

National Assessment of Student Achievement, 2017

Public Report

(National Assessment of Student Achievement
in Mathematics, Nepali and Science for Grade 8)



Education Review Office, 2018

National Assessment of Student Achievement, 2017

Public Report

(Report on the National Assessment of Student Achievement in Mathematics, Nepali
and Science for Grade 8)

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Edited by

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Government of Nepal

Ministry of Education, Science and Technology

Education Review Office

Sanothimi, Bhaktapur

National Assessment of Student Achievement-2017 : Public Report

This Public report of NASA 2017 is prepared by Dr Binod Luitel and Dr Prem Phyak with contributions from Shyam Prasad Acharya, Devi Ram Acharya and Lav Dev Bhatta

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FOREWORD

National assessments not only provide information on the status of student achievements, but also offer significant ideas towards the improvement of learning outcome. Such an assessment helps policy makers to identify the level of students' achievements as well as the factors affecting the achievement of students – which can work as the basis for revising and formulating policies and programmes to improve students' achievements by enhancing quality of education.

Education Review Office (ERO) initiated the first phase of National Assessment of Student Achievement (NASA) in 2011 and completed two rounds of assessments for Grade 3, 5 and 8 in 2015. For the second phase, ERO has been conducting the national assessments for Grade 5, 8 and 10 – which started from grade 8 in 2017 and is continuing for Grade 5 and 10 in 2018 and 2019 respectively with a plan of repeating the assessment in every four years in the same Grade. These assessments measure students' achievements in curricular domains based on the national curriculum of Nepal as specified in the assessment framework prepared by ERO. The assessment framework specifies the content domains and criteria to be assessed and defines six hierarchical standards to be measured in each criterion.

This is the public report of NASA 2017 for Grade 8 in Mathematics, Nepali and Science designed, developed and conducted by ERO. The assessment was conducted in the national representative sample of 46,266 students from 1950 schools of Nepal – with almost equal number of schools and students in each of the three subjects, considering seven provinces as explicit strata. Three versions of standardized tests together with the background information questionnaire to the sample students, teacher questionnaire to subject teachers and school survey questionnaire to the head teacher were administered in each school. Data were prepared in such a way that, along with presenting overall mean score and proficiency levels, the relation between the achievement scores and various influencing factors was demonstrated with the use of background information questionnaire.

Using Item Response Theory (IRT) and the parameters of linking items, three versions of test were calibrated and joined them together and students' abilities were estimated with reference to the characteristics (parameters) of items. The ability score so obtained was then transformed to a scale score with the mean score of 500 point; and the proficiencies of students in each subject has been defined using the scale score. The mean score in each subject can be considered as the base line to compare students' achievements across the years and tests.

The findings from the NASA 2017 presented in this report provide useful information on the achievement of students for Grade 8 in Mathematics, Nepali and Science across Nepal with several variables including province, gender, home language, ethnicity, socioeconomic status, school types, leisure time and activities in the leisure time, attitude towards teacher and school, school bullying, availability of textbooks, and activities at home. Similarly, a

separate provincial report will be prepared to supplement to this public report. Moreover, the details about the technical aspects including designing, development and administration of assessment, data preparation, parameters estimation and equating, and analysis and reporting of assessment results have been presented in a separate technical report.

This report begins with the overview of national assessment of student achievement in general and Nepalese practice in particular. The next three chapters discuss the NASA results at national level in Mathematics, Nepali and Science subjects respectively. The final chapter summarizes the main results and makes recommendations based on the assessment results.

I wish to acknowledge the collaboration and dedication of subject teachers, experts, subject committee members, and assessment committee members in developing this assessment and supporting for the reporting. My thanks go to the head teachers/principals, teachers and students who participated in the assessment. I also thank the test administrators, District Education Officers and other officers from DEOs, Dr Peshal Khanal, team leader for administrating, scoring and preparing data on behalf of Centre for Educational Research and Social Development (CERSOD).

I highly appreciate the contribution of Dr Binod Luitel and Dr Prem Phyak for writing this report with participation in data analysis and report preparation workshops, and providing inputs for data analysis, designing and preparing technical report as well as this public report. My thanks go to the technical officers from ERO for analysing data and supporting for preparation of this report. They include : Shyam Prasad Acharya, Devi Ram Acharya, Lav Dev Bhatta and Ram Chandra Dhakal. I also acknowledge the contribution of Under Secretary of ERO Rudra Adhikari for overall coordination and facilitation during the processes of assessment, Under Secretary Prahlad Aryal for coordinating the activities during the administration and data preparation phase, Under Secretary Hem Raj Pokharel for coordinating the activities during the analysis phase and Section Officer Prakash Kharel for facilitating during the planning and administrating the assessment. My thanks are due to the entire staff of ERO who supported for conducting this assessment as and when required, and also to the personnel from various Central Level Agencies and the Ministry of Education who contributed for the monitoring of test administration. I also acknowledge the World Bank together with the Australia Council for Educational Research, India for their technical support to ERO for the training on large-scale assessment and its data analysis.

I commend this report to education policy makers, programme designers, teachers, educators and community members who are engaged in improving students' learning, and to those who are interested in supporting students and schools as well as the entire education system towards enhancing the quality of and equity in education in Nepal.

Dr Lekha Nath Poudel

Joint Secretary

Education Review Office

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ACRONYMS

CDC	: Curriculum Development Centre
CR	: Constructed Response
CRT	: Criteria Referenced Test
CT	: Confidence Interval
CTT	: Classical Test Theory
DEO	: District Education Office
DOE	: Department of Education
EMIS	: Education Management Information System
ERO	: Education Review Office
ICC	: Item Characteristic Curve
ID	: Identification
IEA	: International Association for the Evaluation of Education
IRT	: Item Response Theory
MC	: Multiple Choices
MLE	: Maximum Likelihood
MOS	: Measure of Size
NASA	: National Assessment of Student Achievement
NRT	: Normed Referenced Test
OECD	: Organisation of for Economic Cooperation and Development
OMR	: Optical Mark Recognition
One PM	: One Parametric logistic Model
PCAP	: Pan-Canadian Assessment Program
PCM	: Partial Credit Model
PISA	: Programme for International Student Assessment
PPS	: Probability Proportionate to Size
PRC	: Printing Ready Copy
PV	: Plausible Value
RWGT	: Replicable Weight
SE	: Standard Error
SPSS	: Statistical Package for Social Science
SR	: Selected Response
SRS	: Simple Random Sampling
SSDP	: School Sector Development Programmes
TIMSS	: Trends in Mathematics and Science Study
VDC	: Village Development Committee
WLE	: Weighted Likelihood Estimation

CHAPTER 1**AN OVERVIEW OF NATIONAL ASSESSMENT OF STUDENT ACHIEVEMENT, 2017****1.1 Introduction**

This report has been prepared to present and disseminate the findings of National Assessment of Student Achievement (NASA) 2017 for Grade 8. This national assessment was conducted to assess the learning achievement of Grade 8 students in Nepali, Mathematics and Science subjects. This report is organized under five chapters. Chapter 1 provides a concise overview of NASA 2017 based on the technical report that has been prepared to disseminate the detailed presentation of the assessment methods, tools, process, and the techniques used in the data analysis. Chapter 2, 3 and 4 present the main results of the assessment in Mathematics, Nepali and Science subjects, respectively. The final chapter presents the conclusions and recommendations of this study.

The objective of this chapter is to communicate the framework, design and process of NASA 2017 by introducing the concepts and practices of national assessment; describing the assessment designs, methods and process; presenting the test administration process; and describing the data preparation and analysis process. In other words, this chapter conceptualises the national assessment of student achievement and provides an overview of the Nepal's practices on national assessment of student achievement. It also presents the objectives of NASA 2017 and the national assessment cycle which were developed and adopted by ERO. In addition, it presents a summary of the design of NASA 2017, including the design and development of test. It also includes how the background information questionnaires were designed; what process and methods were used for the administration of test; and how data were analysed and reporting of the test results was prepared.

1.2 Introduction to National Assessment of Student Achievement

National Assessment of Student Achievement (NASA) is “designed to describe the achievement of students in a curriculum area aggregated to provide an estimate of the achievement level in the education system as a whole at a particular age or grade level” (Greaney & Kellaghan, 2007, p. 7). NASA studies, including this study, are carried out to provide the Ministry of Education with critical insights into evaluating the overall effectiveness of educational policies and practices in

terms of student achievement. By providing the large-scale data on student achievement, NASA supports the Ministry of Education in the process of assessing its educational policies and provides a direction towards appropriate educational reforms.

The major goal of national assessments is to provide a database for “a type of national education audit carried out to inform policy makers about key aspects of the system” (Greaney & Kellaghan, 2007, p. 7). NASA studies are conducted for both the backward and forward-looking purposes (ERO, 2017). The backward-looking purpose is concerned mainly with building a database to analyse both the strengths and weaknesses of educational policies and practices that affect students’ learning achievement. On the one hand, national assessments gather information for policy makers to understand the changes that have occurred in the students’ learning achievement over the time. On the other hand, they supply the data related to the factors affecting students’ learning achievement – which eventually become a basis for policy makers to revise the existing policies and guide them towards formulating new ones to strengthen quality of education (Poudel, 2017). Moreover, national assessments contribute to ensuring equity and access of all children in education. As these assessments provide data on learning achievement in terms of social variables including gender, ethnicity, language background and identity with geography, national assessments help policy makers to identify which groups of students are performing better and which groups are not performing satisfactorily. This understanding eventually offers significant insights into creating new policies to ensure equity in education (see Poudel, 2016). As Murphy, Greaney, Marlaine and Rojas (1996) claim, national assessments provide “systematic, regular measures of learning achievement in a country that are designed to assist policymaking” (p. 2).

The main purpose of conducting national assessment of student achievement is to provide feedback to the Ministry of Education for improving quality and equity in education. The primary concern of national assessment is to contribute to develop policies to improve education system rather than to identify individual students' achievement. National assessment of student achievements can help the Ministry of Education to make informed decisions towards quality improvement by responding to the following questions (Grenaney & Kellaghan, 2007) :

- How will are students learning?
- Is there evidence of particular strengths and weaknesses in students' leaning?
- Do certain sub-groups of students perform poorly?
- What factors are associated with student achievement?
- Do the achievements of students change over the time?

1.3 National Assessment Practice in Nepal

In Nepal, national assessments of student achievement began in 1995. The assessments conducted between 1995 and 2010 were based on the Classical Test Theory (CTT). Since 2011, ERO has been conducting NASA to study and report on the student achievement in various grades in a certain time interval. It has already completed the two rounds of NASA for the students of Grades 3, 5 and 8 (see, ERO, 2013, 2015, 2015a, 2016). Now, ERO has planned to conduct NASA in Grade 5 and 10 in 2018 and 2019, respectively. NASA 2017 has been administered for Grade 8 students to assess their achievements in Mathematics, Nepali (reading and writing) and Science subjects. Similar to the previous NASA studies, it is a sample-based assessment; but this assessment has been used the sample weights for reporting the results by estimating the achievement of the entire student population of the Grade.

For NASA 2017, ERO has used the Item Response Theory (IRT), instead of CTT, in selecting the test items and analyzing the assessment results. IRT is a popular theory to compare different versions of the tests by calibrating the items and comparing between the results of assessment in different years.

ERO follows globally accepted practices of conducting national assessments. Although the context of each country is different, there are some major practices that are common to national assessments in most of the countries. Building on the comprehensive review of national assessments from various countries (e.g., Greaney & Kellaghan, 2007), ERO adopts the following procedure:

- The Ministry of Education (MOE) selects an implementing agency either from within the MOE system itself or an independent external consulting organization. In the case of Nepal, Education Review Office (ERO) within the MOE system is solely responsible for the national assessments.
- The MOE or implementing agency develops policies and frameworks for assessment in consultation with (and with participation of) key stakeholders such as subject experts, teachers and policy makers.
- The MOE identifies the Grade level and determines the area (e.g., literacy or numeracy) to be assessed.
- The implementing agency (here ERO) defines and describes the areas of achievement testing in terms of both content and cognitive skills and develops test items along with supporting questionnaires and manuals for test administration.
- The implementing agency pilots the test items with the support of external experts, reviews their validity, appropriateness and sensitivity in terms of gender, ethnicity and culture.

- The implementing agency ensures that the assessment instruments are reliable and valid.
- The implementing agency samples the schools; makes arrangement for printing the test papers and other relevant materials; and communicates with the schools and teachers for test administration.
- The implementing agency provides training to test administrators (e.g., focal persons, head teachers and teachers), and then administers the test and survey questionnaires in the selected schools.
- The implementing agency collects test scores and other necessary information, cleans the data as needed and analysed them.
- The implementing agency prepares draft report/s which is/are reviewed by relevant committees and external experts.
- The implementing agency prepares and disseminates final report/s through various means such as publication and the mass media.
- The MOE, implementing agency and relevant stakeholders study the report/s of national assessment and identify the major areas for policy reforms. (ERO, 2017).

1.4 Distinct Features of NASA 2017

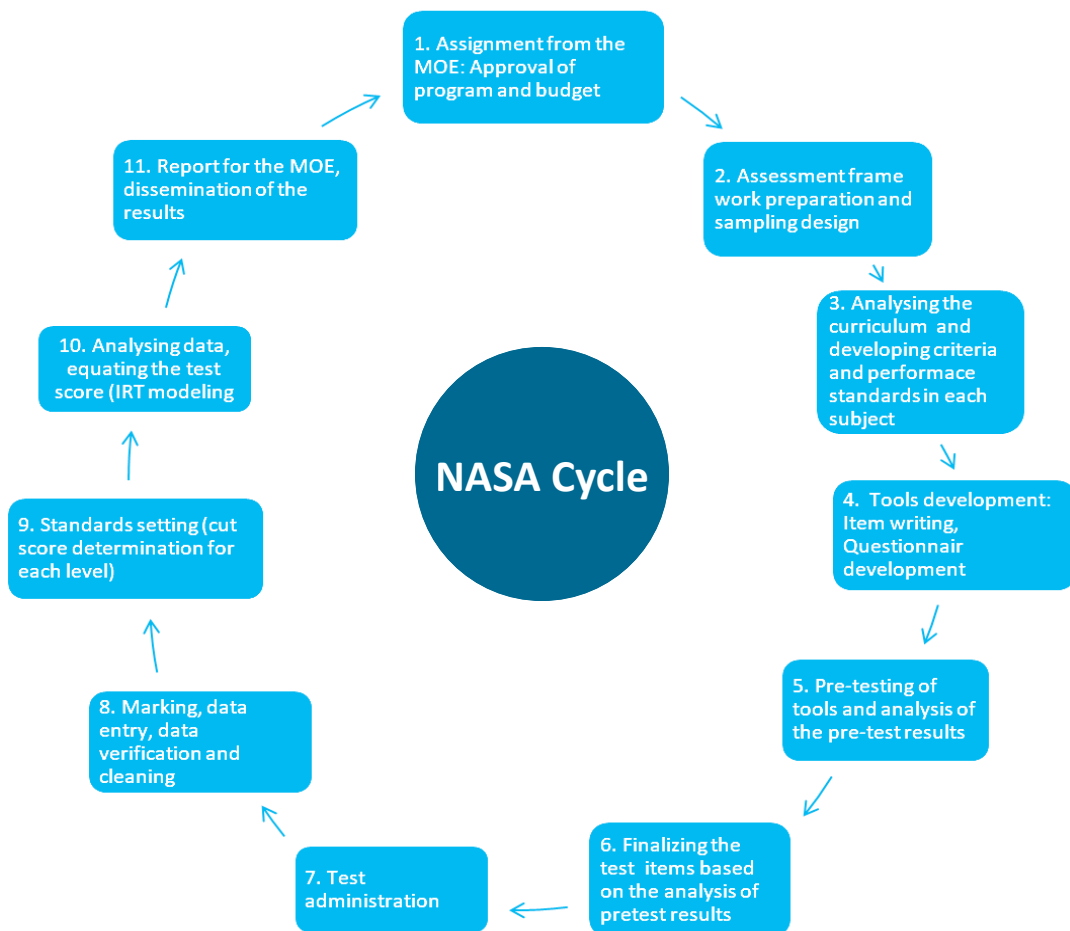
NASA 2017 is conducted for Grade 8 in three subjects—Mathematics, Nepali and Science—in a sample 16000 students of 650 schools. This study has considered seven provinces as the explicit strata and community and private schools as implicit strata. Item Response Theory (IRT) has been used to compare the test results across the years, test versions as well as the similar types of international assessments.

One of the departures from the previous national assessments, conducted by ERO (see, ERO, 2013, 2015, 2015a, 2016), to this assessment is the use of a criteria and standards-referenced assessment instead of a norm-referenced assessment. In addition, this assessment has used a scale score instead of percentage in reporting students' proficiency. The scale score helps to make the results comparable and explains the students' latent traits in relation to the characteristics of the test items. Similarly, the assessment framework (Pant, Singh and Poudel, 2016), as the guiding documents of entire assessment process, has been developed to make NASA 2017 more valid and reliable. The use of sampling weights to estimate the test scores to the entire population is another new step that has been introduced in this assessment.

1.5 NASA Cycle

ERO adopted the following cycle to conduct the national assessment of Grade 8 students in Mathematics, Nepali and Science subjects.

Figure 1.1 : NASA cycle



Source : ERO, 2017

The above figure presents the major steps in planning, designing, administering and reporting of the assessment. NASA cycle begins with the approval of the required budget and programme and goes through the development of the assessment framework, criteria and standards, items and questionnaires; piloting, analysing and selecting the items; designing the test booklets; administrating the test; scoring and preparing data; calibrating items and equating the tests; analysing and setting proficiency levels; and reporting and disseminating the results.

3.6 Objectives of NASA 2017

The purpose of this assessment is to provide feedback to the Ministry of Education to improve the quality of school education. This assessment does not report individual students' performance, nor does it compare between the proficiencies of each individual student and school. Rather it provides the national and provincial results as well as the differences in the achievement scores in relation to various influencing factors such as socioeconomic status, home language, and identity with geographical region. More specifically, NASA 2017 had the following objectives:

- a. To identify the current level of student achievements of Grade 8 students in Mathematics, Nepali and Science.
- b. To identify the variations in student achievement by gender, province, identity with geography, types of school, ethnicity, home language, socio-economic status and so on.
- c. To explore the factors that influence student achievement.
- d. To produce the baseline data for the future for comparing and monitoring the progress of students towards student achievement in assessed subjects.
- e. To strengthen the capacity of the education system in conducting national assessment.
- f. To provide the Ministry of Education with the recommendations for policy making to improve quality and equity, particularly in school education.

1.7 Design and Development of NASA 2017

Following the NASA cycle (Figure 1.1), ERO designed NASA 2017 for Grade 8 in Mathematics, Nepali and Science. ERO developed the framework and test items in collaboration with the subject teachers, experts and researchers at universities. The following process was adopted in NASA 2017 (see NASA 2017 : technical report for details.):

- National curricula of Mathematics, Nepali and Science were analysed and identified subject-wise constructs and domains to be assessed from the national curricula.
- Criteria and six different standards to each criterion were developed for each subject, based on the defined constructs, domains and curricular competencies.
- Criteria, standards and curricular constructs and content domain were analysed and classified them into various cognitive domains, based on the revised Bloom's taxonomy of educational objectives.
- Test items for NASA 2017 were developed through the following activities :
 - a. Assessment framework was developed together with the defining domains and contents

to be assessed by analysing the curriculum and by reviewing the national as well as international practices.

- b. Items were designed and developed through the workshops for the subject teachers and experts, based on the developed criteria and standards.
- c. The prepared items were piloted to the defined number of students of the same Grade (Grade 8) and the items were analysed in relation to the results from the test piloting. The items were analysed by calculating the item facility and item rest correlation and by analysing the distractors for multiple choice items. Item analysis results were used to revise the items. In addition, three test booklets were prepared in each subject, combining items of SR and CR types, representing various contents and cognitive domains, and including range of difficulties. Items were from three different sources including new items, items from previous NASA and items from TIMSS released items for Mathematics and Science. The test booklets were designed by using some common items for the linking purpose.
- d. Scoring keys and scoring guidelines were prepared for each test booklet.
- e. Developed student and teacher background questionnaires for the individual survey and the head teacher questionnaire for the school survey.

1.8 Design and Development of Contextual Questionnaires

Drawing on the insights from the previous NASA studies (see, ERO, 2013, 2015, 2015a, 2016) and other international assessment practices such as PISA (see, OECD, 2017), TIMSS (see, IEA, 2016), ERO, with the support of experts, developed the survey questionnaires for students, teachers and head teachers. The questionnaires included the questions related to the contextual factors on national and community contexts, home contexts, school contexts, classroom contexts, student characteristics and attitude towards school and teacher.

The student questionnaire has covered individual differences of students such as gender, attitude towards subject and subject teacher, and attendance at school. Other factors included in the questionnaire were home related factors such as support to studies, socio-economic status of parents; social and demographic factors such as home language, identity with geography, rural urban location, ethnicity, age, family size; school and classroom related factors such as classroom activities, bullying, and the availability of text books.

The teacher questionnaire includes questions related to teachers' qualification, experience, specific skills such as ICT, age, gender, home language, classroom practices, involvement in school's activities, and regularity.

Similarly, the head teacher questionnaires covers school's physical factors such as physical environment, safety, cooperation with local actors/organization, size of the school, implementation of time schedule; leadership factors such as leadership culture and skills of principal, atmosphere of school; and teacher related factors such as teachers' planning and classroom practice, and teachers' regularity.

1.9 Administration of NASA 2017

First, the school and student samples were selected by choosing an appropriate method and the test was administered in the sample schools. At the same time, the background questionnaires were administered to the same students, subject teachers and head teachers of the same school. The scoring and data entry processes began after collecting the test booklets at the scoring centre in Kathmandu.

Sampling and participation

For NASA 2017, altogether 26 districts were selected, covering seven provinces of the country. At least 650 schools and 16000 Grade 8 students for each subject were sampled. Altogether 1950 schools representing three ecological zones, and 48011 students from these schools were the sample of which the total achieved schools and students were 1950 and 46266, respectively. The sampling design adopted was multi-stage in that the schools were selected from the explicit strata (province) by using a random selection method. Similarly, the students within the schools were also selected by using a random sampling method. (For details, see the NASA 2017 : Technical Report).

Test and questionnaires administration

The test and students' background information questionnaires were administered to each sample student. A separate sample school list was prepared for each subject so that each school and student would appear in the test for only one subject, among the three subjects. Similarly, the teacher and head teacher questionnaires were administered in each sample school. Before administering the test, head teacher and test administrator teachers were oriented on their roles as well as the process of administering the test. For the smooth administration of the test, a short test administration guideline for teachers and head teachers was prepared. The manual specifies the exact conditions under which a test was conducted, including the requirements for the preparation and procedures for ensuring test security. For the effective administration of assessment, District Education Office (DEO) in each district designated ERO focal person to an officer, and ERO

organized an orientation program to the district focal persons about the processes and activities for test administration. In collaboration with the consulting firm, the district coordinators were selected and oriented on how to administer the test effectively. The focal persons in collaboration with DEO and district coordinator managed and supervised the administration of the test. After administering the test, the consulting firm collected the test papers back to the scoring centre in Kathmandu.

Scoring the students' answer sheets

Qualified and trained persons in each subject worked for the scoring of answer booklets in a close supervision of the scoring coordinators. Each student's responses to the SR items and the scores of each CR item together with the responses on the student background questionnaires were recorded in an OMR sheet. Similarly, each teacher's and head teacher's responses to the questionnaires were recorded in a separate OMR sheet.

Use of Item Response Theory

In a large scale assessment, students with various proficiencies and test items with various difficulties in a single assessment could be obvious. The probability of a student's correct or incorrect response to an assessment item is depend on student's ability in relation to the characteristics (e.g., difficulty) of the test item. In order to analyse such variations and difficulties in test items, the item response theory was adopted in NASA 2017. The item response theory is "a method that attempts to enumerate these student and item characteristics in order to calculate the probability that the examinees will answer correctly" (Sudol and Studer, 2010).

1.10 Analysis of Data

First, the data files were prepared using OMR sheets. Then, the data were cleaned before starting the analysis. After preparing the data, item parameters of each test item for each version were estimated, and the three versions of tests were calibrated by using the parameters of linking items. Then these three versions of tests were merged as a single data file for the analysis and ability estimation. After that, the students' ability scores were transformed to a scale score by taking the mean value of each subject as 500, with a standard deviation of 50. This mean value has been fixed as a national level mean score to each subject to compare means of different categories. The sample weights were calculated and replicated to the population estimation and Plausible Values (PVs) were estimated in order to minimise the errors in the population estimation.

Item parameter estimation and calibration

The data files were created in Excel by using an OMR machine and the data were cleaned. After that, IRT analysis was carried out for each item and test by calculating the facility value, item rest correlation and MNSQ to review the item functioning and item fit. The model fit as well as distractors of Multiple Choice (MC) items were also reviewed by producing Item Characteristic Curve (ICC) to each item by using One Parametric Logistic Model (1PM) for the MC items and Partial Credit Model (PCM) of IRT for the CR items. At this point, the disturbing items to the model (items do not fit to the model) were discarded from the analysis.

In NASA 2017, equating, a process of identifying some regularity in response pattern (difficulty) and modelling such regularity for the test, was used to describe students' abilities as well as items in terms of a common scale, even if all students do not take identical sets of items (OECD, 2017). This type of calibration of items and scaling of test supports the interpretation of the test results by using a common scale. Three versions of test booklets were equated and calibrated by using the average parameters of linking items and developed a single set with a joint analysis, using the IRT modelling.

