National Assessment of Student Achievement 2019

MAIN REPORT

(Report on National Assessment of Student Achievement in Mathematics, Science, Nepali and English for Grade 10)

Government of Nepal

Ministry of Education, Science and Technology

Education Review Office (ERO)

Sanothimi, Bhaktapur

2020 (2077 BS)

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Advance Sampling

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FOREWORD

National Assessment of Student Achievement (NASA) communicates the status of student achievements and suggests measures for improving their learning outcome. The assessment provides evidence to the policymakers to formulate practical and implementable educational policies at the national and sub-national level for the needed educational reforms. NASA is a curriculum-based systematic evaluation of student learning outcomes by using standardized tools.

In Nepal, the Education Review Office (ERO) started the NASA work in 2011 with the first national assessment carried out for Grade 8 in Nepali, Mathematics, and Social Studies. In later years, Grade 3, 5, and 8 assessments have been conducted on a periodic basis. During the School Sector Reform Plan (2009-2015), two rounds of assessments (Grade 3, 5, and 8) were administered. During the School Sector Development Plan (2016-2022/23) two rounds of assessments (Grade 5, 8, and 10) will be administered. During SSDP period, NASA 2017 was the first assessment for grade 8, NASA 2018 for grade 5, and the present NASA 2019 is the first assessment of grade 10 administered, and they will act as the baseline for SSDP.

This report of NASA 2019 stands for Grade 10 in Mathematics, Science, Nepali and English subjects based on the response of a national representative sample of 43886 students from 1800 schools of Nepal with an almost equal number of schools and students in each of the four subjects, considering seven provinces as the 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 headteachers were administered in each school. Data were analyzed to present both overall mean score and proficiency levels, and the relation between the achievement scores and various influencing factors with the use of the background information questionnaire. Analysis and comparison of the results were done using the Item Response Theory (IRT) and the parameters of linking items. Results are presented in a transformed scale of student latent ability (θ) with 500 mean and 50 standard deviations. The results presented in this report are the generalized results over the defined population and they provide evidence of the level of learning.

I would like to acknowledge the contribution of teachers, experts, subject committees, and researchers throughout the process of tools development, test administration, data analysis, and report writing. My sincere thanks go to previous Director Generals of

ERO Mr. Tek Narayan Pandey, Mr. Keshab Prasad Dahal, and Mr. Ramsharan Sapkota; consulting firm-CEIR; ERO staff including Anupam Chandra Shrestha, Hari Prasad Aryal, Narayan Prasad Jha, and Mr. Prakash Kumar Kharel for their direct and indirect involvement in various phases of this assessment. I highly appreciate the contribution of Central Level Agencies and the Ministry of Education, Science and Technology for regular support in budgeting, monitoring of test administration, and tools development for the program. I express my gratitude to honourable minister Giriraj Mani Pokhrel, Secretary Gopi Nath Mainali, Dr. Tulasi Thapaliya, Mr. Baikuntha Aryal, Mr. Deepak Sharma for providing valuable suggestion for improving this report.

It is my belief that this report will be evidence to education policymakers, program designers, teachers, educators, community members, and researchers for their role in improving students' learning. I hope this report will be a milestone for bringing about a change in the quality of education at the school level in Nepal.

Mr. Ima Narayan Shrestha
Director General
Education Review Office
November, 2020.

ACRONYMS/ABBREVIATIONS

CDC	:	Curriculum Development Centre
CEHRD	:	Centre for Education and Human Resource Development
CR	:	Constructed Response
CRT	:	Criteria Referenced Test
CI	:	Confidence Interval
CTT	:	Classical Test Theory
DEO	:	District Education Office
DOE	:	Department of Education
EDCU	:	Education Development Coordination Unit
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 Estimation
MOS	:	Measure of Size
N cases	:	Number of cases/students in the population,
NASA	:	National Assessment of Student Achievement
SE	:	Standard Error,
NRT	:	Norm Referenced Test
NU cases	:	Number cases/students in the sample,
NU psu	:	Number of Primary Sample Units (schools)
OECD	:	Organisation 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
PSU	:	Primary Sample Unit
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 Plan
TIF	:	Test Information Function
TIMSS	:	Trends in International Mathematics and Science Study
WLE	:	Weighted Likelihood Estimation

EXECUTIVE SUMMARY

Context

In the beginning of 2019, the Education Review Office assessed the learning outcomes of grade 10 in Mathematics, Science, Nepali and English subjects. The prime objective of this assessment was to prepare the baseline data for School Sector Development Plan (SSDP) as well as compare the learning achievement of 2019 with the previous cycle of NASA (2015) to ensure quality school education. Altogether 43886 students, 1800 teachers, 1800 head teachers from 1800 schools participated in this assessment. National assessment has been well accepted as a means of measuring quality of education (ERO, 2019; TIMSS & PIRLS, 2008) that provides both quantitative and descriptive form of information on student achievement. This is considered as an output of the teaching learning process and its quality (World Bank, 1996). It provides basic information for policy makers, politicians, and the broader educational community and informs policy makers about the key aspects of the system" (Greaney & Kellaghan, 2008b, p. 7, ERO, 2013). In this context, ERO has its roadmap to conduct two rounds of NASA for grades 5, 8 and 10 to assess the quality of education and trends of learning achievement within SSDP period. This NASA 2019 is the first cycle assessment for grade 10 in Mathematics, Nepali, Science and English subjects in the SSDP period.

Objectives of NASA 2019

The main aim of NASA is to provide policy feedback through the assessment of learning and identify the trends of learning over time. NASA 2019 has the following specific objectives:

1. To identify the current level of Grade 10 students' achievement in Mathematics, Science, Nepali and English subjects,
2. To explore variations in student achievement by gender, province, types of school, ethnicity, home language, and socio-economic status,
3. To identify factors that influence student achievement,
4. To identify trend in student learning and produce the baseline data for comparison in the future,
5. To strengthen the capacity of the education system in conducting national assessment,
6. To provide the Ministry of Education, Science and Technology with

recommendations for policy formulation to improve quality and ensure equity, particularly in school education.

Methodology

Three set of questions with background information were asked in each subject. All sets were linked with anchor items. The ERO has used Item Response Theory (IRT) to analyse the latent ability of students using various contextual variables to explain those latent traits of the students. NASA 2019 has used advanced procedure to bring rigor to data analysis by generalizing the results at national level and province levels through 7 explicit strata and various other implicit strata. Student learning outcomes were tested in four subjects: Mathematics, Science, Nepali and English on national representative sample of 43886 students from 1800 schools of Nepal with an almost equal number of schools and students in each of the four subjects, considering seven provinces as explicit strata. The multi-stage sampling strategy - Probability Proportional to Size (PPS) sampling method was used to draw this large sample. Three versions of standardized tests together with the background information in the questionnaire to the sample students, teacher questionnaire to subject teachers and school survey questionnaire to the head teachers were administered in each school. Data were analysed to present overall mean score and proficiency levels and to demonstrate the relation between the achievement scores and various influencing factors with the use of the background information questionnaire. Analysis and comparison of the results were done using Item Response Theory (IRT) and the parameters of linking items. Results are presented in a transformed scale of student latent ability (θ) with 500 mean and 50 standard deviation. The results presented in this report are the generalized results over the defined population and they provide the evidence of the level of learning.

Though the assessment results have shown the national average achievement to be 500 in all four subjects, it does not mean that all subjects have been equally learnt. This report therefore presents the results in terms of what the students can and cannot perform, the existing gap between the written curriculum and the achieved curriculum, and the number of students who have developed their ability at a minimum competency level. Moreover, the student proficiency level is defined into six levels, namely, below basic, basic, proficient 1, proficient 2, proficient 3 and advance level from lower to higher order. To explain what students could learn adequately, a Defining Proficiency Level (DPL) method was used.

Findings, Conclusions and Recommendations

Students are struggling to acquire even minimum learning. Majority of students are not able to learn what is taught in all subjects. In fact, majority of the students have achieved or mastered less than 50% of the curriculum in all subjects. Most of the students could not solve Higher Order Thinking items. Since similar conclusions were also drawn from previous administrations of NASA grade 5 and grade 8 assessments, it can be argued that there are problems in the teaching-learning strategies, remedial actions and the role of head-teachers. On average, students in institutional schools have massively outperformed students in community schools. However, it is worth noting that average scores for students in some community schools were the highest among all schools in all subjects. Deeper analyses of the reasons behind their success should be considered as they can provide valuable insights and lessons for other community schools and policymakers alike.

Province level

The comparative study of province wise achievement in Mathematics shows variation in the achievement level of the students. The achievement of students in Bagmati (521), Gandaki (513), and Lumbini (503) was, on average, better than for students in other provinces and was above the national average (500). Similarly, Bagmati (525), Gandaki (515), and Lumbini (507) were high performing provinces in Science. The achievement in Nepali of province 1 (505), Bagmati (511), Gandaki (516), and Lumbini (513) students was distinctly above the national average. The disparity in achievement by province was much wider in English. The achievement of Bagmati (534), Gandaki (516), and Lumbini (502) students was above the national average. The performance of provinces 1, 2, Karnali, and Sudur Paschim was lower in all four subjects than the national average.

Gender

Learning disparity between boys and girls was one of the major findings in the study. There was a statistically significant difference between the achievement of boys (510) and girls (492) in Mathematics. The difference in the achievements of boys and girls in Science and English was also significant but there was no visible difference in the achievement in Nepali as boys scored (501) and the girls scored (500). The achievement of boys was above the national average in Science, Maths, and English whereas girls performed below the national average in these subjects except in Nepali.

Age

A distinct variation in achievement was seen by age group as well. Students aged between 13 to 19 years participated in the assessments. Among them, students aged 14 and 15 years were the highest scorers in all four subjects assessed. Achievement scores for students aged 16 years or more was lower, on average. This result was consistent in all four subjects.

Home language

There was a significant difference in the achievement of the students who use Nepali as their home language compared to the achievement of the students who use other languages as their home languages. The gaps in achievements of the students who used Nepali as a home language and other languages as home language were in scale scores of 11 in Maths, 17 in Science and Nepali, and 19 in English.

School type

The comparative study of achievement scores showed a vast gap between community schools and institutional schools. The institutional schools topped the community schools by 49 scale scores in Maths and Science, 21 scale scores in Nepali, and 68 scale scores in English subject in their achievement. The achievement of the community schools was below the national average whereas the achievement of the institutional schools was distinctly above the national average.

Achievement by the career aspirations of the students

Based on the future goal, the study showed that students desiring to be doctors/ engineers, civil servants, and working abroad where in-depth learning is required had higher achievement than the achievement of the students longing to be farmers, teachers and employees in private sectors in subjects like Maths and Science.

Parental education

Parent's educational level has a direct positive association with children's achievement in all subjects assessed. Based on the achievement, it can be said confidently that higher the educational qualifications of father or mother, greater the scores of the children has on average. Educated father and mother contributed significantly to their children's learning achievement whereas children whose father or mother was illiterate performed comparatively lower. The achievement significantly differs from illiterate to literate parents and lower qualification to higher qualification of the parents. This result is consistent with the study carried out by Kainuwa & Yusuf

(2013) who stated that children of father or mother with university degrees perform considerably well and get the highest degree in education.

Parental occupation

While analyzing relationship between parental occupation and student learning, student's performance was highest for those whose parents were teachers. Students whose parents were involved in government jobs, business, and handling only household works also had higher scores. Children whose father and mother were involved in agriculture and households, working in other's homes and handling the only households had, on average, lower scores.

Family size

The family size was also seen to be an important predictor in learning achievement of students. Students residing in households where the family size was 4-6 members had higher achievement scores. Beyond that, achievement decreased with additional family members.

Teacher's regularity

Regularity of a teacher in the classroom depicts both dedication and awareness about the importance of deliverance of quality education to shape the bright future of students. Teacher can give an in-depth knowledge regarding the subject matter and it eases the teacher to complete the curriculum on time and therefore, it is an important predictor in students' achievement. Thus, considering the findings above, teachers who were dedicating all their time in the classroom were successful in improving students' achievement. Meanwhile, students with teachers who would come late and go earlier or do not come to class at all had lower achievement.

Interest in subjects assessed

Developing a strong interest in a subject encourages the student to work harder in the subject which helps boost their achievement in that subject. The finding shows that majority of students who enjoyed different subjects mentioned here wanted to learn and excel in those subjects.

Homework and Feedback

Based on the analysis of data, any feedback after homework has boosted student's performance. In addition, feedback given on regular basis was found to be more helpful. The difference in performances of the students who received regular feedback in their homework was higher than those who never received feedback. The achievement was

found in scale score of 6 in Maths, 17 in Science, 11 in Nepali, and 11 in English respectively indicating the importance of receiving feedback regularly. There was a slight difference in favour of the scores receiving regular feedback. The difference in Science and Nepali was statistically significant in the mean score.

Home possession

Variation was seen in the home possession of proxy indicators of material goods such as permanent house, car, motorcycle, TV and computer. For instance, out of 22385 students in Mathematics, 51 % have TV at home and only 43% students have permanent houses whereas 57% did not have computers, 52% did not have motorcycles, and 72% students did not have cars at home. Similar findings were observed in other subjects as well.

Prioritizing the most influencing variables

The magnitude of the coefficients from the multiple regression analysis provides insights on variables that have strong relationship between different contextual factors and student achievement. Since the analysis controls for other household, student, school and teacher level characteristics, the relationship is likely to minimize bias. Some key finding summarizing the overall findings in a priority basis in Numeracy (Math) and Literacy (Nepali) are provided below:

Important variables related to Mathematics

Students in institutional school students perform, on average, much better than community school students in math. Though this is not a causal relationship, there are many who believe that institutional schools are more effective than community schools in improving student learning. Similarly, the relationship between socio-economic status and math scores are positively correlated, but the magnitude is much smaller than for that for a variable indicating institutional schools.

Female students are, on average, faring worse in math than boys, and the difference is both substantial in magnitude and statistically significant. Similarly, student age and math scores are negatively correlated. Compared to Brahmin and Chhetri students, Dalit students are doing significantly worse in math. There is expected positive relationship between father's education level and the child's achievement in Math. After controlling for other factors, children whose fathers have completed grade 8 or higher have higher scores in math and this difference is statistically significant.

There are some school level variables that are also important. For example,

students in schools where the headteacher is permanent, on average, have higher scores in math. Similarly, students in schools where the math teachers are permanent are also doing, on average, better than students where math teachers are not permanent. This is perhaps an indication that these teachers and headteachers can focus more on teaching or administrative duties and not worry about other aspects related to their tenure status.

Findings for Nepali subject

Unlike in Math where we find large institutional school effect, there is no institutional school effect in Nepali. One can argue that both students and institutional schools focus more on subjects such as Math at the expense of subjects such as Nepali that, unfortunately, are not valued greatly both by parents and higher education institutions.

Students in schools where headteacher is a secondary level appointee are performing better than others and the difference is statistically significant. Similarly, students in schools that have instituted initiatives to reward teachers have also performed better in Nepali.

With regards to child level characteristics, female students are doing worse than male students in Nepali, but the magnitude of the difference is substantially lower than in math. Similarly, age of the student and Nepali scores are negatively correlated, a finding consistent with math. There is a positive relationship with regards to having a dictionary and other educational reference books at home. The positive coefficient for dictionary and other educational reference books may be a proxy for these households prioritizing education.

Conclusion

An educational system covers input, process, and output in education. Curriculum, pedagogy, teaching, and learning practices and assessment are at the centre-stage of attention for the formation, implementation, and monitoring and evaluation of educational policies. Rigorous research and evidence-based findings are the pillars for assessing the overall system of education. NASA has been making endeavour to assess the educational output of school education since its establishment as one of its core activities in Nepal.

The main objective of this assessment was to prepare the baseline data for the School Sector Development Plan (SSDP) as well as compare the learning achievement of 2019 with the previous cycle of NASA (2015) to analyse how quality education in

the school system has evolved over time. The study, as before, shows variation in the performance of province-level achievement in Maths, Science, Nepali, and English. Bagmati, Gandaki, and Lumbini are high performing provinces whereas provinces 1, 2, Karnali, and Sudur Paschim are low performing ones. The disparity seems deeper in gender-based achievement as boys, on average, have outperformed girls.

The most appropriate age for learning grade 10 appears to be 14 or 15 years (starting grade 1 while in age 4 or 5) as students in this age group, on average, achieved higher scores than other age group students. Students older than 15 years score lower, perhaps a reflection that these children are repeating grades or that these children, presumably with less conducive learning environment at home, are starting school later.

A substantial difference in achievement has been observed based on the home language. The children, whose home language is Nepali scored higher than those whose home languages were other than Nepali language. This important finding has a notable influence on the use of classroom pedagogy and achievement of students, even in earlier grades.

The achievement of institutional schools is comparatively far better than community schools. Despite the investment of huge resources from the government, the achievement of community school students remained below the average level. Uplifting the quality of community schools has been one of the greatest challenges.

There is a difference in the achievement based on the future goal of children. Students who wished to be teachers, farmers, or to work in private businesses have lower levels of achievement compared to those who aspire to be doctors /engineers or civil servants or work abroad. One could argue that this is partly a reflection of occupations such as doctor, engineering and civil service being valued by the society at the cost of other civilian professions. There is need for occupations such as farming, teaching, and private business to be made dignified professional areas.

There is remarkable difference in the achievement of children from illiterate and literate parents -- there is positive relationship between student achievement and parents with at least grade 8 of education. Similarly, parental profession as well has a positive influence on the achievement of students. Scores were lower for students whose parents were involved in agriculture, household works, and working for other households.

Children from a nucleus family, on average, have achieved higher score than

those from a joint family. Data shows that the greater the number of family members, the lower the achievement of students. Similarly, students with positive attitude have succeeded in excelling in their academics by scoring good grades in various subjects. Likewise, teachers who were dedicating all their time in the classroom were successful in improving the students' achievement.

Similarly, providing feedback on homework is leading to improvement in achievement of students. The availability of a table for study, separate study room, computer for school work, internet, child magazines, story/ poetry, and pictures, dictionary, reference books, and so on at home contributes to boosting their learning performance. Lastly, permanent head teacher and teachers are associated with higher achievement scores. Similarly, permanent school building and infrastructures also similarly positively influence learning as shown by the data.

Recommendations

1 A large number of students are at below grade level and alarming gap exists between intended curriculum and achieved curriculum.

While considering the proficiency levels of students in achievement, the results show their low level of ability as 32% in Maths, 37% in Science, 20% in Nepali, and 30% in English are below the basic level. Furthermore, 59% in Maths, 63% in Science, 37% in Nepali, and 51% in English of students are below basic and basic levels of proficiency, and these levels indicate poor competency level. Only a small number of students have the highest level of proficiency. The majority of the students have achieved or mastered less than 50% of the curriculum in all subjects. This evidence indicates an alarming gap between intended and achieved curriculum.

Recommendation: The overall gaps of intended and achieved curriculum demands a radical change in the policy, resource management, curricular design and implementation process and monitoring and evaluation strategies. Policy reformation, allocation of required volume of budget, activity based curriculum, emphasis on pedagogical delivery, resource management are some of the strategies the government should implement instantly for removing the gaps between intended and achieved curriculum. Moreover, given that below grade level learning is already pronounced by grade 5 as previous administrations of NASA at grade 5 has amply demonstrated, remedial education should be seriously considered in earlier grades. Furthermore, training curricula for Teacher Professional Development (TPD) should be re-oriented to better equip teachers to identify, and provide tailored instruction to, students entering

particular grade with knowledge below grade level (Schaffner, Glewwe and Sharma, 2020). More specifically, a campaign of "***No child is left below minimum level of learning***" is highly recommended at the school level. In this campaign, Curriculum Development Centre is advised to initiate to define the minimum level of learning (learning standards) with the technical coordination with ERO; CEHRD is advised to prepare teacher training guidelines in focus with this campaign and NEB to prepare a guideline to evaluate such learning.

2. Wide gaps in achievement between provinces.

The study shows variation in the performance of province-level achievement in Maths, Science, Nepali, and English. A huge gap between the high performing and low performing provinces in achievement has a scale of 45 in Maths, 43 in Science, 42 in Nepali and 60 in English. Bagmati, Gandaki, and Lumbini are high performing provinces whereas provinces 1, 2, Karnali, and Sudur Paschim are low performing ones

Recommendation : To address the wide gap between high performing and low performing provinces, justified distribution of resources is a necessity. In Province 1, Province 2, Karnali and Sudur Paschim, policy reformation, special emphasis on budget allocation, development of human resource, contextualization of curriculum and close monitoring and evaluation of educational programmes are suggested areas of primary intervention by the government. A minimum standard of infrastructure, learning opportunities, resources, incentives and retention of good teachers and identification of learning difficulties along with remedial teachings are supportive activities to enhance learning and increase students' achievement. Specific curricula and instruction methods that can be embodied in daily teaching guides and related instructional materials can be developed, and distribution of these guides and materials and the teacher training can be packaged together to improve student learning (Schaffner, Glewwe and Sharma, 2020). In addition, small-scale policy experiments should be designed and analysed to help improve the implementation aspects so that programs have a high success probability.

3. Huge disparity in achievement by type of schools

A huge disparity in achievement between community and institutional schools may create a two-tiered society in upcoming days. A huge gap is seen in achievement between institutional and community schools with a range of scale score of 51 in Maths, 49 in Science, 21 in Nepali, and 68 in English.

Recommendation: The gap should be fulfilled by upgrading community schools through strategic interventions in school education. It is imperative to identify malfunctions in input, process, and output of community school mechanism and reform policy for the improvement in the existing condition. A comprehensive analysis of better performing institutional and community schools is sorely needed to explore how poor-performing community schools can be improved. The local governments also have an important role to play in improving the quality of public education.

4. The use of home language also brought a remarkable gap in the achievement.

A remarkable gap has been revealed by the use of home language that ranges in scale score of 11 in Maths, 17 in Science, 17 in Nepali and 68 in English.

Recommendation: This gap can be narrowed by using the home language of children by teachers in the classroom, even in lower grades. Teachers need at least a basic level language learning package for their students or language of the community surrounding the school. Teachers have to be able to communicate in community language, and they have to teach translating, changing codes, using trans-language strategy, and empowering those children who use languages other than Nepali at home. A comprehensive language learning package for teachers for their professional development deserves incorporation in TPD.

5. There is a visible gap in the learning achievement between boys and girls

The study shows a visible disparity between boys and girls in their achievement. The gap ranges in scale scores of 18 in Maths, 16 in Science, and 10 in English though normally there is no gap in Nepali.

Recommendation: The reasons behind such disparity in learning between boys and girls are worth exploring further so that effective interventions to reduce gender differences in learning can be devised. Suggested interventions include teachers paying attention to student-friendly (more focused on girls) behaviour and teaching and learning activities in the classroom, including remedial education. Affirmative action such as scholarships and additional incentives to girls may reduce gender disparity in achievement. Regular interactions with female role models may also help. Apart from these, teachers should create a suitable learning environment for girls by being sensitive in terms of their needs, interest, voices, and providing equal opportunity for classroom participation. Parents are to be encouraged for their roles to support their children's education on equality basis.

6. Students at appropriate age performed better

Students studying in grade 10 at the age of 14 and 15 scored higher than the students of underage and overage studying at the same level. The similarity in the age group among students may have encouraged them to share and discuss their education related problems thereby enabling them to excel in their academics. The gap in the achievement of the students' aged 14 or 15 compared to other age groups has been in scale scores of 28 in Maths, 35 in Science, 40 in Nepali, and 34 in English.

Recommendation: If the student is below age 14 while in grade 10, the child was in grade 1 at or before age 4. Similarly, if the child is aged 16 or above in grade 10, it is most likely an indication that they have repeated grades or started grade 1 in a less conducive environment. In addition to encouraging children to enrol on time, teachers should be trained on formative assessments in earlier grades and remedial education so that these children do not fall behind in studies, particularly in foundational literacy and numeracy skills, and repeat grades.

7. The relationship between students' academic performance and socio-economic status is substantial, but its magnitude varies by subjects

The socio-economic status of a student's family has varying effects on their achievement. Many students have performed better in Nepali language with satisfactory performance in Mathematics and Science despite their low socio-economic status. This situation was reversed in English language. This depicts that the socio-economic background of the students does not entirely decide their academic performance.

Recommendation: Though the socio-economic status of students has varying effects on their achievement, it is not the only major deciding factor. Students can excel and achieve better if they focus more on the study and practice well despite the minimum resources available to them. Despite the different levels of socioeconomic status of students, if the schools provide, for example, sufficient learning materials, library facilities, manage students' clubs, and study programs to the students they can perform well irrespective of their SES.

8. The achievement on assessment of Janajati and Dalit children is lower than other ethnicities

Ethnicity has influenced the achievement of students in Nepali and English. The differences on achievement between Brahmin/ Chhetri and Janajati and Dalit were in scale score of 7 for Janajati and 11 for Dalit in Nepali and 8 for Janajati and 20 for Dalit in English . Students from Brahmin /Chhetri communities are, on average, high

achievers whereas students from Dalit communities are achieving lower.

Recommendation: The achievement score of students from Janajti communities and Dalit communities are below the national average compared to students from communities of Brahmin and Chhetris. The differences may have been caused by medium of instruction, language background, contents of the curriculum, teachers and cultural background. To reduce these gaps, inclusive curriculum, remedial teaching, incorporation of local ideologies in the curriculum, inclusiveness in teaching profession, change of learning culture in Janajati and Dalit students need to be seriously considered.

9. Teacher regularity and availability of study resources have positive relations with learning achievement

Teachers who were dedicating all their time in the classroom were successful in improving students' achievement. Meanwhile, teachers who would come late to class and leave early or do not come to class at all had negative performances. Similarly, availability of study resources such as textbooks, question banks, guides, and reference materials and other supportive resources has positive influence on learning achievement.

Recommendation: School administration should maintain a strict code of conduct for teachers to be regular in the school and it should be made as one of the criteria for their performance evaluation. Regular teachers should be rewarded with incentives. Similarly, government or non-government agencies, supporting students through scholarships or any other incentives, should consider the availability of basic study resources to the students. Parents also should consider making these essential resources available to meet the primary needs of their children.

10. Decreasing patterns on achievement and consistency of NASA results

One-third of students in Maths and Science and nearly half of the students in English scored below the national average. The consistently weak performance of students in NASA 2012, 2015, and 2018 indicate a low return to the investment made by the government in education. The recurring trend underscores the need for ensuring sufficient government intervention to enhance quality education.

Recommendation: Time has already come to carry out a diagnostic study to identify the challenges in the educational system with a focus on teaching-learning process. The critical factors that hinder the achievement and quality education should be

investigated and immediate steps have to be undertaken to recover the educational loss. Pedagogical intervention in the delivery system deserves exploration and adoption of activity based, learner-centered, problem solving, critical thinking, developing 21st century skills and research based learning approaches in teaching with close monitoring and evaluation has now become a necessity. The involvement of parents and community members should be ensured in making the schools accountable for their students' low achievement.

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Figures

CHAPTER 1

AN OVERVIEW OF THE NATIONAL ASSESSMENT OF STUDENT ACHIEVEMENT, 2019

1. Introduction

In this report, chapter 1 presents an overall introduction of the National Assessment of Student Achievement (NASA), its historical overview and objectives. Chapter 2 presents methodological procedures adopted to explore contextual variables, tools and technologies used during the overall study including the explanation of the contextual variables like geography, ethnicity, gender, language and economic status. Chapter 3 provides the basic result by contextual variables whereas Chapter 4 presents analysis of school and teacher effect. Chapter 5, the last one, presents summary of findings, conclusions and recommendations.

This is a report on the national assessment of Grade 10 students in Mathematics, Science, Nepali and English subjects conducted by the Education Review Office (ERO) in 2019. The report of the assessment is based on the curriculum-based standardized test. A comparative presentation is made in all the sub-chapters focusing on province wise results as explicit strata and other variable specific results as implicit strata, for example results by type of schools, gender, ethnicity, and language in a disaggregated form.

The assessment was conducted in 75 sample districts, 1800 schools and 43886 students. The major aim of NASA is to provide valid and reliable information on student learning achievement at grade ten with policy feedback to the Ministry of Education, Science and Technology. Specifically, NASA provides feedback to the teachers, schools, curriculum developers, program and policy executing agencies for the needed reform. A repeated cycle of NASA provides information on the trend of student learning and other contextual variables that provide pathways for the review and design for policy and program.

More specifically, the assessment answers the questions like: How well are the students learning? Is there an 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? (Grenaney & Kellaghan, 2007).This report has highlighted related issues and

problems with some recommendations to the policy makers and other stakeholders.

1.1 National Assessment of Student Achievement

Globally, it has been well accepted that the means of measuring the quality of education is students' achievement (TIMSS & PIRLS, 2008). The national assessment provides both quantitative and descriptive form of information on student achievement, which after is considered as an output of the teaching learning process and its quality (World Bank, 1996). National assessment thus provides basic information for policy makers, politicians, and the broader educational community (ERO, 2013). Students' assessment provides "data for national education audit to inform policy makers about the key aspects of the system" (Greaney & Kellaghan, 2008b, p. 7, ERO, 2013). It is argued that the achievement of the students in a curriculum area be 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, 2008b; NASA, 2013). NASA is also a popular means of determining the achievement of curriculum and finding gaps between the written curriculum and the taught curriculum. So, it is useful for making policy decisions especially when decisions are to be made in relation to the optimum utilisation of resources (EDSC, 2008). As stated earlier, it provides evidence for policy makers on availability of textbooks, class size, and number of years of teacher training. Therefore, every country has accepted that it is "systematic, regular measures of learning achievement in a country that is designed to assist policy making" (Lockheed et al. cited in EDSC, 2008, pp. 19; ERO, 2013; ERO, 2019).

1.2 Evolution of NASA in Nepal

Assessment practice is found to have started from the last years of the decade of 1980s in Nepal. However, the Ministry of Education has formally started the National Assessment since 1995 and continued it up to 2010 on a small scale. Large scale NASA was administered under the Ministry of Education since 2011 AD. Four NASA cycles were completed during the School Sector Reform Plan (SSRP) and two including NASA 2019 has been completed during the School Sector Development Plan (SSDP). In both the plans, NASA is considered as a tool to measure the quality of education for making the educational institutions accountable to achieving the educational goals.

NASA studies are conducted for both backward and forward-looking purposes. 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 (ERO, 2018, 2019).

The assessments completed so far and the upcoming assessments as per the designed NASA roadmap are presented in table 1.

Table 1 NASA Cycles Completed and Planned

SSRP					SSDP					
2011	2012	2013	2015	2017	2018	2019	2020	2020	2021	2022
Grade 8	Grade 3 and 5	Grade 8	Grade 3 and 5	Grade 8	Grade 3 and 5	Grade 10	Grade 8	Grade 5	Grade 10	…
✓	✓	✓	✓	✓	✓	✓	Progressing..			

A complete NASA cycle goes over a period of 3 years. In the first year, all items development, pre-testing of the items and item analysis are completed. In the second year, final test administration is conducted and finally, in the third year, activities like report writing, dissemination of the report and policy informing are done.

The ERO follows globally accepted practices of conducting national assessments. Although the context of each country is different, there are some common practices to national assessments in most of the countries (ERO, 2019). Building on the comprehensive review of national assessments from various countries, ERO has adopted the following procedures:

- The Ministry of Education, Science and Technology (MOEST) selects an implementing agency either from within the MOEST system or an independent external consulting organization. In case of Nepal, Education Review Office (ERO) within the MOEST system is solely responsible for the national assessment.
- The MOEST 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 MOEST identifies the Grade level and determines the area (e.g., literacy or numeracy) to be assessed.
- The implementing agency (ERO in Nepal) 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.

