rate. The low score in Mathematics is particularly troubling since it is possible for students to secure close to a perfect score in this subject.

Table 13. Mean SLC Scores for Different Subjects

Student Group	All Subjects	Nepali	English	Math	Science	Social	HPE
All students							
Pass rate (%)	51.53	92.44	76.19	63.01	81.51	89.33	98.08
Score	47.93	44.48	45.11	37.09	49.54	43.22	62.02
CV of score	0.260	0.265	0.386	0.581	0.301	0.288	0.189
Gender							
Female							
Pass rate (%)	45.81	91.78	73.85	56.68	78.83	87.14	97.95
Score	46.23	43.93	43.57	33.46	47.53	41.64	61.11
CV of score	0.258	0.267	0.392	0.607	0.302	0.295	0.190
Male							
Pass rate (%)	56.01	92.98	78.10	68.17	83.69	91.13	98.19
Score	49.26	44.92	46.36	40.02	51.18	44.49	62.76
CV of score	0.258	0.263	0.379	0.551	0.296	0.279	0.188
School Type							
Public							
Pass rate (%)	41.74	90.97	70.71	56.15	77.81	87.03	97.66
Score	44.16	42.27	39.10	31.71	45.49	40.74	59.26
CV of score	0.221	0.257	0.327	0.571	0.272	0.281	0.180
Private							
Pass rate (%)	88.02	98.31	98.06	90.53	96.35	98.53	99.75
Score	61.91	52.75	67.70	57.30	64.78	52.54	72.38
CV of score	0.185	0.218	0.199	0.374	0.211	0.220	0.133

Another observation worth highlighting is the relatively high score in each of the three subjects with a practical component, namely English, Science, and HPE. The high scores in these subjects are most likely due to the uniformly high scores assigned to students in the practical component of the examinations in these subjects.

The coefficients of variation in the various subjects also provide interesting information on the performance of the students. As can be seen, the CV for Mathematics is distinctly higher than that in other subjects. The implication of this finding is that this subject with the lowest pass rate is also the subject with the largest variation in scores among students. Also notice that the performance varies a lot across students in the other two difficult subjects—Science and English—as well. The least variation in school performance is in HPE, followed by Nepali and Social Studies.

There are a couple of additional interesting observations that can be made from the first five rows of Table 13. The first is that while the pass rates in individual subjects are relatively high (they range from 64 % in Mathematics to 99 % in HPE), the overall SLC pass rate is much lower (52%). Most likely, this difference between pass rates in individual subjects and overall SLC pass rate is related to the fact that a student receives a failing mark in the overall SLC examinations if she fails in any single subject. In other words, the failure rate in the SLC examinations would look less alarming if there were a system of certification in individual subjects instead of in the overall SLC examinations.

The second observation is related to the average performance of students in HPE. The pass rate of 98% in this subject is distinctly higher than the pass rates in the other subjects. Furthermore, the variation in pass rates across students is the lowest in this subject, as indicated by its coefficient of variation 0.189. Also note that the average score in this subject is around 25% higher than the score in Science, the subject with the second highly scores. These figures clearly indicate that the difficulty level across subjects is not uniform suggesting a need to reexamine the course contents of the various subjects.

Figure 8. Subjectwise Average SLC Scores – Public vs Private

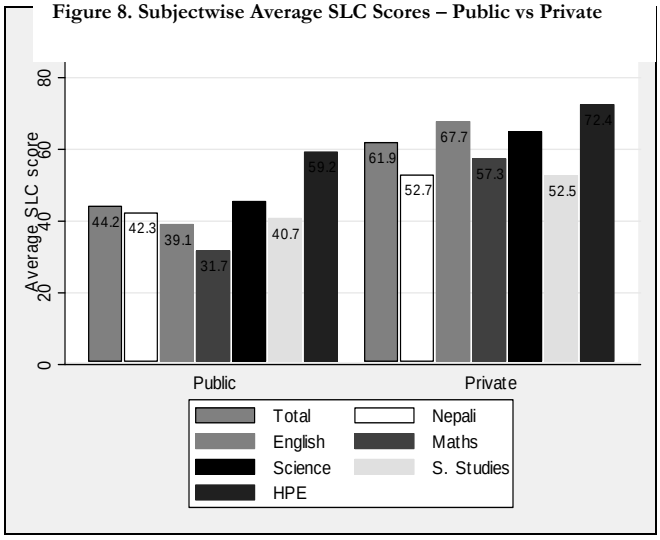
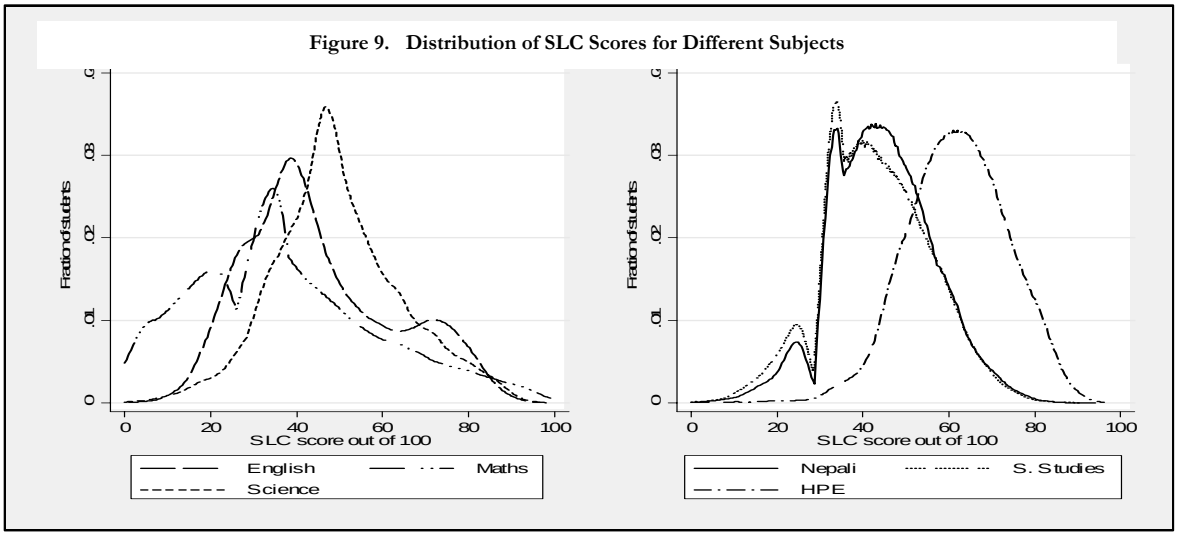


Table 13 also presents information on the subjectwise performance of males versus females and public vs. private school students. Note that the performance of females is poorer than that of males in each subject in terms of both pass rate and average score. And the gender gap in performance is especially high in Mathematics. Furthermore, the variation in scores across females is greater than the variation across males as indicated by the higher CV values for the former. The differences between private and public schools exhibit the same pattern seen for males and females. More specifically, the performance gap between public and private schools is in favor of the latter in each subject. And again, the gap in particularly large in Mathematics. These differences in subjectwise scores between public and private schools can also be seen clearly from Figure 8.

The distributions of scores for the six subjects are shown in Figure 9. The curves in this figure are basically consistent with the information presented in Table 13. Note that the curves for English and Maths are clearly skewed to the right, indicating a concentration of student scores in the low range (high failure rate). The curve for HPE, on the other hand, is heavily skewed to the left. The relative spreads of the curves are also consistent with the CV figures in the table.

Figure 9. Distribution of SLC Scores for Different Subjects



Two particularly interesting observations can be made from Figure 9. First, note that the curve for Mathematics is distinctly higher than the curves for the curves for English and Science in the highest score range (e.g., above 95), even though Maths lags far behind other subjects in terms of average score and pass rate. This observation provides some evidence in support of the argument that while a student can get up to a perfect score in Maths, there are implicit caps on the maximum scores for Science and English. Second, observe that there are dips in the curves for Maths, Nepal, and HPE in the pass score (32) range while the curves for the remaining three subjects are smooth in this range. One potential explanation for the dips in the first three subject curves is the practice of awarding grace marks to help borderline students pass the examinations. Judging from the jumps in these curves, it seems that a large percentage of the students who would otherwise have failed are awarded borderline passing marks, either at the discretion of the marker or later through the official policy of awarding grace marks. As for the remaining three subjects, each of which has a practical component, it can be argued that the practice of generally awarding high scores in the practical component (which is graded separately from the theory component) results in a smoother distribution of scores for these subjects.

The results discussed in this chapter suggest that the SLC performance of students does indeed vary significantly across school types, genders, ethnicities, and school locations. Hence, the evidence provided here supports the theoretical framework, which identifies school type, gender, ethnicity, and school location as potential determinants of student performance. The next section will further analyze the relationship between these factors and student performance, taking into account other intervening variables as well.

6. RELATIONSHIP BETWEEN SLC PERFORMANCE AND DETERMINANTS OF PERFORMANCE

The primary goal of this section is to analyze the relationship between student performance and the various determinants of performance. As a first step in this analysis, we present the descriptive statistics for the performance determinants used in this study. Then—the most important section in this chapter—presents the OLS and Logistic regression results that show the relationship between aggregate SLC performance and the various factors. The approach taken here involves starting with a relatively simple regression model with only a few determinants and progressively adding different sets of determinants to ultimately construct the final and most comprehensive model.

6.1 Overview of the Determinants of Student Performance

The discussion here focuses on the descriptive statistics for these variables. As might be expected from any dataset of this size, there are missing observations in many of the variables. And since the missing observations in different variables are associated with different individuals, the number of individuals that need to be dropped when performing the regression analyses increase with the number of variables included in the regressions. In other words, the descriptive statistics for these variables differ according to the regression models being used. Annex 1 presents the descriptive statistics of the determinants, but only for those individuals included in the most comprehensive regression used in this study.

The second and third columns of Annex 1 list the means and standard deviations of the various performance determinants for the whole sample. The next four columns present the same information for successful and unsuccessful SLC students separately. As school inputs and school process variables are the most interesting factors from a policy perspective, they are the first two groups listed in the table. Most of the figures in Annex 1 are self-explanatory. Furthermore, a number of variables presented here have already been discussed earlier. Hence, only some of the variables in Annex 1 will be discussed below. Figures that either need further clarifications or are particularly interesting from a policy perspective will be given special attention.