Student ability estimation

The parameters of each included test item were recorded and the individual students' ability was estimated using a Weighted Likelihood Estimation (WLE) method, known as case estimation. WLE is the estimation of students' individual ability scores–latent ability (θ) in logits, which has the value of 0 as the average ability, positive for above average and negative for below average. Merging this file with the student data set gives individual ability scores in logits, called case estimation. The latent ability is the estimation of latent trait of the student based on the obtained score in relation to the items having certain characteristics. It is a transformed score (θ) with a mean of 0 and a standard deviation of 1 with some range to cover the latent trait to be measured.

Population estimation

The students' ability estimated by using WLE represents the sample, but it is not appropriate to use these values for the entire population. For the population estimation, 5 Plausible Values (PVs) were generated with the sample weight of students (Xie & Zhang, 2017). It produces unbiased estimate of population parameters if the assumption of scaling are reasonable, but it is not fair to use for the level of student ability. PVs are not individual test scores; they are the measures of the performance of the population.

In NASA 2017, the replicable approach was used to estimate the variances and standard error of population estimation in a required variable (see, Lewis, 2015). The sampling errors or variability was estimated by using Jackknife repeated replication (JRR) method. This method helps to estimate the sampling variance of the sample design, which provides unbiased estimates of the sampling error. It was done by splitting a single sample into multiple sub-samples, and the overall sampling variability was estimated by using fluctuation among the sub-samples. As the confidence level of sample was taken as 95%, which yields a confidence interval (CI) of mean $\pm (1.96 \times SE)$ where SE is the standard error of the population estimation and $\pm (1.96 \times SE)$ is known as margin error of population estimation.

Students' proficiency estimation

The comparison of students' achievement against the proficiency levels is a convenient way to describe student achievement. The students with a certain level of proficiency are able to demonstrate comprehension and the skills associated with that level. Any student within a band/level would be expected to successfully answer to at least 50% of items in a test. In general, the proficiency scale shows that the students whose ability estimate places them at a certain point on a proficiency scale would be more likely to be able to successfully complete the tasks at or below that point (OECD, 2017). In NASA 2017, the logit score (ability score) was transferred into score having 500 as mean score with 50 as standard deviation. The transformation formula used to transfer logit score to the proficiency scale was:

Score on proficiency scale = Logit $\times$ standard deviation + mean score = Logit $\times$ 50 + 500.

Using the mean score of 500 point, 6 proficiencies have been defined within the range of scores of each subject. Moreover, students' ability scores have been described and compared by using these proficiency levels.

The reporting scale of NASA 2017 is proficiency scale which describes what students know and can do at the given level of proficiency. It reports the results for the population-level but not for individual students – assuming that the selected sample of Grade 8 students represent all the Grade 8 students of Nepal. The results from statistical analysis were transformed into the scale score 500 as the mean score (proficiency); and it was then reported by dividing the proficiency scores into six levels. There is specific proficiency description to each level of proficiency defined on the basis of competencies described by the item descriptors. The cut points for the proficiencies were decided from the students' score together with subject experts' judgment, based on the item descriptors.

1.11 Reporting and Dissemination

NASA 2017 of Grade 8 in Mathematics, Nepali and Science students are classified into six proficiency levels base on the transformed ability score having 500 as the national mean with 50 as the standard deviation. The average score of each province for each of the three subjects is also calculated and compared with the national mean. Using sample weights and replication, these results were estimated at the population level. Similarly, frequency, percentage distribution as well as mean and standard errors for all items were also calculated. A factor analysis was carried out for some of the variables, and a correlational analysis was performed between the student achievement and the given background variables to explain their impacts on students' achievement.

The significance difference between the comparable mean values was decided based on the margin error, taking 95% confidence level. In other words, if the margin error/confidence intervals overlap, the differences are defined as not statistically significant, and when the confidence intervals do not overlap completely, a test of significance is required (see CMEC, 2014).

In NASA 2017, the data analysis for each subject was organized under several themes including proficiency levels; provincial levels; gender, ethnicity and language; identity with geography; types of school; and other factors influencing learning achievement.

In order to disseminate the results of the study, two reports – a technical report and a public report – have been prepared. The technical report describes the details of assessment design, process and methods whereas the public report focuses on the main results and implications of the assessment. ERO will submit the reports to National Education Council which is headed by the Minister for Education, and makes them public through various methods, including website, mass media, dissemination workshops and meetings.

CHAPTER 2**MATHEMATICS RESULTS AT NATIONAL LEVEL****2.1 Introduction**

The defined population, sample students and the actual number of students participated in NASA 2017 for the assessment of Mathematics subject were 582178, 15954, and 15482, respectively. Based on the data collected from these students, ERO, using IRT with Conquest software as well as SPSS and Excel tools, analysed the students' results in terms of proficiency levels. In addition, students' achievement scores were analysed in relation to their background information such as socioeconomic status, ethnicity, gender, home language, school type, identity with geography, school and classroom practices, and home environment. The results were also analysed province-wise.

The students' ability scores were estimated by using test scores and these ability scores were transformed into a scale score with the national mean score of 500 point, meaning that the national mean score has been fixed at 500 point for the purpose of analysing the overall test scores. The test scores at various categories as well as the test scores at provincial level were compared considering this score as a base.

The test scores were first drawn from the sample students and analysed by considering the sample weight. After that the generalizability of the test scores were estimated for the entire population of the study—the Grade 8 students in the country—by using a confidence level of 95%. The standard errors and confidence intervals of the mean scores were estimated during the analysis, and the confidence intervals were estimated to identify the statistical significance of the comparable means.

2.2 Defining Proficiency Levels in Mathematics

Five cut-points for proficiency levels were decided first for 6 proficiency levels, as presented in Table 2.1, in Mathematics. This yields the lower and higher levels of proficiencies below 395 and above 606 respectively.

Table 2.1 : Proficiency levels and the score range in Mathematics

Level	Score	SE
Level 6 (Advanced)	606 <	0.13
Level 5 (Proficient 3)	553 — 606	0.72
Level 4 (Proficient 2)	501 — 553	1.01
Level 3 (Proficient 1)	448 — 501	0.9
Level 2 (Basic)	395 — 448	0.79
Level 1 (Pre-basic)	< 395	0.33

Based on the descriptions of items that correspond to each of the above proficiency levels in item person map in Mathematics together with subject experts' judgment, the descriptions of students' six levels proficiency have been defined. These descriptions of six proficiency levels in Mathematics for Grade 8 indicate that what a student at particular competency level can do in Mathematics. The Table 2.2 specifies the competencies of students at various levels of proficiency in Mathematics.

Table 2.2 : A summary of the descriptions of the six proficiency levels in Mathematics for Grade 8

Level	Score	What students can typically do
6	606 <	Students at level 6 can analyse, synthesise and show relationship among different mathematical concepts. They can analyse the pattern and get the solution of unfamiliar problems in some content areas. For example, they can find the angles of a triangle by using the angle relationship of isosceles triangles; analyse the effect of increased/decreased distribution by some numbers on the mean and median; transfer a geometric figure using multiple transformations.
5	553— 606	Students at level 5 can solve daily problems using learnt mathematical concepts and analyse the problems and synthesize the process of solving mathematical problems. They can solve varieties of problems of their level. For example, they can solve verbal problems of simultaneous equations; use the formula of (a^3+b^3) to factorize algebraic expressions; calculate the area of the given right triangle; simplify the algebraic fractions with different denominator and indices; find the number when two numbers are given in different base of number (binary and quinary);

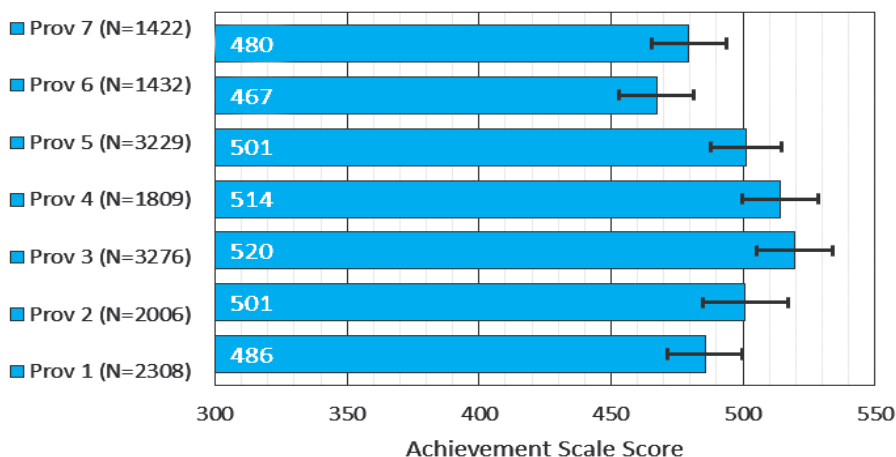
		solve the verbal problems on finding cost price when marked price and discount are given; find the cardinal number of the intersecting sub-sets, complement; solve the simple problems using angle sum relation of a triangle, co-interior angles, alternative angles and corresponding angles formed by the parallel lines; use mean and median in solving daily life problems.
4	501— 553	Students at level 4 can apply the different mathematical concepts to solve simple problems. For example, student can use four simple operation to simplify expression; round off a decimal number; convert the decimal number into the number having other bases; solve the problems of profit and loss involving discount and percentage; rationalize the denominator of irrational number; solve very simple problems on unitary method/ time and work; solve the linear and quadratic equation; find HCF and LCM of two algebraic expressions of degree 2, construct a square and other shapes with the given length using compass and scale; find the image points of a given point using transformations (reflection, rotation and translation); find the distance between two points by using distance formula; deduce the relation to find an exterior angle of a n-sided regular polygon; find the union/intersection of two sets using Venn diagram; identify the rational and irrational numbers; find mean and median of discrete series; explain the angle sum relation of a triangle, relation between co-interior angles, alternative angles and corresponding angles formed by the parallel lines..
3	448— 501	Students at level 3 can apply the limited mathematical concepts in solving problems and they can plan how to gather data necessary to solve simple problems. For example, they can calculate area; volume and length of a cube or cuboid; calculate radius from diameter of a circle; use Pythagorean triples; explain the conditions of congruency of triangles, convert different units of measurement; rationalize the denominator of a fraction; calculate the simple interest using formula; solve liner equation of one variable and two variables; simplify the monomials, identify union, intersection and complement two sets, factorize algebraic expressions using $a^2 - b^2$; identify images after reflection, translation and rotation, find the mean and median of individual series.

2	395— 448	Students at level 2 can describe basic mathematical concept and relations, and calculate simple results using these concepts and relations. For example, students recognize congruent triangles, recognize rectangle, square and parallelogram, identify the pair of angles between parallels, calculate profit and loss percentage from verbal information, multiply simple index numbers convert rational and decimal to each other, identify regular polygon, solve linear equation of one variable.
1	< 395	Students at level 1 have very rudimentary understanding on mathematical concepts such as integers, fraction/decimals, percentage and operations as they perform very basic and only few direct calculations of results, mostly learnt in previous grades. For example, students of this level recognize two dimensional geometric shapes and three dimensional objects; add/subtract polynomials; multiply/divide monomials, calculate profit when cost price and selling price are given;

2.3 Overall Mean Score by Province

The data demonstrates the situation that student achievement in province 3 is found the highest among the seven provinces, while student achievement in province 6 has been the lowest, with the mean score of 520 and 467, respectively. As Figure 2.1 shows, province 3 has the mean score 20 point higher than the national mean score, while in the case of province 6, the score is 33 point lower than the national mean. When the achievements of the provinces with the highest and lowest scores are compared, we can see a 53-point difference between the two extremes.

Figure 2.1 : Mean scores in Mathematics by province

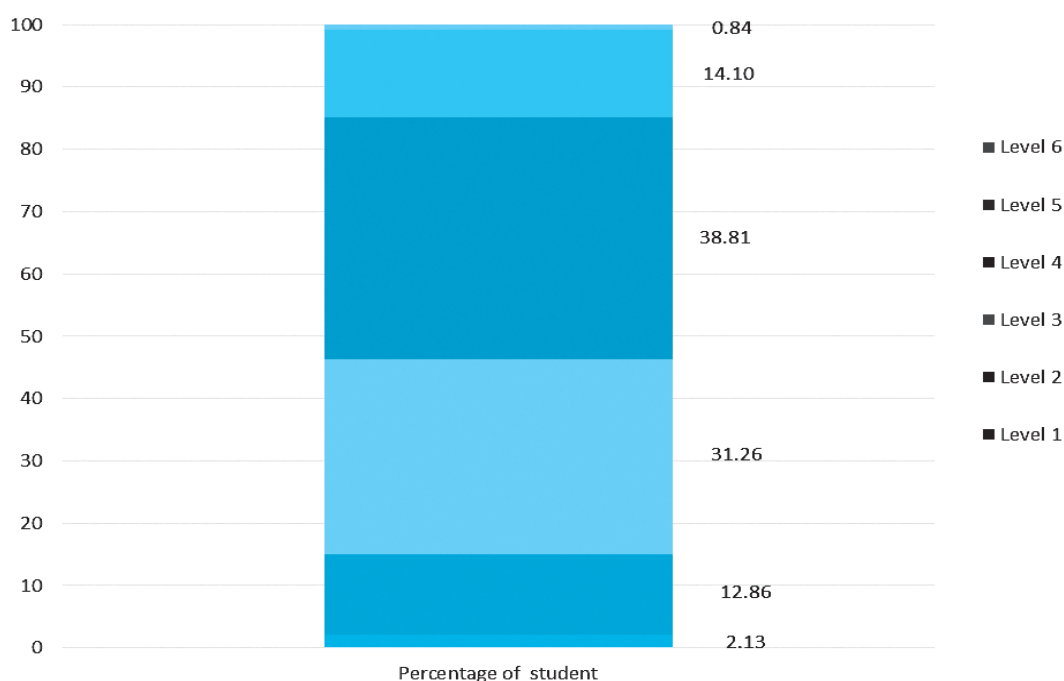


Similarly, the mean scores of province 2, 3, 4 and 5 (with the mean of 501, 520, 514 and 501, respectively) are found higher than the national mean score. The mean scores of province 1, 6 and 7, on the other hand, are found lower than the national mean score; the scores in these provinces are 486, 467, and 480, respectively.

2.4 Students Percentage by Proficiency Levels

The test scores were also analysed in terms of six proficiency levels of students' achievement. The levels included are 1, 2, 3, 4, 5, 6 in the order of lower (pre-basic) to higher (advanced) level. The scores below 395 were considered level 1 while the scores within the range of 395-448 were categorized as level 2. Similarly, the scores within the range of 448-501 and 501-553 were labelled level 3 and level 4, respectively. The scores within the range of 553-606 and above 606 were categorized as level 5 and level 6, respectively.

Figure 2.2 : Student percentage by proficiency levels in Mathematics



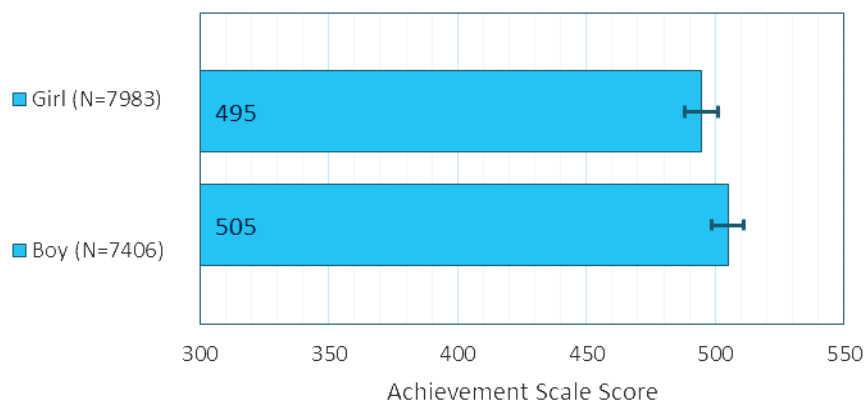
Altogether 6 proficiency levels were identified and the number of students falling under each of these categories was calculated. After that the percentage of students was calculated under each category. In Figure 2.2, the percentage of students under each of the proficiencies levels 1, 2, 3, 4, 5 and 6 have been presented.

The data in Figure 2.2 depicts that highest number of students (38.81%), under all the categories, have achieved the proficiency level 4 – followed by proficiency level 3. The highest proficiency level (level 6) has the fewest number of students (0.84%) which implies that reaching the advanced level has been very difficult for students in mathematics at Grade 8.

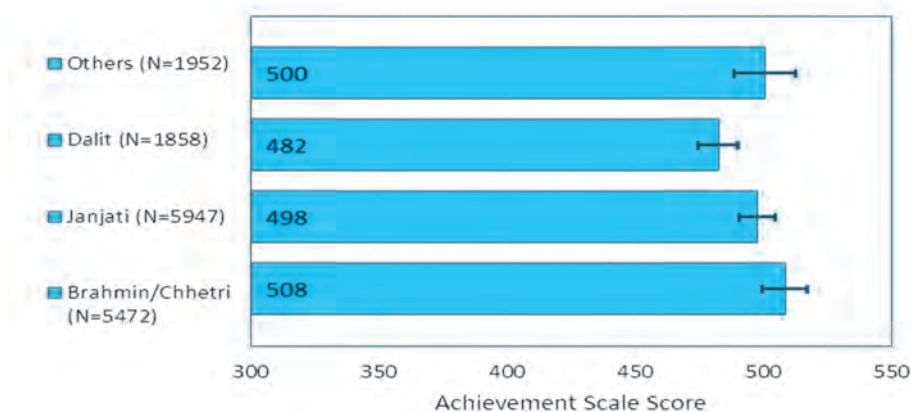
2.5 Results by Gender, Ethnicity and Home Language

The analysis of data from a gender perspective demonstrates that the boy students' mean achievement score has been higher compared to the mean score of the girl students. The boy students have achieved the mean score of 505 (see Figure 2.3), while the girl students have achieved 495. Thus, the boy students have the achievement higher than the national mean. Conversely, the achievement of the girl students is lower than the national mean score by about 5 point. The difference of scores between boys and girls is found statistically significant at the confidence level of 95%.

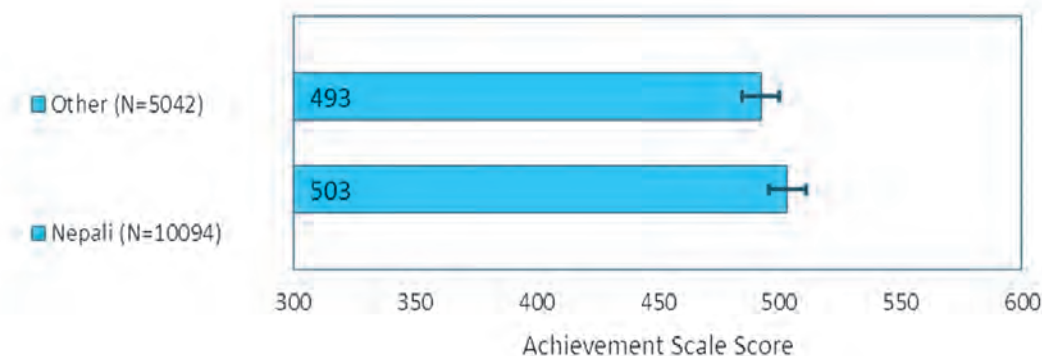
Figure 2.3 : Mean score in Mathematics by gender



The data presented in Figure 2.4 shows that the achievement score gained by Brahmin/Chhetri students was 508, which is higher than the national mean and the score achieved by other ethnic groups and Dalits. Comparing the mean scores of Janajati and Dalits, it shows that Janajati performed better than Dalit as the achievement scores of Janajati and Dalit students are 498 and 482, respectively. However, both scores are lower than the national mean score. Similarly, the differences in the mean scores between Brahmin/Chhetri and Dalit, Brahmin/Chhetri and Janajati students as well as Janajati and Dalit students are statistically significant at 95% of confidence level.

Figure 2.4 : Mean score in Mathematics by ethnicity

Regarding the students' linguistic background (their home language), two categories of students were distinguished : those with Nepali as their home language and the ones having a home language other than Nepali. Their achievement scores show that the students having Nepali as the home language have outscored the ones having other home languages. While the former category of students has the mean score of 503 (slightly above the national mean), the latter category has scored 493 (clearly below the national mean). The difference between these two mean scores is 10 points (see Figure 2.5).

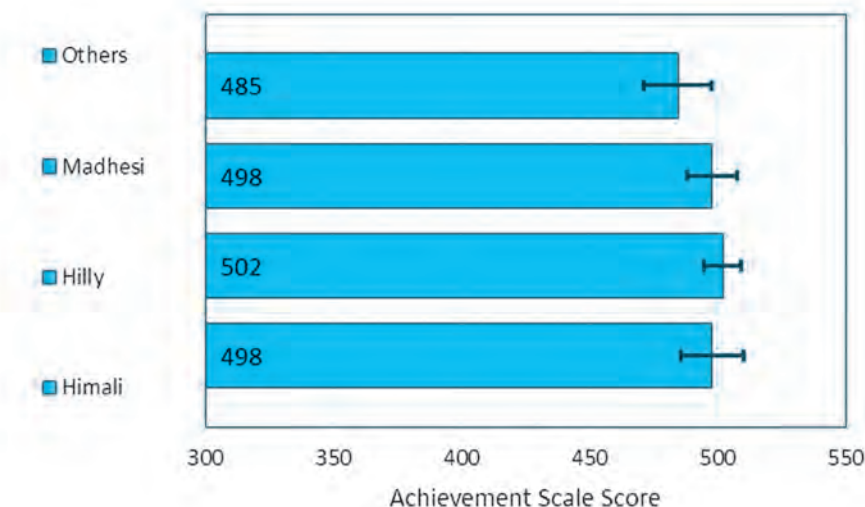
Figure 2.5 : Mean score in Mathematics by home language

The statistical significance test at the 95% confidence level shows that there are statistically significant differences in mean score Nepali and other home language group of students in Mathematics.

2.6 Results by Identity with Geography

The test scores were analysed in terms of the identity with geography as well. The students were asked to choose their identity based on geography (Himali, Hilly, Madhesi and other).

Figure 2.6 : Mean score in Mathematics by identity with geography



As depicted by the data (Figure 2.6), the mean score of students who themselves categorised as ‘Hilly people’ is slightly higher than the national mean, while the mean scores in the case of the students who identified with ‘Himali’ and ‘Madhesi’ are slightly lower than the national mean. As Figure 2.6 present, the Hilly students have achieved the mean score 502 whereas the Himali students as well as Madhesi have achieved the equal mean score of 498, yielding a small difference but not statistically significant between the score of Hilly and Himali as well as Hilly and Madhesi. In the case of students with Madhesi and Himali identity, both have achieved the equal mean score.

2.7 Results by Types of Schools

The mean score was found 485 in the case of community schools and 547 in institutional schools. The score of community schools has remained far lower than the national mean and that of institutional schools is distinctly above the national mean. With the difference of 62 (see Figure 2.7), the gap between the two types of schools seems quite alarming, which obviously gives statistically significant difference at the confidence level of 95%.

Figure 2.7 : Mean score in Mathematics by types of schools

2.8 Results by Various Influencing Factors

With a view to study the influence of various factors on students' achievement, test scores were analysed in terms of parents' education and occupation, students' age, time spent in household chores, support for study they receive, effect of bullying, and the use of free time.

Parents' education and students' learning achievement

To study the impact of parents' education on students' learning achievement, the students were asked to report their parents' education on multiple options (illiterate, just literate, Grade 10, Grade 12, Bachelor's, and Master's and above). The achievement scores are analysed here considering the students' mother's education and father's education separately.

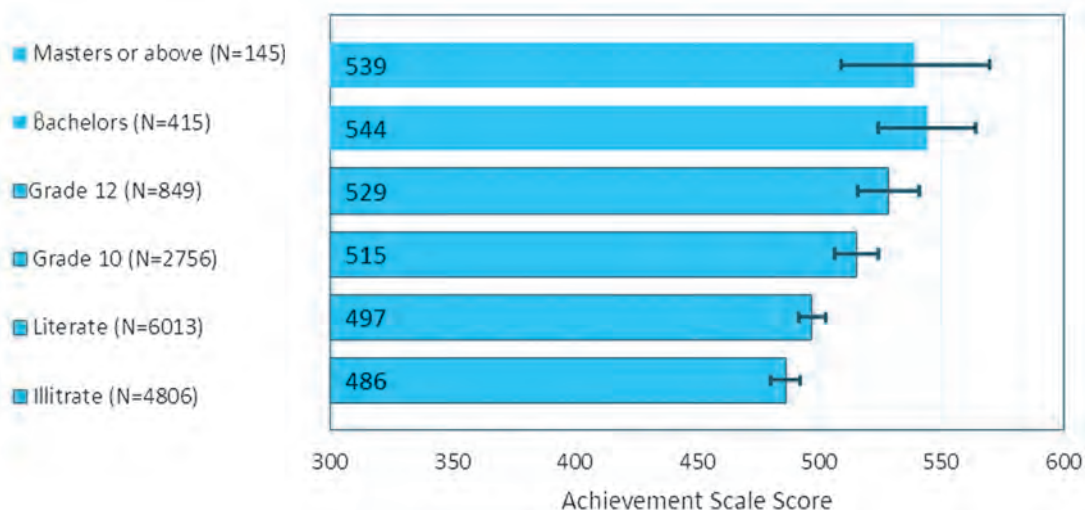
From the analysis of data, we find that out of the total sample of students, altogether 4806 of them reported that their mothers were illiterate and 6013 students reported their mothers were just literate. Similarly, the mothers of 2756 students had the education of Grade 10. Altogether 849 of them reported that their mothers had studied up to the 12th Grade; 415 students said their mothers had studied up to Bachelor's level; and the mothers of altogether 145 students had the qualification of Master's degree and above.