ERO

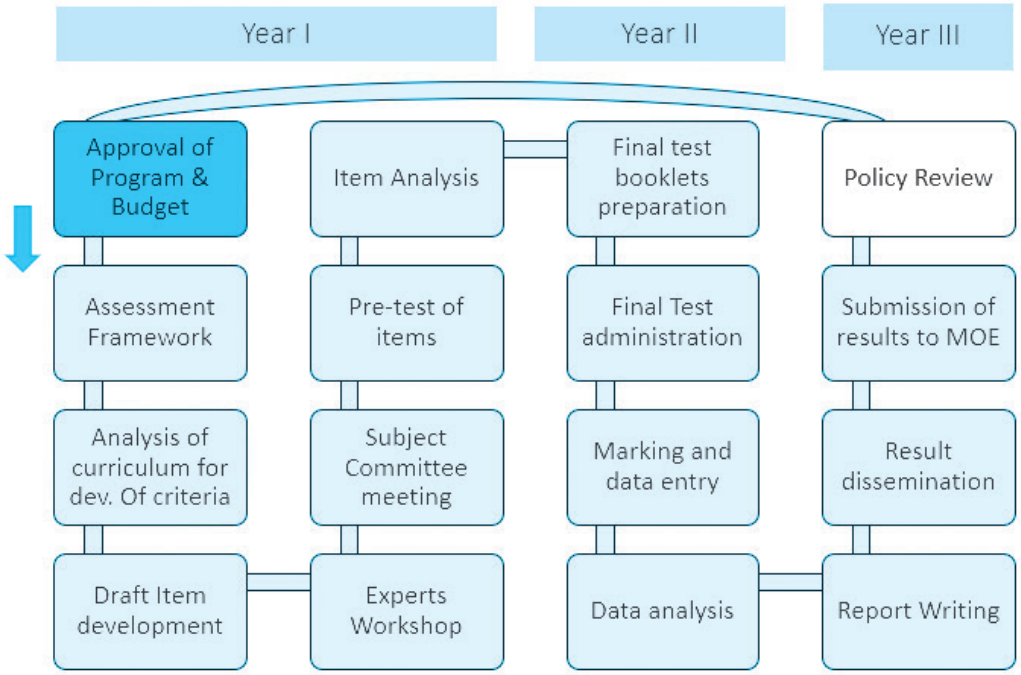
- Pilots the test items with the support of external experts and reviews their validity, appropriateness and sensitivity in terms of gender, ethnicity and culture.
- Ensures that the assessment instruments are reliable and valid.

- Selects the samples schools, arranges for printing the test papers and other relevant materials, and communicates with the schools and teachers for test administration.
- Orients the test administrators (focal persons, head teachers and teachers), and then administers the test and survey questionnaires in the selected schools.
- Collects test scores and other necessary information, cleans the data as needed and analyses them.
- Prepares draft report/s which is/are reviewed by relevant subject committees and external experts.
- Prepares and disseminates final report/s through various means such as publication and the mass media.
- Finally, the MOEST, implementing agency and relevant stakeholders study the report/s of national assessment and identify major areas for policy reforms (ERO, 2017, 2018).

1.3 NASA Cycle

ERO has adopted the following cycle to conduct the national assessment of Grade10 students in Mathematics, Nepali and Science.

Figure 1 NASA process cycle



The figure 1 presents the major steps taken in planning, designing, administering and reporting of the assessment. NASA process cycle begins with an approval of the required budget and programme and goes through the series of assessment procedures: 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.

1.4 Objectives of NASA 2019

The purpose of this assessment is to provide feedback to the Ministry of Education, Science and Technology to improve the quality of school education. This assessment does not report individual students' performance, nor does it compare the proficiencies of each individual student and school. Rather, it provides the national and provincial level 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 2019 has the following objectives:

a. To identify the current level of Grade 10 students' achievement in Mathematics, Science, Nepali, and English
b. To identify variations in student achievement by aspects such as gender, province, types of school, ethnicity, home language, and socio-economic status.
c. To explore factors that influence student achievement.
d. To identify trends in student learning and produce baseline data for future comparisons.
e. To strengthen the capacity of the education system in conducting national assessment.
f. To provide the Ministry of Education, Science and Technology with recommendations for policy making to improve quality and equity, particularly in school education.

1.5 Distinct Features of NASA 2019

The ERO has used Item Response Theory to assess the latent ability of students using various contextual variables to explain those latent traits of the students. This assessment has used advanced procedure to bring rigor to data analysis by generalizing the results in national level and province levels through 7 explicit strata and various

other implicit strata. Use of Replicate Module for estimating the population parameters and Weighted Likelihood Estimation (WLE) for analysis of individual student level and reporting are the examples of its advancement. Furthermore, the advancement of procedures has also been noticed in sampling methods. A Probability Proportional to Size (PPS) sampling procedure has been used in selecting the schools as Principal Sample Unit (PSU), the school clusters. Reporting of student achievement at province level and national level is done in a transformed scale with mean 500 and standard deviation 50 by using the formula:

Average scale score = 500 + plausible value * 50
Or, Average scale score = 500 + logit * 50

The distinct features of this report are:

1. Learning level descriptors prepared through a rigorous analysis.
2. A gap in learning between the written curriculum and the taught curriculum in the form of achieved curriculum is presented by using Defining Proficiency Level (DPL) method.
3. Teacher and school effects are calculated and regression analysis is carried out by including household, student, school and teacher level characteristics to identify most influential contextual variables for learning of the students.
4. To increase the strength of the result, sample size to answer an item is doubled than in previous years by combining two subject test papers to be given to a student. To accommodate this change, the number of items in a test item set for a subject was reduced, but the number of test booklets was increased.

Chapter 2
Methodology

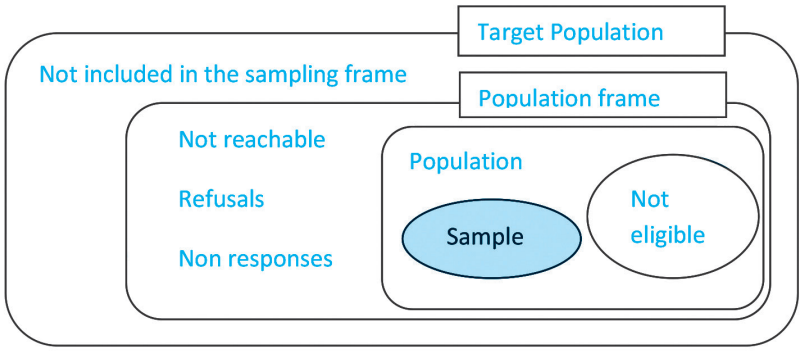
This chapter presents the process adopted for sampling, assessment framework, tools development, setting contextual variables and determining the reliability and validity of the tools. It also presents the statistical tools and techniques used in data analysis of NASA 2019. Moreover, various formula, symbols and techniques used in data analysis and reporting are described in greater details in this chapter.

2.1 Sampling

2.1.1 Target Sampling Frame

Sampling is a process of selecting a set of data from the population by using a defined procedure. In this assessment, the multi-stages sampling process was adopted. In the first step, a list of all 8978 schools to be included in the assessment, with their unique ID (school EMIS code) provided by Department of Education-DOE (now Centre for Education Human Resource Development - CEHRD) was listed. This list was considered as the target population for developing the sampling frame. In addition to the name, location (provincial, district, geography and municipality) and ID (code) of each school, public and private categories, the total number of students, with gender categories, in each school was taken as the sampling frame. These data are available from the EMIS of CEHRD, which are collected through the national census of schools every year. The target sampling frame for this assessment was thus prepared on the basis of the school data of 2019 with 460662 students as the target population.

Figure 2 Conceptual diagram of population for sampling frame.



2.1.2 Population

The population of the study is the schools running the classes up to Grade 10. However, some of the schools did not report the number of students (zero students) and such schools were excluded from the population frame. After the exclusion of non-student school, the schools with less than 10 students were also excluded as the non-eligible schools. Then the population of this assessment reached 9100 grade 10 running schools from which valid population of 8728 schools with student number above 10 or equal 10 students was determined. From those schools, student population was estimated to be 460665 students at maximum at the national level. Sample cluster schools were selected from those schools, by using Probability Proportional to Size (PPS) sampling method. Thus, the population for this assessment covered all students enrolled at Grade ten taken randomly from primary sampling units (PSUs). The exclusion of the schools was defined by following criteria:

- Schools having less than 10 students
- Students who did not respond the test items (during data cleaning)
- Schools at very remote distance or unreachable at the time of assessment
- Schools which do not have students in Grade 10

2.1.3 Sample Size

The educational survey research studies suggest that the sampling precision requirements should be satisfied by a simple random sample (SRS) of 384 students for the main criterion variable. This size of simple random sample of students yields 95% of confidence interval for the student-level estimate with 3% of confidence interval (Margin error). However, a perfect random sampling is not an easy task in such a large-scale national assessment. The sampling design includes the combination of different sampling techniques in different stages, including stratification, clustering and random selection of students. For this, the design effect due to the multi-stage sampling has to be calculated and adjusted while selecting the sample size.

In this assessment, actual sample size was calculated in multi-stage sampling methods. Intra-class correlation was taken from the recently administered survey of grade 3 (for reference). Taking intra-class correlation r = 0.28, greater than NASA 2015 grade 3 (ICC = 0.28) and school cluster size (C) equal to 27, the design effect (deff) was calculated by using the formula given:

$$Deff = 1+(C-1)\times r$$

Where: Deff = Design effect

C = the size of the cluster (number of students within the school who will be assessed in a subject)
r = Intra-class correlation

Now, to calculate the Clustered Sample Size (CSS), using the formula

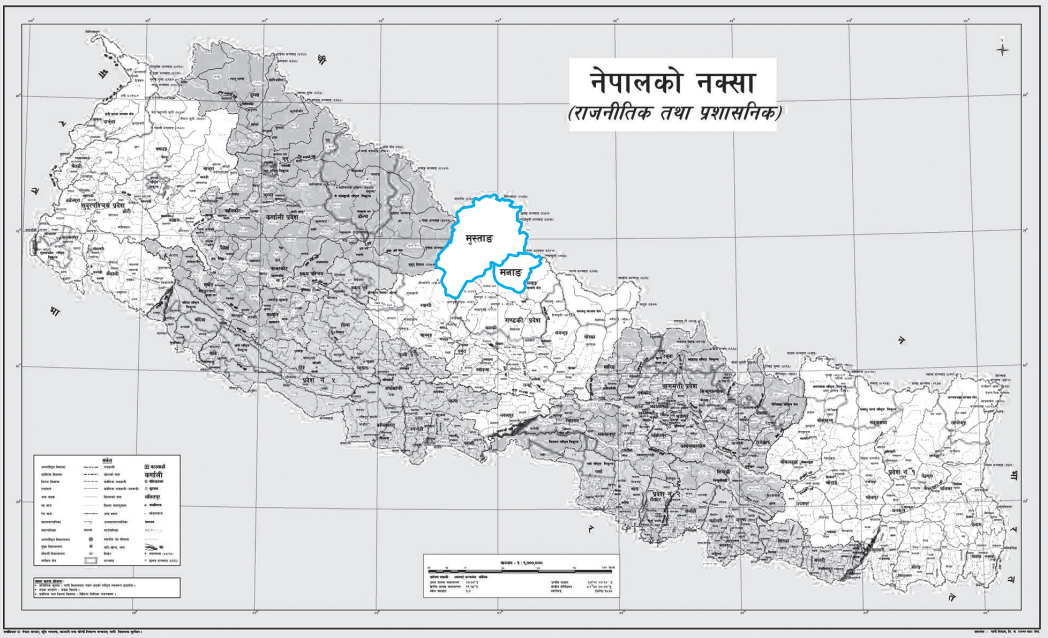
$$CSS = ESS \times Deff$$

Hence, the outputs of sampling are ICC = 0.28, Deff = 8.28, ESS = 384, CSS = 3179, Non-response of students assumed 4%, by the rate of 27 students per PSU, total cluster per province becomes 122.6, by adjusting school non-participation by 4%, school participation is 96%, hence a cluster of province becomes 127. However, when there is less number of students in any province, number of school or students becomes small and vice versa. Now, the 7*127 = 889 schools stand for a subject. For sufficient sampling and better precision, 900 schools per subject were sampled. However, there are four subjects and sampling individually for each subject, there should be 3600 schools. So, to maintain the number of schools within 1800, two subjects were combined in a test paper. Hence, two test papers (combined Science + Math and Nepali + English) were used to administer in 1800 schools from the whole population. Thus, sample is sufficient to generalize the results over the population.

2.1.4 Sample Design and Stratification

The sample design for NASA 2019 Grade 10 assessment was a multi-stage sampling by the selection of schools from each explicit stratum (province). In Nepal, seven provinces are politically divided entities of the country, which govern educational administration within their region in their own. A sufficient number of samples taken from the provinces will ensure the generalizability or the results. The selection of districts from each geographical location was done randomly to incorporate Mountain, Hill and Terai areas as far as possible. The Primary Sampling Unit (PSU) schools (clusters) were selected within the district by using PPS method. The selected 75 districts from all 7 provinces are presented in the following figure 3:

Figure 3 Sample in map (Manang and Mustang are excluded)



2.1.5 Selection of the Schools and the Students

From the population, a total 48600 students was estimated to be taken as the sample. However, number of students in the EMIS database did not match with real test administration. Thus, number of participated students was less than the estimated sample. Viewing the different sizes of schools, the maximum sample size was fixed to be 27 per school, which is called Measure of Size (MOS).

In the case of a sample school having more than 27 students, the students were selected by using a random sampling method otherwise all the students were taken as the sample with defined number of students. More specifically, the number of students sampled from each of the selected schools was of two different ways: (i) If the size of the students was less than or equal to the expected sample size (MOS), all the students were sampled. (ii) When the size of the students was greater than the expected size, the required number of the students was selected randomly. The probability of selection of a particular student from schools was always the same.

Because of school replacement and student non-response adjustment, calculation

of sample weight by PPS sampling methods was completed. In the raw database, some records were background information only and some were subjective test item response only with unidentified unique ID or school deleted from the database. So, finalized and cleaned data by removing duplicate cases, outliers and invalid entries was as per given in following table 2.1.

Table 2 Number of participated students from the sample in four subjects.

Provinces	Number of participated students in each subject			
	Math	Nepali	Science	English
Province 1	3667	3477	3394	3424
Province 2	3424	3166	3193	3092
Bagmati	4023	3955	3659	3918
Gandaki	2630	2822	2359	2809
Lumbini	3845	3535	3540	3496
Karnali	2073	2585	1929	2542
Sudur-paschim	2703	3013	2563	2936
Total	22365	22553	20637	22217

Thus, difference between estimated population 24300 and real participated students 22365 in Science or 22553 students in Mathematics was because of difference in number of students in the day of test and EMIS database, student non-participation and school replacement. Similar interpretation goes in Nepali and English languages as well.

Table 3 Number of participated school by types in four subjects.

Provinces	**Nepali and English**		**Math and Science**	
	Community	**Institutional**	**Community**	**Institutional**
Province 1	110	29	122	29
Province 2	113	10	121	10
Bagmati	106	58	106	61
Gandaki	86	31	86	20
Lumbini	107	30	121	29
Karnali	99	5	81	4
Sudur-paschim	105	11	100	11
Total	726	174	737	164

In the sample, type of school (community and institutional) was an implicate

stratification whereas provinces was an explicate stratification.

2.1.6 School Weight

School level base weights were calculated using the formula:

$$BW^{i}_{sc} = \frac{N_{pop}}{n_{sc} \times N^{i}_{mos}},$$

Where N_{pop} was the population size (students), nsc was the total number of schools sampled within each explicit stratum; and N^{i}_{mos} was the measure of size (MOS) assigned to the school (i). School level base weights were calculated for all sampled schools that satisfied the condition for eligible students actually participating in the study. For example, in Mathematics, altogether 900 schools were sampled, out of which 1 school did not participate in testing due to some unavoidable circumstance. For this, a school-level non-response adjustment was calculated separately for each explicit stratum, using the formula:

$$Sc_{adj} = \frac{n_{sc}}{n_{psc}},$$

Where n_{sc} is the total number of originally sampled schools; and n_{psc} was the number of schools that actually participated.

The final school weight was then calculated with non-participation adjustment to the base school weight. The final school weight was then equal to the product of the school base weight and non-participation adjustment,

$$W_{sc} = BW^{i}_{sc} \times Sc_{adj}$$

2.1.7 Student Weight

For schools with 27 grade 10 students, student base weight was 1; and for schools with more than 27 students and fewer, the base weight was calculated using the formula:

$$BW_{st} = \frac{N_{st}}{n_{st}},$$

Where N_{st} was the total number of students at Grade 10 in the sampled school, and n_{st} as the number of sample students from the class.

A student non-participation adjustment was calculated for any school that had at least one student who was sampled and was eligible to do the test but did not participate for some reason. This was calculated with the formula:

$$St_{adj} = \frac{n_{st}}{n_{pst}},$$

Where n_{st} was the number of sample students and n_{pst} was the number of students

Sch_code		Province	Sample_size	Sch_pi	Sch_wt	Within_sch_prob	Within_sch_wt	Final_st_prob	Final_st_wt	Sum_of_final_wt	School_base_wt_adj	Sch_non-response_adj	Student_base_wt_adj	Stu_non-response_adj	Final_st_WT_adj	Final_Sch_WT_adj	Final_Sampling_Wt_adj
160840007	.....	2	25	0.04	25.92	0.66	1.52	0.03	39.39	1103.04	25.92	1.00	39.39	1.00	39.39	25.92	1021.00
240210004		3	25	0.03	36.48	0.93	1.08	0.03	39.39	1103.04	36.48	1.00	39.39	1.00	39.39	36.48	1436.97
580140001		5	25	0.05	18.58	0.47	2.12	0.03	39.39	1103.04	18.58	1.00	39.39	1.00	39.39	18.58	732.04
460500011		5	25	0.03	36.48	0.93	1.08	0.03	39.39	1103.04	36.48	1.00	39.39	1.00	39.39	36.48	1436.97
550420005		6	25	0.04	23.45	0.60	1.68	0.03	39.39	1103.04	23.45	1.00	39.39	1.00	39.39	23.45	923.76
370360001		4	25	0.05	18.58	0.47	2.12	0.03	39.39	1103.04	18.58	1.00	39.39	1.00	39.39	18.58	732.04
20290028		1	25	0.10	9.85	0.25	4.00	0.03	39.39	1103.04	9.85	1.00	39.39	1.00	39.39	9.85	387.98
404100013		5	25	0.03	39.39	1.00	1.00	0.03	39.39	1103.04	39.39	1.00	39.39	1.00	39.39	39.39	1551.92
460320007		5	25	0.03	39.39	1.00	1.00	0.03	39.39	1103.04	39.39	1.00	39.39	1.00	39.39	39.39	1551.92
520240008		5	25	0.03	39.39	1.00	1.00	0.03	39.39	1103.04	39.39	1.00	39.39	1.00	39.39	39.39	1551.92
670170010		7	25	0.03	37.88	0.96	1.04	0.03	39.39	1103.04	37.88	1.00	39.39	1.00	39.39	37.88	1492.23
70310011		1	25	0.03	36.48	0.93	1.08	0.03	39.39	1103.04	36.48	1.00	39.39	1.00	39.39	36.48	1436.97
250270133		3	25	0.03	36.48	0.93	1.08	0.03	39.39	1103.04	36.48	1.00	39.39	1.00	39.39	36.48	1436.97

2.2 Test Administration and Supervision

Test administrators for NASA 2019 were appointed from Resource persons, School Supervisors, and Headteachers. The appointed test administrators were trained to administer standardized National Assessment as per the NASA test administration guidelines. For the support and inspection of the test administration, a teacher from the schools who was not teaching the assessed subject in the particular school was also appointed. For other support, two other support staff were assigned for test administration in a school.

For monitoring and supervision of the NASA test administration, three types of monitors were mobilized. Some civil servants at central level agencies from the Ministry were appointed by ERO and some by EDCU. A team of supervisors was mobilized for immediate support and monitoring of the process in every sample district. In bullet points, adoption of the test administration process has been summarized below:

- One school participated in two subjects' subject area.
- Subject teachers were not allowed in the test administration hall; rather they were assigned to provide responses on the Teacher's Background Information Questionnaire.
- Test administration centre head oriented the students, support staff and invigilator to ensure smooth test administration.
- Clear instruction to the students was provided to write with their full efforts in a

low-stake environment.

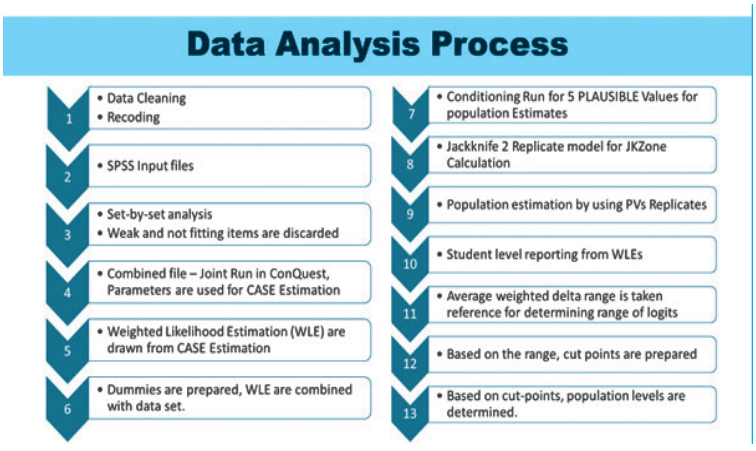
- After the test administration, the head teachers also responded to the background information questionnaire provided to them.
- To maintain the confidentiality of the test items, no one was allowed to copy the papers, take the pictures of the paper, or keep the test papers in the school.
- After the test administration was over, test booklets were collected at the EDCU by a consulting firm. Each school submitted their monitoring report, test administrator's report and list of participated and non-participated students/schools.

2.3 Analysis Methods

The data analysis methodology consists of two parts. The first part is item analysis and the second part is data analysis and interpretation. In the first part, SPSS 23 was used to code, recode and clean the database. During the data cleaning, duplicate cases, outliers, and unidentified cases were cleaned. All the background variables were recorded to make them readable for ACER ConQuest 4.x software. Also, dummy variables were prepared for conditioning the run in ConQuest.

ACER ConQuest 4.x software was used to analyse the items to generate item parameters in set by set manner. Later, joint file was prepared by combining all three sets of a subject and the joint run of all three sets was useful to generate item level parameters viz. difficulty parameter, discrimination parameters, item fit parameters, distractor analysis, ICC plots, TIF plots. From the joint run, item parameters in the form of logits were generated and those parameters were fixed for case analysis. After the case analysis, ".wle" file was generated for case estimation that was used for conditioning the run. The overall data analysis process is presented in figure 2.4.

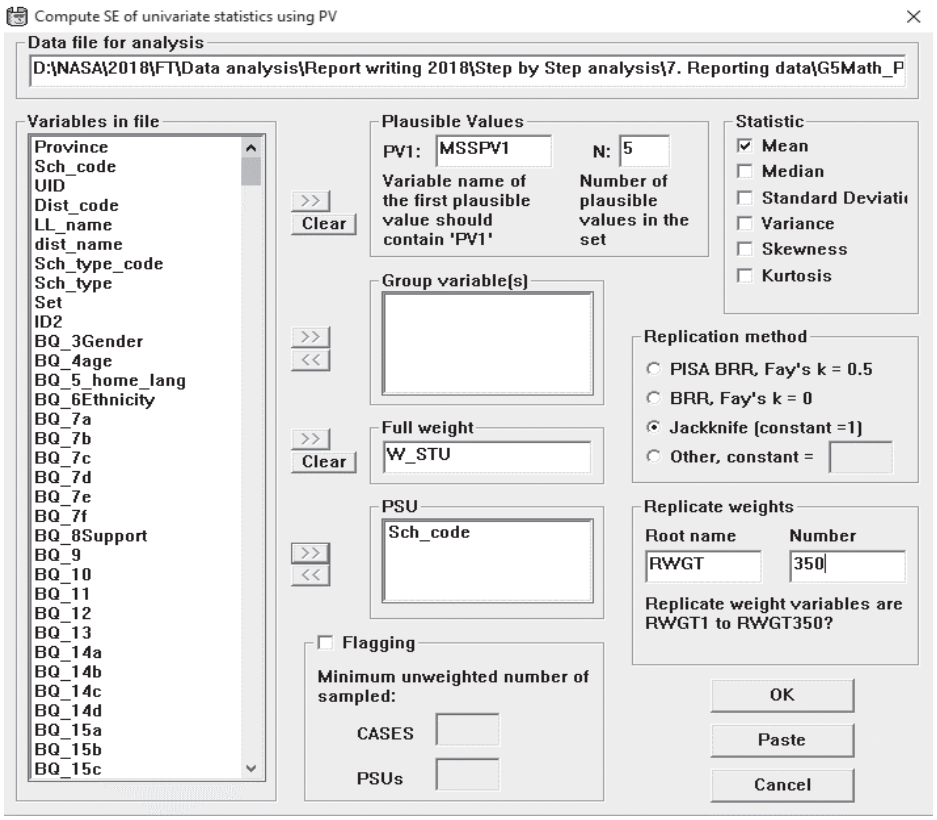
Figure 5 Data analysis process of NASA 2019



After the estimation of WLE and Plausible values (5 PVs), a process of replicate weights was used to estimate standard errors of population estimates. The figure below shows an example of Replicate module used in NASA 2019. [See ERO (2017) for detail process and formula used]

A sample of front end of estimating population parameters from replicate module is presented in figure 6

Figure 6 Replicate module used to calculate the Standard Estimate of Univariate Statistics using PVs in Mathematics



2.4 Tools Development, their Reliability and Validity

2.4.1 Assessment Framework

Curriculum based test items were developed based on the Assessment Framework. The assessment framework is a plan of content, item type, content domain and proportion of test items to be included. It is a blueprint of whole standardized assessment of NASA.

The assessment framework was developed before designing the test and developing the test items. The assessment framework was developed to:

provide a clear guideline for a sound assessment approach to inform policy makers and the other concerned stakeholders on quality of education. It includes domains to be assessed, the statement of criteria together with standards, specification of items, framework for contextual variables to be considered while conducting an assessment and brief guidelines for assessment design (ERO, 2017).

The assessment framework has identified and described the domains and constructs to be assessed in Mathematics, Nepali, English, and Science subjects. It has also proposed a framework for designing background questionnaires for students, teachers and head teachers. In addition, it has presented a brief guideline on overall methodological approach to be adopted for the assessment. (www.ero.gov.np – Assessment framework of grade 10).

2.4.2 Item selection for Mathematics

The following specification table presents content domain, criteria, weightage percentage, number and types of items, allocation of marks and distribution items in each of the six standards.

Table 4 Table of specification for item selection

Content domain	Weightage (%)	Marks	Weightage for items of various standards
Arithmetic	12	10	The weightage of items in each set should be around as follows: Level 1: 10%, Levels 2, 3, 4 and 5 each: 20%, and Level 6: 10%.
Mensuration	14	11	
Algebra	23	18	
Geometry	26	21	
Sets and trigonometry	11	9	
Data and probability	14	11	
Total	100%		

Note:

1. The total number of SR (selected response) items (MCQ), CR (constructed response) items carrying 1 mark each (very short answer question), CR items carrying 2 or 3 marks should be asked.

2. While selecting the items for each content domain it is necessary to select both SR and CR items with a reasonable ratio.

2.4.3 Item selection for Nepali language

ब्लुमको परिमार्जित वर्गीकरणका ६ तहहरू: सम्झना, बुझाइ, प्रयोग, विश्लेषण, मूल्याङ्कन र सृजनात्मकतामध्ये (Anderson & Karthwohl, 2001) सम्झना, बोध (बुझाइ), प्रयोग गरी तीन तहलाई यथावत समावेश गरी बाँकी तीन तहलाई तार्किक क्षमता (Reasoning) का रूपमा वर्गीकरण गर्ने र सोही ४ तहका परीक्षण साधन तथा प्रश्न निर्माण गर्ने गरी तयार गरिएको छ। यिनै वर्गीकरणलाई आधार मानी सिकाइ उपलब्धिको राष्ट्रिय परीक्षणमा निम्नानुसार ४ तहका भारअनुसारका प्रश्नहरू उपयोग गरिएको छ।

Table 5 **प्रश्नको छनोटका लागि विशिष्टीकरण तालिका** *(Table of specification for item selection)*

विषयवस्तुको क्षेत्र (Content domain)	**भार (Weightage)**	**जम्मा पूर्णाङ्क (Marks)**	**विभिन्नस्तरमा अङ्क विभाजन (Weightage for items of various standards)**
पढाइ (शब्द भण्डारसमेत)	60%	48	प्रत्येक स्तरको भार देहायको प्रतिशतको नजिक हुनेछ। Level 1: 10%, Levels 2: 20%, Level 3: 20% Level 4: 20%, Level 5: 20%, Level 6: 10 %
लेखाइ (शब्द भण्डार तथा कार्यमूलक व्याकरण र वर्ण विन्याससमेत)	40%	32	
Total	100%	80	

द्रष्टव्य:

१. प्रति प्रश्न १ अङ्क आउने उत्तर छनोट गरिने (SR) बहुवैकल्पिक प्रश्नहरू १८ देखि २४ ओटा र प्रति प्रश्न १ अङ्क आउने उत्तर अति छोटो उत्तर आउने रचना गर्नुपर्ने प्रश्न (CR items) ६ देखि १२ ओटा हुनेछन् भने कूल अङ्क ८० हुनेगरी अङ्क भारअनुसार रचना गर्नुपर्ने (CR) २, ३ वा ४ अङ्क आउने प्रश्नहरूको सङ्ख्या १६ देखि २४ हुनेछन्।

२. प्रत्येक क्षेत्रबाट प्रश्नहरू छनोट गर्दा उत्तर छनोट गरिने (SR) र रचना गर्नुपर्ने प्रश्न (CR items) दुवै खालका प्रश्नहरू समावेश गरिनु आवश्यक छ।

2.4.4 Item selection for Science

Table 6 Table of specification for item selection

Content domain	Weightage (%)	Marks	Weightage for items of various standards
Physics	30	24	The weightage of items in each set should be around as follows: Level 1: 10%, Levels 2, 3, 4 and 5 each; 20%, and Level 6: 10%.
Chemistry	30	24	
Biology	30	24	
Geology and Astronomy	10	8	
Total	100%	80	

Note:

1. The total number of SR (selected response) items (MCQ) should be between 18 to 24 and the number of CR (constructed response) items carrying 1 mark each (very short answer question) should be between 6 to 12 so that the total number of questions carrying 1 mark each will be 28-32, CR items carrying 2 or 3 marks each should be 16 to 25 depending upon how much marks each question carries provided total marks of the test will be 80.
2. While selecting the items for each content domain it is necessary to select both SR and CR items with a reasonable ratio.

2.4.5 Item selection for English language

The following specification table presents content domain, criteria, weightage percentage, number and types of items (Selected response-SR and Constructed response-CR), allocation of marks and distribution items in each of the six standards.

Table 7 Table of specification for item selection

Content domain	Weightage (%)	Marks	Weightage for items of various standards
Reading	60%	48	The weightage of items in each set should be around as follows: Level 1: 10%, Levels 2, 3, 4 and 5 each; 20%, and Level 6: 10%.
Writing	40%	32	
Total	100%	80	

Note:

1. The total number of SR (selected response) items (MCQ) should be between 18

to 24 and the number of CR (constructed response) items carrying 1 mark each (very short answer question) should be between 6 to 12 so that the total number of questions carrying 1 mark each will be 28-32, CR items carrying 2, 3 or 4 marks each should be 16 to 24 depending upon how much marks each question carries provided that total marks of the test will be 80.

2. While selecting the items for each content domain it is necessary to select both SR and CR items with a reasonable ratio.

2.5 Item Development and Selection

2.5.1 Item development workshop

Item development process began with a one-day orientation to the well trained item writers on test items development followed by workshop to write draft items by school and university teachers. After computer setting of those developed items, expert workshop was organized. Experts in the workshop reviewed the items to ensure their alignment with curriculum framework and also checked the level and appropriateness of the items.

After the experts' workshop editing the items, the subject committee workshop finalized the test item booklets. What followed the subject committee workshop was final language editing and layout design before printing them in a secured press.