The first group of explanatory variables deals with school and teacher inputs. The data indicate that, on average, approximately Rs. 3,930 are being spent annually on each student in the sample. The majority of the sample schools, however, actually have far lower expenditures, especially in the case of public schools.[15] The figures for the next variable indicate that the average student-teacher ratio in secondary school is relatively low at 37 students per teacher. But observe from columns (4) and (6) that there is a substantial difference in both expenditure per student and student-teacher ratio between the samples for successful and unsuccessful students. Similar differences can be observed for most of the other variables as well, indicating that there is a correlation between these variables and performance in the SLC examinations.

Continuing with school resources, note that, on average, students have to wait a total of 20.5 days (total delay for Grades 9 and 10) after the school year has begun before receiving their full sets of textbooks. Furthermore, the average wait for the weaker students is 25 days, an 11 day extra wait compared to the stronger students. Interestingly, however, there is little difference between the two groups of students in terms of the next variable *Pukki buildings*—in both cases around 90% of the students studied in schools with Pukki secondary school buildings. So it is unlikely that this indicator of physical infrastructure has a significant impact on student performance. But there is a substantial difference between these two groups of students in terms of the adequacy of library facilities and science labs. While less than 29% of the weaker students enjoy access to a proper library, around 41% of the stronger students have adequate library facilities. The percentage of students in schools with adequate science labs is dismally low—only 13%. The percentage is even lower for the weaker students. The remaining school input variable listed in the table is *Grade 10 class size***.** Considering that the average class size is 78 students, the difference in class size between the two student groups is not very large.

When it comes to teacher inputs, the figures for all the variables are quite striking. First, observe that, on average, secondary school teachers have substantial teaching experience (14.5 years). Furthermore, there is virtually no difference in teaching experience among the teachers of the two student groups. These figures indicate that lack of teaching experience is not a problem at the secondary school level and that this variable most likely cannot even partly explain the differences in performance across students. The quality of the experience, however, might be questionable. But this aspect of experience is not captured by our data. The mean for the next variable shows that approximately 58% of secondary school teachers have B. Ed. degrees. Interestingly, the percentage of B.Ed. teachers is higher for the *poor* performance student group than for the stronger students, indicating, at best, the irrelevance of this degree in effective teaching. The statistics for the teacher training variables are equally surprising—the poorly

[15] The average annual expenditure per student for over 75% of the public school students is less than Rs. 3,200.

performing students appear to have faced "better" trained teachers than the other group. This apparently strange result might be partly explained by the fact that teachers in private schools—the schools with better SLC performance—are not required to have B.Ed. degrees and generally have limited access to the different training programs.

Among the school process factors, the summary statistics for the academic policy variables are particularly interesting. Observe from the *Maximum failures allowed* variable that, on average, even students who fail one to two subjects are promoted to higher Grades in secondary school. But the lower mean for the stronger student group indicates clearly that the promotion policy is more stringent in schools with more successful students. Similarly, the students with better performance in the SLC examinations are tested more often (12 times per year) than weaker students (8 times per year). The academic policy variable that stands out the most, however, is homework requirement policy. On average, only 46% of the students are from schools where regular homework assignments are given. And this figure is substantially different for the two groups of students suggesting that homework policy might be playing an important role in the students' learning process.

As for the other school process variables, it might be pointed out that there is very little difference between the two groups of students in the mean for the variable *Head teacher effectiveness,* suggesting an absence of a relationship between this variable and student performance. The average score of around 2.8 (on a scale of 1 to 4) coupled with the very small standard deviation for this variable indicates a relatively uniform tendency among respondents to rate the head teacher favorably. Interestingly, the teachers for around 33% of the students report that they use an interactive teaching approach in the classroom. And this percentage is higher for the better students. Similarly, the average teaching load faced by teachers and the average number of weeks of instruction reported by schools are also slightly higher for these students. But note that the average teaching load for the whole sample is only 3.45 hours per day suggesting that most teachers are not overburdened with teaching load.

One of the issues raised by secondary school teachers is that the current SLC course is too vast to be properly covered in the 9th and 10th Grades. This claim is supported to some extent by the data which indicate that, on average, only 93% of the course is completed by schools before the SLC examinations. And the course completion rate is lower for the weaker student group.

Among the student characteristics variables, the performance differences among students from different ethnic groups and between the sexes have already been discussed in earlier section. Now let us look at three student characteristics dealing with the study habits of the student. The first is the percentage of school days missed in Grade 10. Observe that there is a noticeable difference in the means for this variable between the stronger and weaker students, with the latter missing around 7.6% of the school days compared to 5.7% in the case of the former. The second is the average number of hours spent by the student on her studies during the six months preceding the SLC examinations. The mean for this variable is relatively large—around 5.2 hours per day. And as expected, the figure is larger for the stronger students. The mean for the third variable in this category, *Read magazines regularly*, indicates that only around 19% of the weaker students read magazines and newspapers regularly compared to 31% for the stronger students. There is also a substantial difference between the two student groups in terms of their academic ambition. While around 50% of the stronger students expect such a master's or higher degree, only 33% of the weaker students have such expectation.

Observe that there are noticeable differences between the two student groups in terms of the variables dealing with the students' situation during the examinations as well. And all of these differences are in the expected direction. For example, while 29% of the weaker students had to prepare their own food during the exam period, only 15% of the stronger students had to do so. Similarly, around 17% of the weaker students report being sick during this period compared to just 13% among the stronger students.

All of the family input variables also have mean values that differ between the two student groups in the expected direction. In particular, note that there is a Rs. 12,000 difference in annual family expenditure between the weaker and stronger students. Similarly the mean wealth for the stronger student group is higher by around Rs. 690,000 compared to that for the weaker group. These figures suggest that a family's economic background is indeed an important determinant of performance. The number of SLC graduates in the family and the number of books at home are also higher for the better students. Finally, observe that the amount of time students have to spend on household chores daily is only 1.8 hours. But the weaker students report spending almost 40% more time on household chores than the stronger students.

The next set of variables in Annex 1 represents the national, community, and school contexts. Focusing on the school-related context variables, first observe that the average school size is 731 students and that it is larger for the weaker student group. The second interesting observation is the difference in the mean for the variable *No. supervision visits* between the two student groups. While the average number of school supervision visits per year by various Government officials is 10.2 for the weaker student group, the comparable figure for the other student group is only 9.7. But the lower number of visits for the stronger student group might actually be related to the fact that many of the better students are from private schools—schools where such visits seldom take place. The number of PTA meetings, however, is larger for the latter student group although, on average, there are only around 2 such meetings per year in both cases. The differences in the other context variables between the successful and unsuccessful student groups are also in the expected direction. For example, compared to the unsuccessful student group, the successful group has a higher HDI, suggesting that the community's socio-economic status has a positive influence on student performance. The figures for the other community context variables indicate that successful students come from more urbanized and centrally located areas.

The discussions about student performance in the previous section and about the various determinants in this one suggest that the factors listed in Annex 1 might indeed be related to student performance. It should be noted, however, that the observed relationships between the factors and student performance in these discussions are based on analyses that look at one factor at a time. Such as approach to analyzing the relationship between each factor and performance fails to account for the influence of other factors that might also be related to performance. Hence, it is not possible to draw conclusions regarding the existence of relationships between performance and the various determinants based on Annex 1 alone. One efficient way of controlling for the influence of other intervening factors while analyzing the relationship between any single factor and student performance is using a multiple regression model. The following two sections use multiple regression techniques to analyze the relationship between performance and the various factors.

6.2 Relationship between Aggregate SLC Performance and Various Performance Determinants

OLS Regression Results for Aggregate SLC Performance

Annex 2 presents the Ordinary Least Squares regression estimates. A number of alternative specifications of the model are presented in the table so that readers may judge the robustness of the conclusions reached. The average SLC score (out of 100) of the student is the dependent variable in all regressions shown in the table. If an explanatory variable has a statistically significant association with student performance, then the estimated coefficient for that variable is marked with one, two, or three asterisks depending on the significance level. [16] The associated p-value[17] is given in parentheses next to the coefficient. The standard errors used in the computations of the p-values have not only been corrected for heteroscedasticity, but they also take into account the stratification and clustering used in the sample design. Note that the sign and magnitude of the coefficient associated with any explanatory variable indicate the direction and strength of the variable's relationship with student performance.

Basic Model: Relationship between School Inputs and Student Performance

Model (1) in Annex 2 is the most parsimonious specification and includes only school input factors as explanatory variables. The most important implication of the results from this regression is that school inputs do matter! In particular, observe that the coefficient on the log of expenditure per student is positive and statistically significant at the 1% level, which indicates that increasing the expenditure per student has a positive impact on student performance. More specifically, the coefficient value of 2.68 says that, on average, a one hundred percent increase in expenditure per student is associated with a 2.68 point increase in SLC score, assuming there are no changes in the other school inputs. Similarly, the table also shows that student-teacher ratio has a statistically significant (at the 5% level) negative relationship with student performance. Hence, there is a possibility that increasing the number of teachers can have a positive impact on student performance.

The other variables that are statistically significant either at the 5% or 1% level are delay in textbook delivery, existence of an adequate library, and percentage of teachers who have taken the 10-month SEDU training. As expected, delay in textbook delivery is associated with lower score in the SLC examinations, while an adequate library appears to help raise the score. Recall that, on average, students have to wait for 20 days (combined wait in Grades 9 and 10) before they have access to the full set of textbooks. Hence, the negative impact of the delay in textbook delivery is a serious problem. Similarly, since only 40% of the students find their libraries adequate, the lack of proper library facilities is negatively affecting the majority of students. But perhaps the most interesting policy-related result is the negative relationship between performance and the percentage of teachers who have taken the 10-month SEDU training. One explanation for this negative association might be the absence of teachers in the school while the

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[16] The significance level is an indicator of the confidence we have in the observed result—the smaller the significance level, the more confident we can be that the observed result is not just due to pure chance. For example, if a coefficient is statistically significant at the 5% level, it means that there is less than 5% chance that the result we observed is due to pure luck. In other words, we can be at least "95% confident" that there is indeed a relationship between the associated explanatory variable and the dependent variable.

[17] A coefficient is significant at the X% level if its p value is smaller than X. For example, the pvalue of a coefficient must be smaller than .05 for the coefficient to be significant at the 5% level.

teachers are on training. Another potential explanation for the insignificant or negative impact of training might be the failure of teachers to effectively apply the skills gained from the training to the classroom. Although not statistically significant, observe that the coefficient on the average number of days teachers spend on short-term training is also negative. Again, the explanation for this counter-intuitive result might lie in the loss of teaching days associated with training and in the ability of teachers to translate knowledge into practice.