The impact of mother's education is noticed in students' learning achievement as presented in Figure 2.8. As the figure depicts, students' learning achievement in mathematics is found lower than the national mean in the case of the students having illiterate and just literate mothers (with the mean score of 486 and 497, respectively). The score of students having literate mothers can be considered close to the national mean while the score of the children of illiterate mothers is obviously poor compared to the national mean. In the case of students of all other categories

(considering the education of their mothers), the scores are higher than the national mean – whereby the highest mean score was found among the students having mothers with Bachelor's level education (544 point). However, compared to the score of the students with mothers having Bachelor's level of education, the children of mothers with Master's level and above have some poorer mean score; the gap between these two categories remaining 5 point.

On the whole, a difference with 58 point is seen between the lowest and highest scoring categories of students, with the implication that mother's education has positively influenced the learning achievement in mathematics at Grade 8.

Figure 2.8 : Mean score in Mathematics by level of mother's education

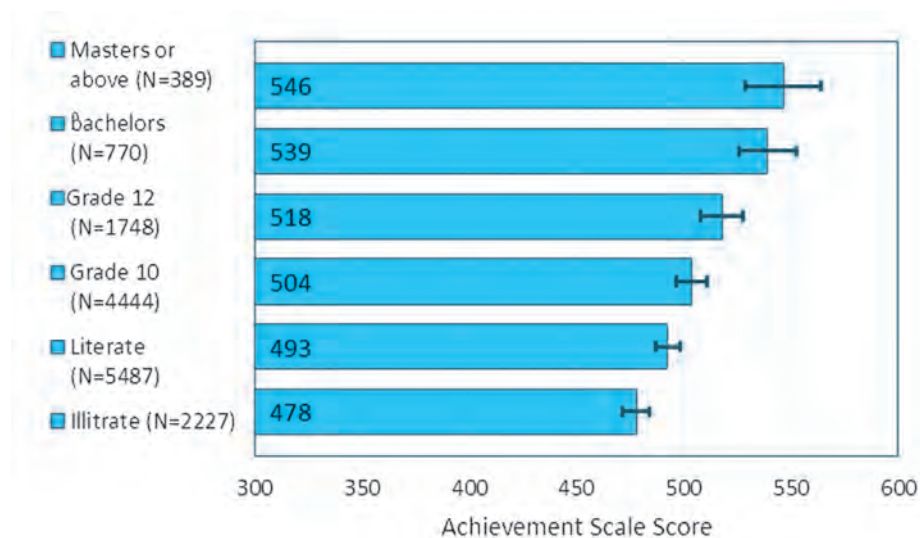


Similarly, there is a statistically significant difference between the mean scores of students having any of the two groups of mother, except for the students with mothers having Bachelor's and Grade 12 or Master's/above qualifications. In the case of Bachelor's and Master's/above, the mean score decreases slightly as the qualification of mother changes Master's/above from Bachelor's level.

The Figure 2.9 shows the influence of father's education on the learning achievement of students. As the data show, out of the total sample of students, altogether 2227 students reported that their fathers were illiterate; 5487 of them said that their fathers were just literate. In the same way, the fathers of 4444 students had the education of Grade 10. Altogether 1748 students' fathers had studied up to the 12th Grade; 770 students said their fathers had studied up to Bachelor's level; and the fathers of altogether 389 students had the qualification of Master's degree and above. Like in the case of mothers' education, the impact of father's education is clearly noticed in

students' learning achievement as presented in Figure 2.9. As the figure depicts, students' learning achievement in mathematics is found lower than the national mean in the case of the students having illiterate and just literate fathers (with the mean score of 478 and 493 point, respectively). In the case of students of all the remaining categories of fathers, the scores are higher than the national mean. Thus, the highest mean score was found among the students having their fathers' education Master's degree and above (546 point), followed by the students with fathers having Bachelor's level education (539 point), Grade 12 (518 point) and Grade 10 (504 point).

Figure 2.9 : Mean score in Mathematics by level of father's education



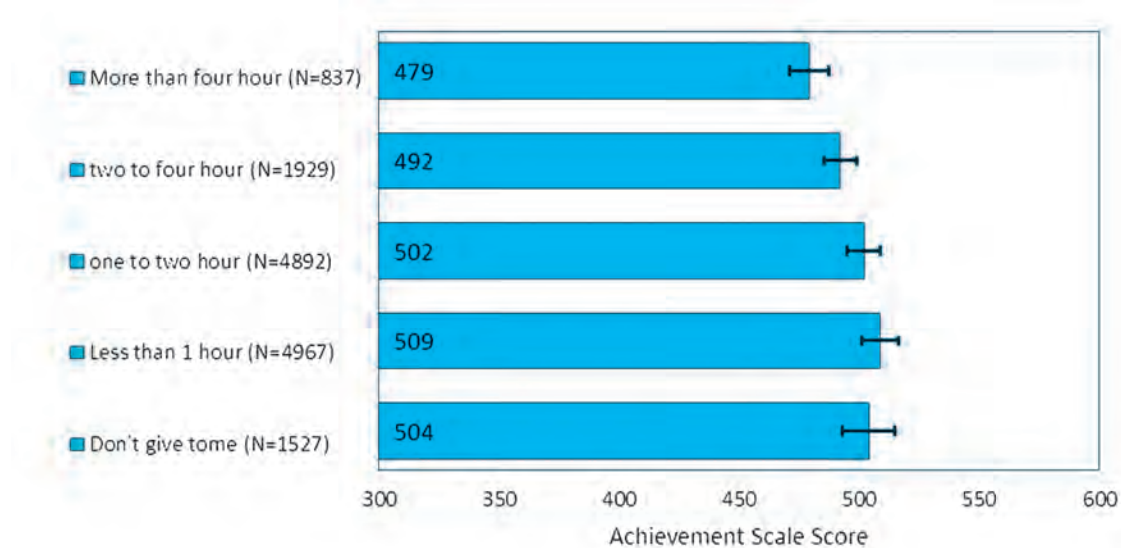
One of the differences on the influence of father's education on students' scores from the mother's education is that there is a continuous growth in average scores when the level of education goes higher level, which was not the situation when mother's education goes from Bachelor's to Master's level. The gap between these two extremes is seen greater than the gap in the case of mothers' education. Thus, father's education is found having a strong influence in students' learning achievement in mathematics at Grade 8. It is seen that there are statistically significant differences between the mean scores of the students having any of the two groups of fathers except Bachelor's and Master's at the confidence level of 95%.

Results by students' involvement in household chores

Using the background questionnaire, sample students were also asked to self-report how much time they spend every day for the household chores. As the data have demonstrated, altogether

1527 students do not even give time to household chores. The number of students spending less than 1 hour in household chores is 4967; those spending 1-2 hours are 4892; and 1929 students were found spending 2-4 hours for household chores. In the same way, some students (837) reported that they spend more than 4 hours in household chores every day.

Figure 2.10 : Mean score in Mathematics by students' involvement in household chores



From the data presented in Figure 2.10, those students who have spent a maximum of 2 hours for household chores every day have scored above the national mean. On the other hand, the students spending more than 2 hours have scored less than national mean. The mean score of the students who have spent more than four hours in household chores is 479 in mathematics; the poorest score among the 5 groups of students categorized in terms of the time spent on household chores. In general, the trend of the more the time given in household chores, the less the achievement has been noticed. However, the students giving less than one hour for household chores have scored more than those who have given absolutely no time for such chores. This suggests that a short time given in household chores has been supportive for students' learning achievement in mathematics.

Students' learning achievement by age group

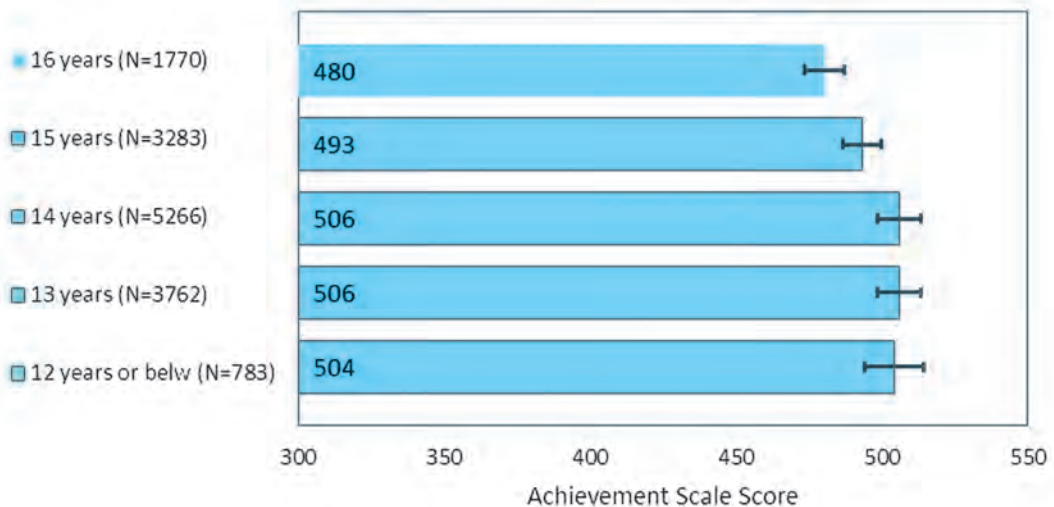
During the study, students were also asked to report their age to analyse its relationship with the learning achievement. The reported ages were grouped into five age groups—12 and below, 13, 14, 15, and 16 and above. The majority of students (5266) are 14 years old, while 3762 are 13

years old; 3283 are 15 years old and 1770 of them are 16 years old. The smallest group of students was of the age of 12 years or below in which there were 783 students. The influence of age in learning achievement can be seen in the data presented in Figure 2.11.

As the data indicate, two groups of students (15 years old and 16 years old) have the mean scores less than the national mean with the score of 493 and 480, respectively. The highest mean score is found in the age group of 13 years (with 506 point). The students of grade appropriate age have achieved a higher mean score than the students of older age groups (15 years old and 16 years old). But the score of the younger age group (12 years old) is not much different from the score of Grade appropriate age group in mathematics (see Figure 2.11).

Although, except for the age groups of students 13 and 14 years, there are some differences in the mean scores between the different age group of students. Statistically significant difference in the mean scores is found except for the students' mean scores between age 12 and 13/14, and 13 and 14 years group at the confidence level of 95%.

Figure 2.11 : Mean score in Mathematics by age group

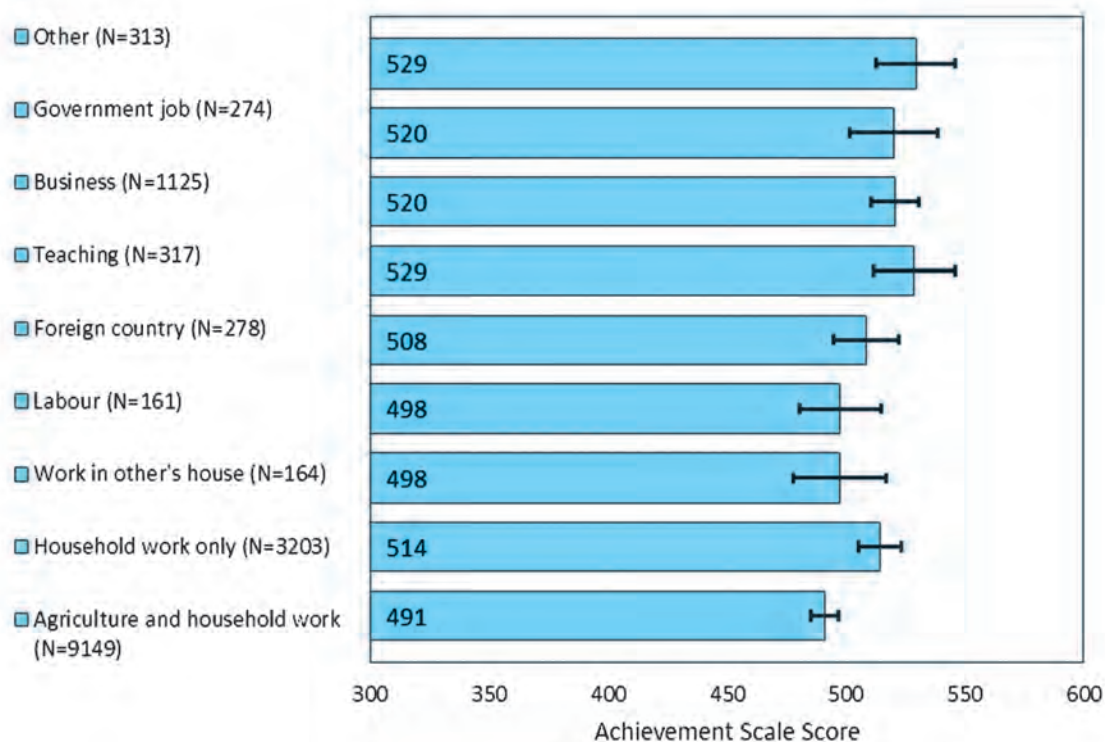


Parents' occupation and students' learning achievement

To analyse the impact of parents' occupation on students' learning achievement, the students were asked to report their parents' occupation on multiple options (agriculture and household work, household work only, work in others' houses, labour, foreign country employment, teaching, business, government job, and other jobs). The achievement scores are analysed here by considering the students' mother's and father's employment separately.

The impact of mother's occupation is noticed on students' learning achievement as presented in Figure 2.12. From the figure, it is seen that the students' learning achievement in mathematics is found lower than the national mean in the case of the students' mothers having the occupation of agriculture and household work, labour, and work in others' houses (with the mean score of 491, 498 and 498 point, respectively). In the case of students of the remaining categories (considering the occupation of their mothers), the scores are higher than the national mean whereby the highest mean score is found among the students having mothers' occupation of teaching (529 point). Considering the mean scores from the highest point towards the bottom, the data depicts that the second highest score is 520 (in the case of mothers having the profession of business), 520 (in the case of government job), 514 (in the case of household work only), and 508 (foreign employment).

Figure 2.12 : Mean score in Mathematics by mother's occupation

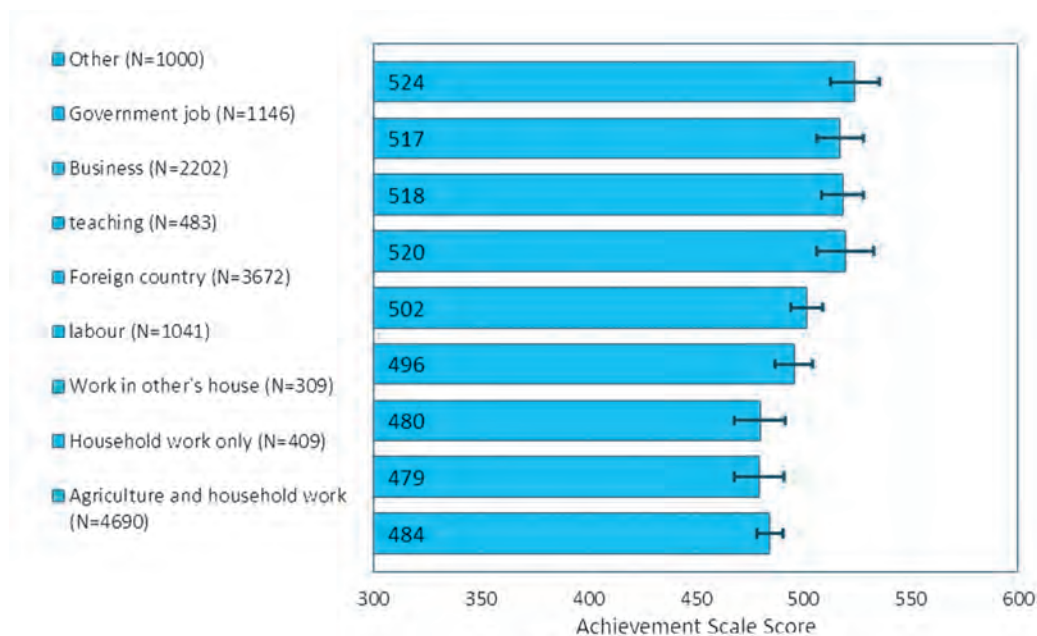


Overall, a remarkable difference between the lowest and highest scoring variables (with 38 point, which is considerable) is noticed. This implies that the noticeable influence of mother's occupation is found in Grade 8 students' learning achievement in mathematics. Similarly, the mean score of the students with mother's occupation other than agriculture and labourer are statistically significant with the students' average scores with the mother's occupation agriculture. Similarly,

the mean score of each group of students having mother's occupation as business, teaching and government service and each group of students having mother's occupation other than these three are statistically significant at the confidence level of 95%.

The Figure 2.13 depicts that the influence of father's occupation on the learning achievement of students. The students' learning achievement in mathematics is found lower than the national mean in the case of the students' fathers having the occupation of agriculture plus household work, only the household work, work in others' houses, and labour (with the mean score of 484, 479, 480 and 496 points, respectively). The students of the remaining categories (considering the occupation of their fathers) have scored higher than the level of national mean. Accordingly, the highest mean score is found among the students with their fathers having teaching as occupations (520 point). Considering the mean scores from the highest point towards the bottom, the data depict that the second highest score is 518 (in the case of fathers having the profession of business), 517 (in the case of government job), and 502 (in the case of foreign employment).

Figure 2.13 : Mean score in Mathematics by father's occupation



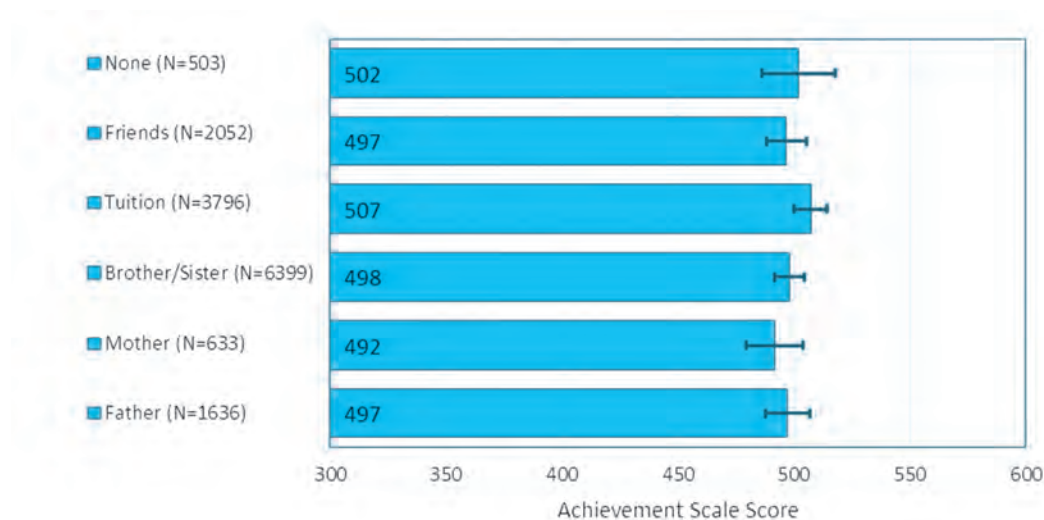
A remarkable difference is noticed between the lowest and highest scores. Between the two extremes, the gap of 41 point is found, which is considerable. Similarly, the influence of father's occupation is found visible in Grade 8 students' learning achievement in mathematics. The mean score of the students with father's occupation other than agriculture, household work and working

in other's house are statistically significant with the student's average scores having fathers of these occupations. Similarly, the mean score of each group of students having father's occupation as business, teaching and government service and each group of students having father's occupation other than these three groups are statistically significant at the confidence level of 95%.

Results by the support student received for study

As Figure 2.14 presents, students receiving support from their siblings (brothers/sisters) was higher (altogether 6399) compared to the number of students who received from other sources. This number was followed by the number of students receiving support from tuition classes (3796). Those receiving support from their friends were 2052. In the same way, some of them reported to have benefited from the support given by their fathers (1636) and mothers (633), while 503 students had reported that they studied Mathematics subject, independently without support from any sector. Details of the data regarding the results by support to the students are depicted in Figure 2.14.

Figure 2.14 : Mean score in Mathematics by support student receive for study



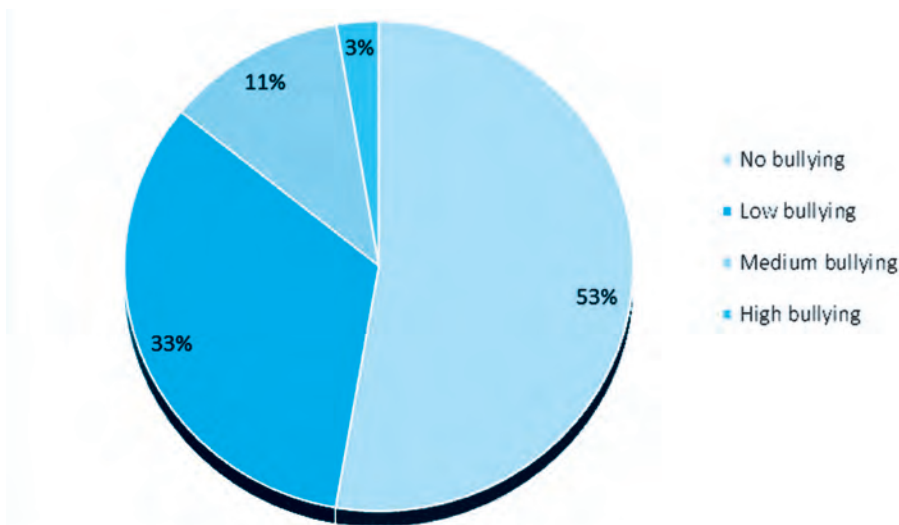
The data depict that only two categories of students have scored greater than the national mean – those who received support from tuition classes and those who studied independently (having no support from others) – with the mean scores of 507 and 502, respectively. The students receiving support from other persons have scored below the national mean – although the score of those receiving support from fathers, siblings (brothers/sisters) and friends looks a bit close to the

national mean – which has remained 497, 498, and 497, respectively. The students receiving support from mothers have achieved only 492. The gap between the highest and lowest mean scores is 15 point.

Students' bullying experiences and achievement

Through the background questionnaire, the students in this assessment were asked to respond whether they had the experience of being bullied during one month's period (in the previous month from the assessment). Accordingly, they reported their bullying experience, which has influenced their achievement score. Six types of bullying experiences were recorded from students' response, and these responses were grouped into three categories : students experiencing any one or two types of bullying as low bullying; experiencing any three or four types of bullying as medium bullying; and experiencing any five or six types of bullying as high bullying. The pie chart (Figure 2.15) presents the percentage of student experienced different types of bullying and percentage of student experienced no bullying. The figure depicts that 47 per cent of students experienced at least one level of bullying of which 33%, 11% and 3% of students experienced a low medium and high level of bullying. Similarly, the mean scores of the students experiencing different levels of bullying, it was found that highly bullied students have poor mean score than the other groups, and the students experiencing medium level of bullying have lower mean scores than the low bullied and no bullied students. It indicates that the bullying has a negative influence on the students' achievements; the level of bullying increases the mean score decreases.

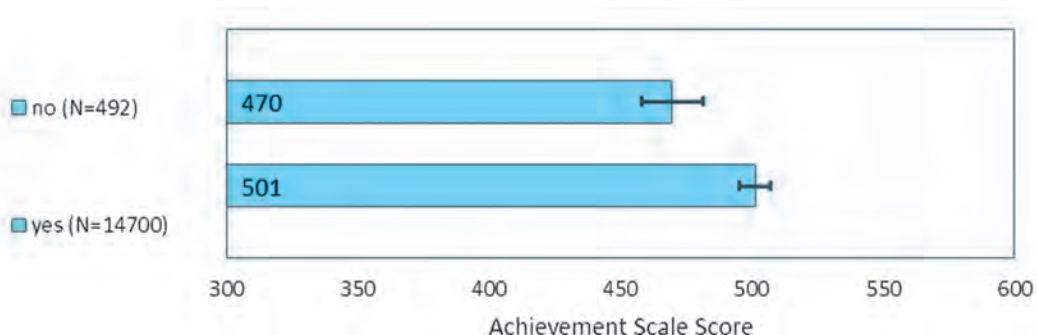
Figure 2.15 : Percentage of students experiencing different levels of bullying in Mathematics



Results by the availability of textbook

Most of the students in this study (altogether 14700) had textbooks, while some students (492) did not have. The percentage of students who did not have Mathematics textbook was 3.2. Figure 2.16 shows the mean score of students having textbooks and those who did not have it.

Figure 2.16 : Mean score in Mathematics by the availability of textbook



As the above figure indicates, the students who did not have textbooks achieved 470 mean score, which is considerably lower than the national mean score. In the case of the students who had access to the textbook, the mean achievement score has remained 501, a slightly higher figure compared to the national mean score. The scores between the student having textbooks and not having textbooks remain statistically significant at the confidence level of 95%.

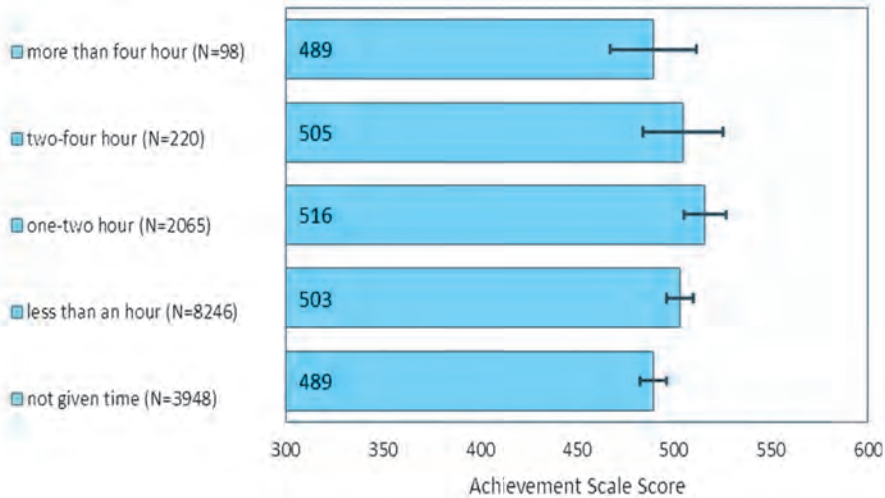
Results by students' time of watching TV

The number of sample students spending time in watching TV every day for less than 1 hour, 1-2 hours, 2-4 hours and more than 4 hours was 8246, 2065, 220 and 98, respectively. Altogether 3948 students did not have the habit of giving time to watch TV. Figure 2.17 shows the mean achievement scores of these different categories of students.