2.5.2 Pre-test of Test Items

To generate item parameters for all the items, they were pre-tested on 300 students. Altogether six versions were pretested in the pre-test sample districts and schools. The pre-test was done in the following number of schools and students:

Table 8 Number of schools and students participating in pre-test

S. No.	Subject	No. of sets piloted	No. schools piloted	No. of students participated
1	Mathematics	6	80	1800
2	Nepali	6	80	1800
3	Science	6	80	1800
4	English	6	80	1800

After the pre-test, the items were analysed to produce item parameters. Those parameters were

- difficulty,
- item-rest correlation,
- internal consistency and
- distractors analysis

The proportion of items in final booklets of four subjects was thus maintained.

Table 9 Representation of various cognitive domains in the test

Cognitive Domain	Math	Science	Nepali	English
Remembering	18%	27%	25%	37%
Understanding	30%	30%	31%	33%
Applying	39%	27%	28%	13%
Reasoning	12%	16%	16%	17%
Total	100%	100%	100%	100%

Table 10 Example of item analysis and decision in the pre-test of Mathematics items

Item code	Set	criteria	Level	Area/Domain	Item description/ content	Cognitive level	Item type	Maximum	Mean	P value	Item rest correlation	Full marks	Key
1.1.1.4	D	1	1	Geometry	Measurement of angle	Understanding	SR	1	0.50	0.50	0.28	1	B
3.3.1.3	E	3	1	Geometry	Classification of triangle	Understanding	SR	1	0.52	0.52	0.31	1	C
3.4.2.2	F	4	2	Numeracy	National place value system	Remembering	SR	1	0.59	0.59	0.40	1	B
6.7.3.5	F	7	3	Numeracy	Square and cube number	Applying	SR	1	0.35	0.35	0.30	1	B
7.6.1.2	B	6	1	Numeracy	Rounding off	Understanding	SR	1	0.52	0.52	0.35	1	D
…	…	…	…	…	…	…	…	…	…	…	…	…	…

2.5.3 Item Booklet, Scoring Key and OMR Design

Selected items, in each subject, were arranged into three booklets with some linking items between the booklets. Scoring keys for SR items and scoring schemes for CR items were prepared for each booklet. Based on the booklets and scoring schemes, OMR sheets were designed to use for data generation and entry process.

2.5.4 Preparation of the scoring scheme and guidelines

A group of teachers and experts of the respective subjects worked for compilation, review and finalization of the scoring schemes for each subject. For multiple choice and other selected response (SR) types of items, answer keys were reviewed and reconfirmed. For created response types of items, the possible answers as well as marks to be provided in each step were reviewed and confirmed. For dichotomised items, conditions for 0 and 1 credit were clearly specified. For CR items with partial credit conditions, each of the credits 0, 1, 2 and so on were clearly mentioned. Along with the preparation of scoring scheme for each subject, some guidelines for scoring were also prepared. Rubrics were developed including score distribution, in various skills of writing and levels of proficiency.

2.5.5 Review of test booklets and scoring schemes

At the final stage of item selection and item booklet preparation, subject committee of each subjects reviewed the items and item booklets by editing the items, confirming the data, and formatting the items. The subject committees prepared the final test booklets which were then sent for preparing Printing Ready Copy (PRC). The subject committees also reviewed the scoring schemes.

While selecting the items and preparing the test booklets for the final test, the following criteria were considered:

- Curriculum based
- Coverage of all content areas
- Proper representation of various cognitive domains
- Assessing the various levels of proficiencies
- Items having a range of difficulties from p-value 0.15 to 0.90
- Proper discrimination power of the items, item rest correlation r>0.02
- Comparability with previous NASA and TIMSS

2.5.6 Preparation of item Register

Working with subject experts, ERO prepared an item register in each subject in an excel sheet. Item ID (unique), item descriptor for each item and scoring keys for MC items and various credits as well as description of each credit of CR items were included in the item register. The following is the example of an item register:

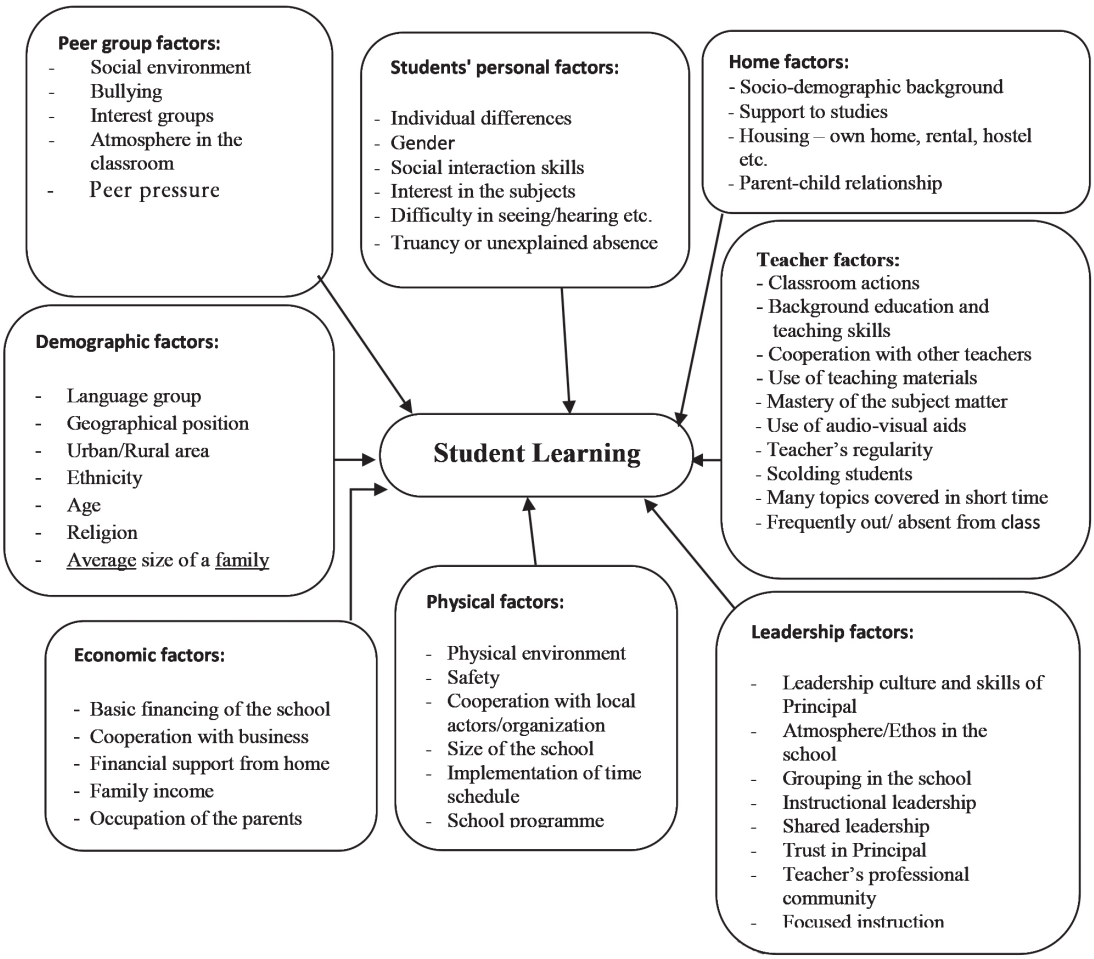
Table 11 Example of Item register of Mathematics

Item code	Set	criteria	Level	Area/Domain	Item description/ content	cognitive	Item type	Max_ score	P-value	Item rest correla-tion	Full marks	Set A	Set B	Set C	Key	Label	Label	…
1.1.1.4	D	1	1	Geometry	Measurement of angle	Understanding	SR	1	0.50	0.28	1	1		1	B	M1SRQ1	M1SRQ1	…
3.3.1.3	E	3	1	Geometry	Classification of triangle	Understanding	SR	1	0.52	0.31	1	2			C	M1SRQ2	M1SRQ2	…
3.4.2.2	F	4	2	Numeracy	national place value system	Remembering	SR	1	0.59	0.40	1	3			B	M1SRQ3	M1SRQ3	…
6.7.3.5	F	7	3	Numeracy	square and cube number	Applying	SR	1	0.35	0.30	1	4		7	B	M1SRQ4	M1SRQ4	…
7.6.1.2	B	6	1	Numeracy	rounding off	Understanding	SR	1	0.52	0.35	1	5			D	M1SRQ5	M1SRQ5	…
22.7.2.2	A	7	2	Numeracy	square and cube number	Understanding	SR	1	0.32	0.45	1	6			C	M1SRQ6	M1SRQ6	…
9.10.1.1	A	10	1	Time, money and measurement	Time	Remembering	SR	1	0.88	0.23	1	7			C	M1SRQ7	M1SRQ7	…
11.18.2.5	A	18	2	Time, money and measurement	Weight	Applying	SR	1	0.28	0.42	1	8			C	M1SRQ8	M1SRQ8	…
10.20.1.5	C	20	1	Arithmetic	Fraction	remembering	SR	1	0.41	0.42	1	9		9	A	M1SRQ9	M1SRQ9	…
12.17.3.2	F	17	3	Geometry	Volume	Applying	SR	1	0.32	0.35	1	10			D	M1SRQ10	M1SRQ10	…
13.22.3.2	A	22	3	Arithmetic	Fraction	Higher ability	SR	1	0.29	0.21	1	11			C	M1SRQ11	M1SRQ11	…
13.23.2.3	C	23	2	Arithmetic	Decimal	Remembering	SR	1	0.54	0.39	1	12			D	M1SRQ12	M1SRQ12	…
14.24.2.2	C	24	2	Arithmetic	Decimal	Understanding	SR	1	0.32	0.37	1	13			A	M1SRQ13	M1SRQ13	…
14.20.3.6	F	20	3	Arithmetic	Fraction	Understanding	SR	1	0.47	0.52	1	14			B	M1SRQ14	M1SRQ14	…
16.27.2.2	E	27	2	Arithmetic	Unitary method	Understanding	SR	1	0.63	0.49	1	15			C	M1SRQ15	M1SRQ15	…
15.25.2.2	C	25	2	Arithmetic	Decimal	Remembering	SR	1	0.61	0.34	1	16	22	17	A	M1SRQ16	M1SRQ16	…
9.19.1.1	C	19	1	Time, money and measurement	Weight	Remembering	SR	1	0.51	0.15	1	17			B	M1SRQ17	M1SRQ17	…
Old 9.4		9	4	Arithmetic	Basic operation	Higher ability	SR	1			1	18	21		B	M1SRQ18	M1SRQ18	…

2.6 Background Variables

The ERO has developed a framework for collecting background information through the questionnaires after studying students, teachers, and school survey instruments used in various international assessments such as Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Pan-Canadian Assessment Program (PCAP) together with the tools used in previous NASA conducted by ERO in timeline with some discussions with academicians, practitioners, parents, teachers and the students. Besides, student attitude scale used in previous NASA was revised and used. The following figure shows the overall framework adopted for background information questionnaires used in the study.

Figure 7 Concept of contextual variables. (Source: ERO, 2018)



Following student background variables were included in the assessment

Table 12 Student background variables/variable blocks

School Id	Student's subject related activities in classroom
Location of School	Mother's education
Student's gender	Mother's occupation
Student's age	Father's education
Language spoken at home	Father's occupation
Caste/ethnicity	Number of family members
Identity with geography	Home possession and accessories
Time spent beyond school time	Activities in leisure time at school
Support for study at home	Frequency of extra activities at school
Availability of textbooks	Frequency of participation in extra activities
Time to reach school	Attitude towards teacher
School opening and attendance days in last month	Attitude towards school
Homework and feedback	Bullying at school
Student's future aim	Teacher's time on task.
Attitude of student towards subject	

2.6.1 Teacher Questionnaire

Teacher questionnaire was used to collect the following information:

- Gender, age, first language
- Teaching conditions including class size, access to resources, percentage of students having textbooks, access to substitute teachers in case of absence
- Educational experience, teacher qualifications and teaching experience
- Teaching-learning practice and conditions at school
- Professional engagement with learning, such as access to and interest in professional development, interest in teaching, and time spent on preparation for classes
- Availability of instructional support such as classroom visits and feedback by head teacher, school supervisor
- Teaching methodology, such as medium of instruction, use of assessment, and style of teaching

- Satisfaction with working conditions, such as tenure, pay rate, and level of supervision
- Relationship between the school and community, such as interactions with parents, involvement in school committees
- Attitude of cooperation from students

2.6.2 Head-teacher Questionnaire

- Questionnaire for head teachers was used to collect the following information:
- Gender and age
- Educational and management experience and qualifications
- School environment, including the quality of buildings and facilities, as well as availability of resources
- School records, such as fluctuations in student number, student and teacher absenteeism
- Professional engagement of school leadership, such as access to and interest in professional development and interest in education
- Leadership style and use of time
- Assessment of teachers' work
- Satisfaction with working conditions
- Relationship with the community

2.6.3 Students' Attitude Survey

In order to find the relation between attitude of students towards the subject and achievement, the attitude survey questionnaire was administered. The questionnaire was adapted from shortened version of FSMAS, Fennema Sherman Mathematics Attitude Scales (Fennama & Sherman, 1976). The attitude survey questionnaire was included in the students' background information questionnaire. The following are the statements used to identify the attitude of students towards the subject:

Self-confidence

1. Studying Mathematics makes me feel nervous.
2. I am always under a terrible strain in a math class.
3. I am able to solve Mathematical problems without much difficulty.

Value

4. Mathematics is important in everyday life.
5. Mathematics is one of the most important subjects for people to study.

6. High school math courses will be very helpful to me no matter what I decide to study.

Enjoyment

7. I have usually enjoyed studying Mathematics in school.
8. Mathematics is dull and boring.
9. I am happier in a Mathematics class than in any other classes.

Motivation

10. I would like to avoid using Mathematics in college.
11. I am willing to take more than the required classes of Mathematics.
12. I plan to take as much courses of Mathematics as I can during my education.

2.6.4 Socio-economic Status (SES) Survey

The questionnaire to assess the socio-economic status of the family was included in the students' background questionnaire. The aggregate of the students' responses to the questions on the following seven factors indicates the SES of the student's family.

- Two variables related to parental education, including mother's and father's education,
- Two variables related to parental occupation, including mother's and father's occupation,
- Availability of various home accessories,
- Availability of home possessions, and
- Type of school (public or private) attended by student.

2.7 Test Administration

Preparation for test administration begins with printing, packing and delivery of test items and background questionnaires. ERO conducted a one-day orientation on test administration and test booklet collection process to the head teachers of each sample school in 75 districts. With the help of two teachers, the head teacher of each sample school administered the test. Subject teacher and head teacher of the sample school (in which test was administered) filled teachers' and head teachers' questionnaires respectively. Then students' answer sheets as well as teacher's and head teacher's responses were collected in the scoring centre in Kathmandu. The process followed for the purpose of test administration is described in this section.

For completion of the works, some of the tasks of test administration were outsourced to a consulting firm, while others were carried out by the DEOs and the schools. The sub-headings deal with the tasks and process adopted to accomplish the work of test administration of NASA 2019.

Following activities were completed before administering the test to maintain peace and security in a low-stake environment.

- Delivery of head teacher guidelines for test administration. These guidelines mentioned every steps of test administration on what to do and what not to do.
- Delivery of test booklets in the sample schools.
- Orientation to the district level head teachers and monitors.
- Test administration arrangement by allocating monitoring team to the centres, scheduling test administration.
- Random selection of the test taker students where the number of sample students was more than the number of students present in the sample class.

Test administration had three parts: in the first part, background questionnaire of students, head teacher and corresponding subject teacher was administered. After completion of the background information questionnaire response by the students, a ten-minute break was scheduled. After the 10 minutes break, two-hour test administration was completed.

Math/Science Group: Time allocation = 30 minutes to fill background information questionnaire + 1 hour Math + 1 hour Science

Language test Group: Time allocation = 30 minutes to fill background information questionnaire + 1 hour Nepali + 1 hour English

To ensure proper administration of the test, monitoring and sample school visits were conducted by different agencies during the test administration. Educational Development Coordination Unit - EDCU (the then District Education Office) not only managed the whole process of test administration, but also monitored the administration process at school level. The ERO also sent at least one person to each district to facilitate and monitor the administration of the test. Besides, the consulting firm also monitored the process of test administration. After the test administration, the consulting company collected the booklets and delivered them to the Kathmandu centre. After collecting the answer sheets in the Kathmandu centre, data preparation was completed by adopting the following steps:

- Optical Mark Reader (OMR) sheet development and printing
- Answer sheet coding and marking and scrutiny
- OMR input of the scores and cleaning the data
- Submission of clean data and marked answer sheets to the ERO

2.8 Item Parameter Estimation, Item Review and Calibration

Item parameter estimation of each item was carried out and the items were reviewed accordingly. During the analysis, decisions were made on whether or not to use any particular item in the analysis. Classical as well as IRT parameters were estimated to review the items. Item parameters in IRT were used not only for item selection but also to estimate students' latent ability. Based on the item parameters of linking items, three versions of tests were calibrated and these three sets were integrated into single set for analysis. Item parameter estimation, item review and calibration of the test were some of the key processes of IRT analysis from which students' ability was estimated and data were further analysed.

2.9 Reliability and Validity

The validity of the test items was assured by using the assessment framework. The item level parameters and set level reliability of Mathematics and Nepali subjects are given below:

2.9.1 Reliability

Reliability refers to the consistency of a measure. Reliability is a very important piece of validity evidence. It also refers the quality of items and consistency of the results. Though there are various ways of measuring reliability, internal consistency is considered one of the most used reliability measure. In table 13, reliability of every five booklets of all four subjects is presented.

Table 13 Reliability of item booklets in Mathematics, Science, Nepali and English

S. No.	Booklet	Reliability			
		Mathematics	Science	Nepali	English
1	Set 1	0.84	0.86	0.76	0.75
2	Set 2	0.88	0.82	0.83	0.81
3	Set 3	0.91	0.90	0.77	0.78
4	Set 4	0.82	.85	0.80	0.80
5	Set 5	0.85	0.90	0.75	0.74

All the sets were highly reliable (reliability>0.82).

2.9.2 Validity and reliability

Since the entire test items were developed and standardized according to National Curriculum and the Assessment Framework, NASA 2019 test sets were considered to be valid. In the test, although there were more items, few items were discarded due to mis-fit of the items in the analysis: total of 84 items in Mathematics, 70 items in Science, 32 items in Nepali, 35 items in English were used in the analysis.

2.10 Item Parameters

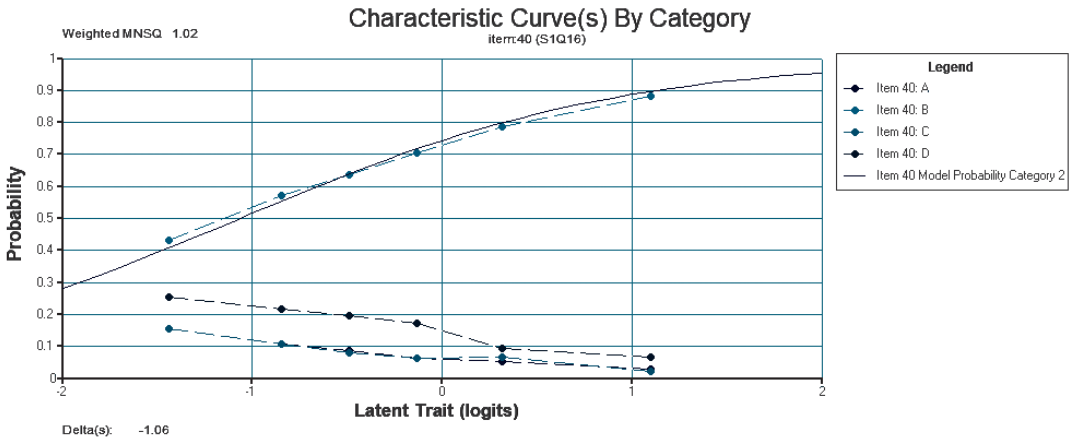
In the table, the "Avg Delta" represents the IRT parameter of difficulty. The remaining ones are classical parameters.

Table 14 Example of item parameters (Science – NASA 2019)

Item	N	Facility	Item-Rest Cor	Item-Total Cor	Wghtd MNSQ	Avg Delta
item:2 (S1Q2)	13028.00	61.48	0.37	0.46	0.93	-1.15
item:3 (S1Q3)	13028.00	57.83	0.25	0.34	1.03	-0.91
item:4 (S1Q4)	13028.00	34.00	0.30	0.38	1.09	0.26
item:5 (S1Q5)	13028.00	28.09	0.31	0.39	1.13	0.62
item:6 (S1Q6)	4152.00	38.68	0.43	0.5127	0.961497	-0.01505
item:7 (S1Q7)	4152	35.62139	0.169016	0.262259	1.161496	0.13288
….	…..	…..	……	……	……	……

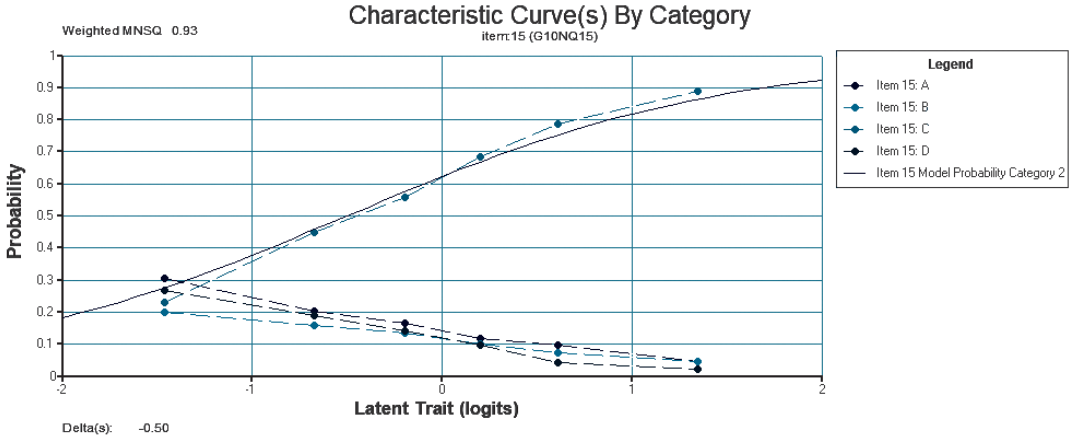
Item analysis was carried out by using ConQuest 4.x software that generated various item level statistics and curves as well. Some examples of item analysis output are given below:

Figure 8a Example of item characteristics curve in Science



In the figure, B is the correct option (answer), other options A, C and D are the distractors. Similar analysis from ICC was carried out in all subjects.

Figure 8b Example of item characteristics curve in Nepali



In the item analysis, the acceptable range of Item-rest correlation was taken r > = 0.2 and Weighted MNSQ was considered from 0.8 – 1.20 acceptable. Facility index was used as it was because all the items are already standardized. Two items in Mathematics from set-2 (item number 3 and 4) were discarded because of out of range MNSQ and negative item-rest correlation. The produced ICCs were used to analyse the item's appropriateness in the model.

2.11 Plausible Values (PVs)

Plausible values (PVs) improve precision of prediction ability for the population estimates. The PVs are calculated with conditioning background variables and some school related index. Conditioning provides unbiased estimates for modelled parameters. In this assessment, five plausible values (PV1 – PV5) were used to estimate population ability.

In this context, Yamamoto & Kulick (2000) mention that the PVs approach "uses students' responses to the items together with all background data in order to estimate directly the characteristics of student populations and sub-populations" (cited in Laukaitytė, 2016, p. 9). But, PVs are not individual test scores; they are the measures of the performance of population.

It produces unbiased estimate of population parameters if assumption of scaling is reasonable, but it is not fair to use it for level of student ability.

The following inputs were prepared to generate the PVs:

- Case estimation using weighted likelihood estimation (WLE)
- Provinces
- School type
- Group with highest frequency is set to zero before using conditioning.
- School mean index of WLE, etc.

The following table is an example of plausible values in Nepali subject drawn by conditioning run:

Table 15 PVs and RWGT (Example from Grade 10 Mathematics)

RWGT449	RWGT450	MSS_WLE	Sch_code	MSS_PV5	MWLE	PSu	PL_MS SPV1	PL_MS SPV2	PL_MS SPV3	PL_MS SPV4	PL_MS SPV5	W_STU	SD_ PVs	MSSPV1	MSSPV2	MSSPV3	MSSPV4	MSSPV5
18.96	18.96	464.00	10010003	425.87	-.7	900	2	2	2	3	1	18.9573	1....	510.61	494.01	499.62	539.42	474.60
18.96	18.96	417.54	10010003	383.66	-1.6	900	1	1	0	1	0	18.9573	1....	471.64	464.50	437.80	464.20	441.47
18.96	18.96	473.54	10010003	458.65	-.5	900	2	1	1	2	2	18.9573	1....	504.33	481.26	464.08	503.30	500.33
18.96	18.96	523.23	10010003	524.52	.5	900	3	3	3	3	3	18.9573	1....	530.21	527.99	547.33	545.44	552.05
18.96	18.96	417.54	10010003	446.60	-1.6	900	1	1	1	0	2	18.9573	1....	468.12	481.04	462.78	452.50	490.87
18.96	18.96	442.89	10250005	427.09	-1.1	900	1	2	1	1	1	18.9573	1....	488.59	492.28	488.88	463.22	475.56
18.96	18.96	417.54	10250005	414.04	-1.6	900	0	2	0	0	1	18.9573	1....	453.04	495.41	450.19	450.34	465.31
18.96	18.96	442.89	10250005	403.07	-1.1	900	2	1	1	1	1	18.9573	1....	493.76	485.46	484.55	484.25	456.70
18.96	18.96	442.89	10250005	454.23	-1.1	900	2	1	1	1	2	18.9573	1....	493.00	489.67	468.41	478.22	496.87
18.96	18.96	417.54	10070003	412.76	-1.6	900	1	1	1	0	1	18.9573	1....	474.94	483.03	470.34	440.26	464.31
18.96	18.96	464.00	10070003	496.70	-.7	900	2	2	2	1	3	18.9573	1....	504.12	495.49	520.88	475.11	530.21
18.96	18.96	430.91	10070003	443.87	-1.4	900	1	1	2	1	1	18.9573	1....	465.02	478.24	515.98	470.75	488.73
23.27	23.27	453.85	10030001	450.89	-.9	900	1	1	2	2	2	23.2658	1....	468.65	470.63	491.38	502.23	494.24
18.96	18.96	545.73	20390001	545.37	.9	900	3	4	4	5	4	18.9573	1....	547.11	557.42	576.73	602.87	568.42
18.96	18.96	491.24	20390001	502.04	-.2	900	2	3	3	2	3	18.9573	1....	519.01	525.65	547.13	509.88	534.40
18.96	18.96	523.23	20390001	489.92	.5	900	4	3	3	3	3	18.9573	1....	557.57	534.93	530.43	530.08	524.89
18.96	18.96	453.85	20390001	458.71	-.9	900	2	2	2	1	2	18.9573	1....	493.99	520.99	505.83	480.14	500.39
18.96	18.96	507.66	20390001	506.59	.2	900	3	2	3	3	3	18.9573	1....	534.94	521.54	542.82	532.61	537.97

2.13 Provincial Results

Provincial results are prepared separately in each subject. The provincial results provide the opportunity of comparing the results in major variables. In each subject, provincial report begins with comparing overall mean scores of provinces followed by the mean scores in relation to various influencing variables on the achievement of students.

2.14. Defined minimum learning and proficiency descriptors

This is an original method developed by ERO staff[1]. In this method, descriptor of minimum learning of each proficiency level of the students is calculated by multi-stage analysis of the data. First, all items into of correct answer by each performance level of those students is calculated. This performance level is defined based on the latent ability of the students (WLE variable) while using IRT. Then, cut-score for each proficiency level is defined. For example, in NASA 2019, 50% correct answer is noticed. Then, by identifying the items associated with the performance level of the students, descriptors of each proficiency level students are written. Thus, curriculum-based assessment framework represents the intended curriculum; delivery of the curriculum to students is taught curriculum and then the level wise descriptor are generated. This method is termed as DPL (Defining Proficiency level).

1 Prepared by Mr. Shyam Prasad Acharya, named as Defining Performance Level (DPL) method. Using this method, data analyst and report writers can see the linkage between intended curriculum, taught curriculum and achieved curriculum and generate the proficiency descriptors

Chapter 3. Basic Results

Chapter 3.1 Results of Mathematics

3.1.1 Introduction

In this chapter, the basic results of population estimates drawn from the responses of 22365 students in 900 schools from 75 districts are presented. This is half of the total number of schools covered in this study. Population estimates presented in this chapter are based on the five plausible values drawn from WLE and conditioning variables like school mean index, student background variables, student weights, provinces, and gender. The population mean/achievement score is presented in all basic results with either standard error or confidence interval (CI). In most of the bar-charts, the confidence interval of the population mean is represented by a line with cap in both ends. Such population estimates do not represent the individual level results. Thus, all the achievement scores reported are the mean scores weighted by adjusted student weights, and the difference is reported at a confidence level of 95%. The standard errors and confidence intervals were estimated to identify whether the difference in mean was statistically significant by groups.

The students' ability scores were transformed into mean 500 and standard deviation of 50. This reporting has always national mean score fixed at 500 points to compare any two or more groups. The formula for transforming the student ability (logits or q) was:

Average score = 500 + logits * 50

Variation of average score comes from the variation in the logits (latent ability of students/WLE). The five PVs are also generated based on the logits.

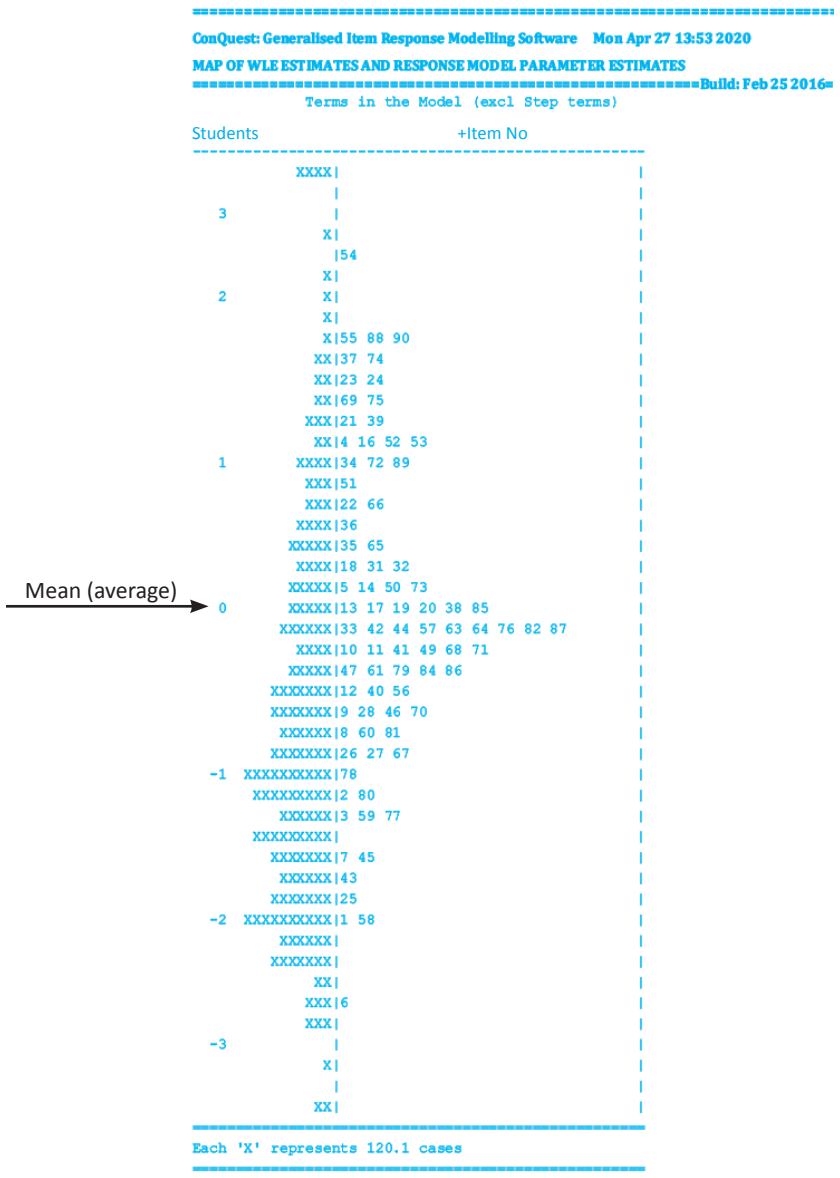
3.1.2 Wright-map of student ability and item difficulty in Mathematics

A simple and powerful graph used in psychometrics is termed Wright Map, which presents the location of both respondents and items on the same scale. Wright Maps are commonly used to present the results of dichotomous or polytomous item response models. This map is plotted from person estimates (latent ability) and item parameters produced by an item response analysis.