There are two other factors that have a statistically significant, albeit weak, relationship with student performance: "pukki" buildings in secondary school and the existence of an adequate science lab. A school's physical facilities generally do not seem to have a significant association with student performance in the literature. Perhaps the result observed here can be attributed to the fact that the 10% of schools that do not have "pukki" buildings are also the most disadvantaged schools in other aspects. So we should expect the relationship between building type and performance to be insignificant when we account for other factors as well.

The results of this first regression are interesting not only for the significant relationships they show but also for the relationships they don't show. In particular, note that the class size in Grade 10 does not seem to matter—a result that is consistent with the evidence found in the international literature. Similarly teacher turnover, average teaching experience of the teachers and the fraction of teachers with B.Ed. degrees also do not have statistically significant associations with performance. Note that the model also includes the squared teaching experience as an explanatory variable to account for potential non-linear relationships between experience and performance. But the coefficient on the squared term is also insignificant. The insignificance of the B.Ed. degree indicated in this regression raises questions about the quality and relevance of the training being delivered to future teachers by the Faculty of Education at the university level in Nepal. And the insignificance of teacher turnover suggests that the lack of continuity suffered by students as a result of teacher turnover is perhaps not very important.

The regression results discussed above have given some interesting insights into the relationship between school inputs and student performance. But they have to be viewed with caution since the model does not control for other important factors that could affect student performance. Furthermore, observe that the adjusted-R^2 of the model is only 0.168 indicating that the variations in school inputs can explain, at most, only 16.8% of the variation in student performance. But if the statistically significant coefficients in Model (1) continue to remain significant even when other variables are included in the regression, then our confidence in the observed relationships would be much stronger.

Refining the Model: Adding School Process Variables

The regression in Model (2) is a refined version of Model (1). Apart from the variables in Model (1), this new model also includes a set of school process factors among the explanatory variables. Note that now the absolute values of the significant coefficients of all the variables from Model (1) are smaller than before. This is to be expected since the school process variables can now explain some of the performance differences across students that were earlier being picked up by the school input variables alone. Also observe that the addition of school process factors has greatly increased the explanatory power of the regression as indicated by the substantially higher adjusted-R^2 of Model (2).

Looking at individual variables, the coefficient on the log of expenditure per student and the delay in textbook delivery are again statistically significant at the 5% level, indicating that these variables are significantly associated with student performance even when school process factors

are taken into account. But the variables representing building type, library facilities, and science lab facilities no longer show a significant relationship with performance. Also note that the coefficient on student-teacher ratio is now significant only at the 10% level. The coefficients on the variables dealing with teacher training are also significant only at the 10% level.

Among the school process variables, note that the only school-level variable—head teacher effectiveness—is not significantly related to performance. Most of the other school process variables in this regression, however, do have a statistically significant relationship with performance in the expected direction. For example, the results indicate that, on average, an increase in the annual weeks of instruction by one week is accompanied by a 0.21 point increase in SLC score, assuming the other factors in the regression are unchanged. As for school academic policies, the greater the number of subject failures allowed for class promotion, the poorer the performance in SLC examinations. On the other hand, requiring students to do home assignments regularly and testing them frequently seems to help their performance. More specifically, there is a 1.8 point difference in score between students required to do homework assignments regularly and students not required to do so.

It is interesting to note that the regression shows a positive and statistically significant association between interactive teaching style and SLC scores, a finding that supports modern teaching approaches. It may be recalled that only around 33% of the SLC students are exposed to this teaching style. The coefficient on average teaching load, on the other hand, is statistically insignificant. And as might be expected, the SLC course completion rate has a positive and significant relationship with performance. Recall that the average course completion rate is only 93%. And it turns out that only around 30% of the schools (most of which are private schools) are able to complete the whole course before the SLC examinations. Hence, an overwhelming majority of SLC students have been suffering from the inability of their schools to complete the course in time.

Note that the regression also includes two "interaction" variables: the product of instruction time and class size, and the product of course completion rate and family expenditure. The interaction term between instruction time and class size is included here since there is some evidence in the literature that the effect of additional instruction time is smaller when classes are small than when they are large (Coates, 2003). But although the coefficient for this variable has the expected negative sign, it is statistically insignificant. The second interaction variable basically tests the hypothesis that the negative impact of low course completion rate is greater on students from economically worse off families since they are less able to afford academic assistance at home. And, indeed, the negative sign on this statistically significant coefficient indicates that the effect of improved course completion rate is smaller when family expenditure is larger.

The last set of explanatory variables in this regression represents the highest degree expected by the student at the time she was taking the SLC examinations. As mentioned earlier, it reflects the student's attitude towards academics and is the sole indicator of student-level school process in our model. The positive and significant coefficients indicate that, on average, a student who ultimately expects to get a Bachelors, Masters, or higher degree has a better performance than a student who expects to get an SLC degree only. In particular, the average score of students expecting a Masters or higher degree is around 6.3 points higher than students who do not have ambitions beyond SLC. And judging from the progressively smaller coefficients on Bachelors and Intermediate degrees, it would be reasonable to say that the influence of academic ambition increases with the height of the ambition. Interestingly, the coefficient on "No idea" is statistically significant and second only to the coefficient on Masters degree in terms of

magnitude. The reason for this is most likely due to the fact that since around 35% of the students in this category are from private schools, they are likely to perform well on average. In contrast, among the students choosing Intermediate/+2 as their ultimate goal, only 10% are from private schools. Similarly only 12% of the students whose ultimate goal is to get a Bachelors degree are private school students.

Refining the Model: Adding Student Input Variables

Model (2), while comprehensive in its treatment of school factors, does not take into account the influence of student and family-related variables on student performance. Regression results upon adding student factors among the explanatory variables are given by Model (3). Again, the adjusted-R^2 value shows that there is a substantial increase in the explanatory power of the regression in moving from Model (2) to Model (3). In terms of the statistical significance of school input and process variables, there is a remarkable consistency between Models (2) and (3). Except for the variables dealing with teacher training, the coefficients of all other variables that were significant in Model (2) remain significant in Model (3) as well.

The main difference between the results of the two models is that now the library variable and average teaching load of teachers are statistically significant at the 10% level. Recall that the existence of an adequate library had a significant association with student performance in Model (1) as well. While the observed positive relationship between average teaching load and student performance looks counter-intuitive at first glance, the explanation may lie in the limited number of hours teachers are required to teach on average. Although teachers are overloaded with teaching responsibilities in some schools, the average teaching load in our national sample is only 3.45 hours a day. Furthermore, the data show over 75% of the teachers teaching for less than 3.75 hours each day. In other words, the vast majority of the teachers are not overloaded with teaching responsibilities. Hence, it appears that, on average, an increase in the teaching load can help increase the instruction-time without hurting teaching quality, thereby creating a better learning environment for the students.

Most of the student input variables in Model (3) show a statistically significant relationship with student performance. The negative coefficient on student age indicates that, on average, older students perform poorly compared to younger students. This might partly be due to of the relatively old school-going population in rural and remote areas. The positive and significant coefficient of 1.8 on sex indicates that, on average, the performance of males is 1.8 points higher than that of females even after accounting for the various school factors and other student characteristics included in the regression. This result suggests that the explanation behind the poorer performance of girls may lie elsewhere, as for example, in the cultural practices of the family that put girls at a disadvantage. The relative performance of girls will be discussed further later in the chapter.

The next student characteristic included in this model is the ethnicity of the student. It is represented by five dummy variables which allow us to compare the performance of each of these five ethnic groups with that of Brahmans and provide potential explanations for the inter-ethnic differences in performance. Observe that the coefficient on Chhetris is not statistically significant, indicating that the difference in SLC performance between Brahmans and Chhetris is not significant once the school factors and other student characteristics are taken into account. The performance for Newars, on the other hand, is significantly better than that of Brahmans, albeit only at the 10% significance level.

Interestingly, note that the coefficient on Dalits is statistically insignificant in regressions (3) through (6), even though the results in an earlier section clearly show Dalits lagging behind all the other ethnic groups not only in terms of enrollment but also in terms of SLC scores. This finding suggests that while the socio-economic disadvantages (including overt discrimination) faced by Dalits are most likely contributing to their disturbingly low enrollment rate in secondary school, such disadvantages do not have a significant impact on the Dalits taking the SLC examinations. In fact, their poor performance in SLC examinations can be largely explained by the different school- and student-related variables included in Model (3). Although it is not clear why ethnicity itself is not a significant determinant of performance in the case of Dalits, one explanation might be that the few Dalits who make it to the SLC examinations are a self-motivated select crowd that has learned to deal with the mainstream society's discriminatory behavior against them.

Another interesting finding regarding ethnicity is the significant negative association between Janjatis and performance. The results indicate that, on average, the SLC score of a Janjati student is 1.3 points lower than that of a Brahman student, even after controlling for the other variables in the regression. Clearly, school and student factors alone do not explain why the performance of Janjatis is poorer. Also note that, on average, the performance of the "Others" group is also below that of Brahmans. But since the "Others" group includes all ethnicities not included in the other five groups, the observed difference does not give us any valuable insights into the inter-ethnic performance disparities in the nation. Note that since ethnicity accounts for differences in mother tongue as well, the coefficient on the variable *Language* is statistically insignificant.

The following six variables in the model deal with the student's study habits, educational background, and peer influence. Interestingly, all six variables have a statistically significant relationship with student performance. As might be expected, the greater the number of school-days missed, the poorer the performance. On the other hand, there is a positive relationship between SLC score and the number of hours spent studying each day. More specifically, a one hundred percent increase in the number of study hours is associated with a .475 point increase in SLC score. One implication of this finding is that while more hours of studying positively influences test scores, the impact of an increase in the number of hours a student spends studying diminishes as she spends more and more time on her studies. Another interesting finding is that a student who reads magazines and newspapers regularly has a higher score than a student who does not do so. As the variable *Read magazines regularly* is an indicator of reading habit, the above finding highlights the importance of reading habit in the learning process. Peer influence also seems to play an important role in determining a student's SLC performance as indicated by the statistically significant coefficient on *No. of friends passing SLC.*

At first glance, we would expect that the next variable, which shows the total number of months spent on private tuition and coaching in Grades 9 and 10, to have a positive association with student performance. But since weaker students tend to invest more time on private tuition and coaching classes, it is not surprising that the coefficient on this variable is negative. Furthermore, as coaching/tuition classes are often built into the teaching schedule of private schools and are not always identified as tuition/coaching classes, the collected data tend to understate the time spent on tuition and coaching for private school students compared to public school students. This too could be an explanation behind the negative association behind tuition/coaching classes and student performance. The next variable, *No. of Grade repetitions*, is negatively associated with performance. This finding is consistent with the findings in the international literature as well.