The figure shows that the students who watch TV for 1-2 hours have the highest achievement score (with the mean of 516), compared to the students' score under other categories. The students with the habit of watching TV from less than 1 hour to 2-4 hours have scored more than the national mean. The score of the students watching TV excessively (more than 4 hours a day) and those not giving time for TV have scored the poorest (both scores remaining below the national mean); and the mean for those two is the same. Statistically significant difference in the mean scores between the students watching TV from 1 to 2 hours and the mean score of each of the rest of the categories of students is found. Similarly, statistically significant differences are found

between the rest of the categories of students and the students did not watch TV at the confidence level of 95%.

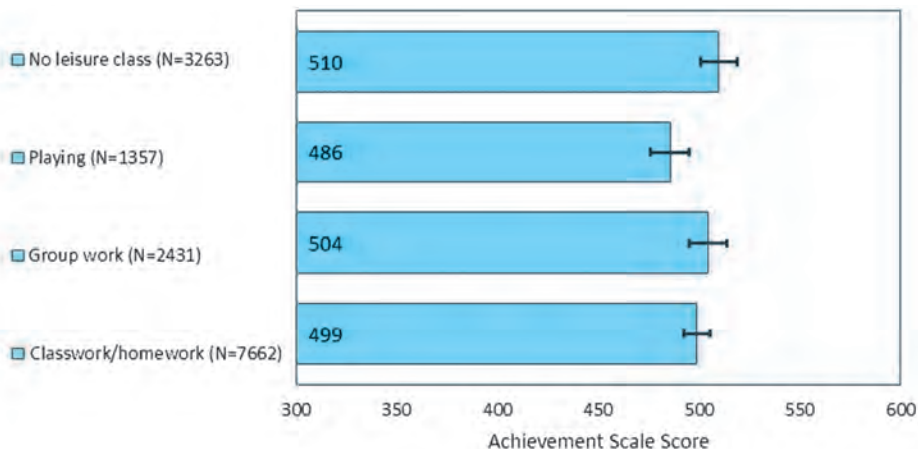
Figure 2.17 : Mean score in Mathematics by students' time of watching TV



Results by the use of leisure time at school

The students in the assessment were also asked to respond to the background questionnaire on how they used their leisure time at school. The sample students using their leisure time in class work/homework, group work, and playing were 7662, 2431 and 1357, respectively. But 3262 students responded that they did not have a leisure time in school. The achievement scores of these 4 categories of students are given in Figure 2.18.

Figure 2.18 : Mean score in Mathematics by the use of leisure time at school



The data indicate that the students having no leisure time have achieved the highest score (with 510), which is clearly above the national mean, while lowest score is seen in the case of students who spent the leisure time by playing (with 486). The students who engaged in group work during the leisure period have gained above the national mean (504), while those engaged in class work/homework have scored slightly less than the national mean (499).

Overall, we can see the discrepancy of 24 point between the highest scoring category and lowest scoring category of students, implying a noticeable influence caused by whether there is leisure time for students and how they used the time.

Results by feedback provided on students' homework

The students were asked to mention how often teachers give them homework and how often teachers provide feedback on their homework. There is no clear indication whether giving or not giving homework influences on students' score. But if teachers provide regular feedback on their homework, students' achievement scores increase.

Figure 2.19 : Mean score in Mathematics by teacher's feedback on students' homework

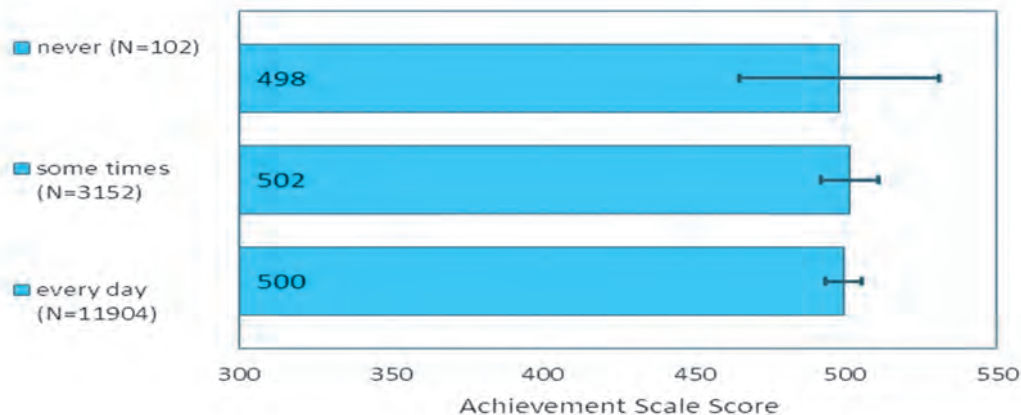
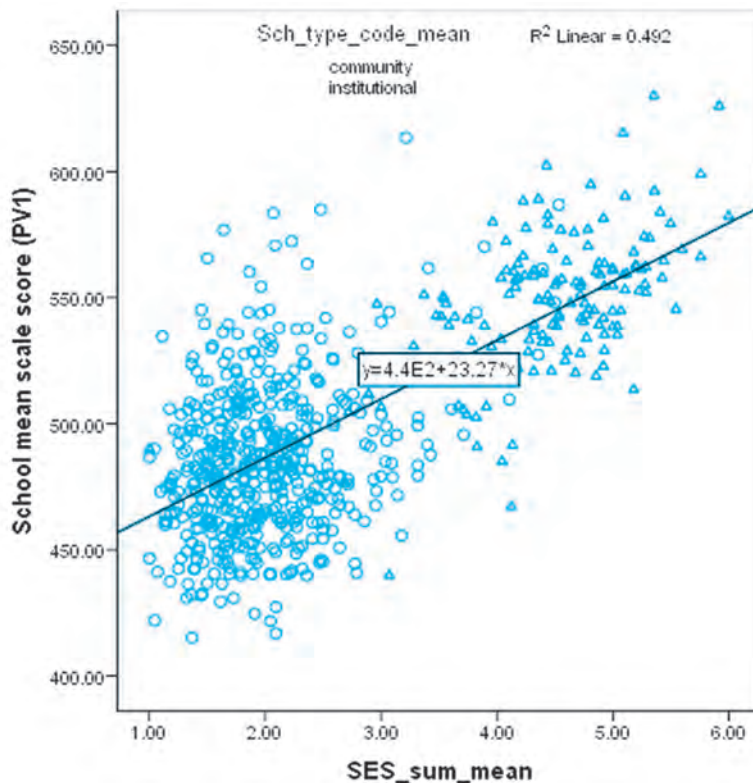


Figure 2.19 shows that the mean score of the students who received feedback regularly is higher (500/502) than the score of the students who did not receive feedback (498), with the difference of 2 to 4 point mean score.

2.9 Relation between SES and Schools' Mean Score

Socio-economic status of students was estimated by aggregating seven variables : mother's education, father's education, mother's occupation, father's occupation, home possessions, home accessories and students attending private schools. A regression model was developed in order to identify relation between mean of each SES and mean score in Mathematics. Plotting schools in relation to students' mean SES and mean score in Mathematics in a two dimensional space we get the scatter plot.

Figure 2.20 : Relation between SES and Schools' Mean Score in Mathematics



The scatter plot (Figure 2.20) shows that the schools with high SES (average SES value of students) concentrated more on relatively high mean score and the schools with low SES concentrated more on relatively low mean score. However, there are some cases of high SES schools having relatively low mean scores. Similarly, there are some cases of low SES schools with relatively a high mean score.

This plot also indicates that most of the private schools have high SES students compared to public schools, and with a few exception, public schools have low SES compared to private schools.

2.10 Attitude of Students towards Teacher and School

Attitudinal questions, related to school and teachers, were asked to students and the responses to each category were tabulated with their frequencies. The data show that the correlation between the attitude of students towards teachers and schools is positive ($r = 0.54$). This high correlation reveals that students have a very similar view towards teachers and schools. This also indicates that making a positive attitude towards teachers has a direct relationship with the school's efforts. The correlation with the sum of attitude towards schools and attitudes towards teachers are $r = 0.075$ and $r = 0.065$ respectively, are positive. However, both correlations are very low.

Moreover, the total of attitude towards teachers and schools correlates with the student achievement, positive ($r = 0.14$), indicating that positive attitude towards schools and teachers can improve the achievement of students.

2.11 Comparing the Overall Results NASA 2017 with the Results of 2013

NASA 2013 score is compared with NASA 2017 based on the Classical Test Theory (CTT), percentage of correct answer (P-value or facility index). Altogether 12 items of NASA 2013 were linked with NASA 2017 from various content and cognitive domains. Items were distributed in different sets. For the better visualization of the achievement scores in linking items, the raw score of both NASA tests 2013 and 2017 of the linking items was transformed into a standardised score (z-score), with mean zero. Then the standardized score was shifted to a scale score of mean 500 and standard deviation 50. The final transformed score is presented in Table 2.21.

Table 2.3 : Comparison of the mean score of NASA 2013 and NASA 2017 based on linking items in Mathematics

Year	Average achievement Scale score (CTT)
NASA 2013	507.96
NASA 2017	492.39

The transformed scale score indicate that the achievement score in 2017 is significantly lower than the previous assessment of 2013 (at $p < 0.05$). This comparison is based on the sample data. The data has not been weighted for the population, and the result is based on the linking items.

CHAPTER 3**RESULTS IN NEPALI AT NATIONAL LEVEL****3.1 Introduction**

The defined population for Nepali subject was 582178 and the number of sample students was 16067. But the actual number of students participated in NASA 2017 in Nepali was 15369. Based on the data collected from these students, ERO, using IRT with Conquest software as well as SPSS and Excel tools, analysed the students' results in terms of proficiency levels. In addition, students' achievement scores were analysed in relation to their background information such as socioeconomic status, ethnicity, gender, home language, school type, identity with geography, school and classroom practices, and home environment. The data were also analysed province-wise.

The students' ability scores were estimated by using test scores and these ability scores were transformed into a scale score with the national mean score of 500 point, meaning that the national mean score has been fixed at 500 point for the purpose of analysing the overall test scores. The test scores at various categories as well the test scores at provincial level were compared considering this score as a base.

The test scores were first drawn from the sample students and analysed considering the sample weight. After that the generalizability of the test scores were estimated for the entire population of the study, using a confidence level of 95 %. The standard errors and confidence intervals of mean scores were estimated during the analysis and the confidence intervals were estimated to identify the statistical significance of comparable means.

3.2 Defining Proficiency Levels for Nepali

Proficiency scale for Nepali was computed by taking the lower and higher levels of proficiency below 383 and above 605, respectively. Four proficiency levels were computed from the score 383 to 605, which gives a range of 222.

Table 3.1 : Proficiency levels and the score range in Nepali

Proficiency Level	Score	SE
Level 6 (Advanced)	605 <	0.04
Level 5 (Proficient 1)	549 — 605	0.53
Level 4 (Proficient 2)	494 — 549	0.76
Level 3 (Proficient 3)	438 — 494	0.73
Level 2 (Basic Level)	383 — 438	0.32
Level 1 (Pre-basic)	< 383	0.13

Based on the descriptions of items that corresponds to each of the above proficiency levels in item person map in Nepali together with subject experts' judgment the descriptions of students' six levels proficiency have been defined. These descriptions of six proficiency levels in Nepali for Grade 8 indicate that what a student at particular competency level can do in Nepali. The Table 3.2 specifies the competencies of students at various levels of proficiency in Nepali language.

Table 3.2 : Descriptions of six proficiency levels in Nepali for Grade 8

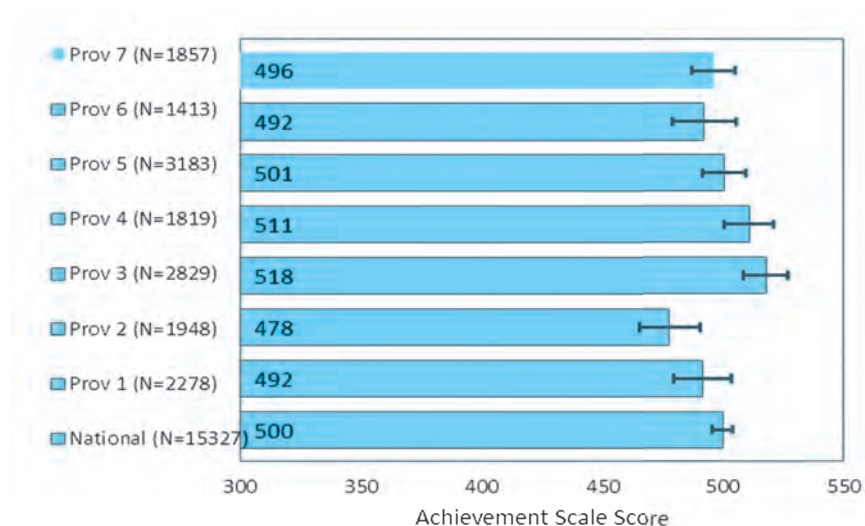
Level	Score range	Description
Level 1	83	दिइएका अनुच्छेदको सीमित बोध गरी अनुच्छेदबाट सोधिएका के, कहाँ, को र कुन जस्ता सरल र सोझो उत्तर आउने प्रश्नको उत्तर दिन, सूची तयार गर्न र साधारण घटनाको क्रम मिलाएर सार्न ।
Level 2	383 - 438	अनुच्छेदमा प्रयुक्त सूचनाको सामान्य बोध गर्न तथा सूचनाको पहिचान गरी सो का आधारमा प्रश्नको उत्तर दिन । नक्सामा प्रयुक्त चिन्हका आधारमा सही सूचना पहिचान गर्न । साधारण र सरल प्रकारका वाक्य वाक्य लेखन गर्न ।
Level 3	438 - 494	अनुच्छेदको बोध गरी सोधिएका प्रश्नको कारण सहित उत्तर दिन, अप्रत्यक्ष सूचना पहिचान गर्न, सरल शब्दहरूको पर्यायवाची शब्द पहिचान गर्न, निर्देशन अनुसार ढाँचा मिलाई सामान्य स्तरको निर्देशित लेखन तथा सामान्य वाक्य रचना गर्न ।
Level 4	494 - 549	अनुच्छेदको मुख्य विषय आसय पत्ता लगाउन । उपयुक्त शीर्षक चयन गर्न । निर्देशित जीवनी, प्रबन्ध/निबन्ध, कथा लेखन । संवाद पूरा गर्न । दिइएका वाक्यमा उपयुक्त चिन्ह प्रयोग र शुद्धाशुद्धि मिलाउन । चिठीको सामान्य स्तरको प्रत्युत्तर लेखन र सामान्य स्तरको निवेदन तयार गर्न, चित्रको सामान्य लिखित वर्णन गर्न तथा वादविवादको विषयमा सामान्य तर्क प्रस्तुत गर्न ।
Level 5	549 - 605	दिइएका घटनाका आधारमा साधारण समाचार र निर्देशित कविता तयार गर्न । अनुच्छेदको विषयवस्तुको बोध सहित तुलना गर्न, सो अनुसार तर्क दिन, मूल्याङ्कन गर्न । अनुच्छेदको सारांश लेखन । उपयुक्त चिन्हको प्रयोग सहित व्याकरणिक रुपमा शुद्ध वाक्य रचना गर्न ।
Level 6	605 <	अनुच्छेदको पूर्ण बोध गरी त्यसमा प्रयुक्त पारिभाषिक/प्राविधिक शब्दको सन्दर्भगत अर्थ बताउन, अर्थ खुल्ने गरी वाक्यमा प्रयोग गर्न तथा उच्चस्तरीय व्यवहारिक लेखन क्षमता प्रस्तुत गर्न ।

3.3 Overall Mean Score by Province

The data show that students' achievement in province 3 is the highest among the seven provinces in Nepali subject. The mean score of this province is 518, which is higher than the national mean score by 18 points. The status of students' achievement in province 2 is the lowest, with the mean score of 478.

Figure 3.1 shows that the mean score of province 4 (511) is higher than the national mean score. Likewise, the difference between the mean score of province 5 (501) and the national mean is very small. The students' achievement in province 1 is below the national mean score (492). Similarly, the mean score of province 6 is slightly higher than the mean score of province 2, but lower than the national mean score. The mean score for this province is 492. The mean score of province 7 is 496 which is slightly lower than the national mean score.

Figure 3.1 : Mean scores in Nepali by province



Overall, the scores show that only three provinces – 3, 4 and 5 – have the mean scores above the level of national mean. The mean scores of other four provinces are below the national mean score.

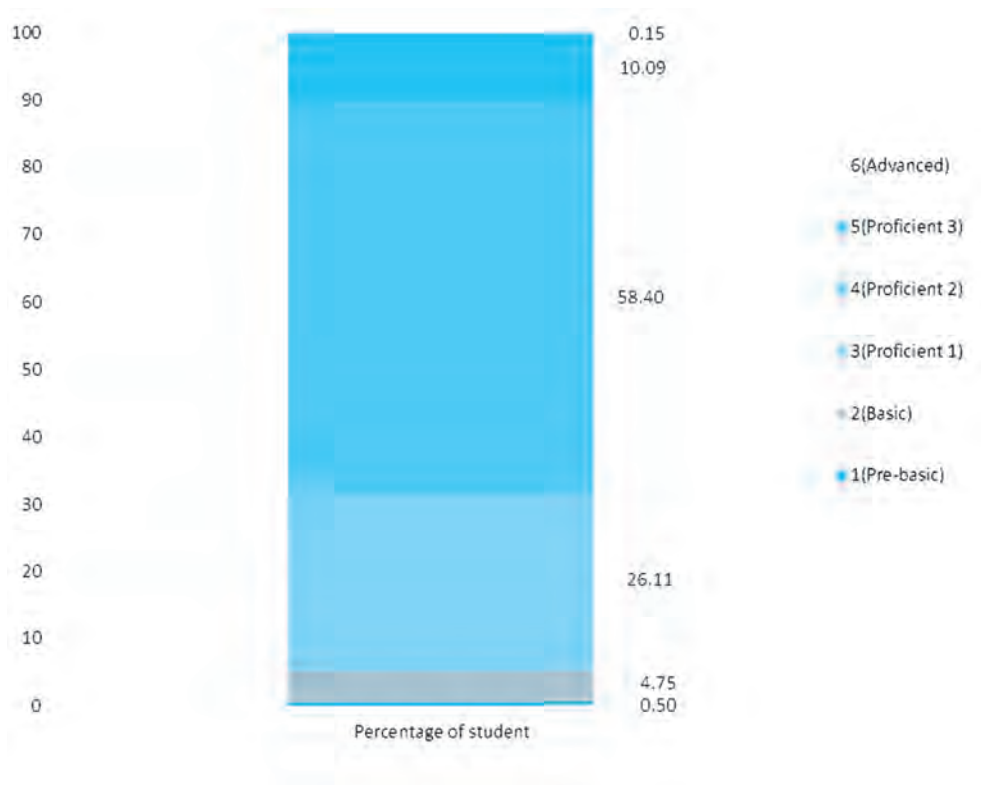
3.4 Results by Proficiency Levels

The test scores were analysed in terms of six proficiency levels. The levels included are 1, 2, 3, 4, 5 and 6 in the order of lower (pre-basic) to higher (advanced) level. The scores below 383 were

considered 'level 1' while the scores within the range of 383-438 were categorized as 'level 2'. Similarly, the scores within the range of 439-494 and 494-549 were labelled 'level 3' and 'level 4' respectively. The scores within the range of 549-605 and above 605 were categorized respectively as 'level 5' and 'level 6'.

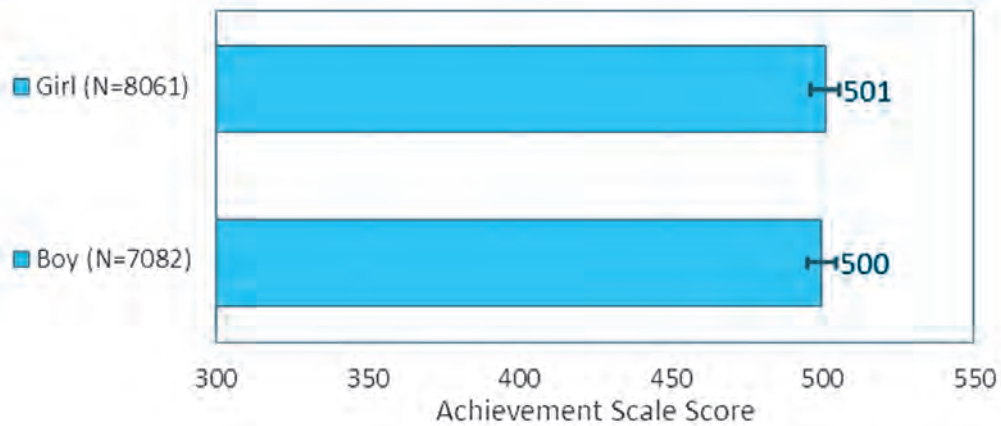
The Figure 3.2 shows that majority of students (58.4%) have achieved the scores that correspond to 'level 4'. Likewise, 26.1% and 10.1% students have achieved the scores of 'Level 3' and 'Level 5' levels, respectively. The data demonstrate that only 0.2% students have achieved 'level 6'.

Figure 3.2 : Student percentage by proficiency levels in Nepali

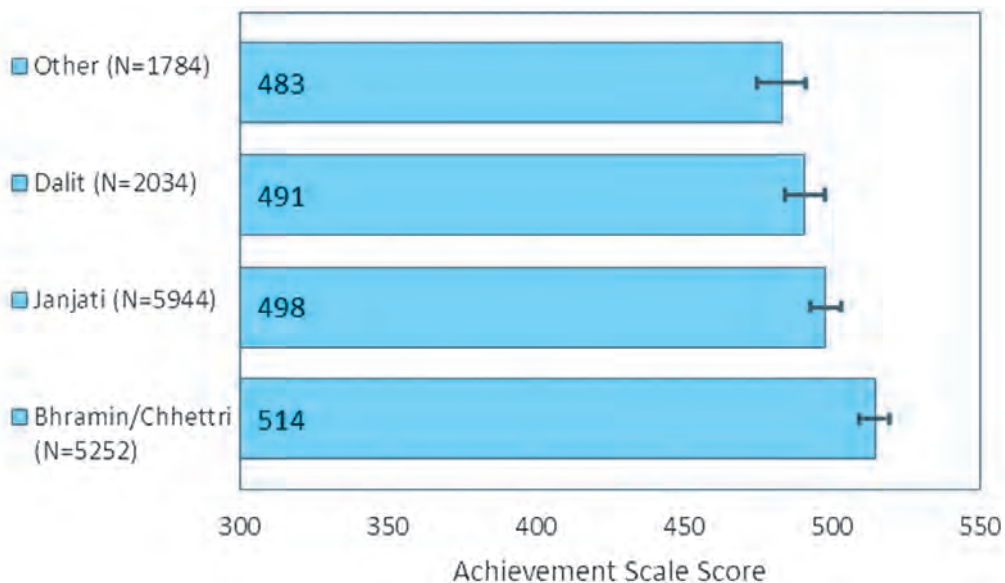


3.5 Results by Gender, Ethnicity, Language

The analysis of data in terms of gender shows that girl students' mean achievement score is slightly higher than the mean score of boy students in Nepali. The girl students have achieved (501), as presented in Figure 3.3, which is slightly higher than the national mean score, but there is no significant difference in the mean scores between girls and boys. The achievement of boy students is 500, which is equal to the national mean.

Figure 3.3 : Mean score in Nepali by gender

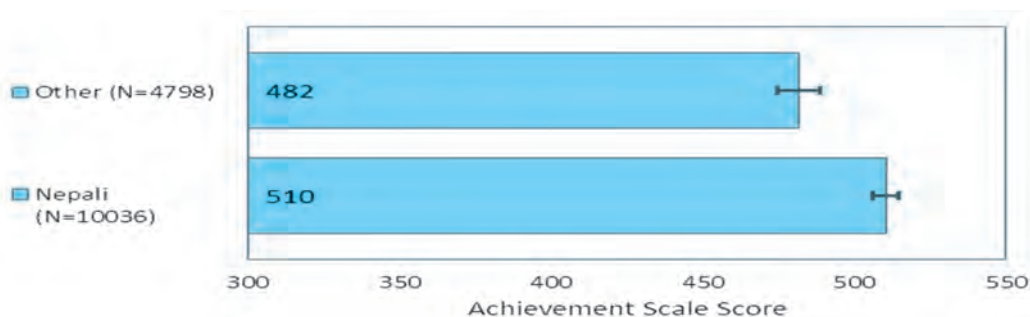
When ethnicity is considered for comparison among students, the mean score achieved by Brahmin/Chhetri students is found higher than the score achieved by the students belonging to other ethnic groups. As presented in Figure 3.4, while the mean score of Brahmin/Chhetri students is 514, Janajati students' mean achievement is 498. The mean achievement score of Dalit students is 491 only. This gives a clear indication that Brahmin/Chhetri students' learning achievement in Nepali is higher than the national mean score while the achievement of students from other ethnic groups is lower than the national mean score.

Figure 3.4 : Mean score in Nepali by ethnicity

While checking statistical significance we see that the mean scores of each of the three ethnic groups of students are statistically significant with other two ethnic groups.