The Wright-map is organized as two vertical histograms. The left side shows candidates and the right side shows the items. The left side of the map shows the

distribution of the measured ability of the candidates from most able at the top to least able at the bottom. The items on the right side of the map are distributed from the most difficult at the top to the least difficult at the bottom. In the following figure, student ability (θ) in the left and NASA 2019 items to the right are plotted in the same scale. When a person and an item lie at the same level, probability of responding that item by the particular person is 50%. Figure 9 presents the NASA 2019 Mathematics Wright-map.

Figure 9 Wright-map showing respondents and item in the same scale



To the left side, an 'X' represents 120 students; their latent ability is given in the logit scale ranging from -3 or less to +3 or more. The distribution of students against the items asked (item numbers are shown to the right side) reveals that most of the items were difficult for the students. Although items were pre-tested and based on the grade 10 curriculum, most of the students are lagging behind below the average latent ability '0'. This indicates that items were difficult for the participating students. This further indicates that performance level of the students was not achieved as expected by the curriculum.

3.1.3 Plausible Values, their Mean and Standard Error

After estimating the student ability (θ) in the form of WLE, five plausible values (PV1 to PV5) were generated by conditioning the data with student background variables and school mean index. Those plausible values are transformed in to a scale of mean 500 and standard deviation 50. Those values were weighted by student full weight and using 450 replicates (just half the number of schools taken in the sample for Mathematics). Then, MSSPV1 to MSSPV5 were calculated to report the population estimates. The mean and standard error of five plausible values are presented in table 16.

Table 16 Mean and Standard Error of five plausible variables in Mathematics

SN	Plausible Values	Mean	SE of mean	Sample Students	Population
1	MSSPV1	500.22	1.037407	22365	432793
2	MSSPV2	500.24	1.037011	22365	432793
3	MSSPV3	500.32	1.032782	22365	432793
4	MSSPV4	500.18	1.029117	22365	432793
5	MSSPV5	500.18	1.029204	22365	432793

3.1.4 Defining Proficiency Levels in Mathematics

Assessment framework for NASA 2019 recommends setting performance level into six levels. For this, five cut-points for proficiency levels were decided by dividing the range of 254 (maximum 615 – minimum 361) by the interval of 42. Thus, six proficiency level cut-points were 403, 446, 488, 530 and 572. Table 17 shows how proficiency levels are determined.

Table 17 Proficiency levels and the score range in Mathematics

Proficiency Level	Score
Level 6 (Advanced)	572 or above
Level 5 (Proficient 3)	572- 530
Level 4 (Proficient 2)	530-488
Level 3 (Proficient 1)	488-446
Level 2 (Basic)	446-403
Level 1 (Below basic)	403 or below

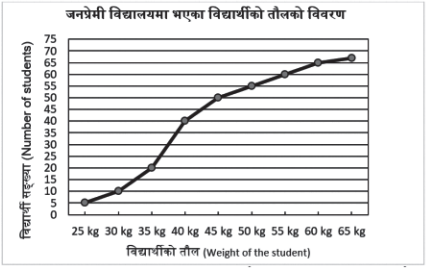
Based on the descriptions of items that correspond to each of the above proficiency levels in item-person map in Mathematics together with subject experts' judgment, the descriptions of students' six level proficiency have been defined. These descriptions of six proficiency levels in Mathematics for Grade 10 indicate what a student at particular competency level can do in Mathematics.

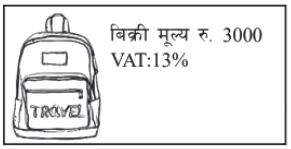
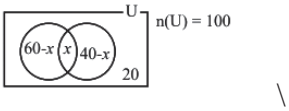
Internationally, students who cross 67% of their achievement are considered as Minimally Accepted Candidate. Replicating the same concept in determining the minimum acceptance level of learning in those six proficiency levels is possible. However, in this assessment, around 50% items were objective and almost equal weightage was given to subjective items. In this analysis 50% correct answers were supposed to be threshold of minimum accepted proficiency for any of the six levels. Accordingly, student responses on every item was analysed to find the response rate for students at different levels of proficiency. As the first step, below level 1 (pre-basic) items were identified. Then level 1, level 2 and level 3 items were finalized. All items were assigned to one of the six levels to draw proficiency descriptors. Table 18 specifies the descriptors of each six levels based on the items answered at least 50% correctly. Items at lower level are supposed to be answered correctly by upper level students.

Table 18 Summary of minimum proficiency level in all six level in Mathematics.

Level	Score	What students can typically do
Level 6 (Advance)	572 or above	- The students shows understanding of concepts independently by giving both appropriate and complete explanations, and can apply the concepts in a variety of contexts using all of the required concepts.

Level	Score	What students can typically do
Level 6 (Advance)	572 or above	- The student solve problems independently by modifying known strategies almost always accurately. - The students applies mathematical procedures independently that are considered to be the most appropriate in solving problems, and justifies the choice with practically no minor errors and omissions. - The student communicates the required knowledge independently clearly, precisely, and confidently always using appropriate mathematical terminology and symbols. For example, most of the students of this level could answered correctly. 17. दिइएको चित्रमा ∠CAD र ∠CBD बराबर हुन्छन् भनी प्रमाणित गर्नुहोस् । [2] In the given figure, prove that ∠CAD and ∠CBD are equal. 
Level 5 (Proficient 3)	572- 530	The students shows understanding of concepts independently by giving both appropriate and complete explanations using most of the required concepts. - The students solves problems independently by choosing the most appropriate strategies usually accurately. - the student applies mathematical procedures independently that are considered to be the most appropriate in solving problems with a few minor errors or omissions. - The student communicate the required knowledge independently clearly and precisely usually using appropriate mathematical terminologies and symbols. For example : 55% of students in this level answered the following item correctly: 22. आलोकले 2 वर्षका लागि बैङ्क A र बैङ्क B प्रत्येकमा रु. 10,000 जम्मा गऱ्यो । Aalok deposited equal sum of Rs 10,000 in both banks A and B for the 2 years. 2 Bank A Aofhb/ 6% (Rate of interest 6%) चक्रीय ब्याज अर्धवार्षिक रुपमा दिइन्छ । (Compound interest is given half yearly) Bank B • ब्याजदर 7% • चक्रीय ब्याज वार्षिक रुपमा दिइन्छ । (Compound interest is given yearly) आलोकले कुन बैङ्कबाट कति बढी ब्याज प्राप्त गऱ्यो ? Which bank did Aalok get more interest and by how much?

Level	Score	What students can typically do
Level 4 (Proficient 2)	530-488	- Students shows understanding of concepts independently by giving appropriate but incomplete explanations using more than half of the required concepts. - Students solve many problems with appropriate strategies frequently accurately. - Students apply mathematical procedures with limited assistance that are considered to be appropriate in solving problems with several minor errors and omissions. - Students communicates the required knowledge independently with some clarity and some precision something using appropriate mathematical terminology and symbols. For example: 50% of the students of this level answered following question correctly. 16. चित्रमा जनप्रेमी विद्यालयमा भएका विद्यार्थीहरूको तौलको सञ्चित बारम्बारता वक्र दिइएको छ । Figure shows the ogive of the weight of students of Janapremi School. [1]  माथि दिइएको चित्रमा कति विद्यार्थीहरूको तौल 55 kg वा सो भन्दा थोरै छ ? In the above figure, how many students have their weight less or equal to 55kg?
Level 3 (Proficient 1)	488-446	The students show understanding of concepts independently by giving appropriate but incomplete explanations. - the student solves the limited problems with with appropriate strategies rarely. - The students apply mathematical procedures with limited assistance that are considered to be appropriate in solving problems with several minor errors.

Level	Score	What students can typically do
Level 3 (Proficient 1)	488-446	- The student communicate the required knowledge independently with some clarity and some precision something using appropriate mathematical terminologies. Some examples of items that were answered correctly by this level students are: 1. चित्रमा देखाइएको झोला किन्नको लागि भ्याट सहित कति तिर्नुपर्दछ ? Including VAT, how much should pay to buy the bag shown in the given figure? (a) रु. 2987 (b) रु. 3013 (c) रु. 3390 (d) रु. 2610 
Level 2 (Basic)	446-403	The students shows understanding of concepts with assistance by giving partially complete but inappropriate explanation. - Students are unable to solve most of the problems. They solve the problems with sufficient clues on very limited range of appropriate strategies rarely and accurately. - The students apply mathematical procedures only those which are considered to be basic in solving problems major errors and omissions. - the students communicate the required the required knowledge unclearly and rarely using appropriate mathematical terminologies. Example: 59% of students of this level answered below question correctly: 1. दिइएको भेन चित्रमा x को मान कति हुन्छ ? What is the value of x in the given Venn-diagram? a) 20 b) 30 c) 40 d) 50 
Level 1 (Below basic level)	403 or below	Students of this level possess the limited knowledge and ability of lower grade and have limited knowledge and skill of grade 10 level contents. They were able to answer very few items based on knowledge level and particularly related to lower grades.

Level	Score	What students can typically do
Level 1 (Below basic level)	403 or below	For example, students of this level could recognize loss amount when cost price and selling price was given. Very few were able to select correct answer in knowledge and understanding level. For example, Only 50% students of this level could answer the following question correctly: 6. एउटा किताबको अङ्कित मूल्य रु. 500 राखिएको थियो । यदि सो किताब रु. 440 मा बिक्री गरियो भने कति रकम छुट दिइएको थियो ? The mark price of a book was Rs 500. If it was sold for Rs 440, what was the discounted amount? (a) Rs 560 (b) Rs 500 (c) Rs 380 (d) Rs 60

Note: although some students of lower level (for example: below basic level) have also answered few items of upper level (for example: basic) correctly, those items were located in upper level (basic level) because rate of correct answer of those items was less than 50%.

3.1.5 Distribution of Students by Proficiency Levels

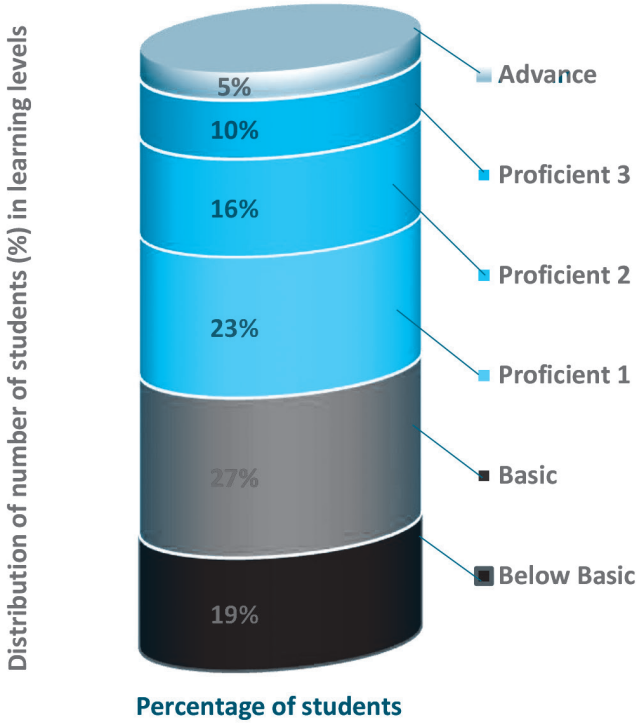
The student achievement scores based on 5 plausible values (PV1 to PV5) were analysed in terms of six proficiency levels of students' achievement. Level wise descriptors are presented in section which also presents the number of students falling in those six levels from population estimate. The standard error of the percentage of students is also presented in Table 19.

Table 19 Distribution of the students in various proficiency levels and their Standard Error

Proficiency Level	Percentage of students	SE	Number of students in the sample	Represented population
Advance	4.66	12.01201	1029	19873.65
Proficient 3	9.815	6.869021	2142	41552.3
Proficient 2	16.37	0.593783	3574	69577.07
Proficient 1	23.437	6.888189	5207	101237.4
Basic	26.736	10.09268	5917	114104.9
Below basic	18.882	2.304984	4212	80758.34

The Below basic level indicates the lowest ability of students who are struggling in the classroom whereas Advance level shows the highest level of proficiency that students at this level crosses even the assessed grade level. Figure 10 shows how students are distributed over those levels visually for Mathematics

Figure 10 Distribution of number of students (%) in different levels



3.1.6 Minimum Level of Achieved Curriculum

The assessed curriculum is that which is reflected by the assessment or evaluation. It can be either formative or summative evaluation of the students. Assessed curriculum is a tested curriculum by school, national or international organization based on the written curriculum/intended curriculum. It is valuable because it enables the educational organizations and stakeholders to evaluate the impact of written and taught curriculum upon students. It determines the level of the learned curriculum. Research (e.g. Berliner, 1984; Turner, 2003) indicates that the mismatch between assessed and taught curricula has serious consequences (cited in MeshGuide). This section presents the level of learning in the form of achieved curriculum in terms of percentage. In this

analysis, it is assumed that every test item is equivalent in the sense that each of them represents a learning objective mentioned in the written curriculum.

As mentioned above, 67% correct response can be considered as for being minimally proficient at any level. As in this assessment, around half numbers of items were objective type (MCQ) and half of them subjective. Fifty per cent (50%) correct responses are considered as the threshold of minimum level of accepted proficiency at any of the six levels. Hence, test items were organized in terms of at least 50% correctly answered items or more at each level of proficiency. Based on this criterion, all the items were re-allocated into six levels. From this rigorous analysis, performance descriptors were developed.

In every level of the proficiency, there are ranges of students from being very weak performers to the highest performers. Considering 50% as the threshold of minimum proficiency of any six levels, percentage of learning was mathematically calculated based on the number of items answered correctly. Mathematical value of achieved curriculum is thus given in table 20.

Table 20 Mathematical presentation of the achieved curriculum

Performance level	Achieved curriculum (number of items %)
Below Basic level (19% students)	Less than 5% of the curriculum
Basic level (27% students)	10% of the curriculum
Proficient level 1(24% students)	24% of the curriculum
Proficient level 2 (16% students)	52% of the curriculum
Proficient level 3 (10% students)	80% of the curriculum
Advance level (5% students)	95% of the curriculum

The above table shows the minimum level of correct response of students in percentage. Since assessment framework represents the written curriculum, and student response represents the taught curriculum, it is easy to infer that 19 out of 100 students could answer only one question correctly crossing the cut-score. By using the definition of DPL, this level of students adequately answers only 1% items of the curriculum. Likewise, basic level students learnt better, they answered 10% and proficient level 1 learnt 24% content of the curriculum. In other words, 70% of the students have achieved or mastered less than 25% of the curriculum in Mathematics. On the other hand, 5% students learnt 95% items of the curriculum. Thus, only 31% students (proficient level 2, proficient level 3 and advance) have achieved the minimum level

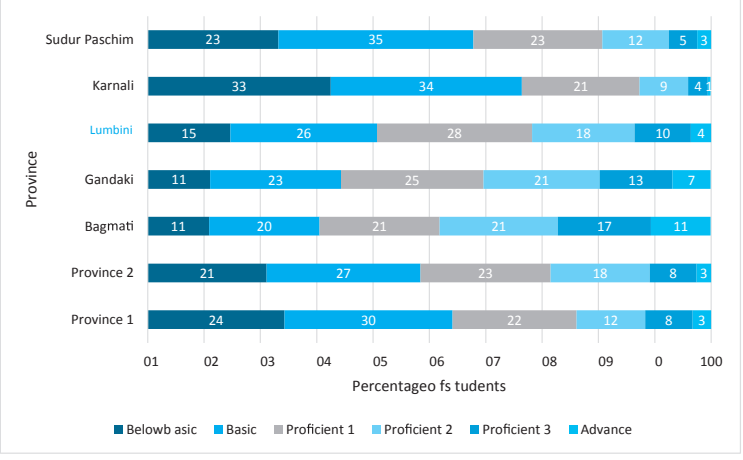
of learning in grade 10.[2] These percentages can be assumed as analogy of percentage of content learnt. According to UNICEF (2020), on average 40 per cent of children across all OECD and EU countries do not have basic reading and mathematics skills by age 15 whereas this percentage in Nepal is 69 for mathematics which indicates the poor educational outcomes in grade 10 Mathematics in Nepal[3].

3.1.7 Achievement by Provinces

The Federal Democratic Republic of Nepal is divided into seven provinces and 753 local government units. While picking up the schools as Principal Sample Units (PSU), provinces were regarded as strata. The average scores described in this section are the transformed/scale score at 500 national average. National mean is taken as reference to contrast with the provincial mean. Those provinces whose average score exceeds the mean score are acknowledged as better performing provinces whereas below 500 are presumed to be of substandard performance.

As explicit strata, provincial results are generalized, i.e., weighted results. As in national level, distribution of students in various provinces was analysed and are presented in figure 11. The below basic level is the lowest level and advance is the highest level of student proficiency.

Figure 11 Province wise distribution of students (%) in six proficiency levels.



2 According to assessment framework, proficient level 1 should be the minimum learning level. Data shows that 69% students did not learn the minimum level in grade 10

3 https://www.unicef-irc.org/publications/pdf/Report-Card-16-Worlds-of-Influence-child-wellbeing.pdf

The figure 11 presents that province 1 and province Karnali have the highest number of students in the lowest proficiency level among all provinces. This reveals that the grade 10 Mathematics curriculum was least effectively delivered or learnt in these areas where as Gandaki and Bagmati province have the least number of students at below basic level and highest number of students in advance proficiency level. This reveals that students have learnt the content of the Mathematics curriculum the most in these two provinces.

The mean score of achievement disclosed in all graphs and tables is based on the plausible values as stated in the introduction chapter. In Figure 12, 500 is the national mean score of achievement and horizontal bar depicts the achievement scores by province.

Figure 12 Achievement of students by provinces in Mathematics.

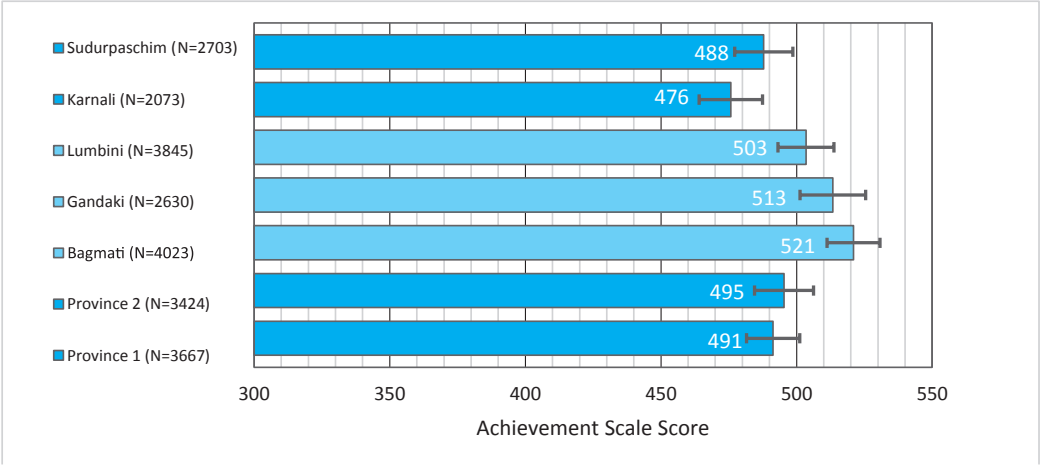


Figure 12 unveils student achievement in Mathematics by province. Students in Bagmati province outperformed the rest with 521 score, while student achievement in Karnali province was observed to be the lowest (476). The difference between the high achieving and low achieving provinces differs by 45 scale scores. Learning achievements of Sudur-paschim Province, Karnali Province, Provinces 1 and 2 were lower than the national average. *The overall result shows that the achievement of Mathematics in Bagmati, Gandaki, and Lumbini was above the national average (500).*

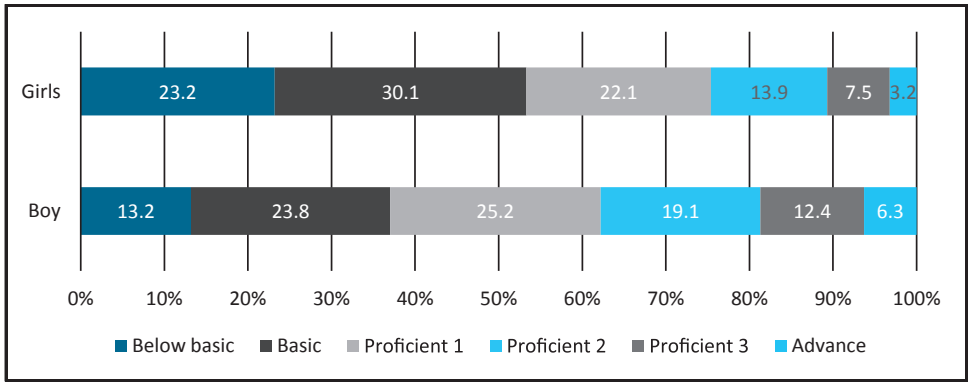
3.1.8 Achievement by Gender in Mathematics

For the uniform and proportionate learning to happen, girls and boys should have equal opportunity and support in their study. To what extent this has been realized can

be analysed. The data shows that 10118 (45.2%) boys, 11034 (49.3%) girls, and 1213 (5.4%) gender undisclosed participated in the mathematics assessment.

Gender as an implicit stratum, a comparison was made in the number of students in defined six proficiency levels. The distribution of students in six performance level by sex is presented in Figure 13.

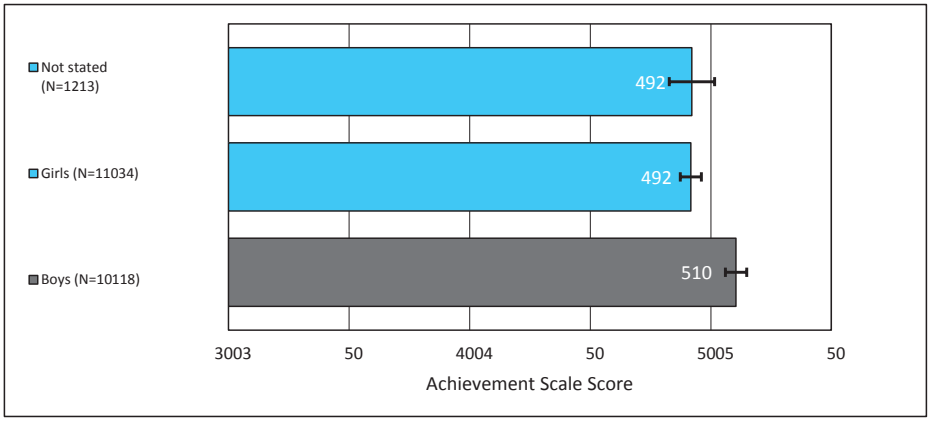
Figure 13 Sex wise distribution of students (%) in six proficiency levels.



The above figure reveals that girls (23.2%) were most disadvantaged whereas disadvantaged boys were 13.2 in the population because these students remained at below basic level and could not learn any one of the content matter adequately. Likewise, only 24% of girls reached upper adequate level (proficient 2, proficient 3 and advance) whereas this level was reached by 38% of the boys.

Comparisons in achievement scores by gender were also done. The results of the comparison are presented in Figure 14.

Figure 14 Achievement of students by gender in Mathematics.

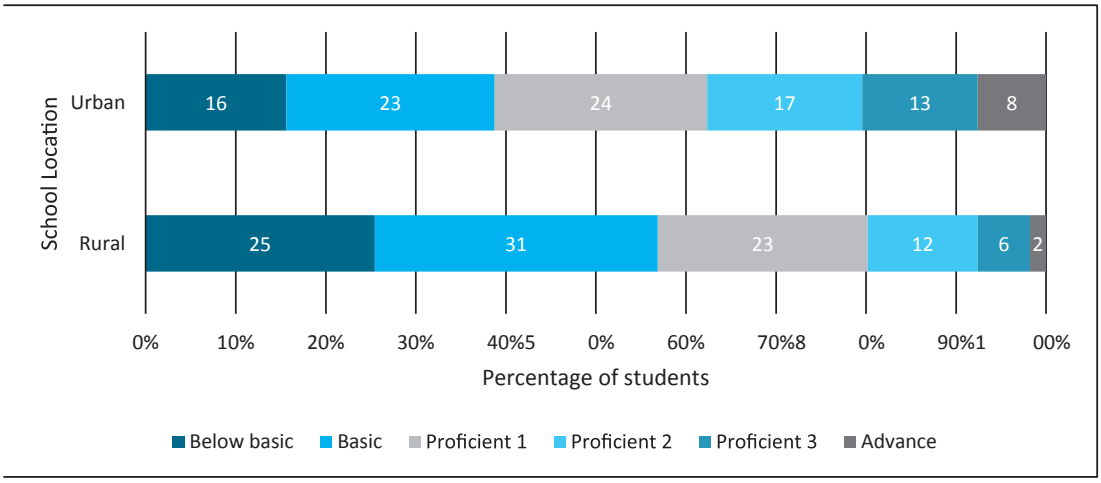


The data reveals that from the gender perspective, boys' achievement score (510) was higher than the mean score of the girls (492) which is lower than the national average (500). The difference in the score was 18 scale score. The varying scores between girls and boys were found statistically significant at $p < 0.05$ confirming that the difference was remarkable.

3.1.9 Achievement by school location in Mathematics

The political division of Nepal is categorized as Metro-Politian City, Sub-metropolitan city, municipality or rural municipality. While categorizing school location into rural and urban areas, rural municipality can be considered as rural location and others as urban location[4]. Based on the above two categories, data shows a difference in distribution of students over six-proficiency level in Mathematics (Figure 15).

Figure 15 School location wise distribution of students (%) in six proficiency levels.



The figure clearly presents the evidence that the percentage of students varies by urban-rural areas in all proficiency levels. In rural areas, below basic level students were higher (25%) than in urban areas (16%). Likewise, summing the upper three proficiency level, urban area students (38%) were more likely to be in higher proficiency level than the rural area students (20%).

The achievement of students in rural and urban areas also differs significantly.

4 Many municipalities are also in rural area which makes difficult to get proper definition and location.

Table (3.6) shows the comparative status of achievement in Mathematics.

Table 21 Achievement of students by school location

SN	Location	Mean	SE	N_cases	NU_cases	NU_psu
1	Rural	484.751	1.607759	152188	7859	325
2	Urban	508.621	1.383467	280606	14506	576
3	National	500		432794	22365	900

NB. N_cases = population, NU_cases = number of unique cases or sample, NU_PSU = number of principal sample unit or schools.

3.1.10 Achievement by Age of students in Mathematics

As a background variable, students were requested to mention their age. These reportedages were grouped into six age-groups; 13 years or below, 14, 15, 16, 17 and 18 years or above. Most of the students were of 14 to 17 years. The smallest cohort of students was of 18 years or above age as shown in figure 16. The association of age on learning achievement can be perceived by the data presented in the following figure.

Figure 16 Achievement of students by the age of students in Mathematics.

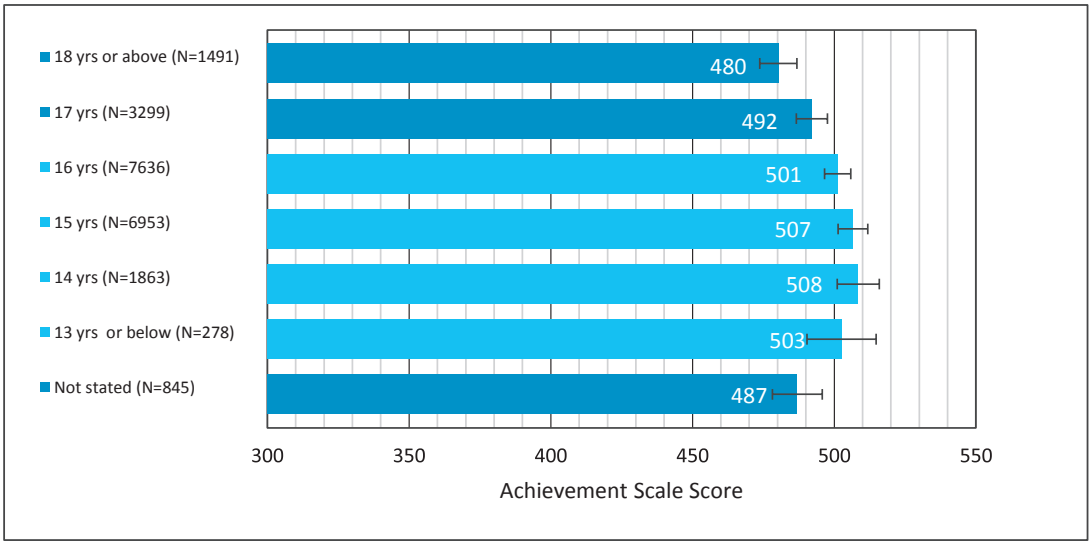


Figure 16 reveals that students aged in 14 to 17 years groups performed superior to the under or above aged students. Students aged14 years (508) and 15 years (507) performed better than others on average. The lowest achievement was found at 18 years or above age (480). The contrast in achievement between the highest and lowest

groups was significant at a 95% confidence level (P<0.05). Based on the findings, it can be generalized that the more appropriate the age of student based on grade, the better was the learning achievement.

3.1.11 Achievement by home language of students in Mathematics

Students were asked about the language they spoke most of the time at their home. Their response indicated that 66.4% communicated in Nepali at their home whereas 33.5% communicated in other languages.

As in previous NASA results (ERO, 2013; ERO 2015; 2016; ERO, 2018; ERO, 2019), home language has shown association with the student learning outcomes. Figure 17 depicts the number of students (%) in all proficiency level of student performance in Mathematics.

Figure 17 distribution of students over six proficiency level by home language

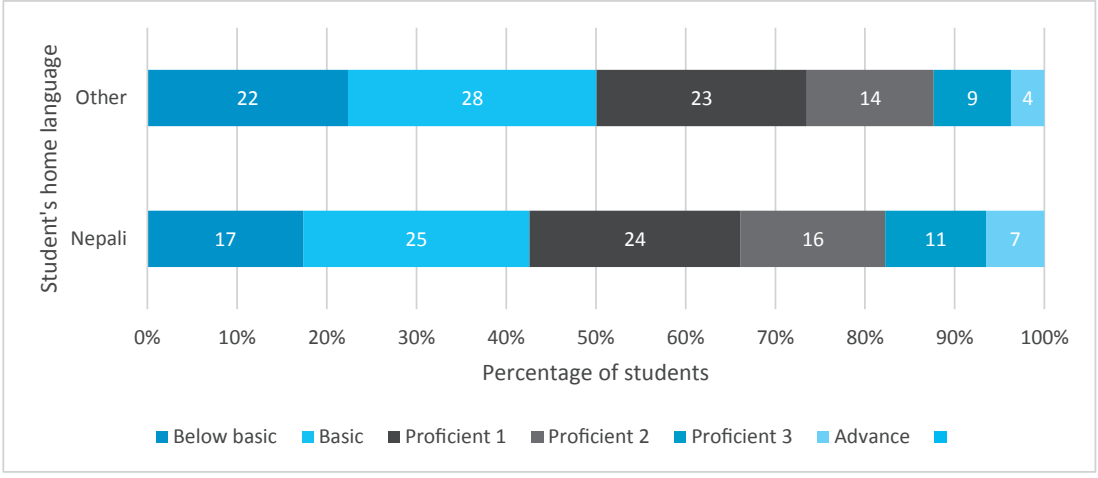


Figure 17 reveals that students speaking other than Nepali (national language) language are disadvantaged in the classroom .This can be perceived from a large percentage (22%) of students remaining at the bottom (below basic level) of all proficiency level which is higher than those who speak Nepali language (17%) at their home.