The variables dealing with the student's personal situation during the examinations too have a statistically significant relationship with student performance. A student who is able to commute daily to the exam center from her own home should have an advantage over students who live farther away. And, as expected, the coefficient on the variable *Commuted daily* is indeed positive. On the other hand, a student who has to spend time preparing her own food during the exam period has a lower score compared to other students. According to the survey data, over 76% of the students who have to prepare their own meals during the exam period come from homes that too far from the exam center to enable them to commute daily. Hence, it is clear that the current practice of conducting the SLC examinations in a limited number of exam centers is placing many students from rural areas at a severe disadvantage. Finally, observe that the health status of the student and the language she uses for writing the examinations are also significantly related to her performance. The negative coefficient on the variable *Sick* shows that the SLC score of a student who is sick during the examinations is lower than that of other students. And writing the examinations in Nepali (rather than in English) seems to have a negative impact on SLC scores. This result is consistent with the opinions of students, teachers, and SLC test examiners reported earlier.

Refining the Model: Adding Family Input Variables

Model (4) extends Model (3) by adding family input variables among the explanatory variables. Notice that there is only a small increase in the adjusted-R^2 of the regression as a result of this addition. The regression results obtained in this case are highly consistent with those from Model (3)—all the coefficients that were statistically significant in Model (3) continue to remain significant in Model (4) except for the coefficient on the interaction between course completion and family expenditure. In other words, most of the school and student factors that had statistically significant relationships with student performance in the previous model have statistically significant coefficients in this model as well.

Altogether, six out of the eight family input variables included in this regression have statistically significant relationships with student performance. Contrary to expectations, however, the distance of the school from the student's home and the student's living arrangements (whether she is living with both parents or not) do not seem to be related to performance. But the coefficient on the remaining family demographics variable, *Family size*, is significant. Its value of -.245 indicates that a unit increase in family size is associated with a .245 point decrease in SLC score.

Recall from our earlier discussion that students from families with stronger economic backgrounds can be expected to perform better in SLC examinations. The coefficients on both indicators of economic status—*Family's annual expenditure* and *Family's wealth*—are positive and significant as expected. Note that both variables are expressed in log form to account for their potential non-linear relationships with student performance. So the annual expenditure coefficient of .414, for example, says that each 100% percent increase in annual family expenditure is accompanied by a .414 point increase in SLC score. As a 100% increase in expenditure for a poor family amounts to a much smaller sum than a 100% increase in expenditure for a rich family, the above coefficient value indicates a diminishing marginal effect of expenditure on student performance. The same is true for the relationship between wealth and student performance.

The next two variables deal with family's educational background and academic environment at home. Again, it may be recalled that the number of SLC graduates in the family is an indicator of the aggregate educational achievement of the family. And as expected, the regression results

clearly show that this variable is positively and significantly related to student performance. Similarly the number of books at home is an indicator of the academic environment in the family. The positive and significant coefficient on this variable suggests that academic environment at home also plays a role in determining the SLC scores of students. The last variable, *Hours spent on household chores*, is negative and statistically significant indicating that those students who have to spend more time on household chores have lower scores. It is worth emphasizing that, on average, girls in our sample spend around 2 hours on household work each day compared to just 1.6 hours in the case of boys. Hence, it is clear that the lower performance of girls can be partly explained by cultural practices that place the burden of household work primarily on the females.

Refining the Model: Adding Context Variables

Model (5) is the final and most comprehensive specification used in this analysis. Observe that the inclusion of context variables has raised the adjusted-R^2 from .475 to .531, thus increasing the explanatory power of the regression to 53.1%.[18] A total of 15 context variables representing all three nested boxes in the theoretical framework are included in this model.

The school and teacher input variables that continue to show a statistically significant relationship with student performance in this regression are expenditure per student and delay in textbook delivery. Among the school process variables, only homework assignment policy, average teaching load, and the highest degree expected by the student are significant. The variables representing time on task and other academic policies no longer exhibit a statistically significant relationship with performance. Interestingly, like in Models (1) and (2), the coefficient on the average number of days teachers spend on short-term training is again statistically significant and negative. Altogether six of the variables that were significant in Model (4) become insignificant in Model (5). As for the student input variables, all the variables that were significant in Model (4) are also significant in Model (5), except for two variables dealing with the student's situation during the examinations: *Commuted Daily* and *Sick*. And apart from the variable representing the family's wealth, all other previously significant family input variables are significant in Model (5) and as well.

It can be inferred from the increased adjusted-R^2 and the relatively large number of changes in the significance of variables when moving from Model (4) to Model (5) that the context variables play an important role in determining the performance of students. The proxy for national context used here is the SLC batch of the student, which is represented by two variables: *SLC Year 2003* and *SLC Year 2004*. The positive and statistically significant coefficient for *SLC Year 2004* indicates that, on average, the candidates taking the SLC examinations that year had higher scores than students from the 2002 batch.

Among the community context variables, the human development index has a positive and statistically significant association with student performance, as expected. In other words, the socio-economic conditions of the community constitute a significant determinant of student performance. More specifically, an increase of 0.1 in HDI value is associated with a two-point increase in student SLC score. Recall that a straightforward comparison of performance between

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[18] It should be pointed out that an adjusted-R^2 value of .51 is relatively high in comparison to many student-level regressions in the literature. The adjusted-R^2 in Wossman (2000), for example, range from .18 to .22 only. Similarly, the regressions analyzing the achievement level of grade 5 students in EDSC (1999) have adjusted-R^2 values in the range 0.20 to 0.33.

students from district headquarters and elsewhere reveals a statistically significant difference in favor of district headquarters. But as can be seen from the results in Model (5), this difference becomes insignificant once we account for the other determinants of performance. The same is true for the difference in average SLC scores between locations that have a bazaar plus easy access to motorable roads and other less accessible locations. The coefficient on the remaining community context variable—number of private schools in the vicinity—too is not statistically significant.

Moving on to the school context, observe that both learning environment variables—*Quite Neighborhood* and *School Size*—included in the model have a positive and statistically significant relationship with performance. While the explanation behind the better performance of students from schools located in a quiet neighborhood is straightforward, the positive coefficient on school size needs more explaining. Within the Nepali context, larger schools are typically more secure financially and have a greater political clout that enables them to draw upon both private and Government resources more easily. Furthermore, most of the bigger schools are located in bazaar areas that have easy access to motorable roads,[19] giving them greater access to resources. Hence, it is reasonable that the average SLC scores of larger schools should be larger.

Among the school governance structure variables, the number of supervision visits by different officials and the number of PTA meetings per year do not seem to have an effect on student performance. The insignificance of the coefficient on supervision visits in Model (5) raises questions about the way such visits are conducted currently.[20] Serious thought needs to go into making supervision visits more relevant. Similar questions can be raised regarding how PTA meetings might be made more worthwhile.

The other school governance indicator in the regression is school type, represented by two variables: *Public, not fully funded school,* and *Private school*. The coefficients on these two variables allow us to compare the performance of these two types of schools with that of fully Government-funded public schools. The statistically insignificant coefficient on *Public, not fully funded school* indicates that, on average, the difference in performance between students from fully funded public schools and this type of public school is not significant. The average score of private school students, on the other hand, is 8.42 points higher than that of fully funded public schools on average. In other words, these results suggest that the better performance of private schools cannot be fully explained by the differences in the various factors (school, teacher, and student input factors; school process factors; and context variable) included in the model. Hence, there must be some other unique characteristics associated with private schools that enable them to educate their children better. Most likely, these characteristics are school process variables that were not properly captured by the relatively crude indicators of school processes used in our model.

The next set of school context variables in the model deals with the socio-economic characteristics of the student body. More specifically, they show the percentages of four types of disadvantaged students in the school. Hence, we would expect each of these four variables to have a negative relationship with student performance. Interestingly, however, the coefficients

[19] While the average school size in locations with bazaars and easy accesses to memorable roads is 849 students, the average size of schools located in other less accessible areas is only 572 students.

[20] It might be pointed out that the correlation coefficient between student performance and the number of supervision visits is actually negative (-.021) and statistically significant at the 1% level. As shown in Model (5), however, the significance of this association disappears when other factors are taken into account.

on *Dalits/Janjatis*, *Non-Nepali Speakers*, and *Extremely Poor* are statistically insignificant. But the coefficient on *Girls* is negative and significant as expected, indicating that, on average, a student from a school with a higher percentage of girls has a lower score than students from a school with a lower percentage of girls.

The last context variable 2, *Exam room adequacy*, is a composite index representing the adequacy of the exam room in terms of furniture, light ventilation, space, quietness, and drinking water availability. As might be expected, this variable has a positive and statistically significant relationship with student performance, indicating that students taking the examinations in rooms with inadequate basic facilities are at a disadvantage compared to other students. In addition to these context variables, Model (5) also includes 15 dummy variables representing the 16 eco-development regions. The purpose of this set of dummy variables is mainly to control for inter-regional differences in SLC performance.

Refining the Model: Adding Indicator of Prior Knowledge Base

As discussed earlier, a student's prior knowledge base is also an important potential determinant of performance. Model (6) attempts to take this factor also into account by including the student's performance in Grade 9 among the explanatory variables. It should be pointed out, however, that Grade 9 scores of students are based on tests designed, administered, and graded by their individual schools. Hence, these scores are actually not comparable across students from different schools. In other words, the Grade 9 score is only a crude indicator of a student's prior knowledge base. Furthermore, as the survey was able to gather Grade 9 performance data from only 25 of the 28 sample districts for just 5,250 students, the Model (6) results are most likely highly biased and valid only for the sample at hand. As a consequence, this study views Model (5) instead of Model (6) as the final model even though the latter is, in theory, more comprehensive in its inclusion of determinants of performance.[21]

The Model (6) results are largely consistent with those for Model (5). The determinants that have statistically significant relationships with performance in both models are listed in Table 14. Among the school input variables, expenditure per student and delay in textbook delivery continue to have a statistically significant relationship with performance. The average number of days teachers spend on short-term training, however, is no longer significant. As for the school process variables, only one classroom-level variable is significant, namely the highest degree expected by the student. As before, a student who plans to get at least a Masters degree has a higher score than students with lower academic ambitions. The teaching style and average teaching load of teachers do not have significant relationships with performance in this regression.