The data shows that there is a variation in the mean score in terms of students' linguistic background as well. The students with Nepali as their home language have achieved far higher than the students whose home language is other than Nepali. As seen in Figure 3.5, the mean score of the students who speak Nepali as their home language is 510, which is higher than the national mean score. But the mean score of the students speaking other languages at home is 482 only, which is low compared to the national mean score. The difference of mean scores of Nepali and other language groups are statistically significant at confidence level of 95%.

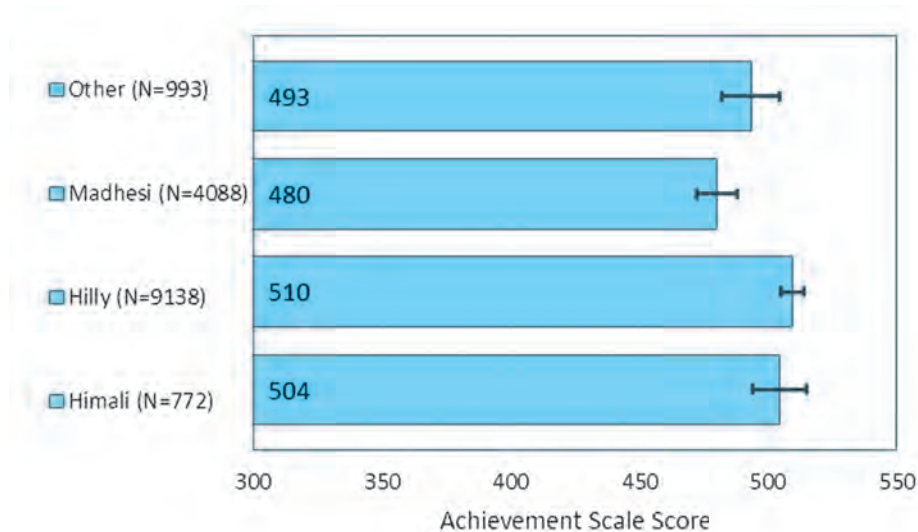
Figure 3.5 : Mean score in Nepali by home language



3.6 Results by Identity with Geography

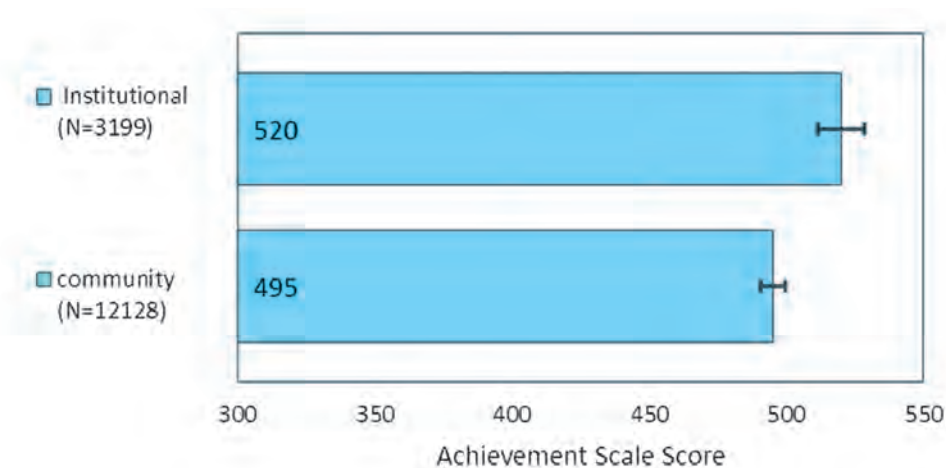
The test scores were also analysed in terms of geographical identity. The students were asked to choose their geographical identity among Himali, Hilly, Madhesi and other. As presented in Figure 3.6, the mean score of Hilly students is higher than the mean score of other students. The students identified with 'Hilly' have achieved 510 mean score while those identified with 'Himali' have achieved 504. Both mean scores are higher than the national mean score. On the other hand, the students' achievement identified as 'Madhesi' has been recorded the lowest; they have achieved 480 only, which is far lower than the national mean score.

It is found that the difference between the mean scores of Hilly and Madhesi as well as Himali and Madhesi students are statistically significant, but the difference between Hilly and Himali students is not statistically significant.

Figure 3.6 : Mean score in Nepali by identity with geography

3.7 Results by Types of schools

There were 12128 sample students who participated in testing from community schools and 3199 students had participated from institutional schools. The mean scores the students from the two types of schools are found 495 and 520, respectively. The score of community schools remained lower than the national mean, while that of institutional schools was distinctly above the national mean. Difference between the two means is 25, which is statistically significant different.

Figure 3.7 : Mean score in Nepali by type of schools

3.8 Results by Various Influencing Factors

In order to understand the influence of various factors on students' achievement, the test scores were analysed in terms of parents' education and occupation, students' age, time spend in household chores, support they receive in studies, effect of bullying, and the use of leisure time.

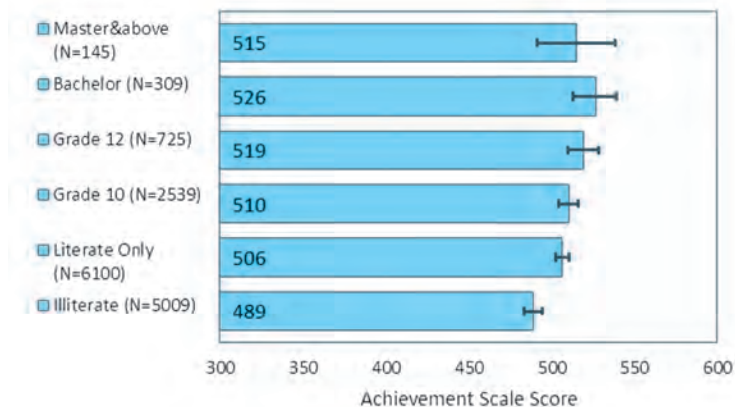
Parents' education and students' learning achievement

In order to identify the impact of parents' education on students' learning achievement, they were asked (in the background questionnaire) to report their parents' education by choosing a response from multiple options (illiterate, just literate, Grade 10, Grade 12, Bachelor's, and Master's and above).

Out of the 15369 students, 6100 had reported that their mothers were 'just literature' while 5009 of them reported they were 'illiterate'. Similarly, 2539 of them mentioned that their mothers had a qualification of Grade 10 while 725 of them reported that their mothers had a qualification of Grade 12. Likewise, mothers of 309 students had Bachelor's and 145 of them had Master's level educational qualifications.

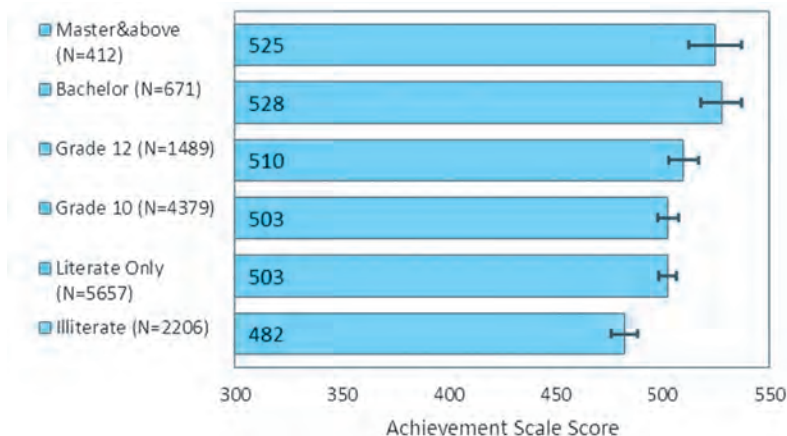
As presented in Figure 3.8, mother's education has impact on students' learning achievement. The mean score of the students whose mothers are 'illiterate' is 489, which is lower than the national mean score. The students' achievements whose mothers are 'just literature' and have a Grade 10 qualification have achieved 506 and 510, respectively. Both scores are higher than the national mean score. Likewise, the mean scores of the students whose mothers have Grade 12 and Bachelor's qualifications are 519 and 526, respectively. However, the students whose mothers have the educational qualification of Master's degree and above have achieved 515 (below the score of the students having mothers with the education up to Bachelor's level). This implies that mother's education above Bachelor's degree may not have necessarily contributed to the students' learning achievement in the case of Nepali subject in Grade 8.

It is seen that there are statistically significant differences between the mean scores of students having any of the two groups of mother except Bachelor's and Master's/above, Grade 12 and Bachelor's, and Grade 12 and Master's qualifications. In the case of Bachelor's and Master's/above, the mean score decreases slightly as the qualification of mother goes Master's/above from Bachelor's level but the difference is not statistically significant at the confidence level of 95%.

Figure 3.8 : Mean score in Nepali by mother's education

The data also show that 2206 students' fathers were 'illiterate'; and 5657 students had fathers who are 'just literate'. Likewise, 4379 of them had Grade 10 graduate fathers and 1489 had fathers with a qualification of Grade 12. Altogether 671 and 412 students had fathers with Bachelor's and Master's degree qualifications, respectively.

As presented in Figure 3.9, fathers' education has influenced the mean score of the students in some notable ways. As the data show, the students whose fathers are illiterate have achieved 482 mean score, which is lower than the national mean score. The mean scores of the students whose fathers are 'just literature' and the students whose father have the qualification of Grade 10 are almost equal. The highest score was achieved by the students whose fathers have a Bachelor's degree (528) which is higher than the mean score of the students whose fathers have Grade 12 (510) and Master's and above qualifications (525).

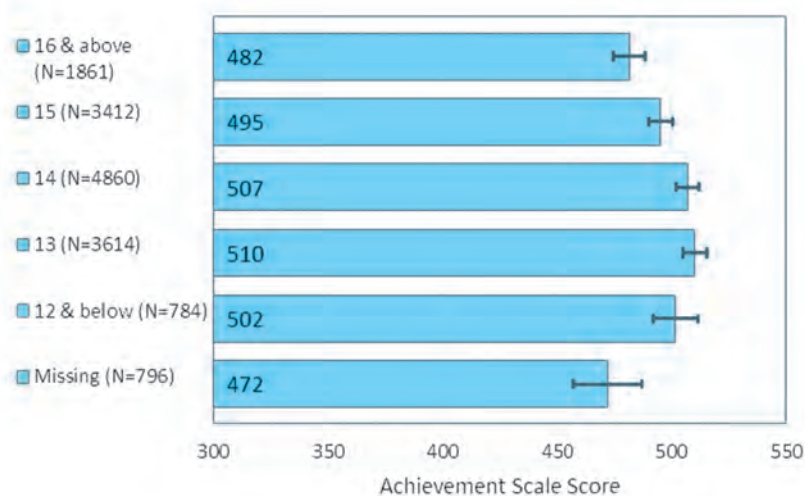
Figure 3.9 : Mean score in Nepali by father's education

There are statistically significant differences between the mean scores of students having any of the two groups of fathers except for Bachelor's and Master's/above, and just literate and Grade 10. In the case of Bachelor's and Master's/above, the mean score decreases slightly as the qualification of father goes up to Master's/above from Bachelor's level, but the difference is not statistically significant at the confidence level of 95%.

Students' learning achievement by age groups

Students were also asked to report their age to analyse the relationship between age and the learning achievement. As the data shows, the students have reported five age groups—12 and below, 13, 14, 15 and 16 and above. Majority of students (4860) are 14 years old while 3614 are 13 years old. Similarly, 3412 and 1861 students are 15 and 16 years old, respectively. Regarding the influence of age in learning achievement, the data indicated that the students who are younger and older than the Grade level age (13-14 years) have achieved a lower mean score compared to the scores of students with a Grade appropriate age.

Figure 3.10 : Mean score in Nepali by age groups



As Figure 3.10 illustrates, the students who are 15 and 16 and above years old have achieved 495 and 482 mean scores, respectively. Likewise, the students who are 12 years old and below have achieved 502 mean score, which is slightly higher than the national mean score. The data show that the students with Grade appropriate age have achieved higher mean score. Students who are 13 and 14 years old have achieved 510 and 507, respectively. Both are higher than the national mean score.

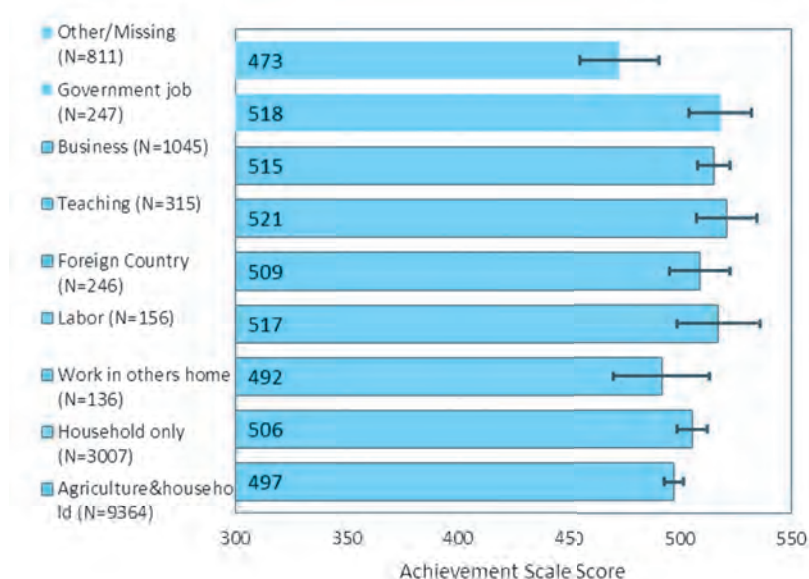
Checking the statistical significance of the difference of any two mean scores, we see that except for the difference between the mean scores of the students with the age of 12 with 13 and 14, and 13 with 14 years all other difference between any two mean scores are statistically significant.

Results by parents' occupation

In order to assess the students' learning achievement in terms of their parents' occupation, they were asked, in the background questionnaire, to report the occupations of their parents. They were given nine categories of occupations to choose from the list, which included : agriculture; household; work at others' home; wage labourer; business; foreign employment; government job; teaching; and others. The data show that majority of students' parents had agriculture (mothers = 9364 and fathers = 4836) as their occupation, 3661 students' fathers are in foreign employment; and 2026 students reported that their fathers had a business. Likewise, 3007 and 1045 students mentioned that their mothers had household responsibility and business as occupation.

As presented in Figure 3.11, the test scores of the students whose mothers were farmers and worked at others' homes are lower than the national mean score. The mean scores of the students in these categories are 497 and 492, respectively. The students whose mothers are teachers and government job holders have achieved higher mean score than the students in other categories. The scores for the students of these categories are 521 and 418, respectively.

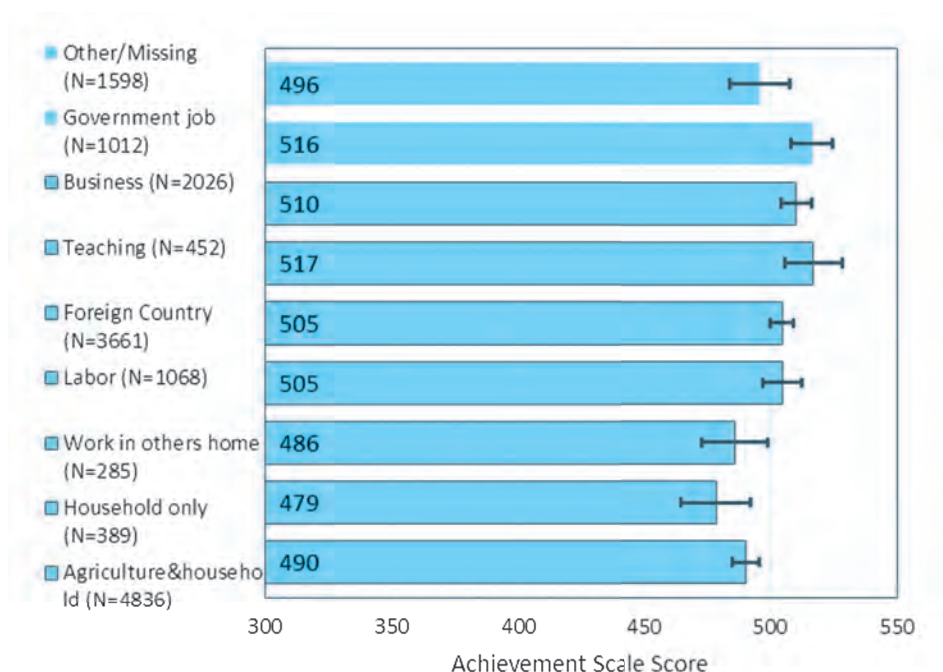
Figure 3.11 : Mean score in Nepali by mother's occupation



The Figure 3.11 shows that the students with their mothers as business persons have achieved 516 mean scores. Likewise, the students whose mothers are in foreign employment and have household responsibilities have achieved 509 and 506 mean scores, respectively.

Figure 3.12 shows that the test scores of the students whose fathers are farmers; work at others' home; and have household responsibilities are lower than the national mean score. The mean scores of the students in these categories were found 490, 478, and 486, respectively. The students whose fathers are teachers and government job holders have achieved higher mean score than the students having their fathers with other occupational categories.

Figure 3.12 : Mean score in Nepali by father's occupation



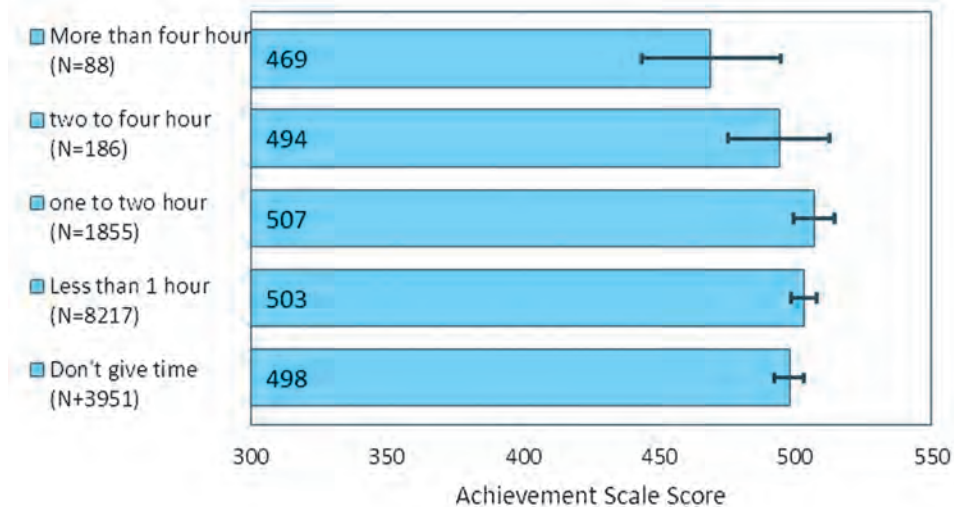
The Figure 3.12 shows that the students whose fathers are wage labourers and in foreign employment have achieved equal mean score (505). Likewise, the students whose fathers are business persons have achieved 510 mean score.

Results by students' involvement in household chores

During the assessment, the students were also asked to self-report how much time they spent doing household chores. This was done in order to analyse the influence of students' involvement in household chores in their test scores. As shown by the data, majority of students (8217) spend

less than one hour in household chores (Figure 3.13). Some students (3951) do not even give time to household chores, while 1855 of them have spent 1- 2 hours in household chores. Very few students (186) have spent 2 - 4 hours in household chores.

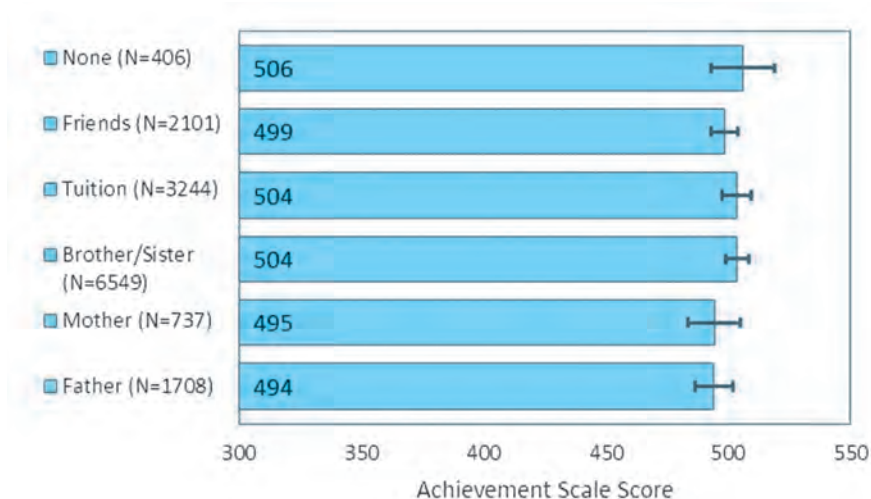
Figure 3.13 : Mean score in Nepali by students' involvement in household chores



As presented in Figure 3.13, the achievement of the students who have spent more time in household chores is less than other students. The mean score of the students who have spent more than four hours in household chores have achieved 469 mean score. Likewise, the mean score of the students who spent 2 – 4 hours have achieved 494 mean score. The students who do not give time in household chores have scored 498. These scores are less than the national score. The students spending 1-2 hours and less than one hour have achieved higher than the national mean score (the scores remaining 507 and 503, respectively).

Results by the support students receive for studies

The number of students (6549) receiving support from their siblings for their study is higher than the students who received support from other persons. A considerable number of students have received support from tuition classes (3244) and friends (2101). Likewise, some students receive support from their fathers (1708) and mothers (737) as well (see Figure 3.14).

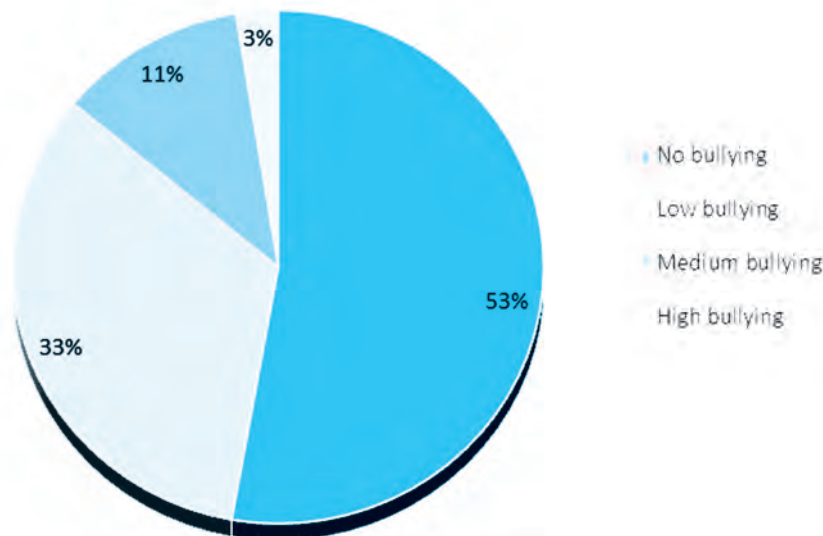
Figure 3.14 : Mean score in Nepali by support received by students for studies

Regarding the learning achievement, the students who have received support from siblings and tuition classes achieved the same mean score (504), which is higher than the national mean score. Similarly, the mean scores of the students who received support from their fathers and mothers are 494 and 495, respectively.

Students' bullying experiences and achievement

The students in this assessment were asked to mention whether they had any experience of being bullying during one month period (in the previous month from the assessment). Accordingly, they reported their bullying experience, which has influenced their achievement score. Six types of bullying experiences were recorded from students' responses, and these responses were grouped into three categories : students experiencing any one or two types of bullying as low bullying, experiencing any three or four types of bullying as medium bullying and experiencing any five or six types of bullying as high bullying. The pie chart (Figure 3.15) presents the percentage of students experiencing different types of bullying and the percentage of students experiencing no bullying. The figure depicts that 47 per cent of students experienced at least one level of bullying of which 33%, 11% and 3% have experienced low medium and high level of bullying. When we compare the mean scores of the students experiencing different levels of bullying, we find that the highly bullied students have a poorer mean score than the other groups, and the students experiencing medium bullying have some lower mean scores than the low bullied and no bullied students. It indicates that bullying negatively influences the students' achievement as the level of bullying increases the mean score decreases.

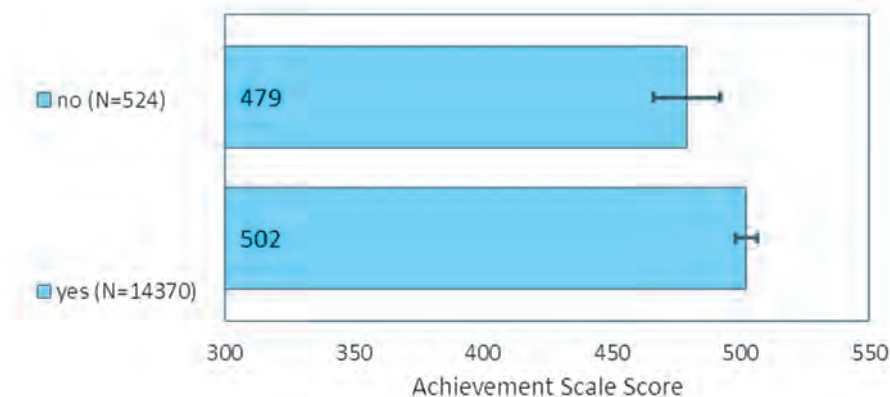
Figure 3.15 : Percentage of students experiencing different levels of bullying in Nepali



Results by the availability of textbook

The majority of students in this study had textbooks. Only a few students (524) did not have textbooks. The results, as presented in Figure 3.16, show that the students who did not have textbooks achieved 479 mean score which looks remarkably lower than the national mean score. But the students having access to the textbook were able to achieve 502, which is higher than the national mean score. The difference between the mean scores of these two groups is found statistically significant.