Relying on the students' responses, the achievement score by their home language in Mathematics is depicted in Figure 18.

Figure 18 Achievement of students by home language in Mathematics.

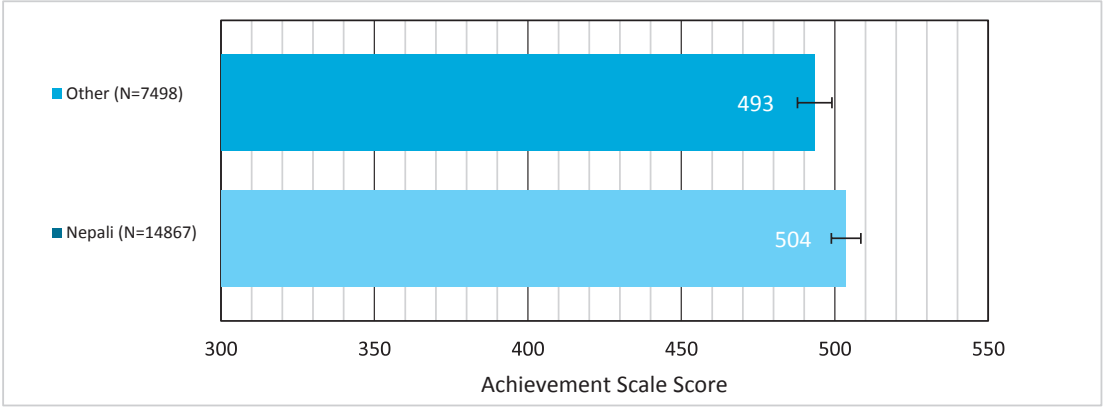
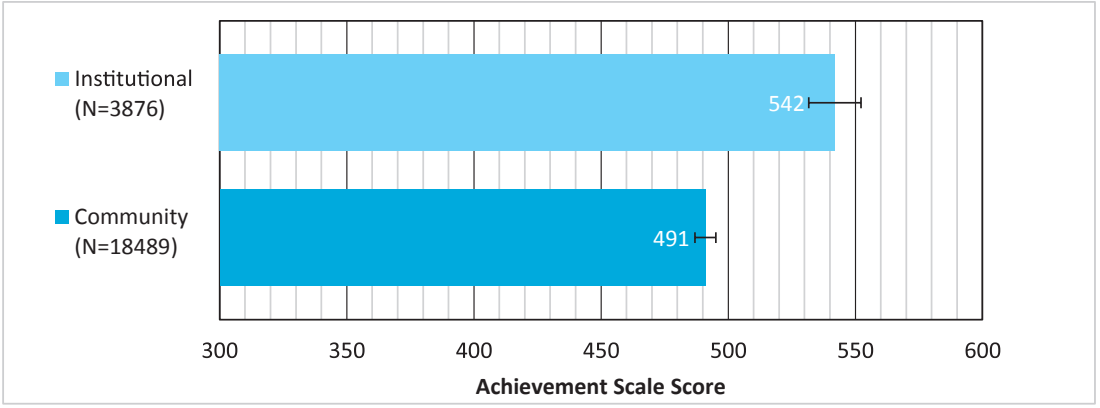


Figure 18 reveals that the students communicating in Nepali at home performed better (504) than those communicating in other languages (493). However, the gap in achievement scale score between Nepali and other language speaking students was 11 scale score, the overlapping confidence interval caps in the figure indicates that difference was not significant at 10% confidence level.

3.1.12 Achievement by type of schools in Mathematics

As the schools were selected from the PPS sampling method at random, out of 901 schools, 737 (81.8%) were community schools, and 164 (18.2%) institutional schools. The majority of the institutional schools were concentrated in the urban areas whereas community schools were spread all over the geographical locations. Comparative analysis of the community and institutional schools is depicted in Figure 19.

Figure 19 Achievement of students by type of schools in Mathematics.



The mean scores of institutional and community schools were 542 and 491, respectively. The score of community schools was lower than both the national mean and institutional schools' achievement. With the variation of 51 scale scores, the gap between the two types of schools was significantly different at $p < 0.05$. *The difference was alarming as the gap between the community and institutional schools was wide. The findings indicate a crucial concern of the educational process in community schools where the government has invested a huge amount of resources for meagre achievement. Private sector invested institutional schools have shown higher learning outcomes. The reason behind such difference could be explained by perceiving the differences in time on task, school management, school location, facilities provided by parents and so on. The most revealing reason behind higher achievement of institutional school children was closely related to socio-economic status of the family that is presented in later sub-chapter.*

3.1.13 Achievement by out-of-school activities in Mathematics

There were seven activities highlighted and requested where students were requested to choose the amount of time spent before or after school time. The main activities included watching TV, internet, mobile, computer; playing with friends and chatting; involvement in home chores; studying and completing homework; working for a wage; reading other books' and helping brother/sister for the study. A total of 22365 students participated in the test. The percentage of students who checked different options is given in Table 22.

Table 22 Percentage of students devoting their time in out-of-school activities

Out-of-School Activities	Per cent of students in the sample according to amount of time spent					
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	<= 4 hour	Not responded
TV, internet, mobile, computer	9%	56%	15%	2%	1%	17%
Play with friends, chat	8%	54%	16%	2%	1%	18%
Involve in home chore	5%	28%	32%	13%	4%	18%
Study and do homework	3%	7%	19%	30%	23%	18%
Work for wage	28%	13%	5%	3%	4%	47%
Reading other books	7%	42%	21%	6%	2%	22%
Help brother/sister for study	8%	35%	27%	7%	2%	21%

Table 22 demonstrates that 56% of the students devote less than an hour of their

time on TV, internet, mobile, and computer. Furthermore, 30% of students were spending 2-3 hours of their time studying and doing homework. Also, there were 25% of students working for wage, and 32% of students were giving 1-2 hours of their time for home chores. The achievement of students was not limited only to their school activities but the out-of-school activities also contributed largely to their achievement. The comparison of achievement of students according to their time spent in those out-of-school activities is given in Table 23.

Table 23 Comparison of achievement of students according to their time spent in out-of-school activities

Out-of-School Activities	Achievement scale score					
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	>= 4 hour	Not stated
TV, internet, mobile, computer	491	504	515	521	508	478
Play with friends, chat	502	505	504	502	504	482
Involve in home chore	500	514	502	494	485	483
Study and do homework	482	488	501	507	513	480
Work for wage	513	494	483	481	485	499
Reading other books	504	507	505	492	484	484
Help brother/sister for study	511	508	501	492	476	487

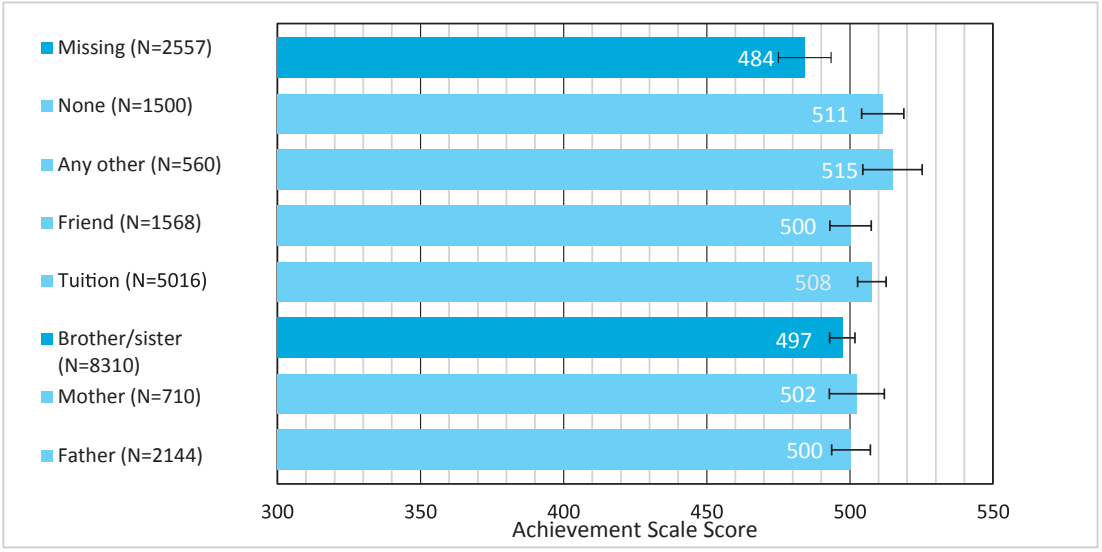
The average score for students who devoted 2-3 hours of their time for TV, internet, mobile, and computer was 521 while it was 508 for who involved in those tools 4 hours or more. Limiting the home chores to less than an hour indicated a better achievement (514) of students rather than spending more time on it. Similarly, there was an increase in the achievement (513) of students when they devoted as much of their time (>=4 hour) on studying and doing their homework. Furthermore, when the students were not working for wage earning, their achievement was higher (513). Data reveals that the activities such as studying and doing homework, using TV, internet, mobile, and computer for 2-3 hours, playing with friends and chatting for less than an hour boosted their achievement whereas the activities such as working for wages depicted a low achievement of students.

3.1.14 Home support in study in Mathematics

Students are in need of support to boost their learning achievement. Based on this belief, students were asked about people supporting them most in their out-of-school activities. The number of students receiving assistance from the siblings for

their study was higher than the students who received assistance from any another category. Few of the students received assistance from mother (N=710) and through friends (N=1568). Furthermore, some students received assistance from their fathers (N=2144) and their mother (N=710). The data presented in Figure 20 demonstrates the achievement of students receiving out-of-school assistance.

Figure 20 Achievement scores according to their support at home



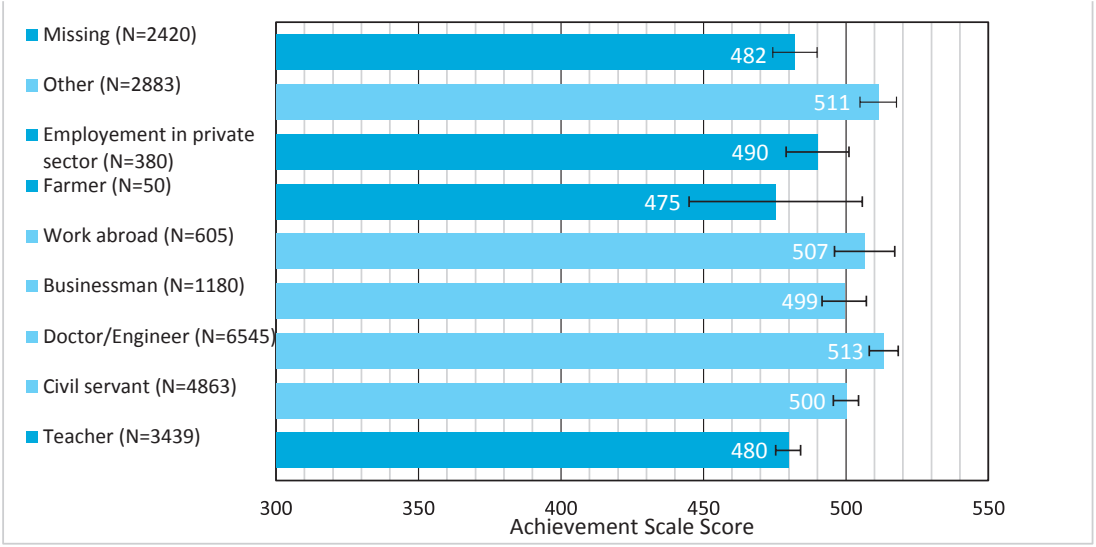
Regarding learning achievement, the students who received assistance through any means (515) was fruitful although the support received from the tuition (508), father (500), friend (500) and mother (502) was also very important; both types of support were positive showing achievement higher than the national mean score and more fruitful from their own home. The support from the siblings (497) was not effective enough to aid in their achievement. Thus any sort of assistance is seen beneficial whether it be through friends, tuition, father, mother, or through any other means but we must also take into consideration the fact that self-learning is also seen to be effective in assisting the achievement of students.

3.1.15 Achievement by the student-imagined future aim

The aim of the students regarding their future can be a great motivating force to excel in their life which can be measured by the indicator of achievement. Acknowledging this fact, students were asked to select their aimed profession in the student survey. The professions questioned included employment in the private sector, farming,

working abroad, businessman, doctor/engineer, civil servants and teachers, and other professions were categorized into other headings. Figure 21 depicts the achievement of the students in accord with their aim in the future.

Figure 21 Achievement of students according to their future aim



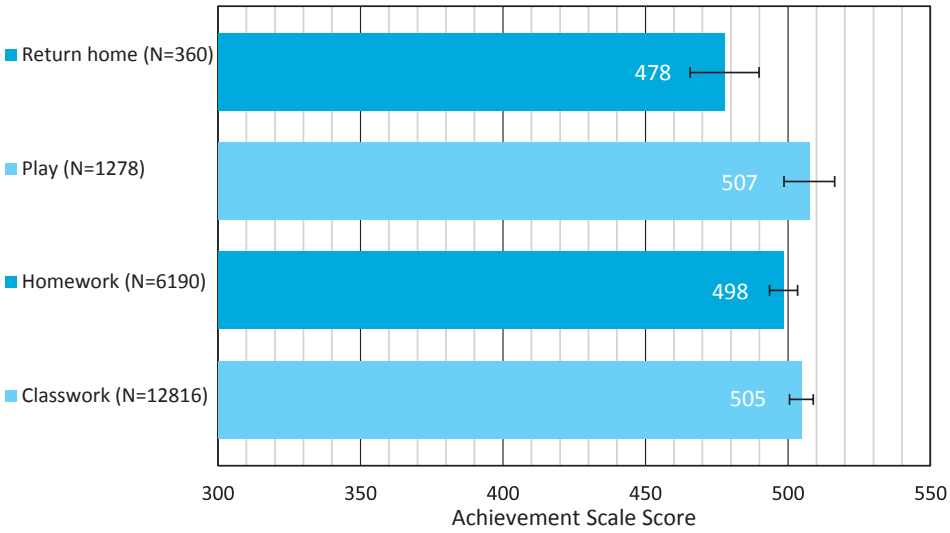
Highest achievement (513) was observed in the students desiring to be doctors/ engineers in their future. Likewise, students aspiring to be farmers in their coming future were seen to have low achievement scores (475). The students longing to work abroad (507), desiring to be civil servants (500), or wanting to be in other professions (511) had also better achievement scores which were higher than the mean (500). Furthermore, students desiring to be farmers, teachers, and to be employed in the private sector had low achievement scores 475, 480, and 490 respectively. Considering all the data above, students desiring to be doctors/engineers, civil servants, and working abroad, where in-depth learning is required, had good achievement scores whereas students longing to be farmers and to be employed in private sectors had low achievement.

3.1.16 Achievement by the way of utilization of leisure time in school

Leisure time allows students to devote their time in areas of their interests. This will relieve them from the constant pressure of studying and can potentially allow them to manage their time effectively. This leisure time could also be of utmost importance to plan their studies and achieve greater heights in their study. Students were, therefore, asked about the way they were utilizing their leisure time (no teaching during a class

period) by providing them options such as returning home, playing, doing homework, and classwork. Figure 22 shows the achievement score of students involved in different activities during their leisure time.

Figure 22 Achievement by utilization of leisure time in school



According to Figure 22, the students doing their classwork were greater in number and their achievement score was 505. Looking at the figure, there were fewer students performing better even though they enjoyed playing in their leisure time and their score was the highest (507). Meanwhile, the students who did their homework had low achievement scores of 478 and 498 respectively which are below the mean value. Taking all the data into consideration, students involved in their classwork or playing had high achievement scores in comparison to the students spending time completing homework or returning to their homes when no teaching was done during class periods.

3.1.17 Achievement by Frequency of extra-curricular activities

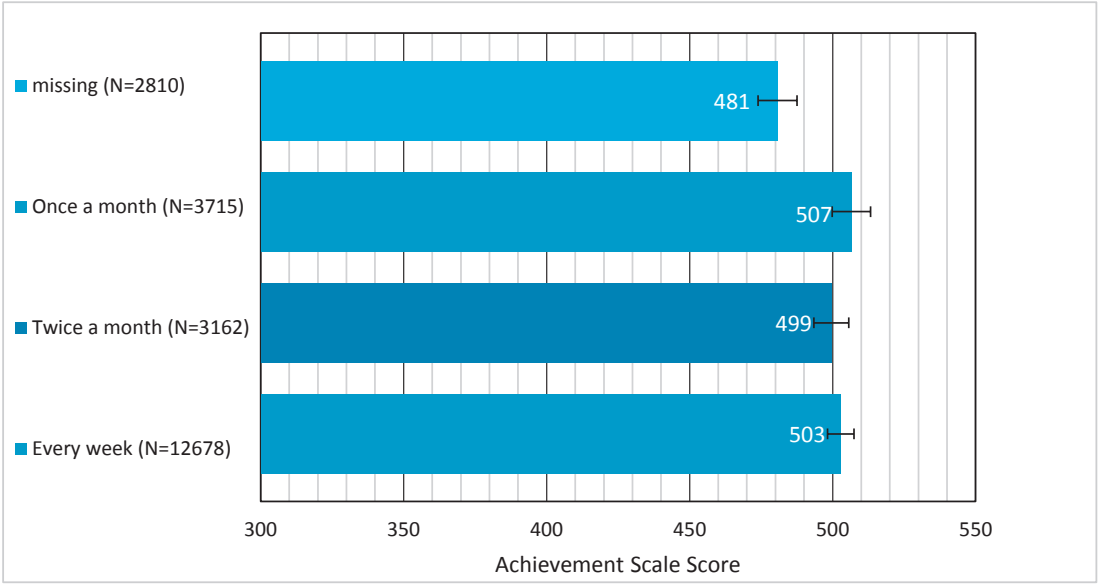
UNESCO emphasizes involvement of students in various extra-curricular activities to develop social and soft skills that promote their wellbeing. These activities can include athletics, sports, voluntary work, photography, drama, music, etc. In some countries, this is also referred to as “co-curricular activities”.

OECD (2019) in its international curriculum analysis, reports ``short bursts of physical activity could improve students’ engagement with learning in the classes

immediately following that physical activity; and regular physical activities could facilitate stable, long-term, enhanced student behavioural engagement with school." National curriculum Framework (2009) of Nepal also emphasizes such activities for social and emotional well-being. Thus, an analysis of the relationship between extra-curricular activities in the school and educational achievement is done in this sub-section.

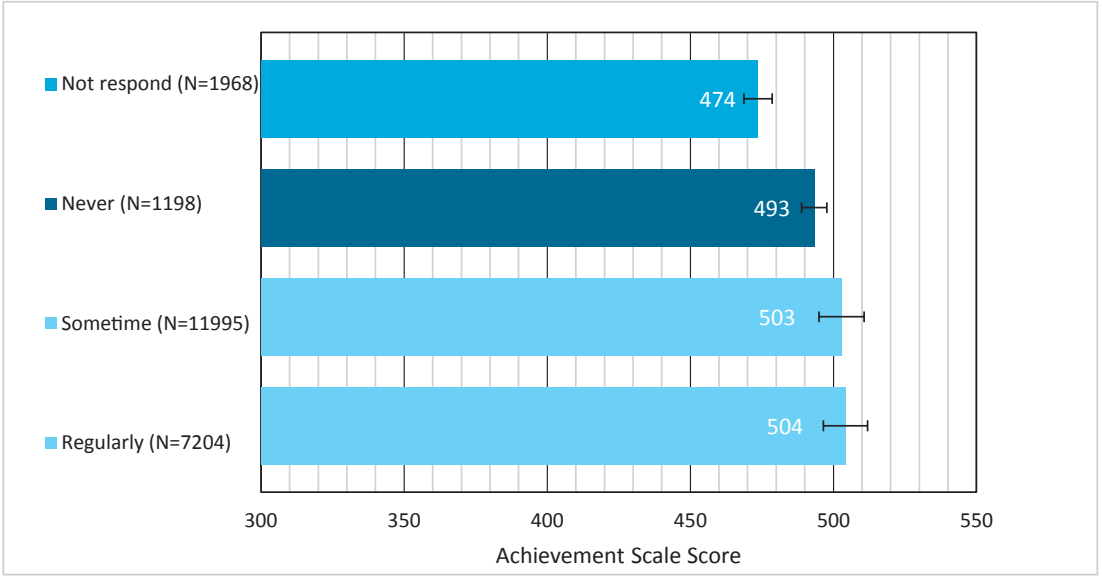
Taking these facts into consideration, the students were asked how often their schools conducted extracurricular activities and the answers are shown in Figure 23.

Figure 23 Achievement by Frequency of extra-curricular activities



Regarding participation in extracurricular activities, students were asked to mention their involvement in three categories viz: regular, sometimes and never. The responses of the students in extra-curricular activities and achievement scores are presented in Figure 24It shows that, out of 22,365 students, 32.2% (7204) of them participated regularly in the extra-curricular activities whereas 53.6% (11,998) of them were engaged in extra-curricular activities only sometimes. Among the students 5.4 %(1198) who never participated in extracurricular activities, they scored 493 which is below national average.

Figure 24 Achievement of students by frequency of involvement in extracurricular activities



The figure depicts that achievement in Mathematics for those who participated in extracurricular activities regularly and sometimes was 504 and 503, above the national average and higher than the score of those students who did not take part in these extracurricular activities. The data indicates that involving students in co-curricular and extra-curricular activities stimulates or has positive association with better learning outcomes.

3.1.18 Parents Education

A kid's education begins at home. Parents are their first teachers and they have a crucial role in shaping up their persona. An equilibrium of education at home and school shapes a student's actual learning. Being an aid in their educational journey will inspire them to have a better performance. Parental motivation plays a pivotal role in successful students. Hence, in order to identify the relationship between parents' education and student learning achievement, students were asked in the background questionnaire to reveal their parents' education by choosing a response from multiple options (illiterate, literate, Grade 8, Grade 10, Grade 12, Bachelors and Masters or above). In the following text, the relation between performance of students and the education of their parents is reported.

3.1.19a Achievement by Mother's Education in Mathematics

Figure 25 Achievement by mother's education

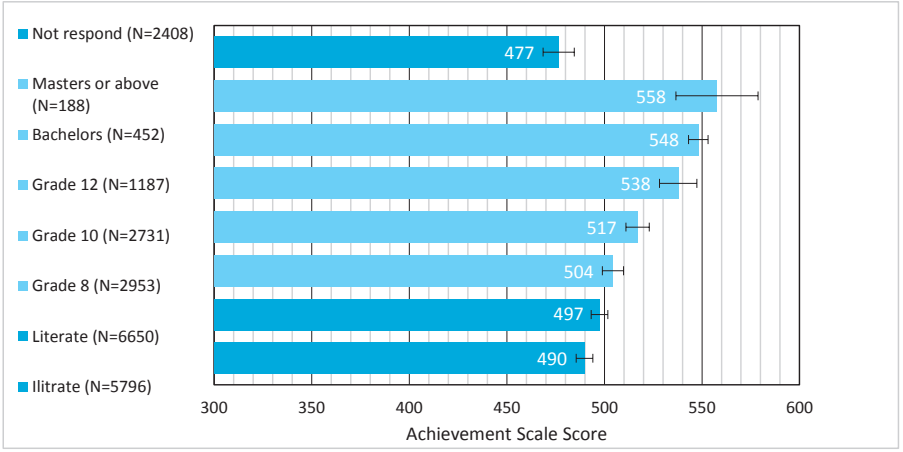


Figure 25 shows that the achievement of students was highest (558) when the mothers had an education level of masters or above which is 58 scale score above the national mean score. The achievement was lowest (490) when mothers were illiterate. Meanwhile the achievement scores were above national average when the mothers had an education from Grade 8 (504) to Bachelors (548). Likewise, the students were unable to perform well when the mother was only literate. Thus, data appears to suggest that illiteracy of mother is one of the factors hindering mothers in supporting the children academically. Even completion of basic level of education by the mother can make a high positive impact on children's learning.

3.1.19b Achievement by Father's Education in Mathematics

Figure 26 Achievement by Father's Education

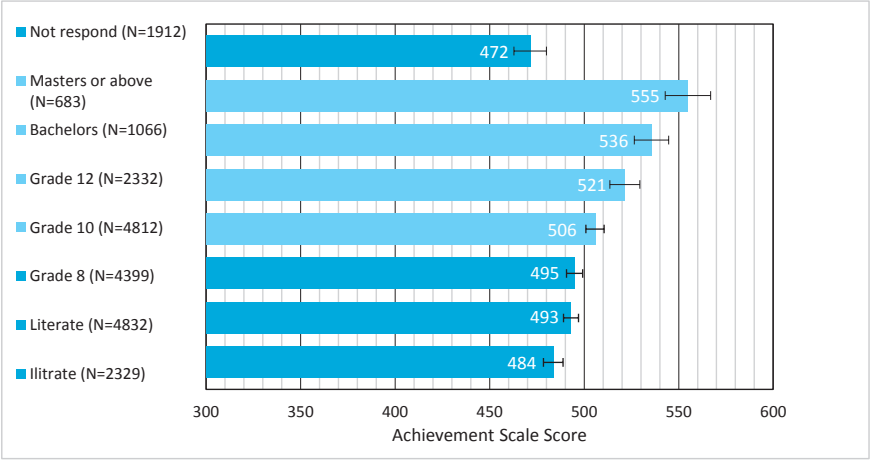


Figure 26 reveals that student's learning achievement has a positive association with their father's educational qualification. Average achievement of the group of students whose fathers were illiterate was lowest (484) which is substantially lower than the national average. In contrast, the group of students whose fathers had Master's degree or above qualification achieved significantly higher score compared to the national average and highest of all the groups. Students' average scores were above the national average even when their fathers were grade 10 pass. In conclusion, father's educational qualification has significant positive relationship with student learning.

3.1.19 Parent's Occupation

The socioeconomic status of a family contributes in providing various kinds of support to children for the learning environment. Parent's occupation also contributes to the wealth of the family. In this study, students were asked to report their parent's occupation. To investigate the influence of parents' occupation on students' learning achievement, the students were provided with the option to choose parent's occupation - government job, business, teaching, working abroad, wage, work in other's home, only household work, and agriculture. The achievement scores were analysed taking into consideration the student's parent (mother's and father's) employment status.

3.1.19a. Student's learning achievement by mother's occupation in Mathematics

Figure 27 Student's learning achievement by mother's profession

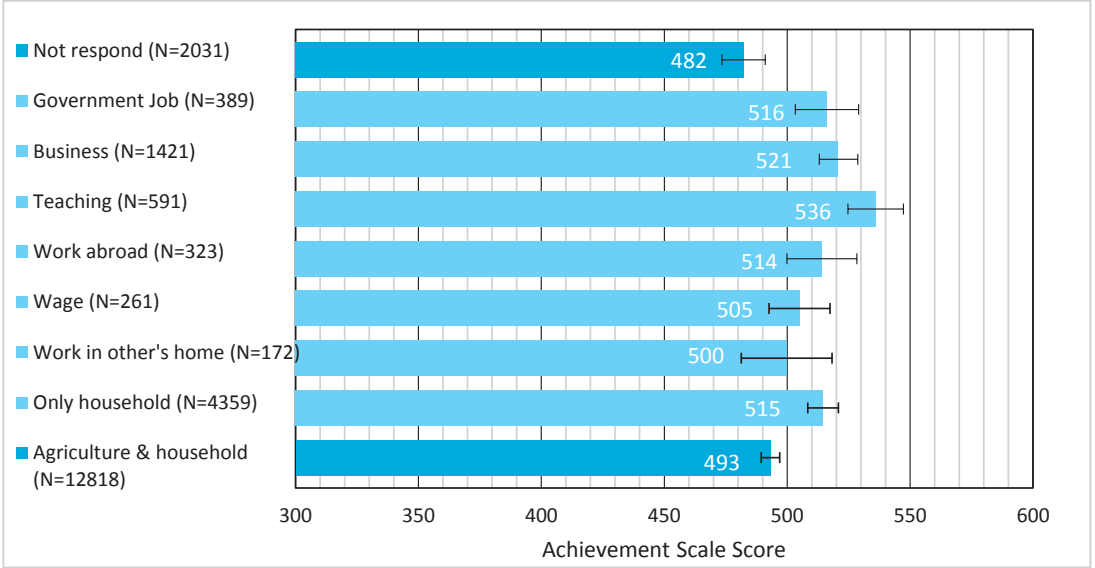
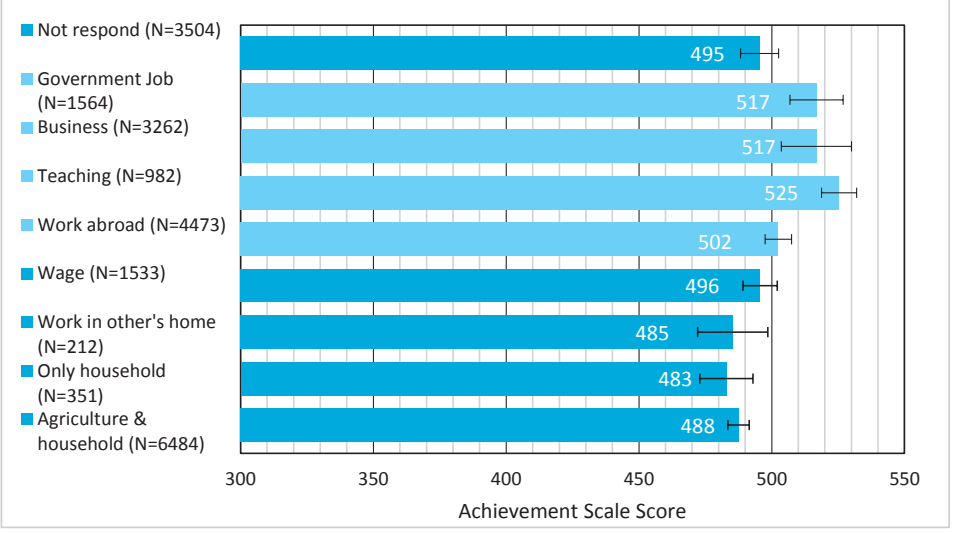


Figure 27 demonstrates the relationship between mother's occupation on a student's achievement. The students whose mothers were involved in teaching had outstanding performance (536). On the other hand, students whose mothers were busy in agricultural and household tasks had a substantially lower achievement (493), which was lower than for children whose parents have other than agriculture as profession. Meanwhile, children whose mother was involved in government jobs (516), business (521), and handling only household (515), were also scoring higher than national average. Interestingly, those students whose mothers work abroad also achieved higher (514) than national average 500. Taking all this valuable information into consideration, there is positive association between mothers who are engaged in teaching, government jobs, business, handling only household works and working in other's homes with student's achievement. In contrast, mothers who were involved in agriculture had negative association with learning of the children.

3.1.19b Achievement by father's profession in Mathematics

Similar to the Mother's profession, fathers' profession may also be related with student learning achievement. Figure 28 presents the student's achievement score against their father's profession.

Figure 28 Achievement by father's occupation



Students had outstanding performance when their fathers were involved in teaching (525). On the other hand, students who father was busy in only household tasks (483) performance had substandard achievement. Meanwhile, the achievement of students

whose fathers were involved in government jobs (517) and business (517) were significantly higher than the achievement of students whose fathers were involved in wage making works, work in other's home and agriculture.