A large number of student input variables continue to show a statistically significant relationship with performance in Model (6). For example, *Sex* and *Janjati* are again significant, as are *School days missed*, *No. of friends passing SLC,* and *No. of Grade repetitions*. And as might be expected, the student's *Grade 9 score* has a positive and statistically significant relationship with performance. But surprisingly, the variables dealing with study habits and tuition/coaching classes are no longer significant, perhaps because of their strong correlations with Grade 9 scores. Among the

[21] Observe from the increase in the adjusted-R^2 that the inclusion of grade 9 results in the model substantially increases the explanatory power of the regression. But as mentioned above, the results cannot be generalized to the larger population of SLC students since they are based on a biased sample.

indicators for the student's situation during the exam, only *Prepared own food* continues to have a significant relationship with performance.

Table 14. Factors with Statistically Significant Coefficients in Model (5) and Model (6)

School input/process	Student	Family	Context
Spending per student (+)	Age (-)	Family size (-)	Exam room adequacy (+)
Delay in textbook delivery (-)	Ethnicity (- for Janjatis)	Hours spent on household chores (-)	School size (+)
Highest degree expected (+)	Sex (+ for males)	No. of SLC graduates in family (+)	School type (Pvt. school) (+)
	School days missed (-)		
	No. of Grade repetitions (-)		
	No. of friends passing SLC (+)		
	Prepared own food during exam (-)		

Note: + denotes positive and – denotes negative relationship with student performance

Family size, *No. of SLC graduates in the family*, and *Hours spent on household* chores are the family factors that remain significant. And of course, the family's economic status also has a significant role with performance, although now it is *Family's wealth* rather than *Family's annual expenditure* that makes a difference. Among the context variables, observe that now the number of private schools in the vicinity has a statistically significant negative effect on performance. This points to the possibility that the benefits private schools bring from the competition they provide are perhaps overwhelmed by their tendency to divert family resources away from public schools where the majority of the students study. The other context variables with statistically significant coefficients are *School size*, *Private school,* and *Exam room adequacy*. Interestingly, the percentage of non-Nepali speakers among the student body now has a negative and statistically significant relationship with performance.

Relative Importance of the Different Factors and Policy Implications

Before proceeding to discuss the regressions using pass/fail status as the measure of student performance, let us briefly take a second look at Model (5)—the final and most important model for this study. Observe that apart from the regression coefficients associated with each variable, the results also include the corresponding standardized coefficients. Recall from the discussion in Chapter 2 that the standardized coefficients in a regression can be compared with each other to give an indication of the relative importance of the different explanatory variables. Such comparisons can be especially important from a policy perspective. Annex 3 ranks the statistically significant variables from Model (5) according to the magnitude of the standardized coefficients and indicates whether or not they can be manipulated through policy intervention.

The school context variables school type (Private school) and school size have the strongest effect on student performance. The implications of the statistical significance of Private school have already been discussed in the earlier subsection. The next eight variables in the ranked list contain two other context variables as well, namely, the district HDI and the year the student took the SLC examinations (SLC year 2004). Hence, context variables are clearly very important

determinants of student performance. Following school type and school size are two student-related variables representing peer influence (Number of friends passing SLC) and past academic performance (No. of Grade repetitions), respectively. Two other student variables, Sex and Ethnicity (Janjati), also make it to the top-ten list. The family background variable No. SLC graduates in family, also ranks quite high. The only school resource or school process variable among the top ten factors is the highest degree expected by student (Masters +), which although listed under school process, could also be simply viewed as a student factor. Hence, like in many other studies in the international literature, the above results imply that student characteristics and family background play a relatively more important role than school factors in determining student outcomes.

Let us now focus on the policy variables. These variables are identified by the symbol P in column (4) of the table. Note that apart from Sex and the ethnicity variable Janjati, all the other variables marked "P" can be influenced by policy intervention. But these two variables have, nevertheless, been included in this list to highlight the fact that while Government policy cannot, of course, influence the gender or ethnicity of a person, it can nevertheless bring about a change in the disadvantages faced by students on account of their gender or ethnicity.

As can be seen from the table, Sex clearly has the strongest relationship with performance among the 12 statistically significant policy variables. As mentioned earlier, the statistical significance of this variable implies that the poorer performance of girls cannot be explained by the gender differences in the other variables included in the regression. Hence, there is a strong possibility that their lower performance is a consequence of the differential and discriminatory treatment they face in society, both at home and at school. For example, while our analysis controls for the differences between boys and girls in the amount of time spent on household chores, it does not take into account other cultural norms and behaviors that can have a negative impact on the academic lives of female students.

Note that, apart from females, Janjatis are also a population group whose SLC scores are statistically significantly lower than those of the dominant population group. As in the case of females, the poorer performance of Janjatis persists even when we control for a host of school and out-of-school factors in the regressions. Hence, the explanation for their poorer performance, too, probably lies elsewhere, as, for example, in the negative differential treatment by the dominant groups in society and in certain intra-cultural characteristics that might not be conducive to academic work. The main policy implication of these findings is that while general interventions aimed at improving the economic status of communities and increasing the resources of schools might be enough to bridge the performance gaps between other population groups, such polices will not be adequate in the case of girls and Janjatis. Targeted policies aimed specifically at girls and Janjatis are necessary to bring the performance of girls and Janjatis at par with the performance of boys and other ethnic groups, respectively.[22]

It must, however, be emphasized that the same policy prescriptions apply to Dalits as well, even though the performance gap between Dalits and Brahmans becomes statistically insignificant after accounting for the different factors in the regression models. The argument in support of targeted assistance for Dalits is based on the participation rate of this group in the SLC examinations. The percentage of Dalits in the study sample is very low (only 2.3%)—many times

[22] It would, of course, be necessary to make a distinction between relatively privileged and underprivileged Janajati subgroups when devising intervention measures.

lower than their proportion in the national population—indicating that the vast majority of Dalits are deprived of the opportunity to get a high school education. The regression results only focus on the limited number of Dalits who do get the opportunity to sit for the SLC examinations, and do not take into account the effects of negative differential treatment and discriminatory behavior on the Dalit students who could not progress to the 10th Grade. Given that discriminatory behavior against Dalits is far more severe and blatant than the behavior against other marginalized population groups, it is very important that the Government increase it efforts to help Dalit students at all level of schooling.

Among the remaining 10 variables that can be influenced through Government intervention, *Homework required* has the strongest relationship with performance. Recall that currently, only 46% of the students are exposed to regular homework in their schools. The percentage for public school students is even lower. Hence, the Government could significantly help in improving the SLC performance of students by making it feasible and mandatory for schools to continuously assess student achievement through regular homework assignments. The other school-related statistically significant policy variables include *Average teaching load*, *Spending per student*, *Average short training days,* and *Delay in textbook delivery*.

The finding that Spending per student is positively associated with performance means there are grounds to argue in favor of increasing the overall spending on schools in the nation. The specific areas that should be targeted for increased budgets, however, cannot be determined from the current study. As discussed earlier, the positive association of average teaching load with performance implies that teachers are working more seriously in schools where the teaching load is reasonably intense. Given that the current average teaching load is not very high, this result suggests that there is a need to redistribute teaching load across public school teachers more equitably.

The main policy implication of the negative association between Average short-term training days and performance is that the Government needs to seriously reevaluate its current emphasis on short-term training if the training programs cannot ensure the effective transfer of material delivered in the training halls to the classroom. The final variable in this category, Delay in textbook delivery, is an indicator of the administrative inefficiency and neglect on the part of the Government in ensuring timely delivery of the most essential educational materials to schools and communities. Since the delay in receiving textbooks has a significant negative impact on student performance, playing a proactive role in ensuring speedy delivery of books to all schools is a straightforward way for the Government to help students perform better.

Among the remaining five policy variables, three (School days missed, Nepali medium, and Family's annual expenditure) represent student/family characteristics. Note that the number of school days missed depends largely on the student's personal circumstances, family attitude towards education, and the student's interest in learning. But there is no doubt that a strict attendance policy in school and increased interaction of the school's staff with the students' families can reduce absenteeism among students. The negative association between the Medium of exam and student performance suggests the need to further standardize the grading practices among examiners. As the majority of the students write their examinations in Nepali, the tendency of examiners to Grade English medium papers more leniently puts the vast majority of the students at a disadvantage.

As is clear from the positive coefficient on Family's annual expenditure, the performance of students is better among the economically better off families. While income transfers to poor

families are outside the scope of education policy instruments, the above finding suggests that the Government should either consider increasing financial assistance to needy students or decreasing the cost of education to public school students in general. The latter approach to compensating for income differentials across families would basically require the Government to increase their funding to schools. At this juncture, it should be reemphasized that the significant positive association between HDI and performance also points to the important role of economics in determining student performance. Recall that HDI has a stronger relationship with performance than any of the twelve factors identified as policy variables. Hence, it is clear that policies aimed at enhancing the academic performance of students cannot be designed in isolation; they must go hand in hand with poverty alleviation programs and other policies that seek to raise the socio-economic status of communities.

The remaining two policy variables deal directly with the student's experience during the exam period. The more important among these is *Exam room adequacy*. Clearly, the current minimum requirements for exam rooms are either not adequate or are not being properly enforced for ensuring that all students have a level playing field, at least, while taking the examinations. As this is partly due to the scarcity of resources, the first step in remedying this situation would be to revise the extremely small budget the Government currently allocates for conducting the examinations. The second remaining variable is *Prepared own food*, which, as discussed earlier, is an indicator of the difficulties faced by many rural students who have to find temporary accommodations around the exam center during the exam period. Given the current security situation in the country, an argument can indeed be made in support of restricting the number of exam centers in the nation. But if the center-periphery inequities in Nepal are not to be perpetuated, the Government must seriously think about ways to assist this category of students with accommodations.

The above discussion has focused only on the policy variables that were statistically significant in Model (5). Note, however, that there are a number of other policy variables that were consistently significant in regressions (2) through (4). The coefficients on these variables became statistically insignificant only upon the addition of context variables in regression (5). Hence, from a policy perspective, it can be argued that these consistently significant policy variables should also be given some attention. The variables in this category are: *Adequate library*, *Hours of instruction per week*, *Maximum failures allowed 9 & 10, Number of times tested in 9 & 10, Interactive teaching approach, Course completion rate,* and *Commuted daily* . Note that except for the last variable, all of these factors are school process variables, suggesting that what goes in the school is very important in determining a student's performance. The signs and statistical significance of these variables have already been discussed earlier. Hence, only a few comments will be added here.