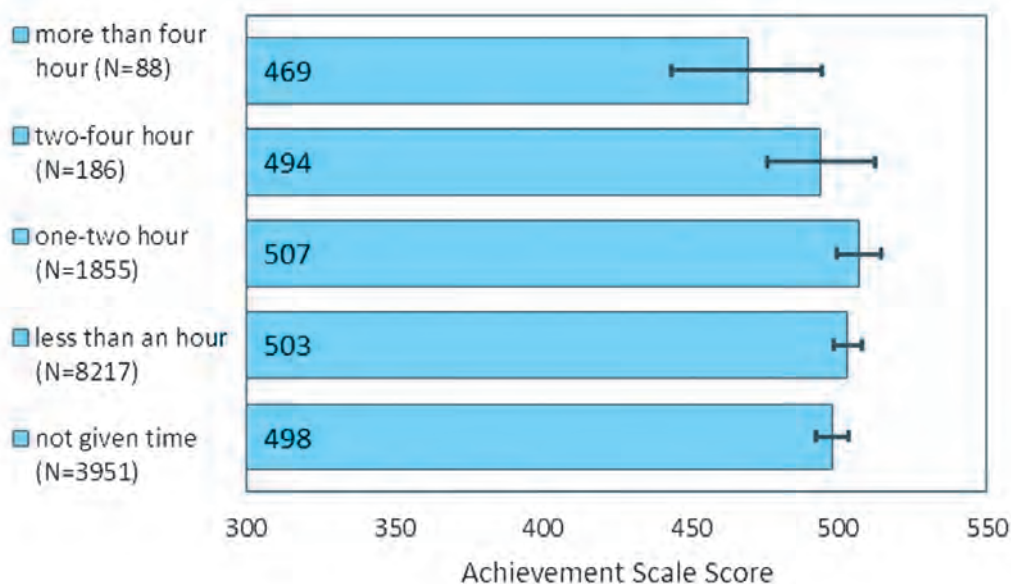
Figure 3.16 : Mean score in Nepali by the availability of textbook



Results by students' watching TV

As shown by the data, the students who watch TV for 1-2 hours have achieved the highest mean score (507) than the students in other categories of TV watching habit. This score is higher than the national mean score. This score is followed by the score of the students watching TV less than an hour (with the mean of 503). However, the score of the students who watched TV for 2 and more hours a day have achieved lower than the national mean score. Finally, the mean score of the students having no habit of watching TV remained 498 only.

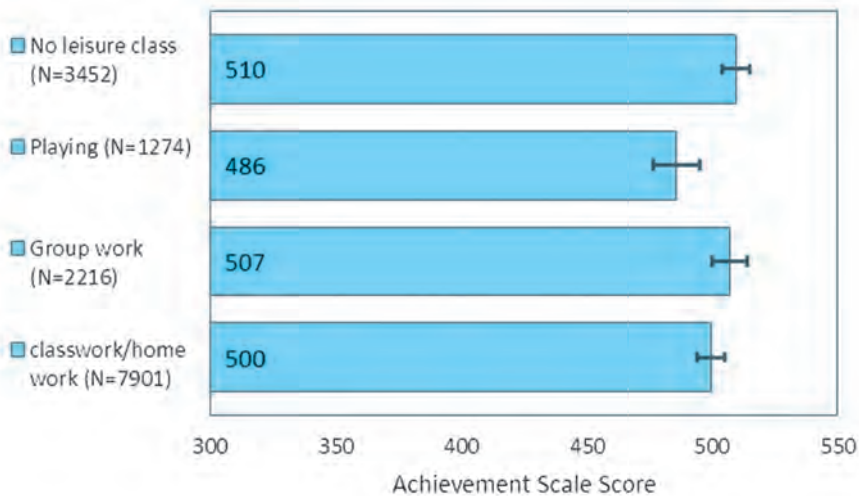
Figure 3.17 : Mean score in Nepali by the time spend in watching TV



Results by the use of leisure time at school

The students in this assessment were also asked to report how they had used their leisure time at school. As seen in Figure 3.18, the students who did not have a leisure time have achieved the highest score (510). Similarly, students spending time on group work and classwork/homework activities during their leisure time have achieved 507 and 500 mean scores, respectively. However, the students who spent their leisure time by playing have achieved 486, which is lower than the national mean score.

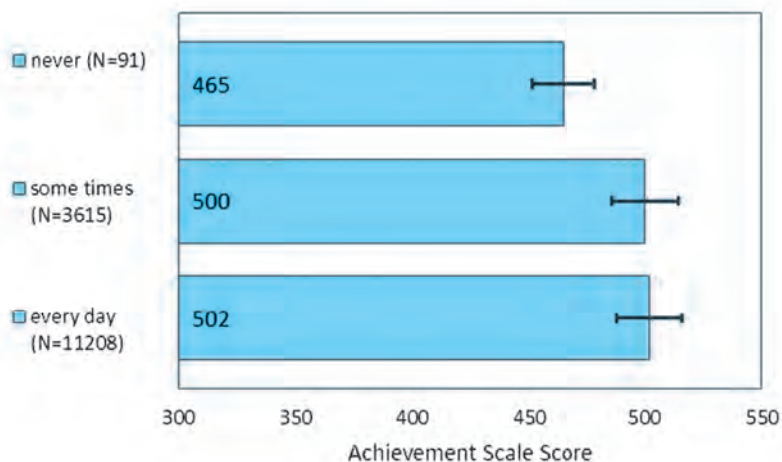
Figure 3.18 : Mean score in Nepali by the activities in the leisure time at school



Results by feedback provided on students' homework

The students were also asked to mention how often teachers give homework and provide feedback to them. The results indicate that there is a remarkable achievement gap between the students who were provided homework and who were not. But the achievement score of the students receiving regular feedback is higher than the scores of the students who did not receive feedback from their teachers.

Figure 3.19 : Mean score in Nepali by teacher's feedback on students' homework



The data presented in Figure 3.19 show that the mean score of the students who received feedback regularly is higher (502) than who did not receive regular feedback (465), with the difference of mean score of 37 point.

3.9 Relation between SES and Schools' Mean Score

Social economic status of students (SES) was estimated by aggregating the seven variables : mother's education, father's education, mother's occupation, father's occupation, home possessions, home accessories and students attending private schools. A regression model was developed in order to identify relation between mean of each SES variables and the students' mean score in Nepali. The following two dimensional scatter (Figure 3.20) plot has been generated by plotting schools in relation SES and the mean score in Nepali.

Figure 3.20 : Relation between SES and schools' mean score in Nepali



The scatter plot shows that the schools with a high SES (average SES value of students) concentrated more on relatively medium and high mean scores, but the schools with low SES spread from low score to high scores. This is somehow different from the results in Mathematics. However, there are some cases of high SES schools having relatively low mean scores. This plot also indicates that most of the private schools have high SES students compared to public schools.

3.10 Attitude of Students towards Teacher and School

Students were also asked some sets of attitudinal questions to understand their attitudes towards schools and teachers. Their responses to each category of questions were tabulated with their frequencies. The data show that the correlation between attitude of students towards teachers and schools is positive ($r = 0.38$). This high correlation reveals that students have a very similar view towards teachers and schools. This also indicates that having a positive attitude towards teachers has a direct relationship with the school's efforts. The correlation of the sum of attitude towards schools and attitude towards teachers are $r = 0.092$ and $r = 0.049$, respectively, which are both positive. However, both correlations are low.

Moreover, the total of attitudes towards teachers and schools correlates with the student achievement, with $r = 0.34$, indicating that a positive attitude towards schools and teachers can contribute to improve the achievement of students, if we take both the attitudes as a single influencing factor.

3.11 Comparing the Overall Results NASA 2017 with the Results of 2013

NASA 2013 score is compared with NASA 2017 by adopting the Classical Test Theory (CTT) and using percentage of correct answer (p-value or facility index). Altogether 8 items of NASA 2013 were linked with NASA 2017 from various content and cognitive domains. For the better visualization of the achievement in linking items, the raw scores from both NASA 2013 and 2017 of the linking items were transformed into a standardised score (z-score), with zero mean. Then the standardized score was shifted to a scale score of mean 500 and standard deviation 50. The final transformed score is presented in Figure 3.21:

Table 3.3 : Comparison of the mean score of NASA 2013 and NASA 2017 based on linking items in Nepali

Year	Average achievement Scale score (using CTT)
NASA 2013	495.23
NASA 2017	504.75

From the transformed scale score, we see that the achievement score in 2017 is significantly higher than the previous assessment (at $p < 0.05$). It should be noted that this comparison is based on the sample data. The data has not been weighted for the population and result is based on the linking items.

CHAPTER 4**SCIENCE RESULTS AT NATIONAL LEVEL****4.1 Introduction**

The defined population for Science subject was 5,82,178; sample students was 15,990; and the actual number of students participated in NASA 2017 was 15,415. Based on the data collected from these students, ERO, using IRT and Conquest software as well as SPSS and Excel tools, analysed the students' results in terms of proficiency levels. In addition, students' achievement scores were analysed in relation to their background information such as socioeconomic status, ethnicity, gender, home language, school type, identity with geography, school and classroom practices, and home environment. The data were also analysed province-wise.

Students' ability scores were estimated by using test scores in relation to item characteristics, and these ability scores were transformed into a scale score with the national mean score of 500 point, meaning that the national mean score has been fixed at 500 point for the purpose of analysing the overall test scores. The test scores at various categories as well the test scores at provincial level were compared considering this score as a base.

The test scores were first drawn from the sample students and analysed considering the sample weight. After that the generalizability of the test scores were estimated for the entire population of the study i.e. the Grade 8 students in the country using a confidence level of 95 %. The standard errors and confidence intervals of mean scores were estimated during the analysis and the confidence intervals were estimated to identify the statistical significant of comparable means.

4.2 Defining Proficiency Levels for Science

The proficiency scale for Science was also computed by taking lower and higher levels of proficiencies below 390 and above 575, respectively (see Table 4.1).

Table 4.1 : Proficiency levels and the score range in Science

Level	Score	SE
Level 6 (Advanced)	575 <	0.158
Level 5 (Proficient 3)	529 – 575	0.643
Level 4 (Proficient 2)	482 – 529	0.829
Level 3 (Proficient 1)	436 – 482	0.830
Level 2 (Basic)	390 – 436	0.692
Level 1 (Pre-basic)	< 390	0.159

Based on the descriptions of items that corresponds to each of the above proficiency levels in item person map in Science together with subject experts' judgment, the descriptions of students' six levels proficiency have been defined. These descriptions of six proficiency levels in Science for Grade 8 indicate that what a student at particular competency level can do in Science. The Table 4.2 specifies the competencies of students at various levels of proficiency in Science.

Table 4.2 : Summary descriptions of the six proficiency levels on Science scale of Grade 8

Level	Score	What students can typically do
6	575 <	Students of level 6 can analyse and justify the solution of complex problems in Science; such as express the complete information about revolution period of moon and justify the reason behind redness of the sun during early morning.
5	529-575	Students of level 5 can apply the learnt concepts and relations in solving problems in a new situation, and they can analyse the solutions. For example, apply the concept of atmospheric pressure, cause of refraction of light and express the boiling point of water at sea level in Fahrenheit; state Mendeleev's periodic law, name of liquid metal, write molecular formula, use of sodium hydroxide and name of zero group of element. Reaction of vinegar and sodium carbonate. Draw a labelled diagram of life cycle of flowering plant and plant cell. Explain the importance of wild life conservation, relation of weather and climate, and cause of growth of plant
4	482— 529	Students of level 4 have adequate knowledge and skills in science of the grade level; they can describe the some complex concepts; and use basic concepts and relations in Science to solve the problems. For example, calculate the volume of irregular object and potential energy, analyse the relation of echo and distance, effect of temperature on gaseous molecule, sound produced by metal and non-metals compare the image formed by plane and spherical mirror, new and full moon, open and closed circuit and wave length of two waves. Describe global environmental problems as acid rain, climate change and greenhouse effect. Analyse the relation of Carbon dioxide and photosynthesis; explain atomic

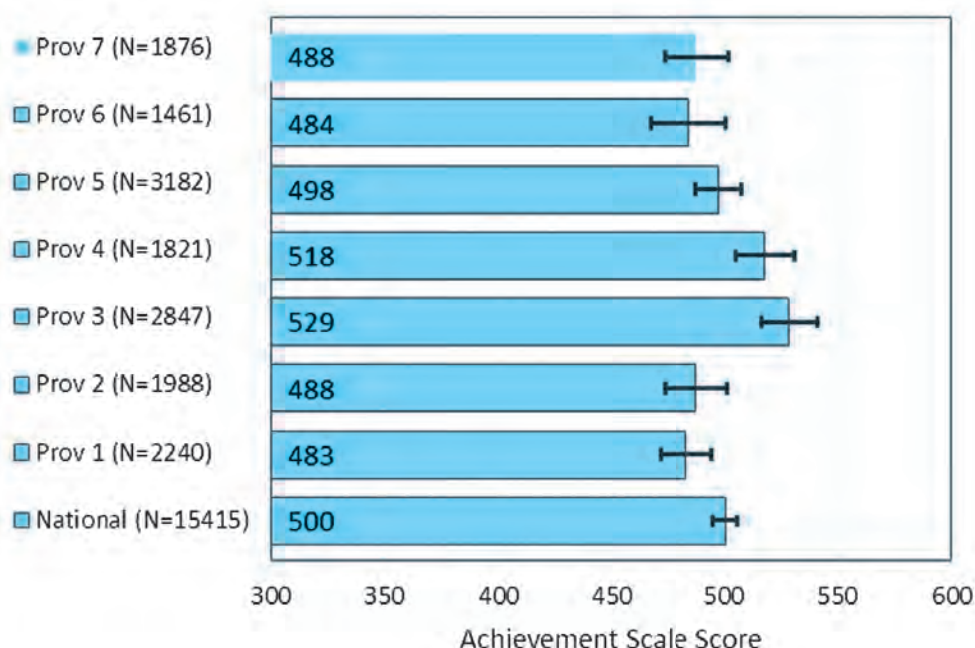
Level	Score	What students can typically do
		structure, distinguish acid and base and write molecular formula of acids, bases and pollutant gases. Find molecular weight; describe the method of removing hardness of water Draw labelled diagram of animal cell and cubical epithelium and write function of cell organelles. Distinguish plant cell and animal cells, androecium and gynoecium, classify animals and plant, explain biodiversity, evolution of life and, describe the relation among cell, tissue and organ. Function of condenser in distillation; mention the type of asexual reproduction in mushroom and importance of vegetative propagation.
3	436 - 482	Students of level 3 have basic knowledge and skills in Science; they can state and use concepts and simple relation in solving direct problems in science. For example, write the formula of relative velocity, calculate the distance by using equation of motion, explain the relation of height and atmospheric pressure, define, soft water, ore, work and mechanical advantage. Recall the atomic number, select the method of separation of mixture, classify lever, write relation of liquid pressure and density, Use method of conserving magnetic strength, distinguish heat and temperature, apply the concept of fundamental unit; write the conditions for seed germination, state reproductive part of a plant and write location of epithelial tissue, analyse the impacts of air pollution and soil erosion, write effects of monsoon, sustainable development, economic importance of forest and name of national parks of Nepal. Classify planet and satellite and name the climatic zones of Nepal.
2	390 - 436	Students of level 2 have some basic scientific knowledge and skills of the grade level; they can define and state some of the terms and concepts in Science such as define acceleration, name the largest planet, and enlist factors for environmental degradation, example of medicinal plant and most useful metal for ornaments.
1	390	Students at level 1 have basic prerequisite knowledge and skills of recognize and recall the simple information and objects. For example, recognize medicinal plants; instruments used to measure length, mass, weight and time; define magnetic induction, distance, displacement, density of substances; give examples of different classes of lever, work and forms of energy, types of energy; list out the sources of heat, cell, acid, base and salt, natural resources and environment degradation; identify the use of metals in daily life, functions of different parts of plants and name of the members of solar system.

4.3 Overall Mean Score by Province

The overall results of the assessment in Science subject show that students from province 3 achieved the highest mean score among the seven provinces. As seen in Figure 4.1, the mean

score of this province is 529, which is higher than the national mean score. Following province 3, the mean score of the students from province 4 is 518, which is higher than national mean score and mean scores of the rest of the provinces is below national mean score (500 point). The status of students' achievement in province 1 is the lowest, with the mean score of 483.

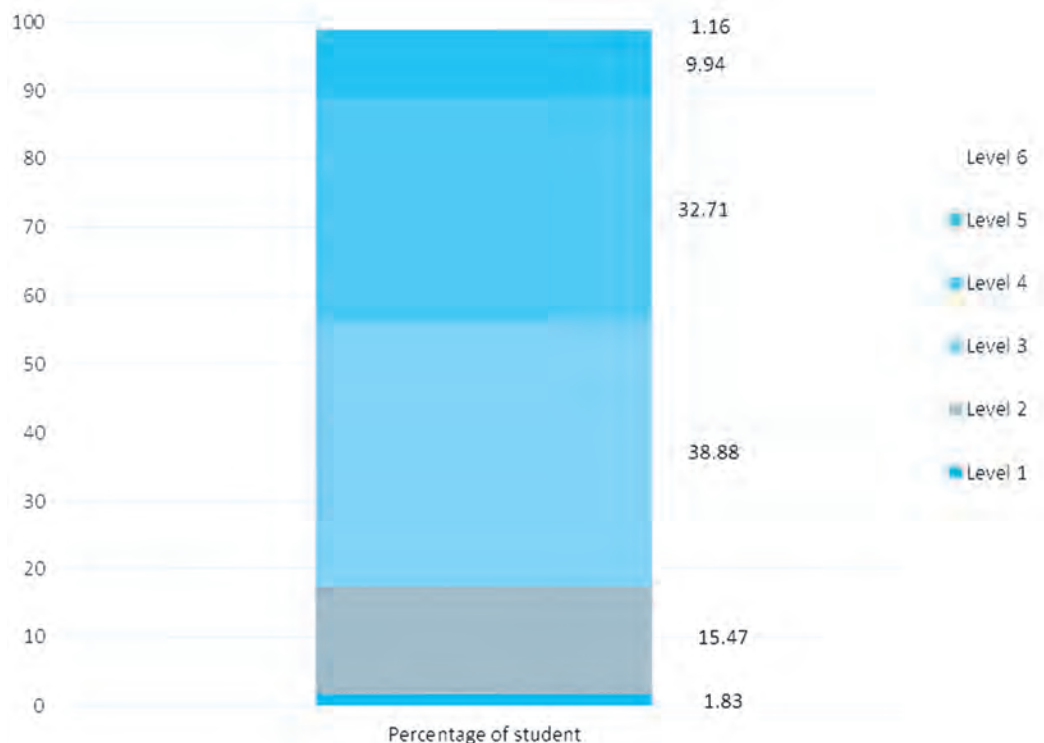
Figure 4.1 : Mean score in Science by province



Similarly, the mean scores of provinces 6 and 7 are 484 and 488, respectively – both remaining less than the national mean score. Likewise, the mean scores of province 5 and 2 are 498 and 488, respectively. All these scores are less than the national mean score. The overall scores show that only two provinces – 3 and 4 – have achieved above the national mean score.

4.4 Results by Proficiency Levels

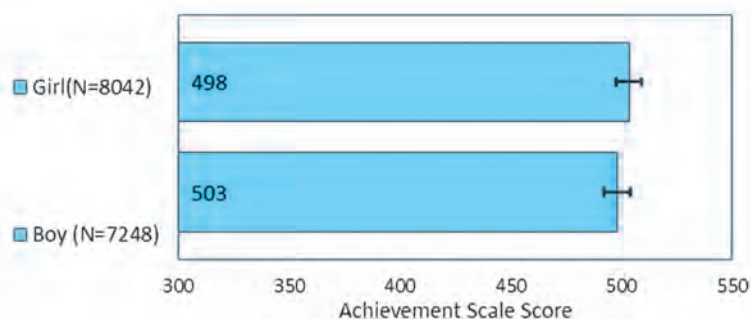
The test scores were analysed in terms of six proficiency levels of students' achievement. The levels included are 1, 2, 3, 4, 5 and 6 in the order of lower (pre-basic) to higher (advanced) level. The scores below 390 were considered level 1 while the scores within the range of 390 – 436 were categorized as level 2. Similarly, the scores within the range of 436 – 482 and 482 – 529 were labelled level 3 and level 4, respectively. The scores within the range of 529 – 575 and above 575 were categorized as level 5 and level 6, respectively.

Figure 4.2 : Student percentage by proficiency levels in Science

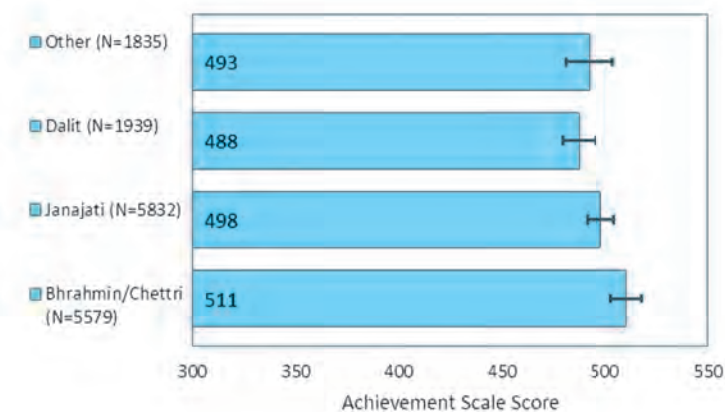
The Figure 4.2 shows that altogether around 39% students achieved the scores corresponding to ‘Level 3’. Likewise, 33% and 15% of them have achieved ‘Level 4’ and ‘Level 2’ of proficiency. The data present that only 1% and 2% students have achieved the advanced and pre-basic levels, respectively.

4.5 Results by Gender, Ethnicity, Language

The analysis of data from a gender perspective shows that girl students’ mean achievement score in Science is lower than the mean score of boy students. The girl students have achieved 498, as presented in Figure 4.3, slightly lower than the national mean score. The achievement of the boy students is 503 – which is slightly above the national mean score. The difference between the mean scores of boys and girls in Science is statistically significant.

Figure 4.3 : Mean score in Science by gender

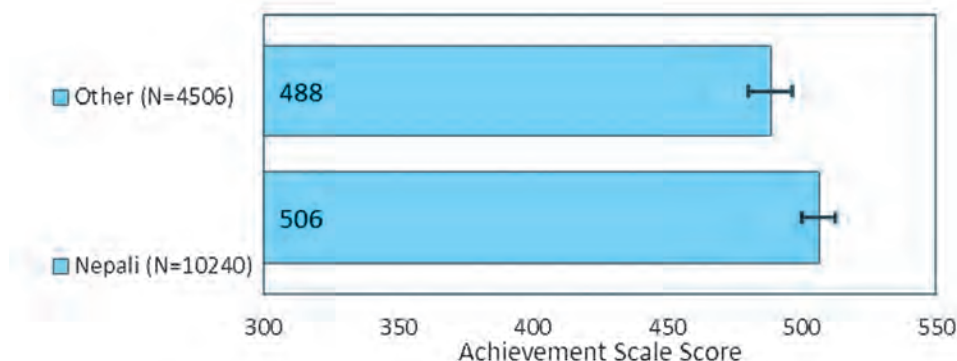
When ethnicity is considered, the mean score achieved by Brahmin/Chhetri students is higher than the scores achieved by the students belonging to other ethnic groups. As presented in Figure 4.4, while the mean score of Brahmin/Chhetri students is 511, Janajati students' mean achievement is 498. The mean achievement score of Dalit students is 488 only. Thus, Brahmin/Chhetri students' achievement in Science subject is higher than the national mean score while the achievement of students from other ethnic groups is lower. The difference between the means of any two of the ethnic groups among three groups : Brahmin/Chhetri, Janajati and Dalits are statistically significant.

Figure 4.4 : Mean score in Science by ethnicity

Likewise, there is a variation in the mean score in terms of students' linguistic background. The students with Nepali as their home language have achieved far higher than the students having a home language other than Nepali. As seen in Figure 4.5, the mean score of the students speaking Nepali as their home language is 506, which is higher than the national mean score. But the mean score of the students who speak other languages is 488 only, which is lower than the national

mean score. The difference in the mean of Nepali home language group and other home language group of students is statistically significant.

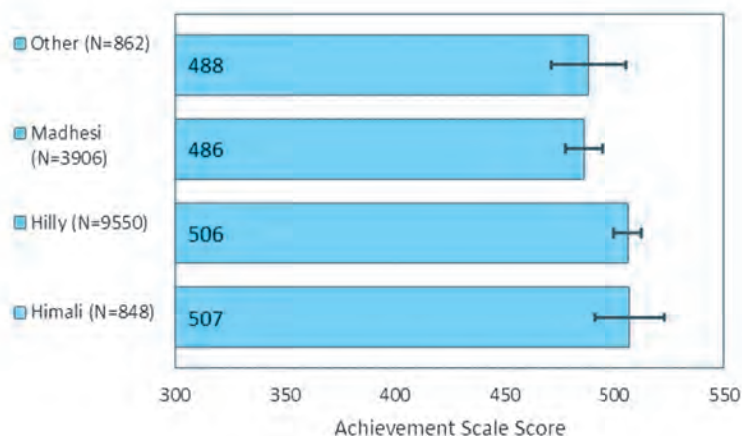
Figure 4.5 : Mean score in Science by home language



4.6 Results by Identity with Geography

The test scores were also analysed in terms of geographical identity. At the time of assessment, the students were asked to choose their geographical identities among Himali, Hilly, Madhesi and other. As presented in Figure 4.6, the mean scores of students identified as Himali (507) and Hilly (506) are almost equal, and both are higher than the mean score of students from other groups of students and the national mean score. The students' achievement of Madhesi is the lowest, and they have achieved 486 only, which is far lower than the national mean score. The difference between the mean of Madhesi with Hilly and Madhesi and Himali are statistically significant.