3.1.20 Achievement by family size

In the background questionnaire, students were asked to mention the number of members in their families. The family size ranged from 3 to 12 members. Figure 29 depicts the achievement of students according to family size.

Figure 29 Achievement by family size

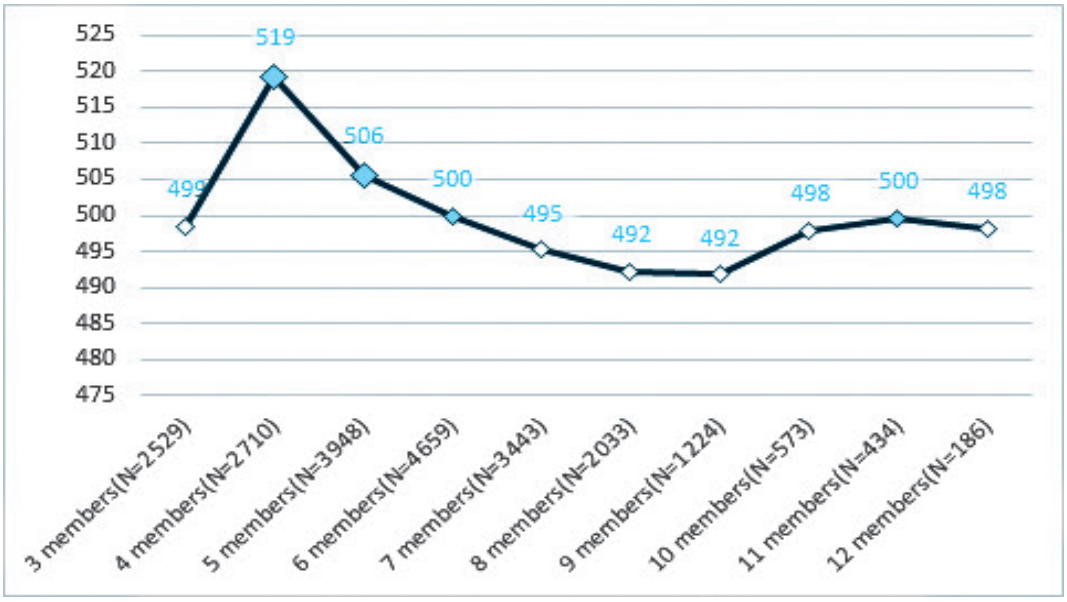


Figure 29 depicts that students' achievement was highest when the family size was limited to 4 members (519). Meanwhile family size of 5 (506) to 6 (500) members and above had the mean score (500) respectively. When family size is limited to 4-6 members the academic performance in math was high.

3.1.21 Achievement by family type

Following the sub-chapter 3.1.20, students themselves responded on the type of their family. The type of family was also analysed categorizing it into nuclear and joint which is depicted in figure 30.

Figure 30 Achievement by family type

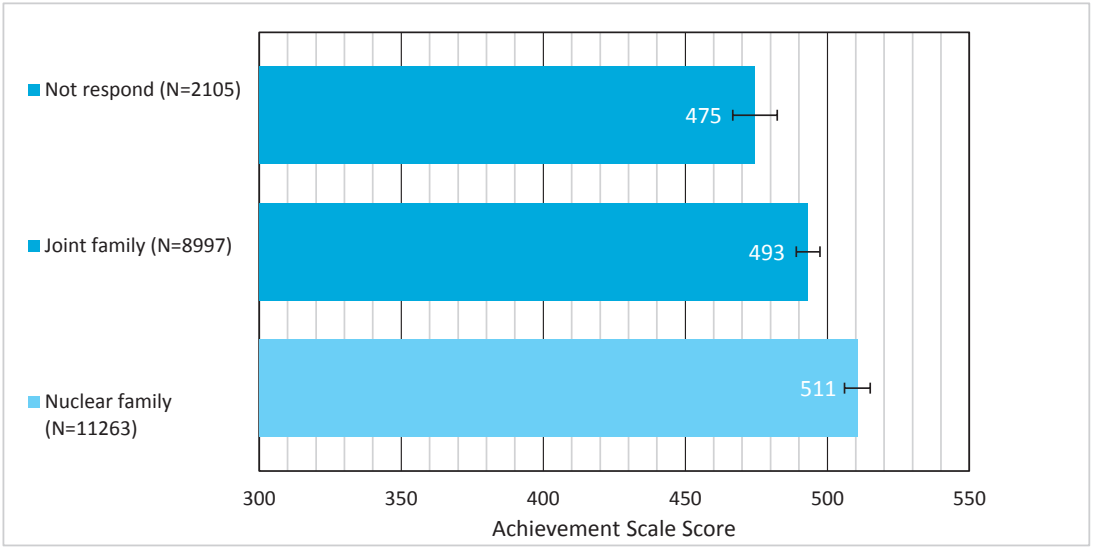


Figure 30 reveals that students with nuclear families had an outstanding performance with 511 scores whereas students with joint families had a poor score of 493. Data shows that nuclear family has a positive relationship with student learning achievement. Although, the correlation of family size with learning achievement in the weighted score is significant, it is very low (weighted correlation r = -0.05).

3.1.22 Availability of home possession with the student-family

Research reveals that various supportive facilities for the study play a significant role in student learning. In this study, students were asked whether their family possessed various items such as tablet for study and dictionary. The percentage of students having those items is presented in Table 24.

Table 24 Availability of home possession with family-student

Home possession	Response (%)		
	I don't have	I have	No response
Table for study	43%	48%	9%
Separate study room	34%	56%	10%
Peace space to study	39%	52%	10%
Computer for school-work	77%	13%	10%
Children magazine, story/poetry and pictures	78%	12%	10%

Home possession	Response (%)		
	I don't have	I have	No response
Reference book for school work support	62%	28%	9%
Internet	72%	18%	10%
Dictionary	68%	21%	11%

Table 24 explores the availability of different commodities as well as an appropriate learning environment at home which may impact achievement of the students. The table shows that 78%, 77%, and 72% of students did not possess children's magazines and story books, computers for school work, and the internet, respectively. Meanwhile, 56% and 52% of students had a separate study room and a peaceful space to study, respectively. The number of home possessions was summed to get the total home possession (Max 8). A correlation between total home possessions with student scores was calculated by using a replicate module of SPSS to calculate the weighted value of correlation. The weighted correlation r = 0.19 (with 5th plausible value), is a positive correlation with learning achievement. The above data shows that many students did not possess basic requirements for enhancing their performance such as availability of child magazines, story/ poetry, and pictures; computers for school work, and the internet facility.

3.1.23 Availability of home accessories

Television, computer, motorcycle, car, and permanent house building are supposed to be a proxy indicator of family prosperity. Percentage of students possessing these home accessories is presented in Table 25.

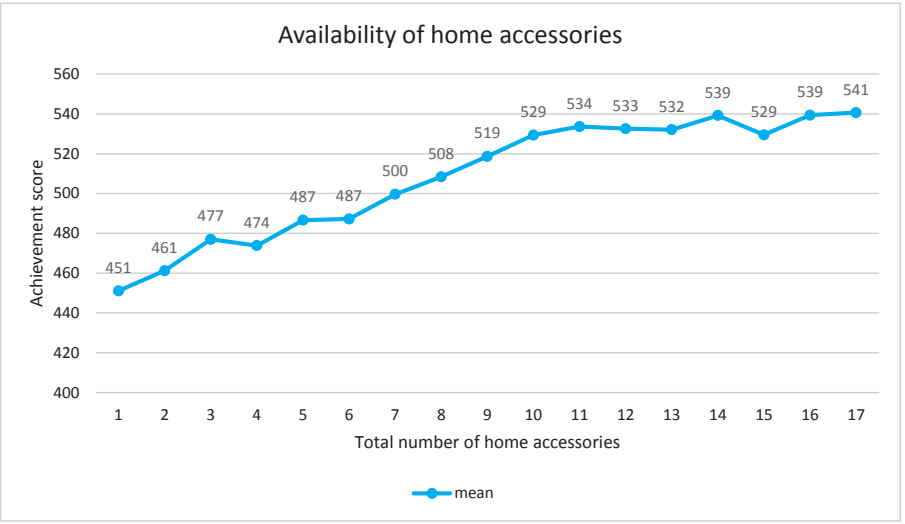
Table 25 Availability of home accessories

Home Accessories	Number of accessories possessed				
	none	one	Two	three	no response
Television	29%	51%	7%	2%	12%
Computer	57%	20%	2%	1%	20%
Motor-cycle	52%	23%	4%	2%	19%
Car	72%	3%	0%	0%	24%
Permanent house	35%	43%	5%	2%	16%

Table 25 shows that 72%, 57%, and 52% of the students do not own a car, computer, and motor-cycle respectively but 51% of the students have a single television and 43%

of them have a permanent house to live in. The association of the number of home accessories (wealth) with learning achievement is presented in figure 3.17

Figure 31 Availability of a number of home accessories



The above graph clearly shows an increase in achievement among the students when the number of accessories is increased. In the graph, when students possess 1 to 3 home accessories, achievement slightly increases from 451 to 477. While increasing home accessories from 5 to 10, achievement increases from 487 to 529. Similarly, as the numbers of home accessories continues to increase from 11 to 17, the achievement consistently increases from 534 to 541. The correlation between the number of home accessories and the achievement score is r = 0.35, a high correlation. Thus, the number of accessories has a positive association with the achievement of students in mathematics.

3.1.24 Personal mobile phone of school student

Before COVID-19 pandemic, people in Nepal used to believe that personal mobile phones with school students ruined their studies. To investigate this public belief, a question was asked to the students whether they had a personal mobile phone and the way they used it if they had one. Data shows that 36.3% of students have their own mobile phones. Mobile phones can be productive or unproductive; it depends on where they use them. Data reveals that 32.3% of students use Facebook with their mobile phones. The association of using Facebook is positively associated with learning achievement. As the data shows, those who use Facebook on their mobile phone have

a higher mean achievement score of 516 than those who don't use Facebook with 496 score. However, data does not clearly present whether those who don't use Facebook come from only those who do have mobile phones.

3.1.25 Student attitude towards School, Teacher and Mathematics

3.1.25a Attitude of students towards their teachers

A positive attitude towards anyone can affect a person's life favourably. Students with a positive outlook can view life challenges and the situations they go through with confidence. Thus, students were asked to rate on given statements about their Mathematics teacher. The responses in seven questions were coded 1 for the lowest positive attitude and 4 as the highest positive attitude. The sum of those seven responses was recorded into 1-7 = 1, 8-14=2, 15-21=3 and 22-28=4. Then the achievement against those responses was compared. The result is presented in Figure 32.

Figure 32 The attitude of students towards teachers and their achievement

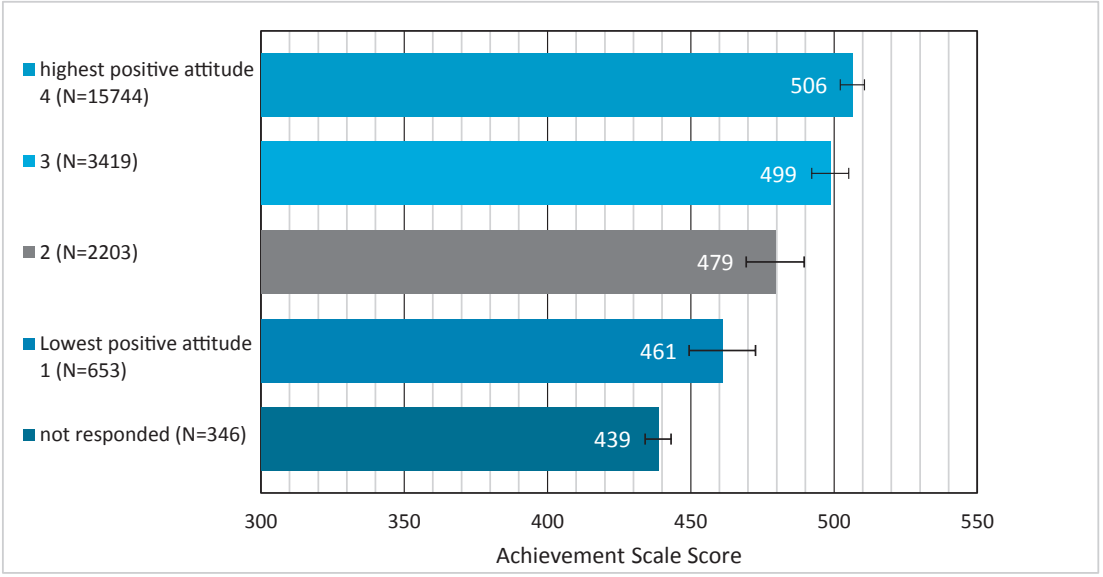
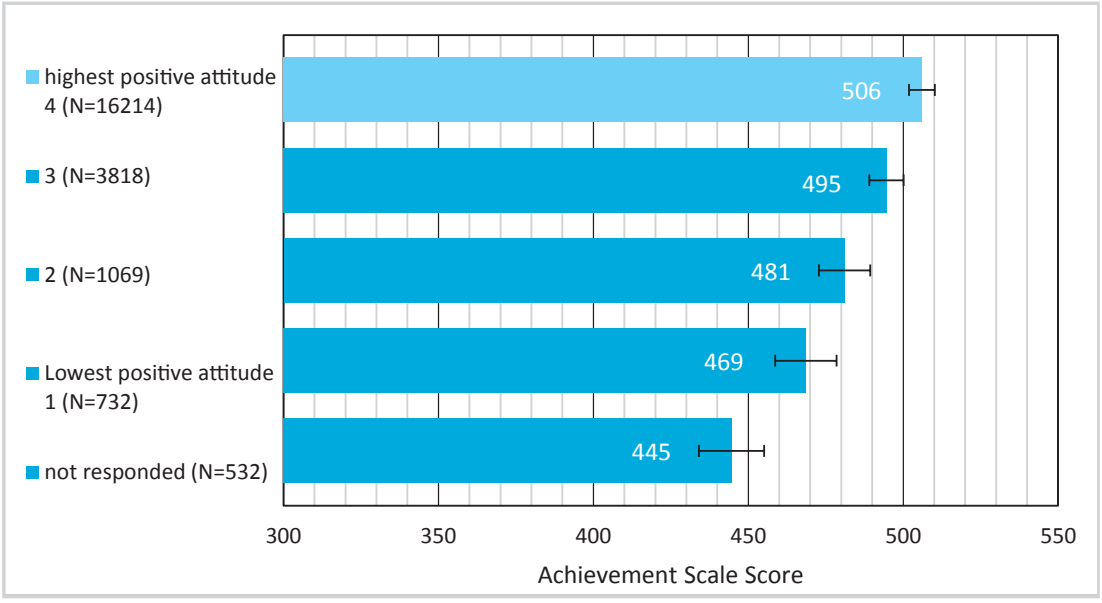


Figure 32 reveals that students with the highest positive attitude towards teachers had the highest level of achievement (506) whereas students with the lowest level of attitude had lowest achievement scores (461). Thus, we can clearly see that there is positive relationship between students with an increase in a positive attitude towards the teacher and academic performance.

3.1.25b Attitude towards school

Students were asked to rate on given statements about their school. The responses in four questions were coded 1 for the lowest positive attitude and 4 as the highest positive attitude. The sum of those seven responses was recorded into 1-4 = 1, 5-8=2, 8-12=3 and 13-16=4. Then the achievement against those responses was compared. The result is presented in Figure 33

Figure 33 Achievement by the attitude of students towards school



From Figure 33, we can see that students with the highest positive attitude towards school had the highest level of achievement (506) whereas students with the lowest positive attitude had poor achievement scores (469). Overall, there is a positive association between attitude towards school and the achievement score.

3.1.25c Student's attitude on the utility of Mathematics

Positive attitude on utilizing Mathematics in everyday life helps students to boost their confidence in Mathematics. Thus, students were given four choices to choose which were rated on a scale ranging from strongly agree, somewhat agree, somewhat disagree, and strongly disagree. Their responses are shown in Table 26.

Table 26 Student's attitude on utility of mathematics

Description	Number of students in percentage			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. Math can help me to calculate household problems	76.8	9.3	0.9	1.1
2. Learning math enables me learn other subjects better	67.6	26.4	3.4	2.6
3. I like to exercise Mathematics	79.3	17.1	2.3	1.4
4. I have to do Mathematics good to get job	83.2	13.0	2.0	1.8

Table 26 shows that students were strongly agreeing to the fact that Mathematics helped them to calculate household problems (76.8%), doing mathematics to get a good job (83.2%) and they liked doing the mathematics exercises (79.3%). Students also strongly agree to the statement that says Mathematics subject is extremely useful to get a good job.

3.2.25d Like and dislike of Mathematics

Students were asked questions about their opinion on liking or disliking Mathematics. Their responses are shown in Table 27.

Table 27 Students' like and dislike of Mathematics

Description	Number of students in percentage			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. Generally, I do Mathematics better	53.1	39.3	5.6	1.9
2. I want to learn Mathematics more	86.3	11.4	1.5	.9
3. I enjoy learning Mathematics	79.0	17.4	2.3	1.3
4. I can learn Mathematics fast	43.4	45.1	8.1	3.5
5. I feel learning Mathematics difficult	24.2	35.7	16.6	23.5

Table 27 reveals that 86.3% of students were highly interested in learning Mathematics and 79% keenly enjoyed learning mathematics whereas 59.9% found

learning mathematics difficult. Data shows that despite the students' curiosity and enjoyment in studying mathematics, they find it difficult as a subject.

3.1.26 Achievement by feedback on homework in Mathematics

Research depicts that regularity of teachers' responses (check) or feedback on students' classwork, homework, project work, and tests have a creditable role in improving their students' learning performance (Dahal, 2019, p.76). Thus, students were asked to rate how often their teacher provided feedback on homework. The response is plotted with the achievement which is shown in Figure 34.

Figure 34 Achievement by feedback on homework in Mathematics

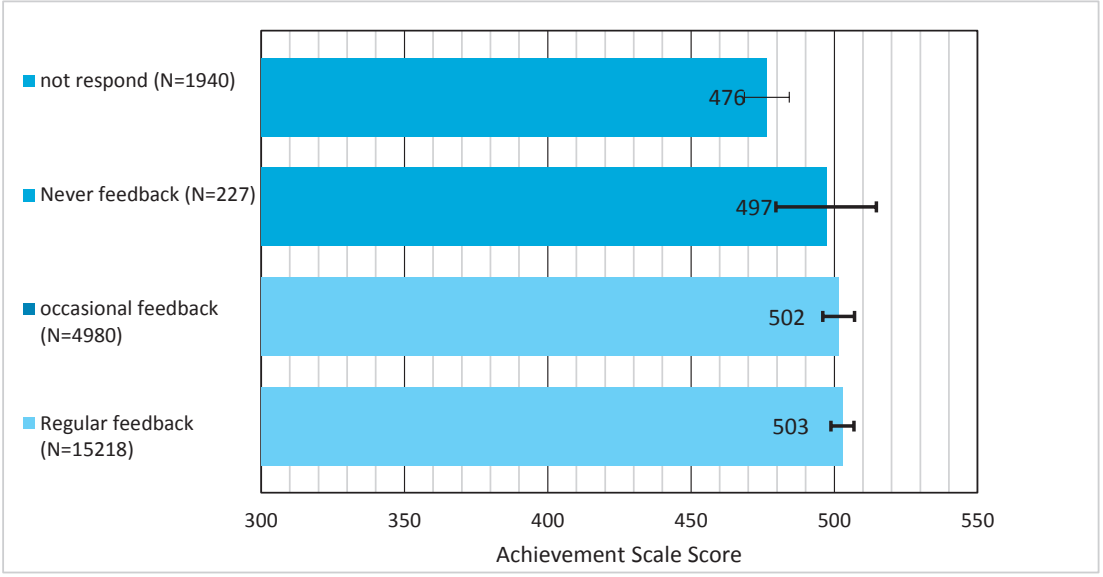


Figure 34 presents the status of achievement with respect to frequency of feedback provided on homework in Mathematics. The figure reveals that when the teacher provides the students with regular feedback (503). Meanwhile feedback once in a while (occasional 502) also was found to be beneficial. Poorer performance was seen when no feedback was provided to the students. Hence, feedback to the students can boost their performance, more so when it is provided on a regular basis.

3.1.27 Time on task of Mathematics teachers

Regularity of teacher in the classroom is one of the most important factors for the achievement level of the students. Regularity thus contributes to the achievement level of the students directly and specifically in difficult subject matter. Students rated the

regularity of the teachers. Their response is presented in Table 28.

Table 28 Regularity of teachers in the Mathematics classroom

Response type	How is the regularity of a Mathematics teacher?			
	No of students	Percent	Valid percent	Cumulative percent
Spends all time in the class	18333	82	82	82
Enters late and moves earlier	1415	6.3	6.3	88.3
Mostly does not appear in the class	941	4.2	4.2	92.5
No response	1676	7.5	7.5	100
Total	22365	100	100	

Table 28 shows that the highest number (18333) of students reported that their teacher used to spend all the time in the class. Meanwhile, 941 students responded that their teachers mostly do not appear in the classroom. Furthermore, 1415 students stated that their teachers entered classroom late and moved earlier.

Figure 35 Comparison of achievement by teacher's regularity in Mathematics classroom

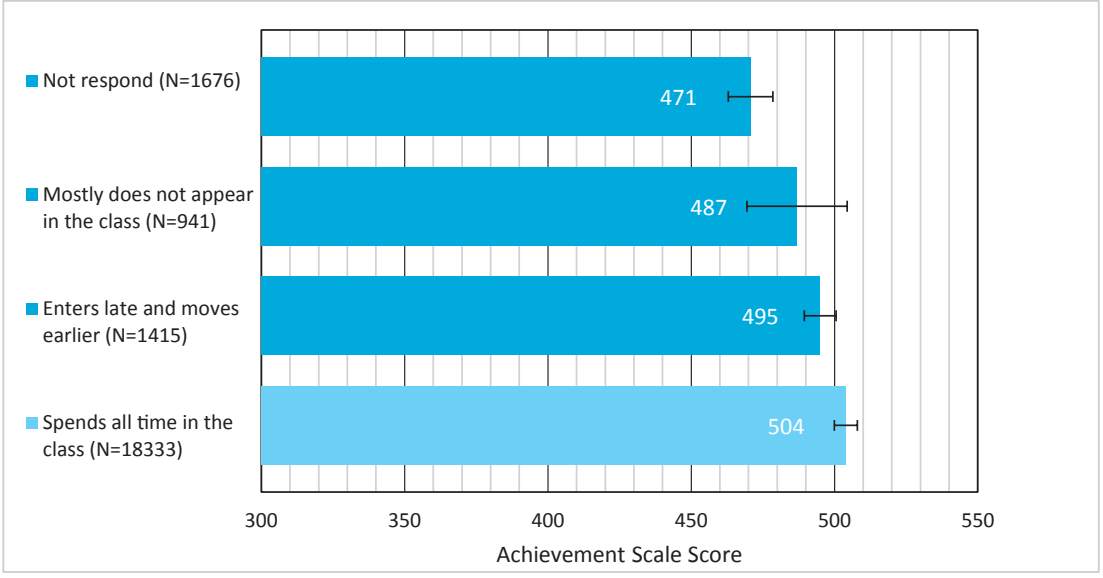


Figure 35 demonstrates that students whose teachers spent all the time in the class had a higher achievement with a mean score of 504 than the students whose teachers

did not have regularity in classroom. Students whose teachers entered late and left earlier also had a low score with a mean score of 495. Taking all the information into consideration, teachers devoting all their time in the classroom were seen very much effective in boosting the performance of students.

3.1.28 Use of textbook, old questions, guess paper and guides

Students were asked about the types of resources they used during their study. These include math textbooks, the old set of questions, guess papers, and guides. Table 29 presents the number and percentage of students utilizing different resources.

Table 29 Use of textbook, old questions, guess paper and guides

Type of resources	Number of students (N)	N Percent
1. Math textbook	16711	74.7
2. Old set of questions	15364	68.7
3. Guess paper	6692	29.9
4. Guides	4739	21.2

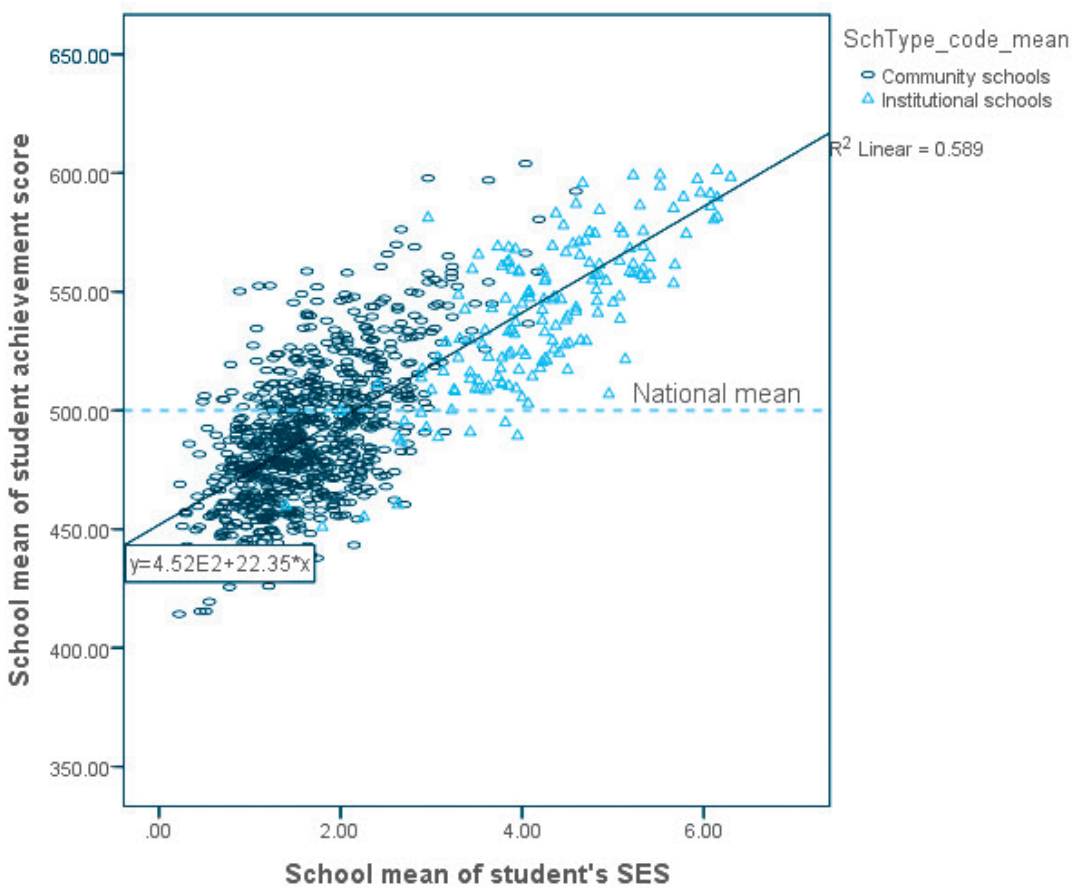
Table 29 reveals that a maximum of 74.7% of students used math textbooks as their resource and 21.2% used guides as their source. Meanwhile, old sets of question papers were also used by most students. *This gives a clear picture that the math textbook and old sets of math questions were the main sources of their study.*

3.1.29 Achievement by Socioeconomic Status (SES)

In this study, socio-economic variables are parents education and occupation, home possessions, home accessories, participation in institutional schools, parents education - mother grade 10 pass, father grade 10 pass, home possessions - reading room, peaceful place to study, computer, children books, reference books, internet facility, and dictionary. Out of these eight possessions, at least four possessions: home accessories as television, computer, motorcycle, car, permanent house are considered of good contributing quality. Those accessories could be a maximum of 4 categories, so the maximum sum will be 20. Among 20 possibilities, at least 7 accessories were taken as higher SES. In parents' occupations, when parents are not involved only in agriculture or household, they are taken as having higher SES. From those variables, seven dummy variables were prepared. Thus, the school mean of those seven dummy variables was taken as total SES.

A scatter plot of socioeconomic status against students' transformed latent ability (WLE) was plotted. The produced scatterplot is presented in figure 36.

Figure 36 Relation between SES and school's mean score in Mathematics



The scattered plot in Figure 36 depicts that socio-economic conditions has a huge influence over student achievement in mathematics. The R2 = 0.59 indicates that SES has a high effect up to 59% in student's learning achievement in grade 10 Mathematics. SES represents not only availability of facilities required for grade 10 students to study *but also admitting in private school, parent's education level, and their profession as well.* With more resources, support can be provided to the students to facilitate their learning, provide resources like books, providing peaceful space and room, computer, internet, and TV. Data shows that the higher the SES effect, the higher the disparity to lower SES families.

One interesting fact found in the data was that out of top achieving schools, top three come from community schools and out of seven top achieving schools, *highest achieving three schools are community schools.* Given that students from high socio-economic conditions predominantly go to institutional schools, this fact suggests that students from low socio-economic conditions can also obtain quality education if community schools meet certain enabling conditions.

This data urges to plan for those two-thirds or more students from low-SES families to provide educational support in school to minimize the high effect of SES.

Chapter 3.2
Science

3.2.1 Introduction

In this chapter, the basic results of population estimates drawn from the responses of altogether 21766 students from 75 districts and 901 schools are presented. Population estimates presented in this chapter are based on the five plausible values drawn from WLE and conditioning variables like school mean index, student background variables, student weights, provinces, and gender. The population mean/achievement score is presented in all basic results with either standard error or in confidence interval (CI). In most of the bar-charts, the confidence interval of the population mean is represented by a line with a cap on both ends. Such population estimates do not represent the individual-level results. Thus, all the achievement scores reported are the weighted mean scores weighted by adjusted student weights, and the difference is reported at a confidence level of 95%. The standard errors and confidence intervals were estimated to identify whether the difference in mean was statistically significant.

The students' ability scores were transformed into a mean 500 and a standard deviation of 50. This reporting has always a national mean score fixed at 500 points to compare any two or more groups. The formula for transforming the student ability (logits or q) was:

Average score = 500 + logits * 50

Variation of the average score comes from the variation in the logits (the latent ability of students/WLE). The five PVs are also generated based on the logits.

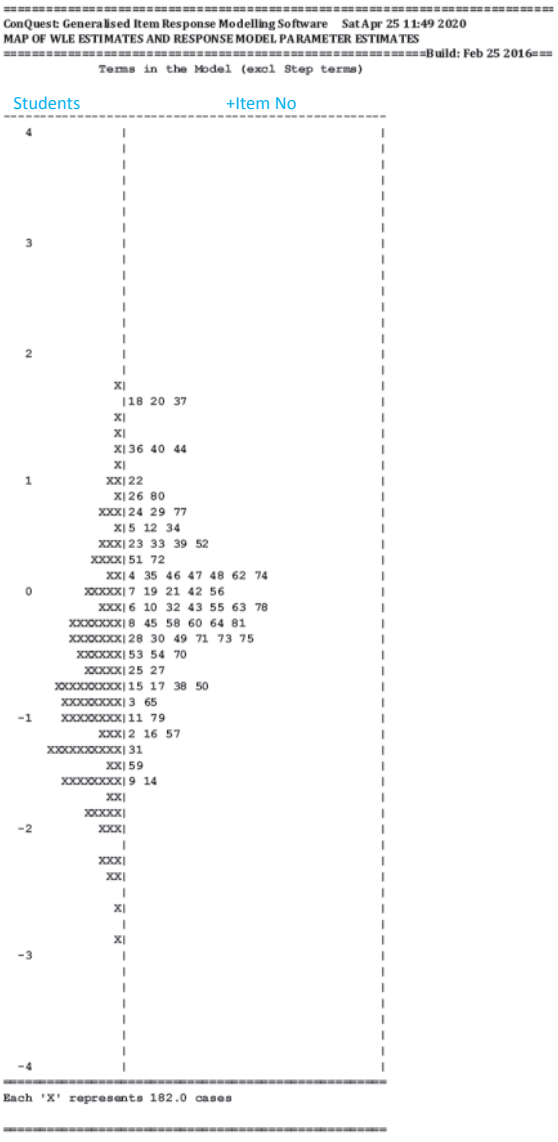
3.2.2 Wright-map of student ability and item difficulty in science

A simple and powerful graph used in psychometrics termed as Wright Map, presents the location of both respondents and items on the same scale. Wright Maps are commonly used to present the results of dichotomous or polytomous item response models. This map is plotted from person estimates (latent ability) and item parameters produced by an item response analysis.