First, observe that, apart from homework policy, a school's academic polices regarding evaluation and promotion are also equally important determinants of performance. The regression results show that frequent testing and strict promotion policies have a positive influence on student performance in the SLC examinations. Second, the results provide evidence in support of the view that the current SLC curriculum is too vast to be covered in the allotted timeframe, and that differences in student performance across students can be partly explained by the differences in course completion rates. Perhaps the positive association of *Hours of instruction per week* with performance is also related to the vastness of the course. Given that only around 30% of the schools are able to complete the course on time, a reevaluation of the SLC curriculum is in order. Third, these results also indicate that the traditional, strictly-lecture formats used in classroom teaching need to be changed. Hence, both university programs in

education and training programs available to teachers should actively promote an interactive teaching approach in the classroom. Finally, note that while the physical infrastructure of schools does not have a significant association with performance, it does not mean that basic school facilities are not important. In particular, this study finds evidence that proper library facilities can have a positive impact on student achievement. Unfortunately, investment in libraries has not been considered a policy priority in the education sector of Nepal.

Logistic Regression Results for Aggregate SLC Performance

Recall that the dependent variable in this case is the pass/fail status of the student. As explained earlier, the method of Maximum Likelihood has been used to estimate these models. Unlike in the previous Section, where we started with a basic model and progressively added new sets of factors to obtain the final model, only two models are discussed here—one that includes all the factors except for Grade 9 scores and another that includes Grade 9 scores as well. The two models are presented in Annex 4. Observe that models (1) and (2) in Annex 4 are identical to models (5) and (6) in Annex 2, respectively, in terms of the explanatory variables. The coefficients of these regressions indicate how changes in each of the explanatory variables is associated with the *probability* of passing the SLC examinations, assuming all the other factors remain unchanged.

Let us first focus on Model (1). Among the school and teacher input variables, Spending per student continues to show a statistically significant relationship with performance at the 1% level. As this is the most comprehensive school input variable, it is possible to conclude that, on average, higher school inputs are associated with a higher probability of passing the SLC examinations, assuming that the other factors do not change. More specifically, the marginal effects column indicates that, on average, increasing the spending per student by 100% increases the probability that a student passes the examinations by 5%.[23] Similarly, the coefficients on two school process variables—Regular homework required and Highest degree expected—are again statistically significant. Recall from the earlier subsection that homework policy is the most important variable that can be influenced by public policy. Thus the finding in the current regression provides further evidence in support of this important policy variable. As for the effects of the academic ambition, a student whose ultimate aim is to get a Masters or higher degree has a significantly bigger probability of passing the SLC examinations than someone who does not see herself advancing beyond SLC. The same is true for a student who ultimately plans to obtain either a Bachelors degree or is undecided.

Compared to school-related variables, a distinctly larger number of student input variables have a statistically significant relationship with the probability of passing the SLC examinations. As before, the coefficients on *Age* and *Sex* are significant. And all at the variables dealing with study habits, educational background, and peer influence are significant except for *Months of coaching/tuition*. Also note that the exam-related variable *Sick* is also significant now whereas only *Prepared own food* and *Nepali medium* were significant in Model (5) of Annex 2. Interestingly, however, none of the ethnicity variables are significant in the current regression. As for Family inputs, the two variables indicating the family's economic status are no longer significant. On the other hand, it is interesting to note that two context variables indicating the community's

[23] The assumption here is that the student possesses the mean values of each of the factors in the regression.

locational characteristics, *District headquarters* and *Permanent bazaar+motorable road,* are now significant.

The addition of *Grade 9 score* in Model (2) increases the number of significant coefficients compared to Model (1); otherwise, the results are largely consistent with those obtained in Model (1) in this table and Model (6) in Annex 2. But there are, nevertheless, some surprises. For example, it shows that the probability of passing the examinations is higher for students whose schools have "pukki" buildings, indicating the importance of physical infrastructure. Similarly, students from public schools that are either not funded by the Government or are only partly funded have a higher probability of passing than students from fully funded public schools. But as explained in the discussion on Model (6) of Annex 2, the results of Model (2) in Annex 4 are based on data from a biased sample and cannot, therefore, be generalized to the population of SLC students.

Table 15. Factors with Statistically Significant Relationships with Performance in Model (5), Annex 2 and Model (1), Annex 4

School Input/Process	Student	Family	Context
Spending per student (+)	Age (-)	Family size (-)	HDI (+)
Regular homework required (+)	Sex (+ for males)	Hours spent on household chores (-)	School size (+)
	Read magazines regularly (+)	No. of SLC graduates in family (+)	Private school (+)
	Regular study hours per day (+)		SLC year 2004 (+)
	School days missed (-)		
	No. of Grade repetitions (-)		
	No. of friends passing SLC (+)		
	Prepared own food during exam (-)		
	Nepali medium (-)		

Note: + denotes positive and – denotes negative relationship with student performance

The main purpose of the above discussion was to show that most of the results obtained in Annex 2 are robust to changes in the indicator of student performance. And, indeed, the results for Model (1) and Model (2) are quite consistent with each other and with those obtained for Model (5) and Model (6) in Annex 2. But many of the coefficients that were significant in Annex 2 are no longer significant in Annex 4. One explanation for this change in the significance of the coefficients is that now we are using pass/fail status of the student as the dependent variable instead of a continuous variable representing the score in the SLC examinations. Since pass/fail status is a dichotomous variable that can only take values 1 and 0, there is less variability in the dependent variable when using this indicator of performance. And this loss of variability in the dependent variable means that it is now more difficult to observe some of the relationships that exist between the explanatory variables and student performance. The variables that have statistically significant coefficients in both Annex 2 (Model (5)) and Annex 4 (Model (1)) are listed in Table 15.

6.3 Relationship between Subjectwise SLC Performance and Various Performance Determinants

Annex 5 presents the regression results for each of the six compulsory subjects. The dependent variables in the six models shown in Annex 5 are the SLC scores obtained by the student in individual subjects. And as can be seen from the "Variable" column of the table, all six models use the same set of explanatory variables included in Model (5) of Annex 2. Note that since the existence of a science lab is not relevant for subjects other than science, the explanatory variable *Adequate science lab* has been included only in the Science regression.

The discussion in this section will focus on verifying the robustness of the results. Hence, rather than attempting to explain the details of each regression model separately, it will primarily discuss the common findings across the six subjects and between Annex 2 and Annex 5. But it will, nevertheless, point out some of the more interesting differences in regression results among the different subjects and provide explanations for the observations. The descriptive statistics of the subject-specific explanatory variables used in the regressions presented in Annex 5 are given in Table 16.

In order to identify relationships that are consistent across the subject-wise regressions, the following criteria are used. If an explanatory variable has a statistically significant relationship with performance in all six models, the relationship is considered very stable. If the results are consistent across four or five regressions, such results are considered stable. And a variable whose coefficient is statistically significant in only three of the six models is viewed as having a weakly stable relationship with performance.

Observe that there are altogether twenty-seven variables that show some kind of stable relationship with student performance across the subject-wise regressions. These variables have been listed in Annex 6, grouped according to the degree of stability in the relationship. Among these twenty-seven variables, eleven have highly stable relationships, seven have stable relationships, and nine have weakly stable relationships with performance. Furthermore, as indicated in the fourth column of this table, all except three of these variables have statistically significant coefficients in Annex 2 as well. Hence, there is strong evidence that these variables are important determinants of student performance in the SLC examinations.

There are altogether eight school-related variables. Six of these are school input and process factors while the remaining two (*School size* and *School type: Private school*) are school context variables. But as mentioned in the earlier discussions, the three variables indicating the highest degree expected by the student can be viewed as general student characteristics rather than school/student process variables. Hence, in effect, the subject-wise regressions in Annex 5 indicate that consistently significant determinants of performance include five school factors. On the other hand, there are thirteen (excluding *highest degree expected*) student and family factors that play a significant role in determining the performance of students. Furthermore, seven of the eleven variables with a highly stable relationship with performance are student and family variables. Judging from their relatively large standardized coefficients, it would be reasonable to infer that student and family factors are the most important determinants of student performance.

The remaining six factors are national and community context variables, which also include two variables— *District headquarters* and *Non-Nepali speakers*—that were not significant in regressions (4) and (5) of Annex 2. The first variable, while dealing with the location of the student's school, is also related to the exam conditions faced by the student. As students from district

headquarters can take their examinations in centers within commutable distance, they do not have to suffer the disadvantages faced by students from peripheral areas who need to find accommodations around the exam center. Hence, although the variable *Prepared own food* is no longer consistently significant in Table 16, the difficulties faced by students from peripheral rural areas are partly reflected in the significant coefficient on *District headquarters*. The statistical significance of the second variable, *Non-Nepali speakers*, says that students from schools with larger percentages of non-Nepali speakers have lower scores on average. As might be expected, this variable is not significant in the two subjects that do not require strong Nepali language skills, namely English and Mathematics.

Table 16. Descriptive Statistics for Subject-Specific Variables

	Nepali		English		Math		Science		Soc. studies		HPE	
Variable	Mean	S.d. Dev.	Mean	S.d. Dev.	Mean	S.d. Dev.	Mean	S.d. Dev.	Mean	S.d. Dev.	Mean	S.d. Dev.
Teaching experience (years)	16.17	7.83	15.05	8.25	12.75	6.51	11.81	6.38	16.71	7.90	15.43	7.84
Teachers with B.Ed. Degrees (%)	0.77	0.42	0.78	0.42	0.57	0.49	0.49	0.50	0.70	0.46	0.66	0.47
Teachers with 10-month SEDU training (%)	0.09	0.28	0.12	0.33	0.17	0.38	0.17	0.37	0.12	0.32	0.12	0.32
Average short-term training days	3.44	7.32	3.64	4.95	3.80	5.75	3.77	7.04	4.17	8.21	4.20	6.48
Teacher turnover (%)	0.13	0.22	0.12	0.21	0.11	0.16	0.13	0.23	0.12	0.22	0.13	0.22
Regular homework required	0.69	0.46	0.86	0.35	0.87	0.34	0.77	0.42	0.73	0.44	0.82	0.38
Interactive teaching approach	0.39	0.49	0.56	0.50	0.45	0.50	0.29	0.46	0.30	0.46	0.24	0.43
Teaching load (hours per day)	3.46	0.60	3.46	0.62	3.55	0.53	3.50	0.63	3.50	0.63	3.52	0.61
Course completion rate (%)	96.22	6.71	93.95	8.12	91.28	9.59	89.88	10.89	94.20	9.30	95.81	8.99
Months of coaching/tuition	0.35	1.25	2.27	2.55	3.27	3.12	1.83	2.57	0.23	1.02	0.13	0.73
Number of observations	9,185		9,688		9,242		8,924		8,680		8,442	

(S.d. = Standard Deviation)

In discussing the common results for the subject-wise models, it should also be pointed out that thirteen of the explanatory variables are statistically *insignificant* in all six regressions. The more interesting among these variables include *Grade 10 class size*, three variables representing teacher qualifications and training (*Teaching experience*, *Teaching experience squared*, and *Teachers with B.Ed. degrees*), one academic policy variable (*Maximum failures allowed in 9 & 10*), and one variable related to the accommodation difficulties faced by some rural children (*Commuted daily*). Among these variables, those dealing with teacher qualifications and experience in Annex 5 are subject-specific rather than general school-level variables. Hence, although the coefficients on these variables were insignificant in the aggregate SLC score regressions of Annex 2, there was a possibility that they would be significant in at least some of the subject-wise regressions. It is, therefore, surprising that these factors have a statistically insignificant relationship with performance in the subject-wise regressions as well. The last two factors—*Maximum failures allowed in 9 & 10* and *Commuted daily*—are, on the other hand, statistically significant in the

aggregate score regression of Model (4), Annex 2. Their lack of association with performance in any of the subject regressions is, therefore, also a somewhat unexpected result. Also note that, as in Annex 2, variables *No. of supervisions visits* and *No. of PTA meetings* are insignificant in all the subject-wise regressions, providing further confirmation of their irrelevance in enhancing the academic performance of students.