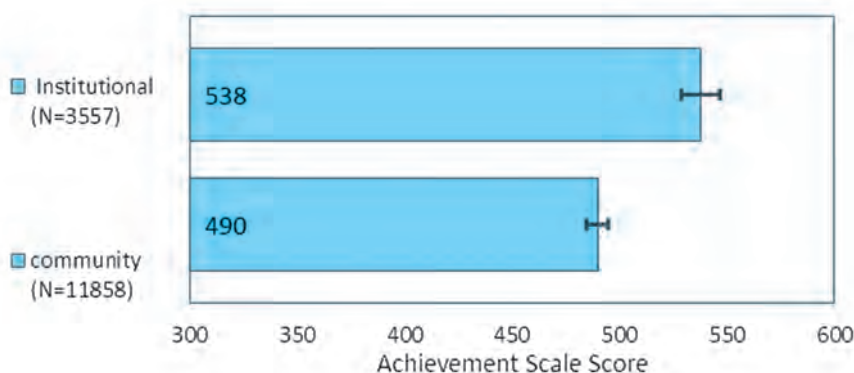
Figure 4.6 : Mean score in Science by identity with geography



4.7 Results by Types of Schools

In total, 11858 students had participated in the test from community schools, while 3557 students had participated from institutional schools. The mean score was found 490 in the case of community schools, and 538 in institutional schools. The score of students from community schools has remained noticeably lower than the national mean, while that of institutional schools is distinctly above the national mean. The difference between the means of these two types is 48 point, which is significant difference at confidence level of 95%.

Figure 4.7 : Mean score in Science by types of school



4.8 Results by Various Influencing Factors

In order to understand the influence of various factors on students' achievement, the test scores were analysed in terms of parental education and occupation backgrounds, students' age, time spent in household chores, support they receive from others, effect of bullying, use of time beyond school time, the time spent for watching TV and the availability of textbooks.

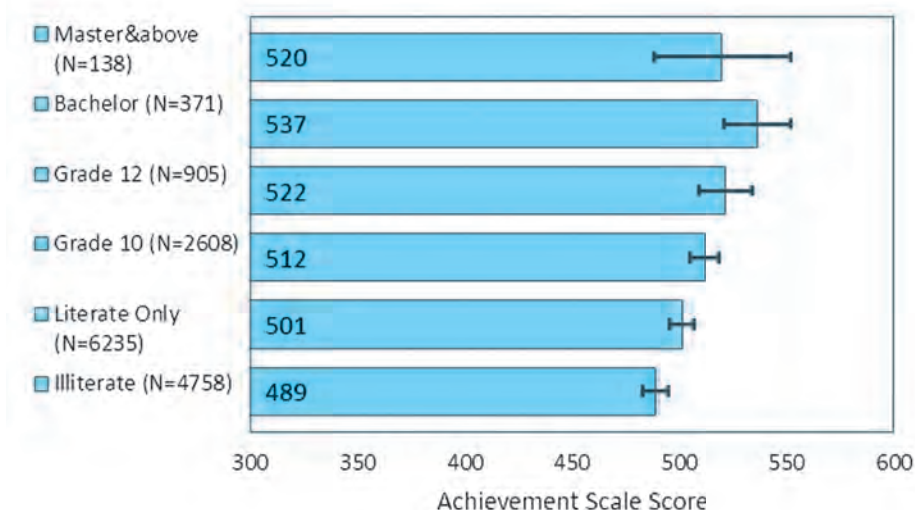
Parents' education and students' learning achievement

In order to identify the impact of parents' education on students' learning achievement, students were asked to respond by selecting from various possible options related to their parents' education (illiterate, just literate, Grade 10, Grade 12, Bachelor's, and Master's and above).

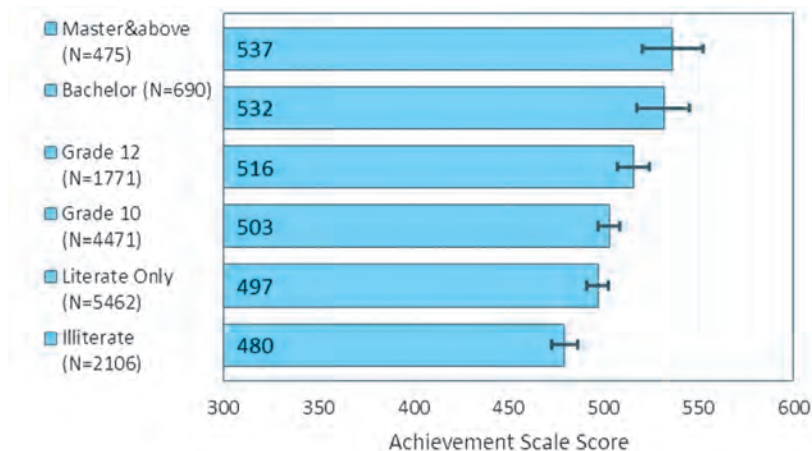
Out of 15415 students in total, 6235 of them reported that their mothers were 'just literature' while 4758 of them reported 'illiterate'. Similarly, 2608 of them mentioned that their mothers had a qualification of Grade 10 while 905 had Grade 12. Likewise, mothers of 371 students were reported as having Bachelor's degree; and those of 138 students had Master's degree and

above as educational qualification. As presented in Figure 4.8, mother's education has impacts on students' learning achievement. The mean score of the students whose mothers are 'illiterate' is 489, which is lower than the national mean score. The students' achievement whose mothers were 'just literate' and a Grade 10 qualification has been 501 and 512, respectively - both scores remaining higher than the national mean score. Likewise, the mean scores of the students whose mothers have Grade 12 and Bachelor's qualifications are 522 and 537, respectively. However, the students whose mothers have been educated up to Master's degree and above have achieved 520. This shows that educational qualifications above Bachelor's degree may not have necessarily contributed to improve students' learning achievement in Science subject in the case of Grade 8.

Figure 4.8 : Mean score in Science by mother's education



Altogether 2106 students' fathers were 'illiterate', and 5462 students had 'just literate' fathers. Likewise, 4471 of them had fathers having the qualification of Grade 10; and 1771 of them had fathers were Grade 12 graduates. The students with fathers having Bachelor's and Master's degree qualifications were 690 and 475, respectively. As presented in Figure 4.9, fathers' education has influenced on the mean score of the students. The students having 'illiterate' fathers have achieved 480 mean score, which is lower than the national mean score. The mean scores of the students whose fathers are 'just literate' and the one whose fathers have a Grade 10 qualification are 497 and 503, respectively. The highest mean score is achieved by the students whose fathers have a Master's degree and above qualification (537) which is higher than the mean score of the students with fathers having Grade 12 (516) and Bachelor's degree qualification (532).

Figure 4.9 : Mean score in Science by father's education**Students' learning achievement by age group**

The students were also asked to report their age. As the data show, they reported five age groups – 12 and below, 13, 14, 15, and 16 and above. Altogether 5119 students were 14 years old while 3635 were 13 years old. Similarly, 3429 and 1833 students were 15 and 16 and above years old, respectively. Regarding the influence of age in learning achievement, the data indicated that the students who were older than the Grade level age (13-14 years) have achieved lower mean score than the students with the Grade appropriate age.

Figure 4.10 : Mean score in Science by age group

As Figure 4.10 illustrates, the students who were 15 and 16 and above years old have achieved 495 and 482 mean scores, respectively. Likewise, the students who were 12 and below years old achieved 503 mean score, which is slightly higher than the national mean score. More importantly,

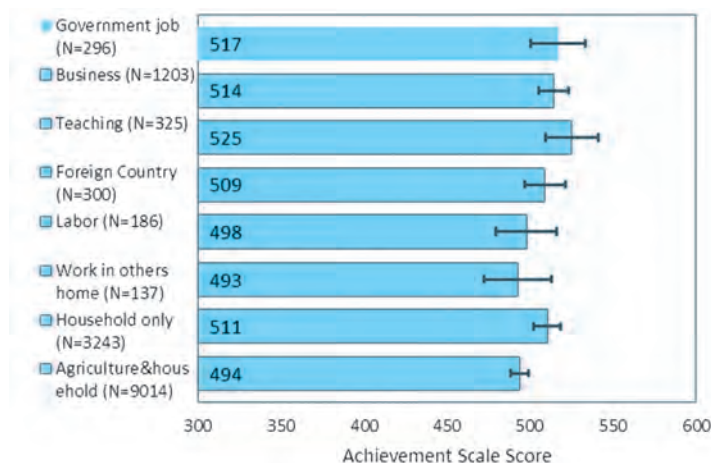
the students with grade appropriate age have achieved higher mean score as 13 and 14 years old students have achieved 508 and 506 mean scores, respectively. Both scores are higher than the national mean score. When we check the significance of the mean differences we found that the difference of mean scores of the students of age groups 12 and 13, 13 and 14, and 12 and 14 are statistically significant.

Results by parents' occupation

The students were asked to report what occupations their parents were involved in. They had given nine categories of occupations to choose from the list : Agriculture; household; work at others' home; wage labourer; business; foreign employment; government job; teaching; and other. The data show that majority of students' parents had agriculture as their occupation (mothers = 9014 and fathers = 4585). In the same way, 3779 students' fathers were involved in foreign employment, and fathers of 2282 students had a business. Likewise, 3243 and 1203 students mentioned that their mothers have household responsibility and business as their occupations, respectively.

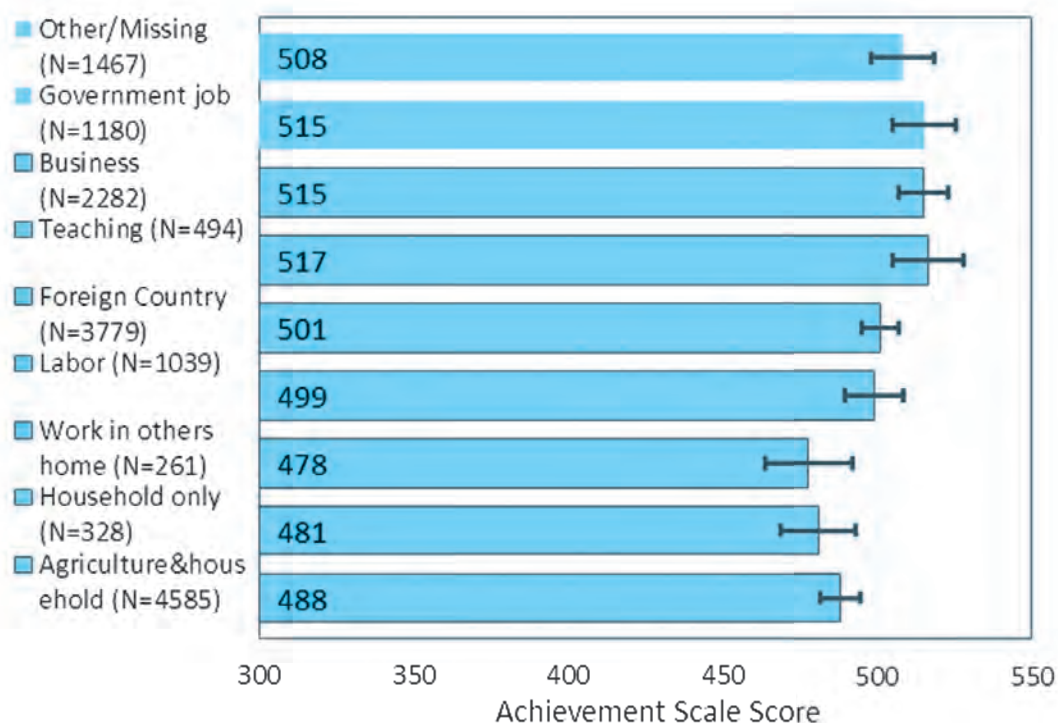
As presented in Figure 4.11, the test scores of the students whose mothers are farmers, work at others' home and wage labourers have a lower score than the national mean. The mean scores of the students in these categories are 494, 493 and 498, respectively. The students whose mothers are teachers (525) have achieved the highest mean score, followed by those having mothers who are government job holders (517). Similarly, the mean score of the students whose mothers are business persons was 514, which is higher than the national mean score. The figure shows that the students whose mothers are in foreign employment have achieved 509 mean score.

Figure 4.11 : Mean score in Science by mother's occupation



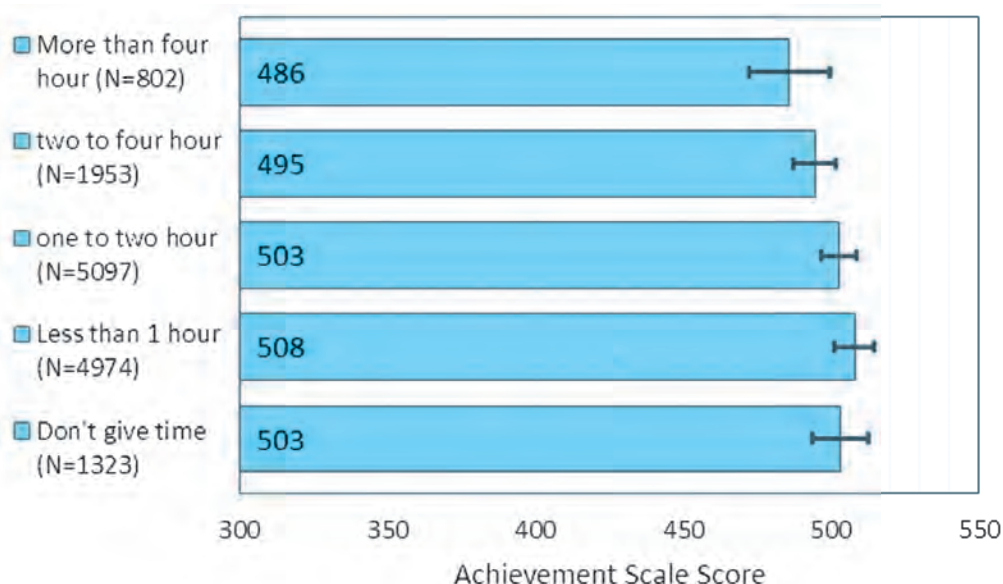
As presented in Figure 4.12, the test scores of the students whose fathers work at others' home; have household responsibilities and are farmers are lower than the national mean score – as the mean scores of the students in these categories are 478, 481, and 488, respectively – each of these scores remain lower than the national mean score. Similarly, the students whose fathers are teachers, business persons and government job holders have achieved a higher mean score than the students in other categories. The mean scores of the students in these categories are 517, 515 and 515, respectively. The figure shows that the students whose fathers are wage labourers and in foreign employment have achieved 499 and 501 mean scores, respectively.

Figure 4.12 : Mean score in Science by father's occupation



Results by students' involvement in household chores

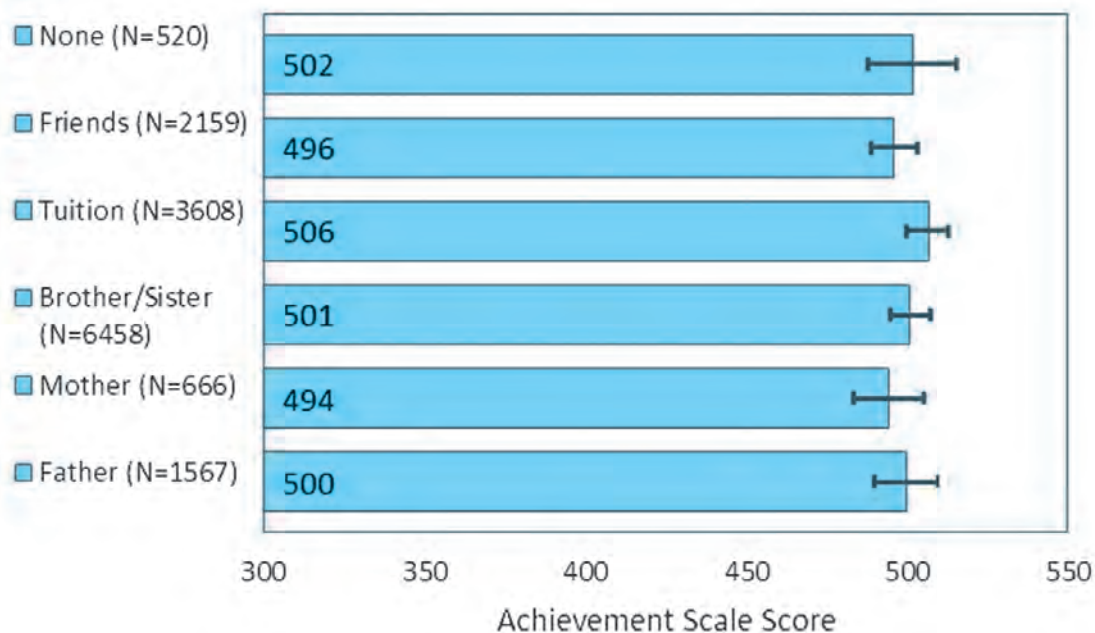
The students were also asked to self-report how much time they spend doing household chores. The data show that 5097 students used to spend 1 – 2 hours in household chores. Altogether 4974 students used to spend less than an hour in doing household chores. Some students (1323) had not given time in household chores, while 1953 of them had spent 2 – 4 hours in household chores.

Figure 4.13 : Mean score in Science by students' involvement in household chores

As presented in Figure 4.13, the achievement of students spending more 2 hours time in household chores is less than the achievement of other students who work less than 2 hours. The mean score of the students who have spent more than four hours in household chores has remained 486. Likewise, the students who spent 2 – 4 hours have achieved 495 mean score. These scores are less than the national mean. The students who had not given time to household chores have 503 mean score. The data also show that the students spending 1 – 2 hours and less than one hour have achieved the mean scores 503 and 508, respectively. These scores are higher than the national mean score.

Results by the support students receive for studies

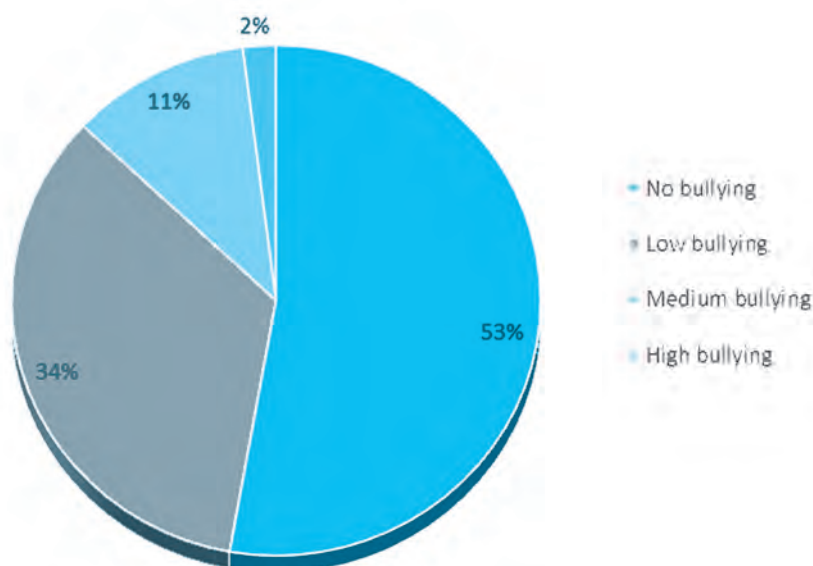
The number of students who receive support from their siblings (6458) was higher than the students in other categories (see Figure 4.14). A considerable number of students received support from tuition classes (3608) and friends (2159). Likewise, some students had received support from their fathers (1567) and mothers (666). Regarding the learning achievement, the students who have received support from their tuition classes and siblings achieved the mean scores 506 and 501, respectively. These scores are higher than the national mean score. Likewise, the mean scores of the students who received support from their fathers and mothers are 496 and 494, respectively. More strikingly, the students who were not supported by anyone have achieved the highest mean score (502), which is higher than the national mean score.

Figure 4.14 : Mean score in Science by support students receive for the studies

Students' bullying experiences and achievement

The students in this assessment were asked to mention whether they had an experience of being bullied during one month's period (in the previous month from the assessment). Accordingly, they reported their bullying experience, which has influenced their achievement score. Six types of bullying experiences were recorded from students' responses and these responses were grouped into three categories : students experiencing any one or two types of bullying as low bullying, experiencing any three or four types of bullying as medium bullying and experiencing any five or six types of bullying as high bullying. The pie chart (Figure 3.15) presents the percentage of students experiencing different types of bullying and percentage of student experienced no bullying. The figure depicts that 47 per cent of students experienced at least one level of bullying of which 34%, 11% and 2% of students experienced a low, medium and high level of bullying. When we compare the men scores of the students experiencing different levels of bullying, we find that highly bullied students have poor mean score than the other groups, and students experiencing medium bullying have some lower mean scores than the low bullied and no bullied students. It indicates that bullying negatively influences the students' achievements as the level of bullying increases the mean score decreases.

Figure 3.15 : Percentage of students experiencing different levels of bullying in Science



Results by the availability of textbook

The majority of students (14435) in this study had textbooks. Only a few students (626) did not have textbook. The results, as presented in Figure 4.16, show that the students who did not have textbooks achieved 479 mean score which is lower than the national mean. But the students who had access to the textbook have achieved 502 mean score which is higher than the national mean score. There is statistically significant difference between the mean scores of the students with textbooks and without textbooks.

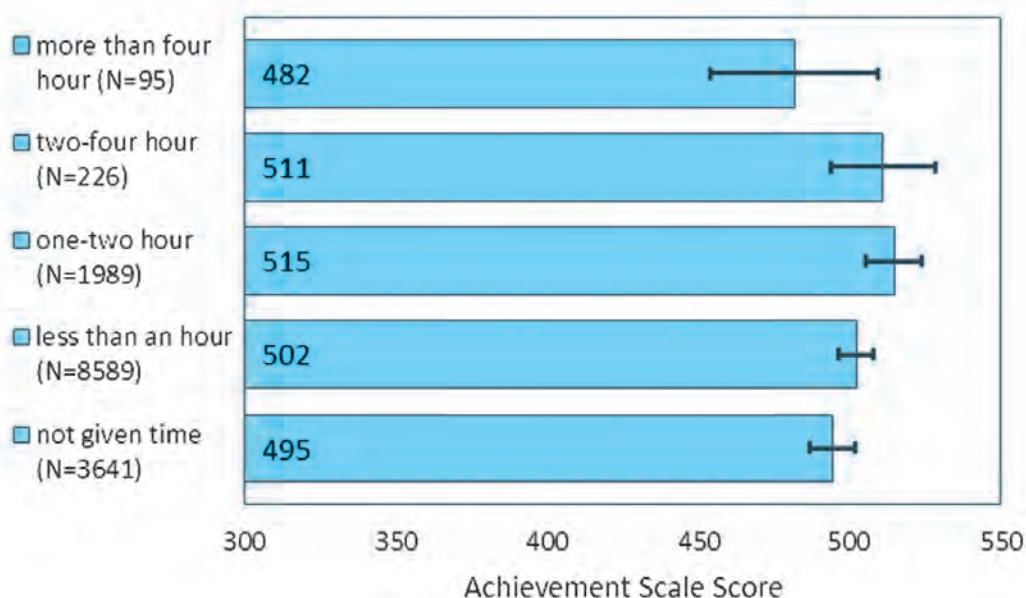
Figure 4.16 : Mean score in Science by availability of textbook



Results by students watching TV

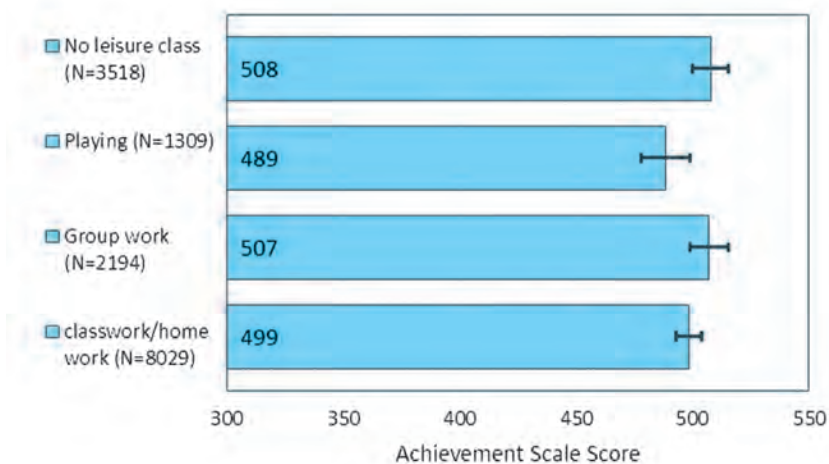
The data show that the students who had the habit of watching TV for 1 – 2 hours have achieved the highest score. The score of the students in this category is 515, which is higher than the national mean. This score is followed by the score of the students who had watched TV 2 – 4 hours a day (511). Similarly, the students watching TV less than an hour achieved 502 mean score. However, the score of the students who had watched TV more than four hours and those who did not give time to watch TV have achieved lower than the national mean score – their mean scores remaining 481 and 495, respectively.