The Wright-map is organized as two vertical histograms. The left side shows candidates and the right side shows the items. The left side of the map shows the

distribution of the measured ability of the candidates from most able at the top to least able at the bottom. The items on the right side of the map are distributed from the most difficult at the top to the least difficult at the bottom. In the following figure, student ability (q) in the left and NASA 2019 items to the right are plotted on the same scale. When a person and an item lie at the same level, the probability of responding to that item by the particular person is 50%. Figure 37 presents the NASA 2019 Science Wright-map.

Figure 37 Wright-map showing respondents and item in the same scale in Science



To the left side, an 'X' represents 182 students; their latent ability is given in the logit scale ranging from -4 or less to +4. The distribution of students against the items asked (item numbers are shown to the right side) reveals that most of the items were difficult for the students. Although items were pre-tested and based on the grade 10 curriculum, most of the students are lagging behind below the average latent ability '0'. This indicates that items were difficult for the participant students. This further indicates that the performance level of the students was achieved not as expected by the curriculum.

3.2.3 Plausible Values, their Mean and Standard Error

After estimating the student ability (q) in the form of WLE, five plausible values (PV1 to PV5) were generated by conditioning the data with student background variables and school mean index. Those plausible values are transformed into a scale of mean 500 and a standard deviation 50. Those values were weighted by student full weight and using 451 replicates (just half the number of schools taken in the sample for Mathematics). After all, MSSPV1 to MSS PV5 was calculated to report the population estimates. The mean and standard error of five plausible values is presented in table 30.

Table 30 Mean and Standard Error of five plausible variables in Science

SN	Plausible value	Mean	SE of plausible value	Sample Students	Population
1	MSSPV1	500.1	1.03951	21766	422012
2	MSSPV2	500.1	1.045	21766	422012
3	MSSPV3	500.2	1.03741	21766	422012
4	MSSPV4	500.0	1.03684	21766	422012
5	MSSPV5	500.4	1.04395	21766	422012

3.2.4 Defining Proficiency Levels in Science

The assessment framework for NASA 2019 recommends setting performance levels into six levels. For this, three cut-points for proficiency levels were decided by dividing the range of 164 (maximum 615 – minimum 442) by the interval of 42. Thus, six proficiency level cut-points were 442, 448, 475, 502, and 556 decided. Table 31 shows how proficiency levels are determined.

Table 31 Proficiency levels and the score range in Science

Proficiency Level	Score
Level 6 (Advanced)	556 or above
Level 5 (Proficient 3)	529- 556
Level 4 (Proficient 2)	502-529
Level 3 (Proficient 1)	475-502
Level 2 (Basic)	448-475
Level 1 (Below basic)	448 or below

Based on the descriptions of items that correspond to each of the above proficiency levels in the item-person map in Science together with subject experts' judgment, the descriptions of students' four-level proficiency have been defined. These descriptions of six proficiency levels in Science for Grade 10 indicate what a student at a particular competency level can do in Science.

Internationally, students who cross 67% of their achievement are considered as Minimally Accepted Candidate. Replicating the same concept in determining the minimum acceptance level of learning in those six proficiency levels is possible. However, in this assessment, around 50% of items were objective, and almost equal weightage was given to subjective items. So, in this analysis, 50% correct answers were supposed to be the threshold of minimum accepted proficiency for any of the six levels. From this point of view, student response on every item was analyzed to find the response rate of those four-level students. For this, at the first step, below level 1 (pre-basic) items were detected then, level 1, level 2, and level 3 respectively. In such a rigor, all the items were assigned to different six levels to draw proficiency descriptors. Table 32 specifies the minimum proficiency level of all six level students in a descriptive form.

Table 32 Summary of the minimum proficiency level in all six levels.

Proficiency Level	Score	What students can typically do
Level 6 (Advanced)	556 or above	Students demonstrate **advance** ability to apply knowledge and skills set forth in the curriculum in a new and unfamiliar situation, and ability to combine and use various relations and components of knowledge and skills in order to solve the problems and develop a new relation.

Proficiency Level	Score	What students can typically do
		For example, they were able to solve problems related to domestic electricity consumption and its bill payment, explore the science on the experiments and conclude, effects of air pressure in daily life examples, conclude type of chemical reaction from given situation.
Level 5 (Proficient 3)	529- 556	Students demonstrate **thorough proficiency** in understanding of and ability to apply knowledge and skills set forth in the curriculum including the combining more than one relations together for solving the problem. For example, they were able to choose appropriate adaptor in given situation; explore science in puncher repairing of wheels of vehicles; calculate the number of hydrogens in unsaturated hydrocarbon; recommend ways to remove permanent hardness of water; make prediction on solubility of ammonia in given situation, write the structural formula of certain alcohols. They also could answer adequately the questions asked from reading paragraph about science magazine (PISA released item); demonstrate the understanding of the concept of greenhouse gases; explain the type of reproduction occurs in diagram of given organism; explain the importance of heart beat.
Level 4 (Proficient 2)	502-529	Students demonstrate **adequate proficiency** in understanding of and ability to apply knowledge and skills set forth in the curriculum. For example, understand the characteristics of image formed by lens and explain the characteristics of glass used as lens; explain the working principle of hydraulic lift, factors which affect the gravity, electricity related areas like circuit diagram, concept of freezing and boiling point, calculate the molecular weight, pH value, asterisk sign elements. They were also able to explain more in relation of afforestation and atmospheric carbon dioxide and some astrological elements like milky way galaxy.

Proficiency Level	Score	What students can typically do
Level 3 (Proficient 1)	475-502	Students demonstrate **partial proficiency** in applying learnt knowledge and skills in various related areas. For example, they are able explain the principle in bending of light passed from one medium to another but can not adequately; able to recall range of contents learnt and use them to solve asked problems in some extent. Although they were able to show minimum learning ability, their performance was not adequate.
Level 2 (Basic)	448-475	Students demonstrate **basic pre-requisite** knowledge and skills needed for studying Grade ten curriculum but can not show performance level ability. For example, students could show knowledge about the relation between pressure and density, name thermometric liquid, know the metallic property of iodine, acidic property of HCl and property of acid. But were not able to explain the relationship between acid and base.
Level 1 (Below basic)	448 or below	Students demonstrate **limited basic** understanding of knowledge and skills set forth in the curriculum. For example, they were able to recognize some facts like fossil fuel, non-renewable energy sources etc.

Note: although some students of lower level (for example: below basic level) have also answered few items of upper level (for example: basic) correctly, those items were located in upper level (basic level) because rate of correct answer of those items was less than 50% in lower level (below basic level).

3.2.5 Distribution of Students by Proficiency Levels

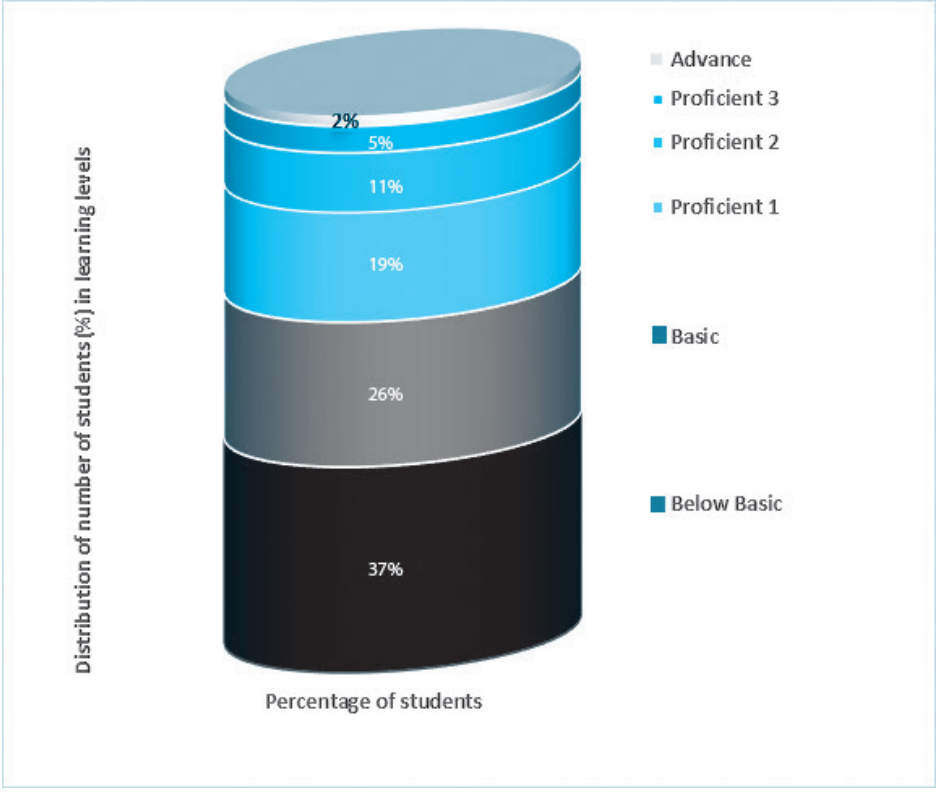
The student achievement scores based on 5 plausible values (PV1 to PV5) were analysed in terms of six proficiency levels of students' achievement. Level wise descriptors are presented in the section which also presents the number of students falling in those six levels from population estimate. The standard error of the percentage of students is also presented in table 33.

Table 33 Distribution of the students in various proficiency levels and their Standard Error

Proficiency Level	Percentage of students	SE	Population	Number of students in the sample	No of schools
Below Basic	37%	0.83959	154481	8021	796
Basic	26%	0.57532	108425	5579	841
Proficient 1	19%	0.50906	81883.1	4201	775
Proficient 2	11%	0.43554	44445.3	2285	566
Proficient 3	5%	0.36747	19305.2	994	294
Advance	2%	0.22736	7892.53	408	124

The below basic level indicates the lowest ability of students who are struggling in the classroom whereas the Advance level shows the highest level of proficiency that even crosses the grade level. Figure 38 shows how students are distributed over those levels visually for Science.

Figure 38 Distribution of number of students (%) in different levels



About two-third (61%) students have remained in below basic and basic level with very limited level of learning. When proficient 1 is considered as minimum expected level for grade 10, only 18% students could answer the items asked based on the national curriculum of grade 10.

3.2.6 Minimum Level of Achieved Curriculum

The assessed curriculum is reflected by the assessment or evaluation. It can be either formative or summative evaluation of the students. Assessed curriculum is a tested curriculum by school, national or international organization based on the written curriculum/intended curriculum. It is valuable because it enables the educational organizations and stakeholders to evaluate the impact of written and taught curriculum on students. It determines the level of the learned curriculum. Research (e.g. Berliner, 1984; Turner, 2003) indicates that the mismatch between assessed and taught curricula has serious consequences. This section presents the level of learning in the form of achieved curriculum in terms of percentage. In this analysis, it is assumed that every test item is equivalent in the sense that each of them represents a learning objective mentioned in the written curriculum.

As mentioned above, 67% correct responses can be considered as for being minimally proficient at any level. As in this assessment, around half number of items was objective type (MCQ) and half of them subjective. Fifty per cent (50%) correct responses are considered as the threshold of minimum level of accepted proficiency at any of the six levels. Hence, test items were organized in terms of at least 50% correctly answered items or more at each level of students. Based on this criterion, all the items were re-allocated into six levels. From this rigorous analysis, performance descriptors were developed.

In every level of the proficiency, there are ranges of students from being very weak performers to the highest performers. Considering 50% as the threshold of minimum proficiency of any six levels, percentage of learning was mathematically calculated based on the number of items answered correctly. Mathematical value of achieved curriculum is thus given in table 34.

Table 34 Mathematical presentation of the achieved curriculum in Science

Performance level	Achieved curriculum (number of items %)
Below Basic (37% students)	Less than 5%
Basic (26% students)	25%

Performance level	Achieved curriculum (number of items %)
Proficient 1 (19% students)	43%
Proficient 2 (11% students)	69%
Proficient 3 (5% students)	86%
Advance (2% students)	90%

Table 34 shows the minimum level of correct responses of students in percentage. Since assessment framework represents the written curriculum, and student response represents the taught curriculum, it is easy to infer that every 37 out of 100 students could answer only one question correctly crossing the cut-score. This by definition of DPL, this level of students could adequately answer only 4% items of the curriculum. Likewise, basic level students learnt better, they answered 25% and proficient 1 level students learnt 69% content of the curriculum. On the other hand, 5% students who lie at the advance level learnt 95% items of the curriculum. Altogether, only 18% students (proficient level 2, proficient level 3 and advance) have achieved the minimum level of learning in grade 10.[5] These percentages can be assumed as analogy of percentage of content learnt.

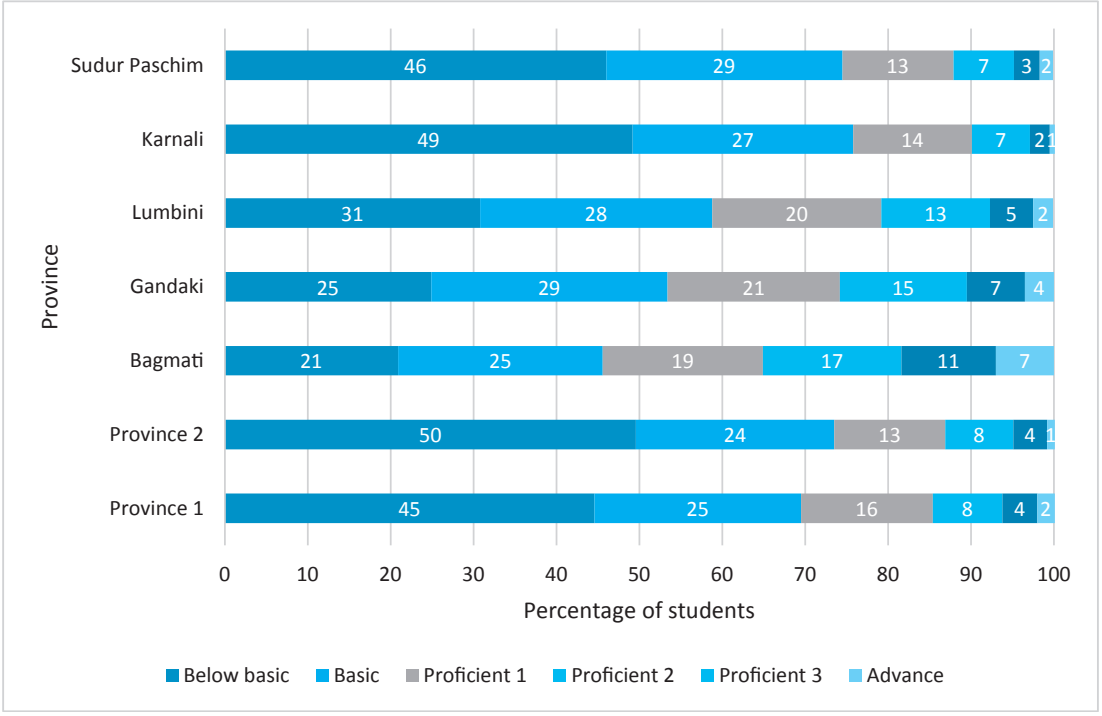
3.2.7 Achievement by Provinces

The Federal Democratic Republic of Nepal has been divided into seven provinces and 753 local units. These provinces were regarded as strata and schools were picked out as Principal Sample Unit (PSU) for the comparative study on achievement by province. The average scores described in this section are the transformed /scale score at 500 national average. National mean is taken as a reference to contrast with the provincial mean. Those provinces exceeding average scores are acknowledged as better performing and below 500 are considered as low performing provinces.

As an explicit stratum, provincial results were generalized, i.e., weighted results are reported like in national level. The distribution of students in various proficiencies by province were analysed and are presented in figure 39. In the figure, below basic level is the lowest level and advance is the highest level of student proficiency. In the figure, higher the number in lower level of proficiency, poorer the result and in contrast, higher the number of students in the upper level, better the result.

5 Data scenario shows that proficient level 1 should be the minimum learning level, 82% students did not learn the minimum level in grade 10.

Figure 39 Province wise distribution of students (%) in six proficiency levels.



The above figure presents province 2 and province Karnali as having the most number of students in the lowest proficiency level (i.e., below basic level) among all the provinces. The figure also reveals that grade 10 Science curriculum was least effectively delivered or learnt in these areas where as Gandaki, Bagmati and Lumbini have fewer students at this level. Bagmati province has the highest number of advance level students (7%).

The mean score of achievement disclosed in all graphs and tables is based on the plausible values as stated in the introduction chapter. In figure 40, score 500 is the national mean score of achievement and horizontal bars depict the achievement scores by province.

The mean score of achievement disclosed here is based on the plausible values as declared in the introduction chapter.

Figure 40 Achievement of students by provinces in Science

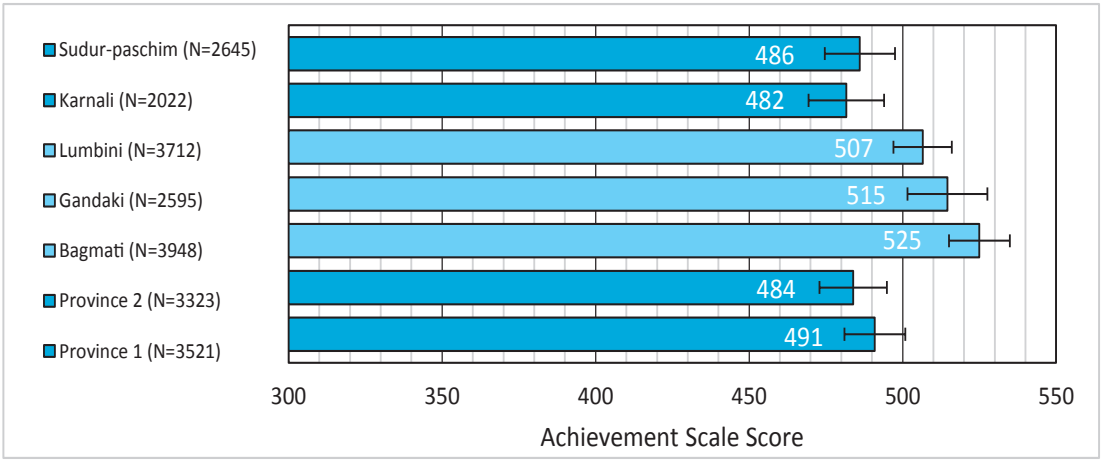


Figure 39 reveals that the student achievement in Science in Bagmati province was the highest (525) among the seven provinces, while student achievement in Karnali was the lowest (482). The difference between the highest achieving and lowest achieving provinces ranges by 43 scale scores. Learning achievements of province 1 (491), province 2 (484), Karnali (482), and Sudur Paschim (486) were lower than the national average. Learning achievements of province Bagmati (525), Gandaki (515), and Lumbini (507) exceeded the national average.

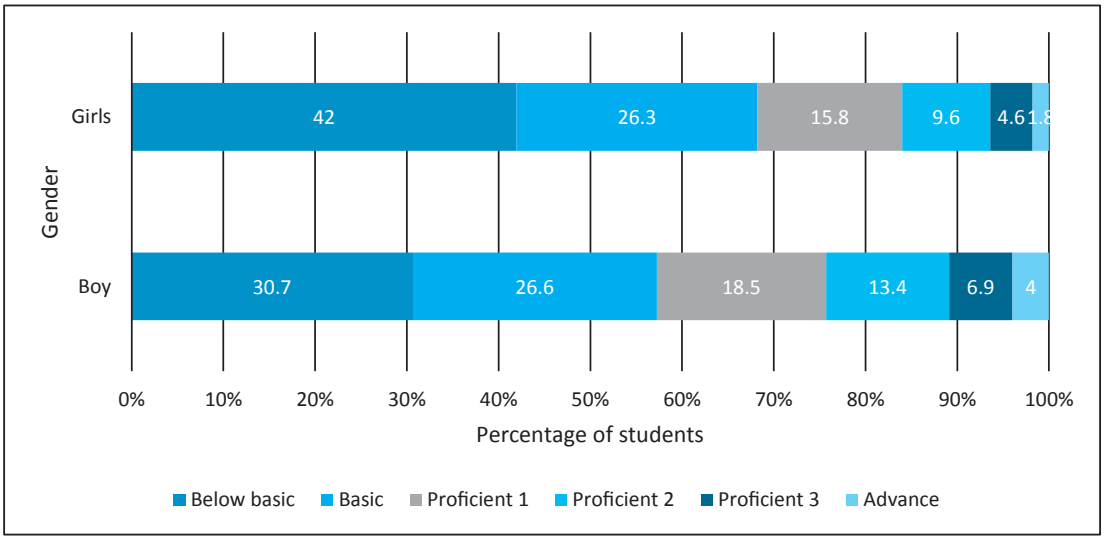
Overall, student in four provinces, namely province 1, province 2, Karnali, and Sudur Paschim were low performing and Bagmati, Gandaki, and Lumbini were high performing as their achievements were above the national average.

3.2.8 Achievement by Gender in Science

For the uniform and proportionate learning to happen, girls and boys should have equal opportunity and backing in their study. In the framework of the questionnaire, students had mentioned their gender. The data shows 191819 (45.4%) boys, 208248 (49.3%) girls, and 21945 (5.2%) have undisclosed their gender.

Gender as an implicit stratum, comparison was made in the number of students in defined six proficiency levels. The distribution of students in six performance level by sex is presented in figure 40.

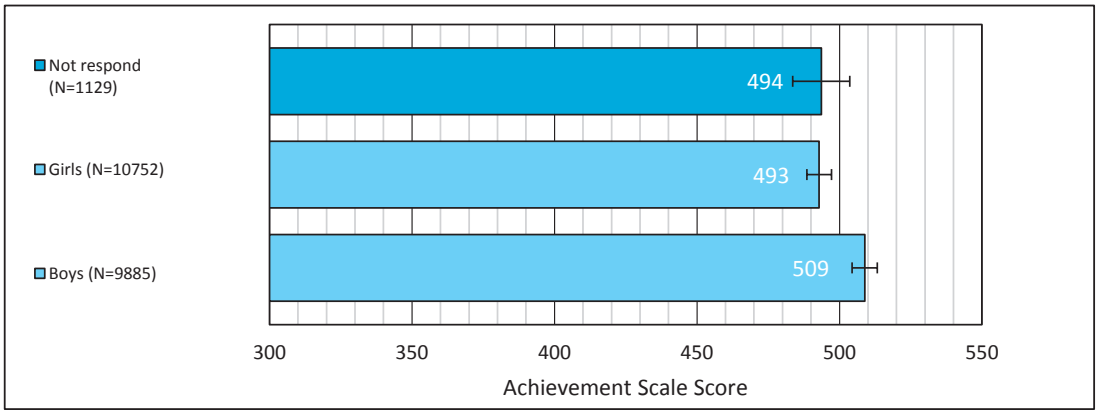
Figure 41 Sex wise distribution of students (%) in six proficiency levels



The above figure shows that higher number (42%) of girls than boys (30.7%) remained at the bottom level (lowest basic level) and in contrast, higher number of boys (13.4 + 6.9 + 4 = 24%) reached adequate level of proficiency than girls (9.6+4.6+1.8 = 16%) reaching at these levels.

In terms of achievement score, comparison of performance of girls and boys was made. The results of the comparison is presented in figure 42.

Figure 42 Achievement of students by gender in Science



The above figure shows the achievement of boys (509) being higher than the mean score of girls (493). Boys have outperformed girls by 16 scale scores. The difference in scores between boys and girls was found statistically significant at 95% confidence

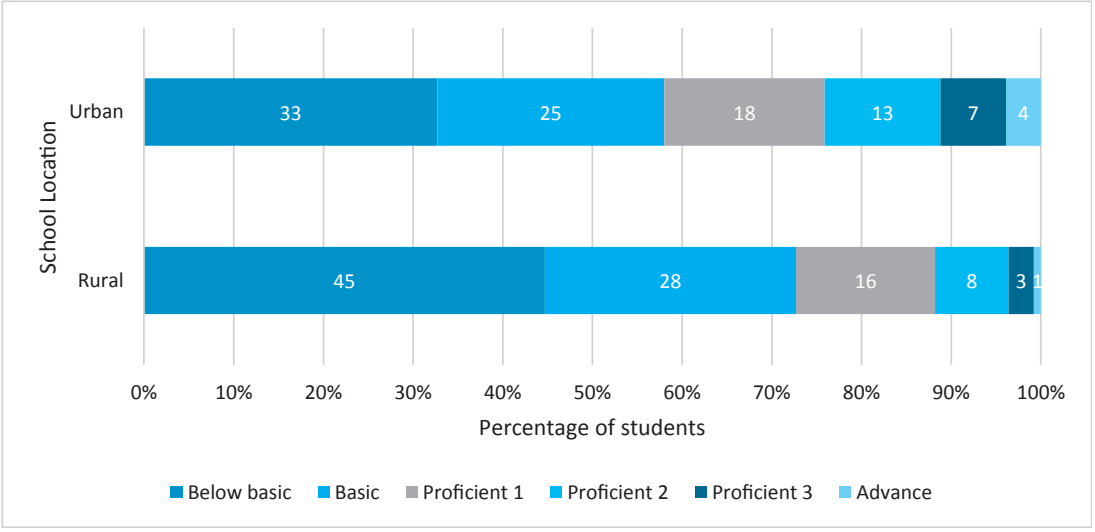
level ($p<0.05$) and the data confirms that the difference in achievement was remarkable.

3.2.9 Achievement by location

The location by political division of Nepal is defined as Metro-Politian City, Sub-metropolitan city, municipality and rural municipality. While making two categories into rural and urban, rural municipality can be supposed as rural location and other as urban. However, many municipalities are also in rural area which is a difficulty to get the exact picture. Comparing those two categories, data shows a different distribution of students over all six-proficiency level in Science.

The achievement by location is presented in Science in figure 43

Figure 43 Achievement by school location in Science



The achievement of rural and urban area also differs significantly. The table 36 shows the comparative status of achievement in Science.

Table 35 Achievement by school location in Science

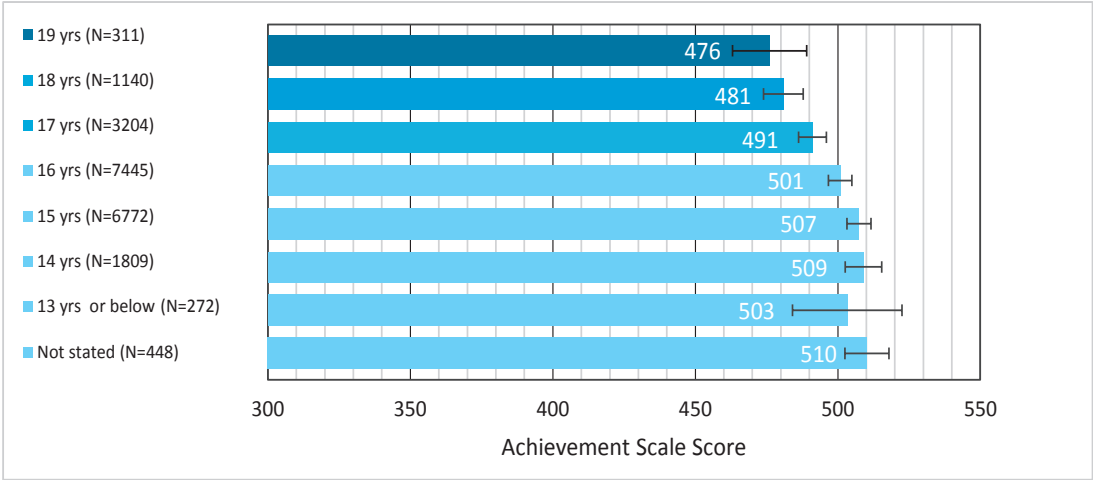
School location	N	Mean	Std. Deviation
Urban	14152	506.909	51.5255
Rural	7614	486.97	44.0658

Urban area students' achievement score was 506.9 against 486.9 score of rural area students. The difference in average achievement score of urban and rural is significant at 95% confidence level.

3.2.10 Achievement by age of students in Science

One of the variables students had to respond to in the questionnaire was to report their age. Ages mentioned by them were categorized into seven groups as 13 or below, 14, 15, 16, 17 and 18 or above. The achievement score by student's age is presented in figure 44 showing the details of the achievement by the age of the students. In the figure, age 19 represents 19 years of age or above.

Figure 44 Achievement of students by their age in Science



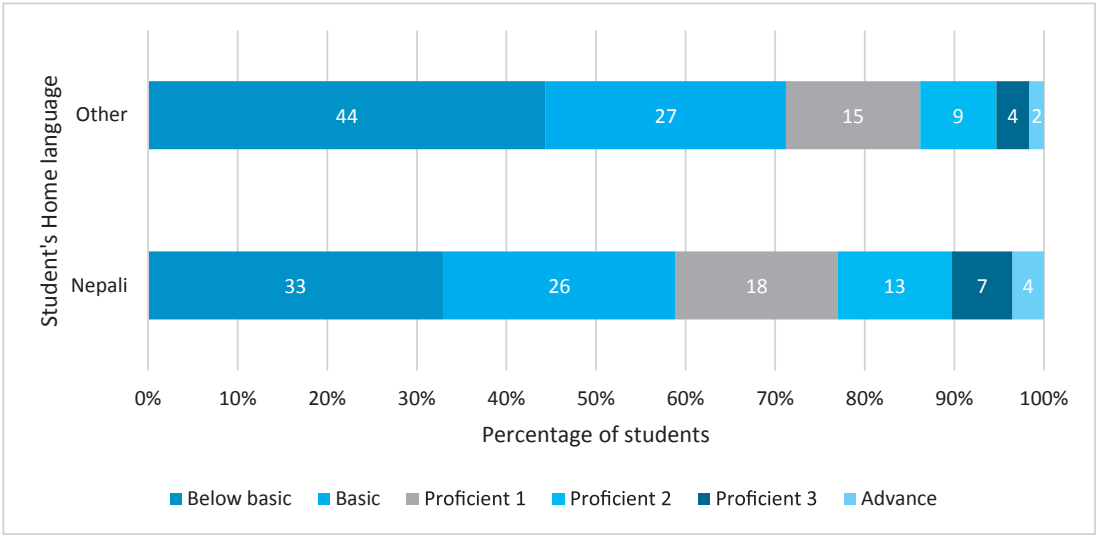
The above figure revealed that students of age group14 performed better than other groups. The highest mean score of achievement of age group 14 was 509. The lowest achievement of age group 19 was 476. The data showed interestingly when the age of the students increased the achievement level in Science has decreased. Achievement was lower when students were over-aged (17 or above and achievement was highest at the age of 14 (509 score) or 15 (507 score). The difference between the highest and lowest achieving groups was 33 scale scores. The difference in the achievement between the highest and lowest groups was statistically significant at a 95% confidence level. The result confirms that appropriate age (14 to 16) is an important factor associated with higher level of proficiency.

3.2.11 Achievement by home language of students in Science

To find the effect of the home language in the achievement of Science, students were prompted to respond about the language they spoke most of the time at their home. Their reply indicated that 65.2% communicated in Nepali in their home whereas 34.5% communicated via languages other than Nepali.