As mentioned earlier, a total of eleven explanatory variables are statistically significantly related to performance in all six subjects. Since all of these variables have a significant relationship with performance in the aggregate SLC regressions of Annex 2 as well, further discussion on their relationship with performance is not necessary. The rest of the section will, therefore, focus on variables that are related with performance in some subjects and not in others. In particular, it discusses the specific subjects in which these variables show a statistically significant relationship with performance and highlights the results that need further clarifications.

The first such result is the relationship between *Spending per student* and student performance. Although this indicator of general school resources is significant in the aggregate SLC score regressions as expected, it is significant only in the English regression in Annex 2. It is not clear why this variable is not significant in the other subject-wise regressions. But note that the signs of the coefficients for these variables in the other subjects are also positive as expected.

Another interesting relationship is that between school facilities and performance. While *Pukki buildings* and *Grade 10 class size* are statistically insignificant in all six regressions, library facilities are significant in the regressions for three subjects, namely Nepali, English, and Social studies. It should be noted that these are social science and humanities subjects where general reading outside the narrow confines of the textbooks can help students to achieve a greater understanding of the subject matter. It is, therefore, not surprising that the existence of an adequate library is positively associated with SLC scores in these three subjects. But it is surprising that the availability of an adequate science laboratory is not related to higher scores in Science. This apparently strange result might perhaps be due to the practice among schools of awarding uniformly high marks in the practical component of Science. This practice essentially makes the existence of science lab largely irrelevant from the perspective of securing higher scores in the practical component of SLC examinations. At the same time, insignificance of the coefficient on this variable implies that the theory portion of Science does not adequately test the student's understanding of practical issues in Science.

Among the teacher input factors, the insignificance of variables dealing with teaching experience and teacher qualifications has already been pointed out earlier. But it is interesting to note that the coefficients on teacher training variables (*Teachers with 10-month SEDU training* and *Average short-term training days*) are negative and statistically significant in the Math regression. The coefficient on *Teacher turnover* is also negative and significant for this subject, while it is insignificant in the other five regressions. These findings might be related to the fact that since Mathematics is the most difficult subject for the majority of students, the loss of instruction time associated with teacher training and lack of continuity in instruction due to teacher turnover have the greatest impact on this subject. Also note that the variable *Interactive teaching* too is significant only for Math.

Setting aside the student-level school process variables and *Course completion rate*, none of the other school process variables are statistically significantly related to performance in more than two of the subject-wise regression. This finding, too, is unexpected considering the importance of a number of these variables in the aggregate SLC score regressions. In particular, note that

Number of times tested in 9 & 10 and *Regular homework required* has a statistically significant relationship with performance only in English. *Teaching load*, on the other had, is significant only in the Social Studies regression.

Finally, it is useful to highlight some findings related to three of the students' personal characteristics, namely ethnicity, study habits, and coaching/tuition lessons. Observe that the coefficient on *Janjati* is statistically significant in all the regressions except for English and Math. This finding suggests that Janjatis might be more at a disadvantage in subjects that require strong Nepali languages kills than in other subjects. Another finding of interest is the relationship of *regular study hours per day* with performance. This variable has statistically significant coefficients only for the Math and Science regression-two of the three subjects students generally find most difficult. Hence, it seems that student effort plays an especially strong role in determining the performance of students in the more challenging subjects.

The findings in this section support the findings presented in the earlier one. In particular, almost all the variables that show some kind of stable relationship with performance in the subject-wise regressions show a statistically significant relationship with performance in the aggregate SLC score regressions of Annex 2 as well. And most of the variables with significant coefficients in less than three subjects are also significantly related to performance in either Model (4) or Model (5) of Annex 2. It is, therefore, clear that the associations between the various factors and student performance discussed in this chapter are relatively stable relationships that largely reflect the reality we are trying to study.

7. CONCLUSIONS AND POLICY IMPLICATIONS

The Study on Student Performance in SLC has conducted a comprehensive analysis of the relationship between student performance in the SLC examinations and various performance determinants using data from a nationwide survey of students, families, schools, head teachers, and teachers. Challenging the notion that the historically poor performance of students in the SLC examinations can be explained in a straightforward manner by simplistic arguments based on anecdotal evidence, it has provided convincing evidence that a host of school-related, student-related, home-related and community-related factors are associated with student outcomes. More specifically, it has shown that while the community context and the student's personal and family characteristics collectively constitute the major determinant of student performance, many school inputs and school processes also play an important role in determining student outcomes. Furthermore, it has identified a number of determinants that can be manipulated by public policy to help improve the academic performance of students. It should be pointed out that the findings presented here are largely consistent with the findings in similar studies in the international literature.

In order to produce a theoretically sound and methodologically rigorous analysis, the statistical models used in this study have been based on a framework that blends the essential elements of two established research traditions, namely production function research and school effectiveness research. The primary statistical tools employed in the analysis are Ordinary Least Squares and Logistic regression models that have been appropriately adjusted to account for the peculiar nature of survey data. But the study has also made liberal use of simple graphs, tables, and descriptive statistics to make the findings more accessible to the general reader.

The analysis of the relationship between student performance and the various determinants was performed in three steps. First, simple descriptive statistics for student performance (the dependent variable) and the complete set of determinants (the explanatory variables) were presented to highlight differences in the determinants between successful and unsuccessful SLC candidates. The findings of the descriptive analysis suggested that there was indeed a relationship between most of these factors and student performance. But as this analysis looked at only one factor at a time, it could not account for the influence of other determinants when analyzing the relationship between any single factor and student performance. Hence, in the second step, regression methods were used to study the relationship between *aggregate* SLC score and the various determinants. These regression results showed that, on average, over thirty explanatory variables were statistically significantly related to student performance even after controlling for a host of other potential performance determinants. Finally, in the third step, similar regressions were performed for each of the six compulsory subjects separately, using *subject-wise* SLC score as the dependent variable. The main purpose of this step was to provide further confirmation of the results obtained in the second step and also to identify determinants that were especially relevant for particular subjects. The findings were highly consistent with the results from the aggregate SLC score regressions. The following four sections summarize the findings of the study and present the policy implications of these findings.

7.1 Overview of Student Performance in the Sample

The descriptive analysis of student performance revealed that the aggregate average SLC score (out of 100) and pass percentage in the sample are only 47.9 and 51.4% respectively. The analysis also showed statistically significant differences in student performance across school types (public vs. private), genders, ethnicities (Brahmans, Chhetris, Newars, Janjatis, Dalits, and Others), and school locations. In particular, the SLC scores and pass rates for public schools, females, Dalits and Janjatis, and students from schools in peripheral rural areas are relatively low compared to the performances of other students. It also showed that the percentage of students from disadvantaged population groups (Dalits, in particular) taking the SLC examinations is far lower than their proportion in the national population. Overall, the sample evidence supports the framework of the study which identifies school type, gender, ethnicity, and school location as some of the potential determinants of student performance.

7.2 Overview of Potential Determinants of Performance

As mentioned earlier, the Study on Student Performance in SLC also briefly looked at the descriptive statistics of all the potential determinants included in the regression models. The descriptive analysis indicated that, in general, there are notable differences in the mean values of these variables when students who passed the SLC examinations are compared with those who failed. In other words, they provided evidence suggesting that these variables are most likely related to student performance. The discussion in this section focuses exclusively on school-related variables.

Let us start by discussing the summary statistics for school inputs. The data indicate that, on average, approximately Rs. 3,930 are being spent annually on each student in the sample. And the average student-teacher ratio in secondary school is relatively low at 37 students per teacher. But the more important finding is that there is a substantial difference in both expenditure per student and student-teacher ratio between the samples for successful and unsuccessful students. Similarly, while students have to wait a total of 20.5 days (total delay for Grades 9 and 10) after

the school year has begun before receiving their full sets of textbooks, the weaker students wait 11 days longer, on average, than the stronger students. Interestingly, however, the data indicate that the vast majority of both groups of students studied in schools with "pukki" secondary school buildings. While this finding could be interpreted as indicating the insignificance of physical infrastructure in explaining differences in performance among students, it also suggests that perhaps building type ("pukki" vs. "kuchchi") is not a good indicator of physical infrastructure. And that a better indicator of physical infrastructure might give a different result. At the same time, there are a notable differences between the two student groups in terms of two other school inputs- adequacy of library facilities and adequacy of science labs.

The descriptive statistics for teacher inputs are also equally interesting. For example, the average teaching experience for teachers in the sample is an impressive 14.5 years and the two groups of students appear to have faced teachers with comparable years of teaching experience. The data on teacher qualifications, on the other hand, actually show a higher percentage of B.Ed. teachers and "better" trained teachers for the *poor* performance student group compared to the other group. As mentioned earlier, this surprising finding can perhaps be partly explained by the fact that teachers in private schools—the schools with better SLC performance—are not required to have B.Ed. degrees and generally have limited access to the different training programs. Similarly, larger teacher absenteeism among public school teachers due to training commitments and other reasons could also be contributing to this surprising result.