Figure 4.17 : Mean score in Science by students time in watching TV

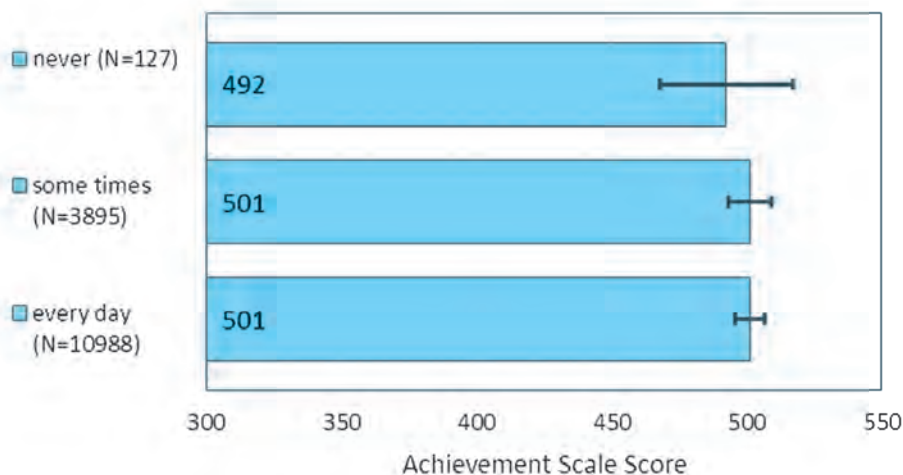


Results by the use of leisure time at school

The students in this assessment were also asked how they used their leisure time in school. As seen in Figure 4.18, the students who did group work in their leisure time and those who had no leisure time have achieved 507 and 508 mean scores, respectively. These scores are higher than the national mean score. Similarly, the students who spent doing classwork/homework activities have achieved 499 mean score, which is slightly lower than the national mean. However, the students who spent their leisure time playing have achieved the mean score 487 only, which is far lower than the national mean.

Figure 4.18 : Mean score in Science by the use of leisure time at school**Results by feedback provided on students' homework**

The students were asked to mention how often their teachers give homework and how often teachers provide feedback to the students by checking their homework. The results indicated that there is some achievement gap between the students who were provided homework and who did not. But if teachers provide regular feedback on their homework, there is noticeable difference in students' achievement scores than that of those students who did not receive feedback from the teachers.

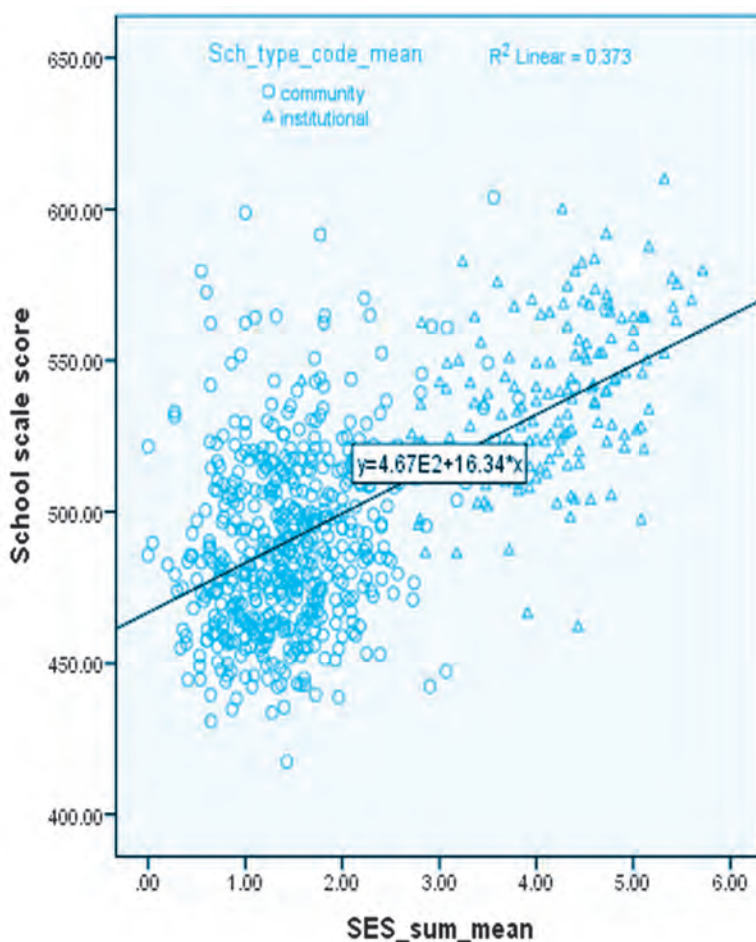
Figure 4.19 : Mean score in Science by teacher's feedback on students' homework

As presented in Figure 4.19, the mean score of the students who received feedback regularly is higher (501) than the scores of the students who did not receive regular feedback (492), with the difference of mean score of 9 point.

4.9 Relation between SES and Schools' Mean Score

Social economic status of students was estimated by aggregating the seven variables : mother's education, father's education, mother's occupation, father's occupation, home possessions, home accessories and students attending private schools. A regression model was developed in order to identify relation between mean of each SES and the mean score in Science. The following two dimensional scatter (Figure 4.20) plot has been generated by plotting schools in relation SES and the mean score in Science.

Figure 4.20 : Relation between SES and schools' mean core in Science



The scatter plot shows that the schools with high SES (average SES value of students) concentrated more on medium to high mean scores whereas the schools with low SES concentrated more on low to medium mean scores. However, there are a number of schools with low SES achieving relatively high scores and a number of high SES schools achieving relatively low mean scores.

This plot also indicates that most of the private schools have high SES students compared to public schools, and with a few exception public schools have low SES compared to private schools.

4.10 Attitude of Students towards Teacher and School

Sets of attitudinal questions related to schools and teachers were asked to the students and the responses were tabulated with their frequencies. The data show that the correlation between the attitude of students towards teachers and schools is positive ($r = 0.69$). This high correlation reveals that students have a very similar view towards their teachers and schools. This also indicates that making positive attitude towards teacher has the direct relationship of the school's efforts. The correlation of the sum of attitude towards school and attitude towards teacher are $r = 0.15$ and $r = 0.14$ respectively which are both positive. However, both correlations are low.

Moreover, the total of attitude towards teacher and school correlates with student achievement is positive ($r = 0.15$), indicating that positive attitude towards schools and teachers can rise the achievement of students if we take the influences of both the attitudes is considered as the single influencing factor.

4.11 Comparing the Overall Results of NASA 2017 with the Results of 2013

The NASA 2013 score of Science in Grade 8 is compared with NASA 2017 based on the Classical Test Theory (CTT), the percentage of correct answer (p-value or facility index). Altogether 10 items of NASA 2013 were linked with NASA 2017 from various content and cognitive domains. For the better visualization of the achievement in linking items, the raw score of both NASA tests 2013 and 2017 of the linking items was transformed into z-score with mean zero. Then the standardized score was shifted into mean 500 and standard deviation 50, total (maximum = 10) for all individual students. The final transformed score is presented in the figure 4.21.

Table 4.3 : Comparison of NASA 2013 and NASA 2017 based on linking items in Science

Year	Average achievement scale score (CTT)
NASA 2013	501.74
NASA 2017	498.75

From the transformed scale score, we see that the achievement score in 2017 is significantly lower than the previous assessment of 2013 (at $p < 0.05$). It should be noted that this comparison is based on the sample data. The data has not been weighted for the population and result is based on linking items.

CHAPTER 5**SUMMARY AND CONCLUSIONS****5.1 Introduction**

NASA 2017 was conducted for Grade 8 in three subjects – Mathematics, Nepali and Science in a sample of 650 schools and 16000 students in each of the three subjects, aggregating the total of 1950 schools and 48011 students as actual sample for the assessment. The sample was designed by considering seven provinces as the explicit strata and community and private schools as implicit strata. Item Response Theory (IRT) was used to calibrate and compare the test versions and results. The assessment results were analysed in Mathematics, Nepali and Science by using a scale score at national and provincial levels. The results were also prepared in relation to the variables such as gender, ethnicity, home language, SES, school type, classroom activities, bullying at school, availability of textbooks and students' attitude towards school and teachers. The confidence interval (CI) for each mean score was calculated to estimate the results for the entire population, and the significant tests were carried out at the confidence level of 95% in order to estimate the effects of various influencing factors on students' achievement.

This final chapter for the public report of NASA 2017 that summaries the assessment method and process; presents the highlights from the results and the trends; includes implication and recommendations of the assessment; and presents conclusions.

5.2 A summary of NASA Objectives, Method and Process

This section presents a summary of the methods and processes used for NASA 2017, which includes some new approaches and methods compared to the previous NASA studies. Some of the new steps of this NASA were : a) the use of criteria and standards-referenced assessment instead of norm-referenced assessment; b) the use of a scale score instead of percentage in reporting students' proficiency; c) the development and use of the assessment framework as the guiding document for entire assessment design; d) the use of sampling weights to estimate the test scores to the entire population; and e) defining seven provinces as strata and reporting the results at provincial level.

Objectives of NASA 2017

As other NASA studies, NASA 2017 was also conducted to provide feedback to policy makers for improving quality of and equity in education. This assessment does not report individual students' performance, nor does it compare between the proficiencies of each individual student and school. Rather it provides the national and provincial results as well as the differences in the achievement scores due to the various influencing factors such as socioeconomic status, home language, and identity with geography. The objectives of NASA 2017 were:

- a. To point out the current level of student achievements of Grade 8 students in Mathematics, Nepali and Science.
- b. To determine the variations in student achievement by gender, province, identity with geography, types of school, ethnicity, home language, socio-economic status and so on.
- c. To explore the factors that influence students' learning achievement.
- d. To generate baseline data to compare and monitor the progress of students' achievement in various subjects.
- e. To develop the capacity of the education system in conducting national assessment.
- f. To provide recommendations for policy making to improve quality of and equity in education, particularly in school education.

Assessment design and development

A multi-stage sampling design was used to sample students for the assessment. In this assessment, the entire population was stratified into seven strata of provinces as explicit strata and the schools were selected from each stratum by using random sampling methods. The students were again selected by using a random sampling method. In order to represent various geographical regions in the sample, schools were sampled from selected districts. Districts were also considered in the sampling process for ensuring the representation of geographical regions as well as facilitating the administration of assessment; however, they were not considered as the strata or reporting units—the reporting units remain national and provincial levels.

The assessment frameworks for all three subjects were prepared by specifying criteria and standards for the assessment. While developing criteria and standards, Grade 8 curriculum of each subject was analysed. In addition to developing criteria and standards for each content domain, the four levels of cognitive domain have been defined by adopting the revised version of Bloom's Taxonomy. The four levels of cognitive domains are remembering, understanding, applying and reasoning. Test items were written using a specification of test which was developed through the

analysis of curriculum. Both the Selected Response (SR) items, mostly multiple choice items and Created Response (CR) items, including dichotomous and polytomous (partial credit) items were used for the test. Items were pilot tested and selected based on item statistics including item facility (difficult parameter) and item rest correlation (item discrimination). Besides, the effectiveness of distractors for MC items were checked by using frequencies of responses in each distractor of piloted test items.

Three versions (sets) of test were administered in each subject where Item Response Theory (IRT) was used to calibrate these three versions to a single set. IRT also facilitates the process of comparing test results across the years and test versions as well as similar types of tests (international regional as well as national). The average value of the parameters of linking items were used to calibrate the different versions of tests as there were some linking items in different versions of tests.

The test booklets were designed by using a rotating booklet design with some linking items for booklets 1 and 2 and some linking items for booklets 2 and 3 of each subject. Some items from previous NASA for Grade 8 in Mathematics, Nepali and Science as well as TIMSS released items for Grade 8 in Mathematics and Science were used in each set as the linking items so that this test could be made comparable through the process of equating by using IRT.

Along with the test booklets, background information questionnaires for students, subject teachers and head teachers were developed and administered. The background questionnaires include questions related to the contextual factors such as home contexts, school contexts, classroom contexts, student characteristics and attitude towards learning. The possible effects of these contextual variables in assessment results were identified by calculating variations in scores relating to these variables.

Test administration and data preparation

In each sampled school, test was administered to the sampled students. Student background information questionnaire was also administered to the same student who took the test. Teacher and head teacher of the same school were also responded the teacher's and head teacher's questionnaire, respectively. Before administering the test, ERO prepared a test administration guideline which was shared to the orientation programme organised for the head teachers and test administrator in each district. District Education Office, Education Review Office and the consultancy firm monitored the test administration to ensure proper administration of test.

After administering test and questionnaire, student answer sheets as well as students, teachers

and head teachers respond sheets were collected at the scoring centre in Kathmandu in a secure manner. The collected answer sheets were scored by trained scorers using marking schemes prepared by experts. Each student's scores in CR items, responses to MC items, and responses to students' background questionnaire were transformed to a separate OMR sheet. Similarly, responses of teacher and head teacher questionnaires were also transformed to a separate OMR sheet. These OMR sheets were scanned and data sets were prepared by using an OMR machine. These scanned data were checked and cleaned and data files in Excel sheets were prepared.

Item parameter estimation and calibration

After receiving data in Excel files, data analysis began with estimating item parameters in each of the versions of test, based on which the items were reviewed. The item parameters were calculated and used to analyse the items and to decide whether an item was included or discarded from the analysis. For this, item facility, item rest correlation and MNSQ were calculated and checked. Besides, ICC of each item was drawn to review the questions. Then, items were calibrated using the parameter of linking items and the final parameters were estimated to the combining test after calibration.

IRT modelling was done by using one parametric logistic model (1PM) for MC items and partial credit model (PCM) of IRT for CR items. Students' ability score (theta value) were estimated first and then, using sample weight of student, the results were estimated for the population. The students' abilities (theta values) were then transferred to a scale having 500 point as mean and 50 as the standard deviation.

Analysis of results

During the analysis of results, students' weights were calculated using a replication method and the results were estimated for the entire population where the Plausible value (PVs) was generated for estimating standard errors in the population estimation. Calculated students' ability scores were transformed to a scale score by fixing the national mean at 500 point in each subject as the scale for measuring and comparing the results.

In each subject, proficiency scales were defined by using the range of students' scores together with analysis of the item descriptors and performance descriptors of various standards. In addition, subject-wise mean scores were calculated in terms of province, gender, identity with geography, home language, age, SES, intensity of bullying at school, school type, activities and support at home, classroom activities and attitude of students towards school and teacher. The

confidence interval of each mean was estimated at 95% confidence level to estimate errors in estimating results for population. Similarly, by using the confidence level, statistical significance of each mean was estimated to understand the possible effect of particular variable on student achievement.

5.3 Overview of Results and Trends

Building on the analysis of assessment results, an overview of the results as well as possible trends have been drawn and discussed in this section. The national mean for this assessment is fixed at 500 point, which will provide a scale for comparing results on provinces as well other variables. It will also provide a baseline for comparing the results across the years as well as different comparable assessments. However, the comparison between the results of this NASA with the results of NASA 2013 was not done using an IRT and replication technique rather the mean scores of the linking items of these two results were compared by using CTT. Based on the analysis of assessment results, an overview of the results as well as possible trends have been analysed and presented in this section.

The following is a summary of major results from NASA 2017 for Grade 8 in Mathematics, Nepali and Science from which some trends on students' achievements have also been drawn and indicated.

There are similar trends on student percentages in various proficiency levels in Mathematics and Science but some difference was found in the case of Nepali

Six proficiency levels have been identified in each subject based on the item descriptors of correctly answered items with their corresponding scores. In each subject, there were a small percentage of students (1 – 2%) who fall in the lowest (level 1) and highest (level 6) level, and in the case of achieving level 5, similar situations were found in each subject as there were 11–13% students in level 5. For other levels (levels 2, 3 and 4), in Mathematics around 39 % students achieved level 4 which is the highest percentage of students among all levels while in Science it is only about 33% as the highest percentage of students are at the level 3 in Science (39%). Similarly, 14-15% students achieved level 2. In Nepali, the scenario is different as the highest percentage of students (58%) achieved level 4, 38% achieved level 3 and relatively small percentage of student (nearly 5%) achieved level 2.

Noticeable variations are found among the provinces

Looking at the mean scores, a similar type of trends for the highest mean score was noticed;

the province 3 has the highest mean score in each subject. But in the case of low mean score, the situation is not the same; the province 6, province 2 and province 1 have the lowest mean scores in Mathematics, Nepali and Science, respectively. While comparing the mean score of each province with the nation mean, province 3 and province 4 have the mean scores higher than the national mean in each subject whereas in the case of Mathematics and Nepali province 5 also has the mean score slightly higher than the nation mean.

Ethnicity and home language impact on students' achievement in all subjects, but gender differences in achievement are not noticeable in Nepali

In the case of gender, in both Mathematics and Science boys are significantly ahead of girls, but in Nepali, there is no significant difference between the mean scores of boys and girls though girls are 1 point ahead of boys. Similarly, among different ethnic groups, Dalits have scored lowest in all subjects with significant difference from Brahmin/Chhetri as well as Janajati. In the same way, Brahmin/Chhetri scored higher than Janajati with a significant difference between their mean scores. In all subjects, Nepali home language group have achieved better than the other home language groups with the highest difference of mean score in Nepali, resulting a significant difference between the mean scores of two groups in each subject.

The students' achievement in Nepali and Science are significantly lower for Madhesi compared to Hilly and Himali students, but in Mathematics difference is not visible

The data show that the students who identified themselves as Hilly students scored the highest in Nepali and Mathematics subjects, and the students who identified themselves as Himali scored highest with marginal differences between Hilly and Himali, and Madhesi students scored the lowest in Nepali and Science subjects. But the students who identified themselves as Madhesi and Himali scored an equal mean in Mathematics. The difference in the mean scores between Himali and Madhesi as well as Hilly and Madhesi students in Nepali and Science are statistically significant. In the case of Mathematics, the difference is not significant.

There are positive correlation between the SES and students' achievements

The general trend of data shows that the schools with high SES (average SES value of students) concentrated more on medium to high mean scores whereas schools with low SES concentrated more on low to medium mean scores. There are a number of schools with low SES achieving relatively high scores and a number of high SES schools achieving relatively low mean scores. However, some differences are noticed between the subjects as there is a high correlation between the SES and scores of students in Mathematics, but the correlation is some lower in the case of

Science and Nepali with the lowest correlation in Nepali. It also indicates that most of the private schools have high SES students compared to public schools, and a few public schools have low SES compared to private schools.

Bullying at school has been showing negative impact on students' achievement

In each subject, around 47% students had experienced at least one level of bullying, experiencing high level of bullying by 2 – 3% of students, medium level by 10 – 12%. The data show that the students' with high bullied experience have a low mean score compared to others, indicating that bullying negatively influences the students' achievements as the level of bullying increases the mean score decreases.

Non-availability of textbooks to the students resulted low achievement of students

Around 3 – 4% of students in each subject did not have textbooks. Comparing the mean score of the students who have textbooks and who did not have textbooks, it is found that student having text books achieved high with a significant difference.

Positive attitude of students towards teachers and schools have positive influence on students' achievement

The correlation between the attitude of students towards teachers and schools is positive in all subjects. The high correlation shows that the students have a very similar view towards teachers and schools. Although correlations are low, the correlation with the sum of attitude towards schools and attitude towards teachers are positive, which indicates that positive attitudes towards schools and teachers have positive influences on students' achievement.

Students from institutional/ private schools are achieving high compared to public/community schools

In each subject, institutional/private schools achieved higher mean score than community schools, yielding a significant difference between them, though the difference of mean scores between public and private schools in Nepali is relatively low compared to other two subjects.

Students enrolled with their appropriate age have performed better

The mean scores in each subject is highest for the students of age 13 and 14 and follows the decreasing trends as age increases from 14 years. There are statistically significant differences in the mean scores except for students' mean scores between the age 12 and 13/14 years, and 13 and 14 years group at the confidence level of 95%. This indicates that students with a right age achieve

better score than the students of low and high age, yielding a significant difference in the mean scores between the high achieving students of right age (13 or 14 years) and the mean scores of the students with the age older than the appropriate age.

There is no indication of positive changes in students' achievements over the years

Using Classical Test Theory (CTT), the results of NASA 2013 and NASA 2017 in Mathematics and Science and Nepali were compared based on the scores of linking items. This comparison indicates that, in Mathematics and Science, there are no signs of improving students' performance rather there is decrease of some points. However, some improvement is seen in students' scores in Nepali but this is only a marginal.

5.4 Implications and Recommendations

Based on the results and findings of this assessment, the following implications and recommendations have been drawn.

1. The wider differences in students' achievements across the provinces demand the planning and implementation of some special programmes to improve the achievement of students, particularly in those provinces with low scores. All provinces should prepare a strategic plan to improve the learning environment in schools to meet a minimum learning outcome among the students, particularly in the provinces having the mean scores below the national mean.
2. The students achieving almost all learning competencies i. e. competencies up to level 5 are only around 11-13 per cent in each subject. Moreover, around 46 per cent students in Mathematics and around 56 per cent in Science have fallen below level 4, which is in fact below the adequate level of proficiency of the Grade. It clearly suggests that classroom practices need to be improved/ changed to increase the level of students' proficiency. More serious concern is that there are many students who could not answer even the easiest items which are far below the level of Grade level competencies (around 15% in Mathematics and 17% in Science). So, the focus should be given to develop activities that contribute to achieve a minimum learning of all students, which may require some targeted interventions in curriculum as well as classroom practices.
3. There is a significant gap in learning achievements between boys and girls in Mathematics and Science. Additional support should be provided to the needy students, especially girls in Mathematics and Science. Moreover, there is a need to review curriculum, pedagogical practices and overall education system to make them gender sensitive.
4. As students' learning standard is significantly low in community/public schools compared

to the institutional/private schools, quality improvement programmes should be planned and implemented by identifying the gaps between the types of schools. A mechanism should be established to make education system accountable towards the learning of students.

5. Although the number is small, some public schools have achieved better results. An incentive scheme should be designed for high achieving public schools and the system of utilising the best practices of better performing public schools should be developed for improving instructional practices in other public schools.
6. The students of appropriate age group have performed better, so the policy and strategy of enrolling age appropriate students should be developed and implemented effectively. Some additional policies and strategies such as supplementary programs for over-aged students and improvement in classroom delivery to reduce Grade repetition are required for reducing the problems found among the over-aged students in schools. Similarly, some alternative programs could be designed for over aged children.
7. Special bi-/multilingual pedagogical strategies and additional support strategies should be designed and implemented in order to reduce the gaps in students' achievements between non-Nepali home language and Nepali home language groups (of students).
8. As 3–4% of students were found without textbooks, ensuring the availability of textbooks to all the students in time is essential to overcome the problem of reduced learning achievement due to having no textbooks.
9. The students from the schools conducting regular classes and ensuring no leisure classes have performed better than the rest students. This suggests that schools should develop and implement the strategy to conduct classes regularly without any leisure time. It further indicates that learning time should be better managed to increase students' engagement for learning in schools by reducing the unscheduled disruptions of classes. For this, it is necessary to change the existing classroom management techniques by minimizing the disruption of classes and by increasing teachers' time on classroom activities.
10. Considering students' social, cultural and other diversities (such as ethnic, geographic) as well as individual differences, it is necessary to utilise diversified and differentiated instructional strategies at classroom.
11. As the regular homework with feedback have positive impacts on student assessment, the system of providing homework regularly together with the feedback from teachers should be developed.
12. Creating the environment to develop positive attitude of students towards subject teachers and schools helps improve students' achievement. One of the strategies in developing positive

attitude of students towards schools and teachers could be implementing child friendly approach effectively in schools and classroom practices. Reducing teacher dominated traditional pedagogical practice by introducing group work, project work, practical activities, discussion, and creative works in instructional practices could be helpful to motivate students and develop positive attitudes towards school and subject.

13. In each of the assessed subjects, almost 47% of students have been experiencing some kind of bullying and a considerable percentage of students have experienced a high level of bullying in school and classrooms. This indicates that bullying is a serious problem in schools. As results indicate negative correlation between the level of bullying and students' achievement, bullying has sharply affected the achievement of students. The strategy for reducing bullying at school and classroom should be developed and implemented.
14. Policies and strategies to supplement the students with low socioeconomic status should be designed and implement to reduce the achievement gaps between the students of different socioeconomic status. This can be done, for instance, by providing additional reading materials to them, or additional support schemes for economically disadvantaged students.
15. It is necessary to develop textbooks, reference materials and other materials in different subjects focusing mainly on those students whose home language is not Nepali. Similarly, teacher preparation and development modality and process also need to be reviewed.
16. Some case studies and qualitative studies may be needed to identify the specific conditions and factors to be considered while planning to improve students' achievements of particular subject/content domains and specific groups of students. Such studies may also help to identify policies, strategies and programs to be implemented for improving the achievement of targeted students.

5.5 Conclusions

The National Assessment of Student Achievement (NASA) works as part of the overall education reform programme of Nepal, and this informs the Government as well as other educational stakeholders about how well the education system is performing towards addressing the learning needs of students as expected in the curriculum. This assessment provides a basis for identifying the areas of reform and interventions in order to improve the quality of school education by improving students' learning. NASA 2017 describes the performance of Grade 8 students in Mathematics, reading and writing in Nepali and Science subjects against the expected performance stated in the curriculum.

Along with describing students' performance under six proficiency standards and comparing performances of provinces, this report has compared students' performance in relation to various factors that influence the achievement of students. These descriptions and comparisons could be the useful source for identifying possible areas of interventions for enhancing students' learning and reducing the achievement gaps among students.

Instead of direct implication of the results to individual students and schools, the concern of NASA is to provide feedback for improving the overall education system as it does not provide achievement results on an individual student-basis or school-basis. However, local education authority, school and individual may utilise the findings of this study to identify the reform areas to be focused.

This study indicates that the performance of a large number of students in Science and Mathematics is far below the Grade level adequate standard. The distribution of students in various proficiency levels in this report indicates that high percentage of students, particularly in Mathematics and Science, are below the minimum level of proficiency (below level 4). Besides, results identified a number of factors including gender, home language, socioeconomic status, and school and home related factors that have influenced the performance of students. The more striking situation shown by the results is that there are no signs of any significant improvement in students' achievement level over the years.

The Governments at various levels as well as agencies and individuals working for school education are suggested to study and use the results of the national assessment of student achievement while designing policies and programmes in education. The results indicate that there is a need for designing some focused intervention programmes to enhance the quality of and equity in education.

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