The final set of school-related factors analyzed in this study includes proxies for school processes. The most interesting among these factors are the academic policy variables representing Grade promotion policies and performance assessment policies. The summary statistics for these variables indicate that while Grade promotion policy is more stringent in schools with more successful students, schools generally have rather liberal promotion policies (students who fail one to two subjects are usually promoted to higher Grades in secondary school). As for performance assessment policies, the statistics for homework requirement policy stand out the most. Although teachers, educators, policymakers all recognize the importance of homework in the learning process, data show that, on an average, only 46% of the students are exposed to regular homework assignments. As might be expected, this figure is substantially different for the two groups of students. Two other interesting results related to the school processes should also be mentioned here. The first is the finding that around 33% of the students have been exposed to an interactive teaching approach, and that this figure is higher for the better performing student group. The second is the statistics on course completion rate. Data indicate that, on average, students end up taking the SLC examinations even though their schools are able to complete only 93% of the course. The situation is worse for the weaker student group.

7.3 Relationship between the Potential Performance Determinants and Student Performance

The evidence presented earlier suggests that the factors under consideration are indeed related to student performance. But it is not possible to draw firm conclusions regarding the relationship between any single factor and student performance without controlling for the influence of other intervening factors. As mentioned earlier, this study has used multiple regression methods to account for other intervening factors in analyzing the relationship between student performance and the various determinants. This section summarizes the main findings of the regression analyses.

The potential determinants of performance considered in this study can be grouped into the following broad categories: school input and process factors, student factors, family factors, and context variables. Among the more than 70 variables representing these categories of factors, 29 have statistically significant[24] relationships with *aggregate* SLC performance. Most of these relationships continue to remain statistically significant in the subject-wise analyses of the determinants of performance. Interestingly, only seven of these factors are school input and process factors. On the other hand, eleven are student-related factors and five are family factors. The remaining six are context variables. Furthermore, when the variables are ranked according to their relative impacts on performance, only one school factor makes it to the top-ten list. The top three include two context variables and one student variable. While these findings imply that that non-school factors are more important than school factors in determining the performance of students in the SLC examinations, it should be pointed out that the two top ranking context variables, school type and school size, are indicators of *school* context. Hence, the overall school environment clearly plays a very significant role in determining a student's learning outcomes.

The factors that show a statistically significant relationship with student performance in the final aggregate SLC score regression are summarized in Annex 7. The directions of their relationships with performance are indicated in parentheses. Note that there are a number of significant factors in each of the four categories of variables show in the table. The entries in the table are self-explanatory.

Table 17. Statistically Significant Factors in the Final Aggregate SLC Score Regression

School Input/Process	Student	Family	Context
Spending per student (+)P	Age (-)	Family size (-)	Exam room adequacy (+) P
Days spent on short-term training by teachers (-)P	Sex (+ for males)P	Family's annual expenditure (+)P	HDI (+) P
Teaching load (+)P	Ethnicity (- for Janjatis)P	Hours spent on household chores (-)	Quiet neighborhood (+)
Regular homework required (+)P	Read magazines regularly (+)	No. of books at home (+)	School size (+)
Delay in textbook delivery (-)P	Regular study hours per day (+)	No. of SLC graduates in family (+)	School type (Private school) (+)
Highest degree expected (+)	School days missed (-)P		SLC Year 2004 (+)
	Months of coaching / tuition (-)		% of girls in school (-)
	No. of Grade repetitions (-)		
	No. of friends passing SLC (+)		
	Prepared own food during exam (-)P		
	Nepali medium (-)P		

Note: The + denotes positive and – denotes negative relationship with student performance; P denotes policy variable.

It must be reemphasized that the subject-wise regression results too largely support the findings presented above. However, there are a few interesting findings from the subject-wise regressions that are not captured in Annex 7. The first is the relationship between library facilities and student performance. The results show that adequate library facilities are positively associated with performance, but only in the case of Nepali, English, and Social Studies. The implication of this finding is that library facilities play a particularly important role in helping students to gain a better understanding of the subject matter in the social sciences and humanities. The second finding of interest is the positive relationship between course completion rate and SLC performance in three of the six subject-wise regressions. Considering that schools, on average, complete only 93% of the SLC course, it is clear that a large number of the students are not fully

[24] At the 10%, 5%, or 1% level.

prepared at the time of the examinations. The third interesting finding from the subject-wise regressions deals with the performance of Janjatis. Their performance is statistically significantly lower than that of Brahmans in all the regressions except for English and Math, suggesting that they might be facing linguistic and cultural disadvantages in subjects that require strong Nepali languages kills.

7.4 Policy Implications

Among the various factors that have statistically significant relationships with student performance, the ones that that can be influenced by policy intervention are identified by the symbol "P" in Table 17 The findings summarized above suggest that Government activities aimed at influencing these policy variables can help to bring about an improvement in the average performance of students taking the SLC examinations.

Policy Variables Related to the Student's Demographic Characteristics

Recall from the previous discussion that the gender of the student has the strongest relationship with performance among the 13 statistically significant policy variables listed in Table 17 The statistical significance of this variable implies that the difference in performance between girls and boys cannot be explained by the other performance determinants considered in this study. Hence, it is likely that the lower performance of girls is a consequence of the differential and discriminatory treatment they get in society, both at home and at school. As in the case of females, the poorer performance of Janjatis also continues to persist even when we control for a host of school and out-of-school factors. These findings suggest that general Government interventions aimed at improving the economic status of communities and increasing the resources of schools are not adequate for bringing the performance of girls and Janjatis at par with the performance of boys and other ethnic groups, respectively. In other words, *targeted* policies aimed specifically at girls and Janjatis are needed to bridge the performance gaps discussed above. It should be emphasized, however, that Janjatis are a highly heterogeneous group that includes some relatively privileged ethnic groups as well. Hence, polices targeted towards Janjatis should focus on those Janjati groups that are socio-economically disadvantaged. In other words, there is a need to review current gender and ethnicity-based incentive schemes that view both poor and well-off members of these population groups as deserving candidates.

As discussed in earlier, the same policy prescriptions apply to Dalits as well. In fact, the need for assistance targeted specifically towards Dalits is even greater since this most deprived population group faces blatantly discriminatory behavior from all other population groups in society. But note that the academic problems faced by Dalits are reflected more in their disturbingly limited presence in the SLC examinations than in the performance of the select group of Dalits that get the opportunity to sit for the examinations. It is highly likely that the discrimination and negative differential treatment Dalits face in school is at least as important as their low economic status in explaining their low enrollments in not just secondary school but also in earlier Grades.

Policy Variables Related to School Characteristics

Among the remaining policy variables, homework policy has the strongest relationship with performance. While most educators and policymakers recognize the importance of homework assignments in helping students to learn the subject matter, our sample data show that only 46% of the students are exposed to regular homework in their schools. Furthermore, the practice of assigning and grading homework regularly is less common in public schools than in private

schools. Hence, these findings indicate the need for policies and programs that will make it not only mandatory but also feasible for schools to incorporate regular homework assignments in their teaching schedules. While not listed in Annex 7, variables dealing with promotion and testing of students are also significant determinants of performance in a number of regressions performed in this study. Hence, there is some evidence that more frequent testing and less liberal promotion policies can also help to improve the performance of students.

The other school-related statistically significant policy variables include average teaching load, spending per student, days spent on short-term training, and delay in textbook delivery. Recall that while the positive association between average teaching load and performance looks surprising at first glance, this finding can be explained by the fact that, on average, the teaching load for secondary school teachers is not very high. Hence, it points to the need for redistributing teachers across schools and classes to equalize teaching loads rather than decreasing the number of hours teachers are required to teach. Furthermore, it also indicates that small increases in teaching responsibilities could, on average, help to increase the instruction-time without hurting teaching quality.

As indicated in earlier, spending per student is a proxy for the overall inputs going into the school. The positive association between this variable and performance is in line with the findings in the international literature and supports the argument for increasing the overall amount of Government funding going into schools. This finding suggests that the Government should not reduce its funding commitments to schools even as it moves towards handing the management of schools over to communities. The negative association between short-term training and student performance, on the other hand, calls into question the Government's current emphasis on short-term training. Even if the training packages are of high quality in terms of content, the ultimate test of their effectiveness is student performance. Whether the negative association between training and student performance is due to loss of instruction days while teachers are away on training or due to the inability of the teachers to translate knowledge into practice, it is clear that the existing approach to teacher training is not delivering the desired results. At the very least, the Government must take steps to ensure that teacher development does not conflict with the amount of time that should be spent in the classroom.

The last school-process policy variable listed in Table 17 is the delay students face in receiving the complete set of textbooks. Since this factor has a significant negative impact on student performance, there is distinct possibility that the Government can have an immediate impact on student performance by taking concrete steps to ensure the speedy delivery of books to all public schools in the nation.

Policy Variables Related to the Student's and her Family's Characteristics

The policy variables related to the students' demographic characteristics have already been discussed. Table 17 lists four more student-related policy variables and one family-related policy variable. One such student variable is the number of school days missed by the student. As discussed in Chapter 5, although student absenteeism primarily depends on student and family factors, the school's policies also play an important role in encouraging regular attendance in school. More specifically, a strict attendance policy in school and regular interaction of the school's staff with the students' families can reduce absenteeism among students. The policy implication of the negative association between the second variable—writing the examinations in Nepali—and student performance is that there is a need to further standardize the marking scheme and grading practices among examiners. The last two student variables, exam room

adequacy and prepared own food, are related to the circumstances under which the student sat for the examinations. At the same time, they are also related to the inequalities in the nation between regions, between district headquarters and the peripheral areas, and between students with different economic backgrounds. Hence, policies for tackling these problems should be viewed as subsets of more general regional development and poverty alleviation policies.

The only family factor marked as a policy variable in Annex 7 is the family's annual expenditure. Since the positive association between this variable and student performance points to the importance of the family's economic status in determining student outcomes, it calls for the continuation and expansion of programs aimed at assisting financially weak students. After all, poverty is rampant in all segments of society and cuts across genders, ethnicities, and regions. Hence, this finding means that along with providing assistance to students on the basis of their gender and ethnicity, it is also very important to have programs that provide targeted assistance to poor students regardless of their gender and ethnic origin.

Policy Variables Related to the Community Context

As a final note on the policy implications of the findings summarized in Annex 7, it should be pointed out that the important role of economics in determining student outcomes is also indicated by the significant positive association between HDI and student performance. Viewing this finding alongside the finding that a student's personal and home characteristics are, at least, as important as school factors in determining student outcomes, it would be reasonable to conclude that policies aimed specifically at improving the SLC performance of students must go hand in hand with other more general human development policies. In other words, the policies designed to improve student performance must be located within the context of plans and programs aimed at improving the quality of education, empowering marginalized population groups, alleviating poverty, reducing inter-regional inequalities, and speeding up the economic development of the country.