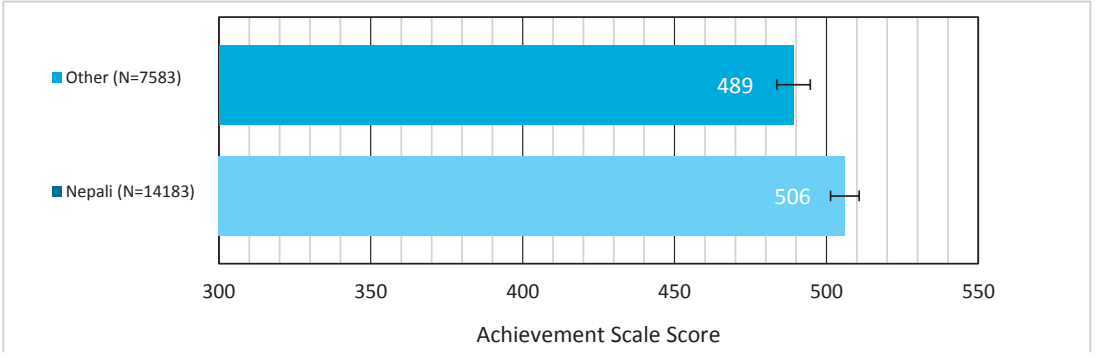
Based on the proficiency level attained by students, number of students who are located in six levels, disaggregated by their home language, is presented in figure 44.

Figure 45 distribution of students over six proficiency level by home language



The comparative presentation of student achievement score by home language is displayed in figure 46.

Figure 46 Student achievement by home language in Science

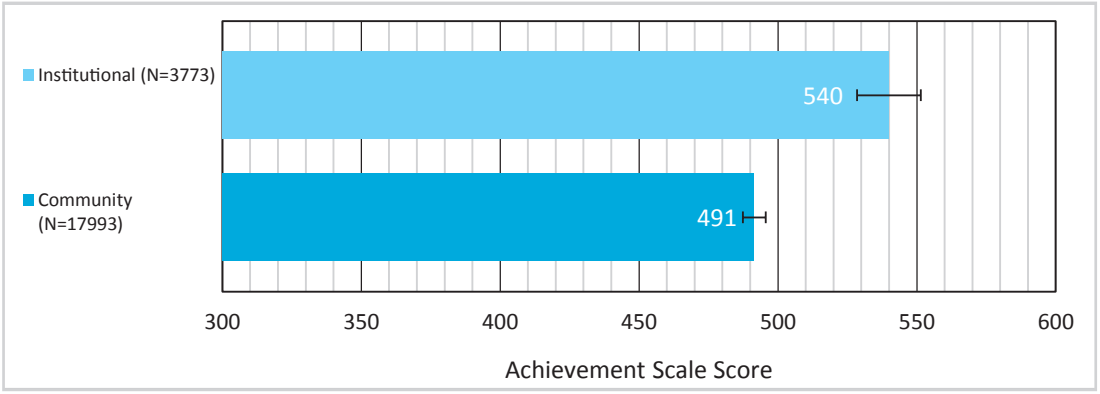


The data indicates that the achievement score of the students who use Nepali language at their home performed higher (506) compared to the score (489) of students who spoke other languages at their home. The difference between these two groups ranged 17 scale scores which were statistically significant at $p < 0.05$. The result indicates that home language is one of the influencing factors in the learning achievement of students in Science.

3.2.12 Achievement by type of schools

As the schools were selected from the PPS sampling method at random, out of 901 schools, 737 (81.8%) were community schools, and 164 (18.2%) institutional schools. The majority of the institutional schools were concentrated in the urban areas whereas community schools were dispersed all over the geographical locations. Comparative analysis of the community and institutional schools is presented in figure 47.

Figure 47 Achievement of students by type of schools in Science



As displayed in the figure 46, the achievement score of the students from institutional school was 540 whereas the score of the students from community school was 491. The data shows a wide gap between these two types of schools with a range of 49 scale scores. The difference in the achievement between these institutional and community schools remains statistically significant at<0.05. Data urges to initiate and implement the improvement plan for the community schools although many community schools are also performing as high as institutional schools; more than half number of community schools remain below than the national average schools.

3.2.13 Achievement by out-of-school activities

There were seven activities highlighted and requested to choose their amount of time consumed before or after school time. The main activities included playing with TV, internet, mobile computer; playing with friends, chatting; involvement in home chores; studying and completing homework; working for a wage; reading other books; helping brother/sister for the study. A total of 21,766 students participated in the test. The number of students (in percent) who responded in different time slots is given in the table 36.

Table 36 Percentage of students devoting their time in out-of-school activities

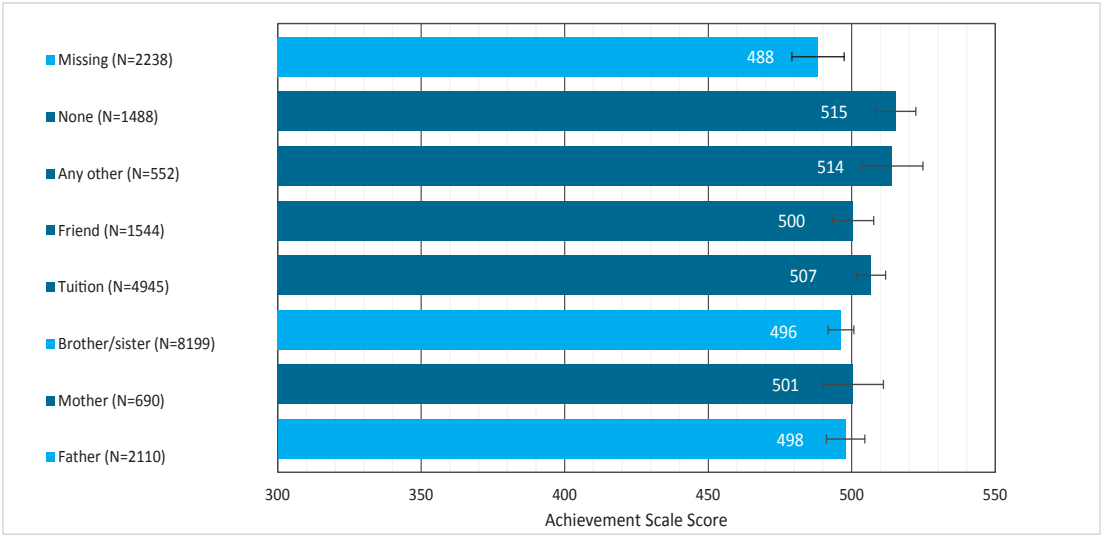
Out-of-School Activities	Percent of students in the sample according to amount of time spent					
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	>= 4 hour	Not responded
TV, internet, mobile, computer	9%	57%	15%	2%	1%	16%
Play with friends, chat	8%	55%	16%	2%	1%	17%
Involve in home chore	5%	28%	33%	13%	4%	17%
Study and do homework	3%	7%	19%	31%	23%	17%
Work for wage	28%	13%	5%	3%	4%	47%
Reading other books	7%	42%	22%	6%	2%	21%
Help brother/sister for study	8%	35%	28%	7%	2%	20%

The above table presents the percentage of achievement of students in Science -based on their time spent in out- of school activities. Fifty seven (57) % of students out of 22365 students spent less than one hour of their time on TV, internet, mobile, and computer; 55% spent less than one-hour playing and chatting with their friends. Similarly, 33% of them were involved in home chores for 1 to 2 hours. Studying and doing homework for about 2-3 hours covers some 31% of the students. Among them, 13% work less than one hour for wages and 42% get opportunities to read other books. Apart from these activities, 35% of the students even look after their brother/sister and support their study at home. The data on the table displays variations of activities students performed after school. Less than one-hour refreshment with friends, play with TV, internet, and mobile seems to be fruitful, however, for the purpose of study and homework, 2-3 hours used by students seems to be a rational act. Working for wages, however, was not supportive for the study.

3.2.14 Home support in study

The learning achievement of the students depends considerably on the support provided in their family. With this belief 21,766 students were inquired about the person supporting them most in their out-of-school activities. Students were assisted in learning Science by their father, mother, brother or sister, friends, and even by the tuition teacher. Figure 47 presents the responses along with their achievement.

Figure 48 Achievement scores according to support at home in Science



The bar diagram displays different personalities supporting students' learning out of school activities and their achievement in Science. Out of a total of 21,766 respondents, 9.6% of them were supported by their father and achieved 498 whereas only 3.17% got support from their mother and achieved 501. Similarly, 37, 6% of students were supported by their sister or brother, 22.7% by tuition teachers, and 7% benefited from their friends at home. These students achieved 501,496,507and 500 scores respectively. The data showed 2.5% students were supported by other means and 6.8% got no support at home however, they obtained 514 and 515 scores. The overall result shows that just the guidance of their brothers and sisters is not sufficient. There is no significant difference in the achievement in Science between the students who were supported by their relatives or tuition teachers as both groups' scores exceeded the national average.

3.2.15 Achievement of student by future aim

The future aim can be a great motivating force to excel in the life of students which can affect their achievement. Acknowledging this fact, students were asked about their aim in their future incorporating different types of professions. The professions inquired included employment in the private sector, farming, working abroad, businessman, doctor/engineer, civil servants and teachers, and all other professions were categorized into other headings. Figure 48 depicts the achievement of the students in accord with their aim in the future.

Figure 49 Achievement of students according to their future aim

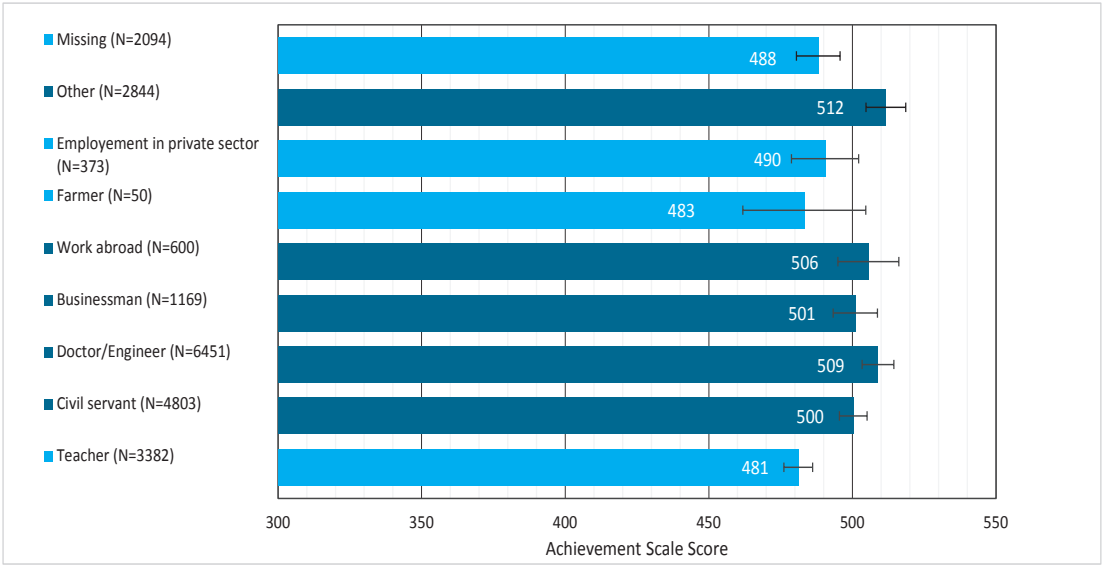


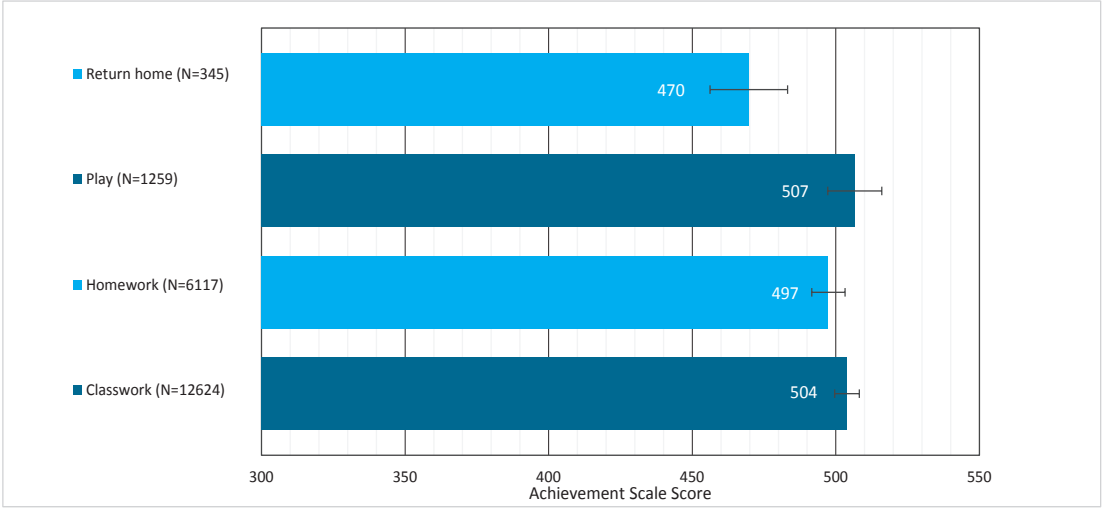
Figure 48 unveils the future aspirations of students and their impact on learning achievement in Science. The mean scores of the students whose aims in future are to be a civil servant (22%), doctor/engineer (29.6%), business person (5.3%), and to work abroad (2.7%) were 500,509,501 and 506 respectively and these scores were on or above the national average. Conversely, the achievement of the students who dreamt of being a teacher, farmer, or private business person, their achievement was 481,483 and 490 respectively and these scores were below the national average.

As the achievement of students aspiring to be civil servants, doctors/engineers, and working abroad were fairly above the national average it can be concluded that future goals affect also the achievement in Science.

3.2.16 Achievement by utilization of leisure time in the school

Students often get free time even in school hours. Leisure time allows students to devote their time to the activities of their interest relieving them from the constant pressure of study. They can utilize their time effectively. This leisure time could also be of utmost importance to plan their studies accordingly and achieve greater heights in their study. The students were asked the way they were utilizing their leisure time by providing them some of the options such as returning home, playing, doing home-works, and class-works. Figure 50 shows the achievement score of students involved in different activities during their leisure time in the school.

Figure 50 Achievement by the utilization of leisure time in school



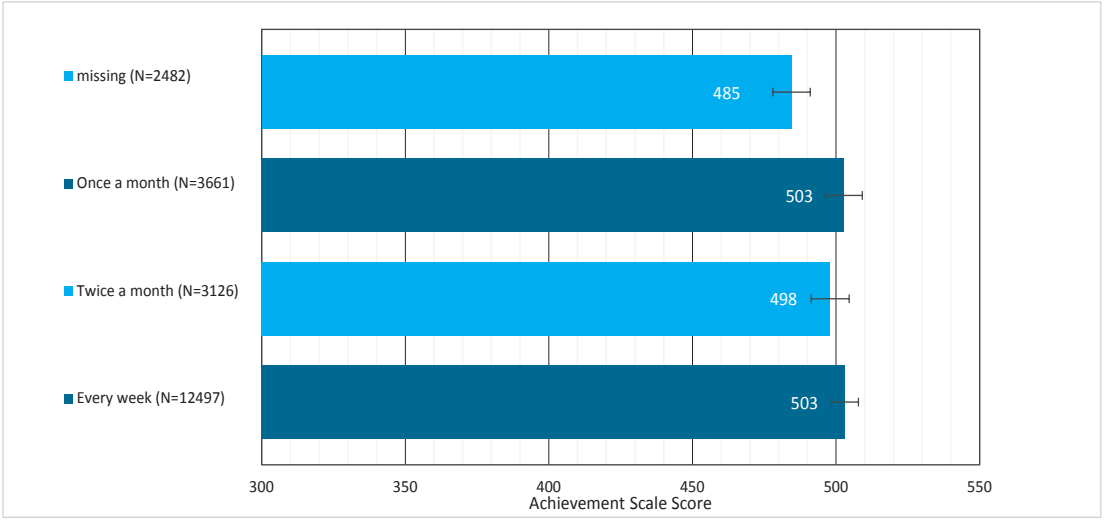
Regarding the use of free time in school, figure 50 displays that in total 20,345 students were inquired about their utilization of leisure time. Sixty two(62) % students used to do their classwork, 30% homework,1.7% only played, and 6.1%went home and their achievement scores retained as 504,497,507 and 470 respectively. The result shows that students engaged in classwork and games during leisure time scored slightly above the national average whereas students who were engaged in homework or return home achieved below the national average. In conclusion, students need physical activities or games and sports and they should be engaged in classroom activities as well.

3.2.17 Achievement by frequency of extra-curricular activities

The learning achievement of students depends on their physical and mental engagement in activities such as athletics, sports, voluntary work, photography, drama, music, etc. UNESCO emphasizes the involvement of students in various extra-curricular activities to develop social and soft skills that promote their wellbeing. In some countries, this is also referred to as co-curricular activities. Study shows short bursts of physical activity could improve students' engagement with learning in the classes immediately following physical activity; and regular physical activities could facilitate stable, long-term, enhanced student behavioral engagement with school (OECD, 2019) fostering social and emotional well beings (NCF, 2009). Thus an analysis of the frequency of happening of extra-curricular activities in the school and student's involvement was analyzed to compare to their educational achievement in

this section. Considering these facts, the students were asked how often their schools conducted extracurricular activities and engaged them. The answers are presented in figure 51 including their impact on achievement in Science.

Figure 51 Achievement by frequency of extra-curricular activities



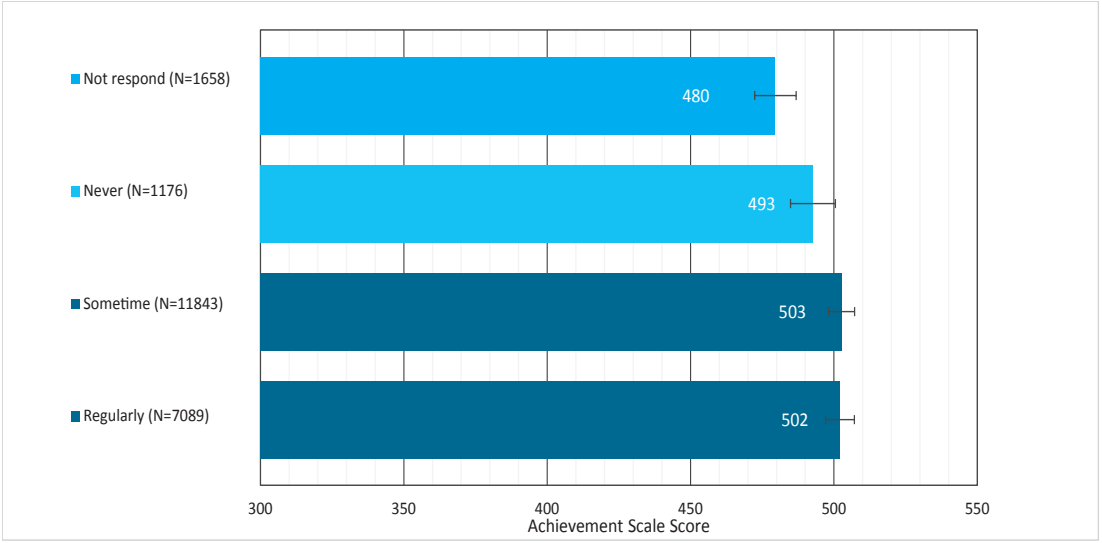
Extracurricular activities organized in schools were categorized into every week, twice a week, once a month as presented in the bar diagram. Figure 51 depicted that out of 21,766 students, 57.4% stated that extracurricular activities used to be held every week and 16.8 % informed that it used to be held once a month. Their achievement in both groups in Science was 503. Schools where extracurricular activities used to be held twice a month (14.3%) achieved 498 whereas schools where there was no frequency of extracurricular activities (11.4%) achieved 485. The bar diagram clearly shows that students participating in weekly or monthly extracurricular activities achieved slightly higher than students involved in extracurricular activities twice a month (498) whereas schools where no extracurricular activities were held achieved only 485. The overall result shows that organization of extracurricular activities is beneficial though the difference is not statistically significant in the achievement of Science.

3.2.18 Achievement by the frequency of taking part in extra-curricular activities

Students were asked to respond on the frequency of taking part in extra-curricular activities organised by the school. The questionnaire set to measure frequency of participation of students in extracurricular activities were categorized as regular,

sometimes and never. The detail picture has been mentioned in the bar diagram in figure 51.

Figure 52 Achievement of students by frequency of involvement in extracurricular activities



The dataset presented in figure 51 provides a clear picture of frequency of learners' participation in extracurricular activities in school.

3.2.19 Parents Education

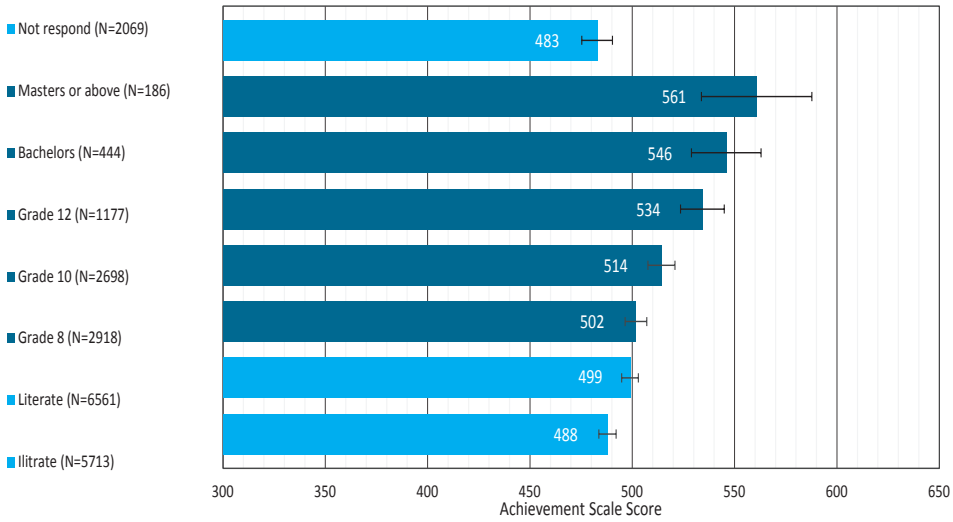
A child's education begins at home. Parents are their first teachers and they have a crucial role in shaping up their persona. Equilibrium of education at home and school shapes a student's actual learning. Parental motivation plays a pivotal role in ensuring success of students. In order to identify the impact of parents' education on students' learning achievement, they were asked (in the background questionnaire) to reveal their parents' education by choosing a response from multiple options (illiterate, literate, Grade 8, Grade 10, Grade 12, Bachelors and Masters or above). In the following text, the relation of performance of students and the education of parents is presented.

3.2.19a. Achievement by Mother's Education

A mother's educational background can have a profound impact on learning achievement of children. Therefore, participants were asked to mention the academic qualification of their mother that was included in the questionnaire. The qualification

of mother was categorized as illiterate, literate, grade 8, grade 10, grade 12 Bachelor, and Master. The achievement in Science based on mother's academic qualification is presented in figure 53.

Figure 53 Achievement by mother's education

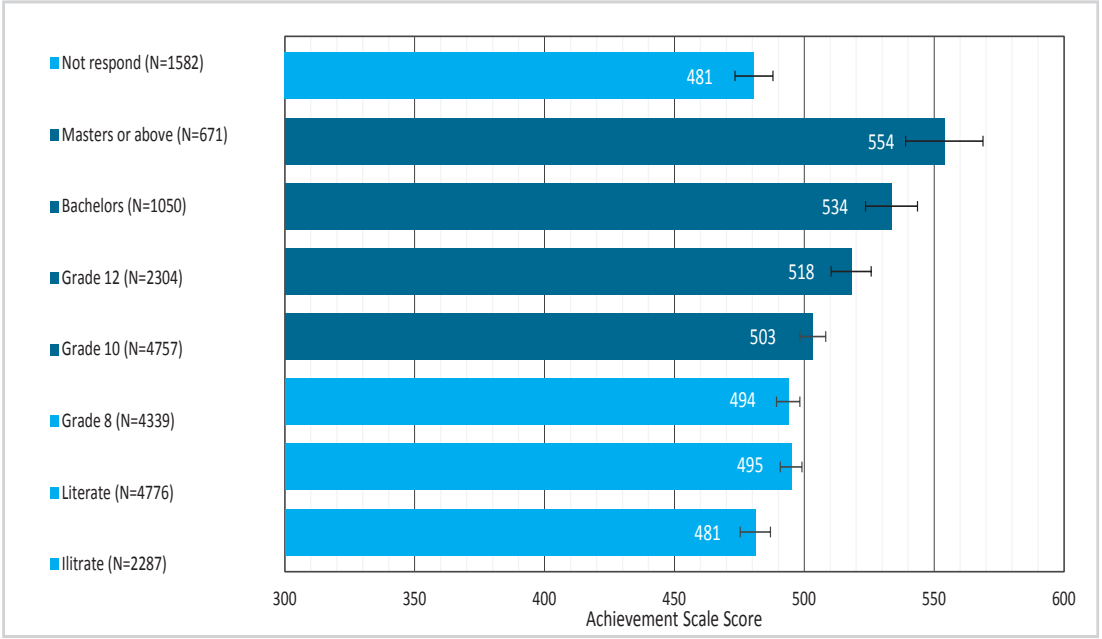


The bar diagrams in figure 53 reveals the mother's education level and its impact on children's achievement in Science. The data showed that a mother's education has a positive effect on Science achievement. Illiterate mother's children have the lowest achievement (488) whereas children of master's degree holder mothers have the highest achievement (561). Similarly, when the qualification of mother increases from Grade 8, Grade 10, Grade 12 to Bachelor's, the achievement increases to 502, 514, 534, and 561 respectively. Difference between highest and lowest achievement based on the mother's qualification was 73 scale score. The difference in achievement associated with mother's education was statistically significant at $p<0.05$. In conclusion, a mother's education has a positive impact on the achievement of students in Science.

3.2.19b. Achievement by Father's Education

The learning achievement of students is also related to educational background of the father. The information associated with the qualification of father was also categorized as illiterate, literate, grade 8, grade 10, grade 12, Bachelor and Master Degree holder. Learning achievement of students is presented in figure 54.

Figure 54 Achievement by Father's Education in Science



The dataset in the diagram shows that father's education has a positive effect on learning achievement in Science. Illiterate father's children had the lowest score (481) whereas children of Master's degree holder fathers had the highest achievement (554). The educational qualification of father has a direct relation with the achievement of children. When the qualification increases from grade 8, grade 10, grade12, to Bachelor's, achievement of children also increases from 494,503,518 and 534 respectively. In conclusion, father's educational background has a direct relation with a positive impact on learning achievement of children in Science.

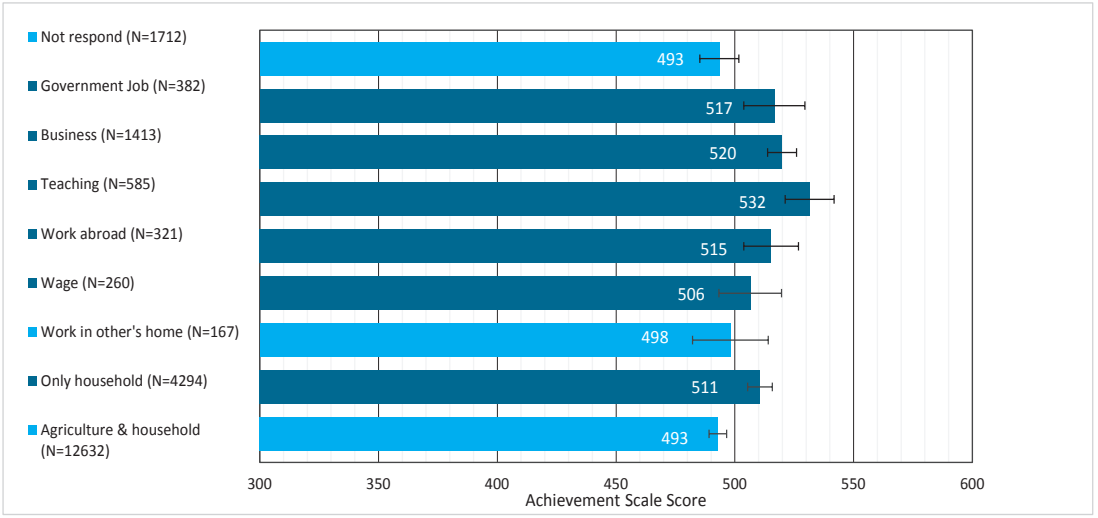
3.2.20 Parent's Occupation

Professional background and socioeconomic status of a family has a sturdy association with educational achievement of children. To investigate the influence of parents' occupation on students' learning achievement, the students were requested to report their parent's occupation providing them diverse alternatives (government job, business, teaching, working abroad, wage earning , work in other's home, only household, agriculture and household). The achievement scores are analysed taking into consideration parental (mother's and father's) employment separately.

3.2.20a Achievement by mother's occupation

Occupational engagements of students' mothers as said above were included in the questionnaires. Responses to the question" What is your mother's occupation?" are presented in figure 55.

Figure 55 Achievement by mother's occupation



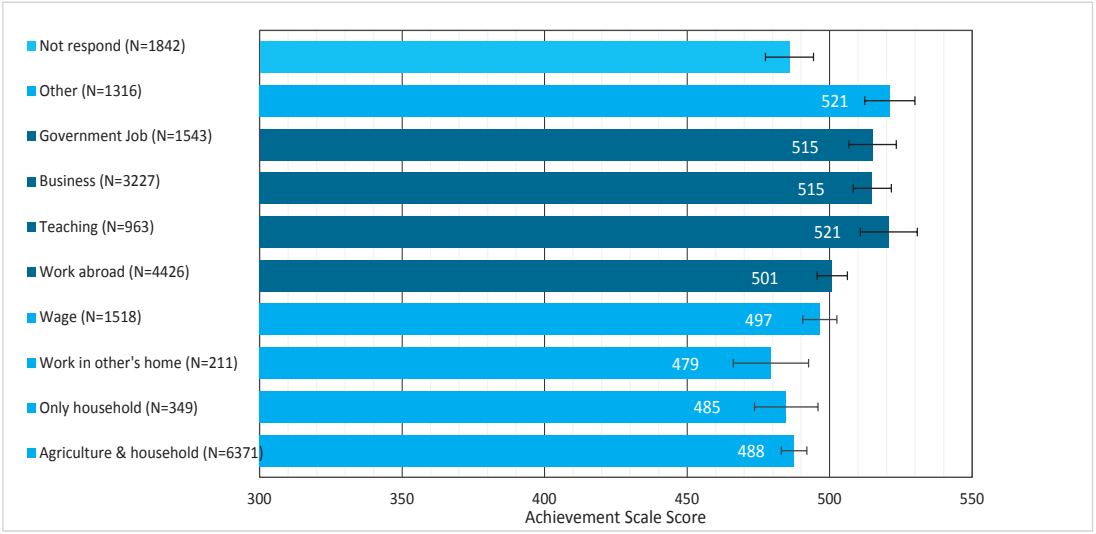
Professional categories exhibited in figure 55 clearly shows that occupational involvement of mother has a direct impact on students' achievement. Children whose mothers were engaged in agriculture and household, only households and working in other's homes scored 493,511 and 498 respectively. Conversely, the children whose mothers were wage workers (506), working abroad (515), teaching (532), involved in business(520), and government job holders (517) achieved remarkably higher than children from household workers. The difference between highest-achieving children (532) of mothers in teaching occupation and the lowest score (493) of agriculture and household working mother's children was 39 scale scores. There is a significant difference between high achieving and low achieving children at $p<.0.05$ based on their mother's professional background. Overall results show that there is a positive relation between mother's occupation and children's learning achievement as regular income makes the family financially sound.

3.2.20b. Achievement by father's occupation

Father is taken as the breadwinner of family in Nepalese society who plays a dominant role to maintain the financial status which is related with providing better

options of educational opportunity. The professional background of the father has a direct impact on the learning achievement of students. Occupational variations of the father were grouped into agriculture & household, only household, wage, work abroad, teaching, business, and government job. The responses of the students are presented in figure 56.

Figure 56 Achievement by father's occupation



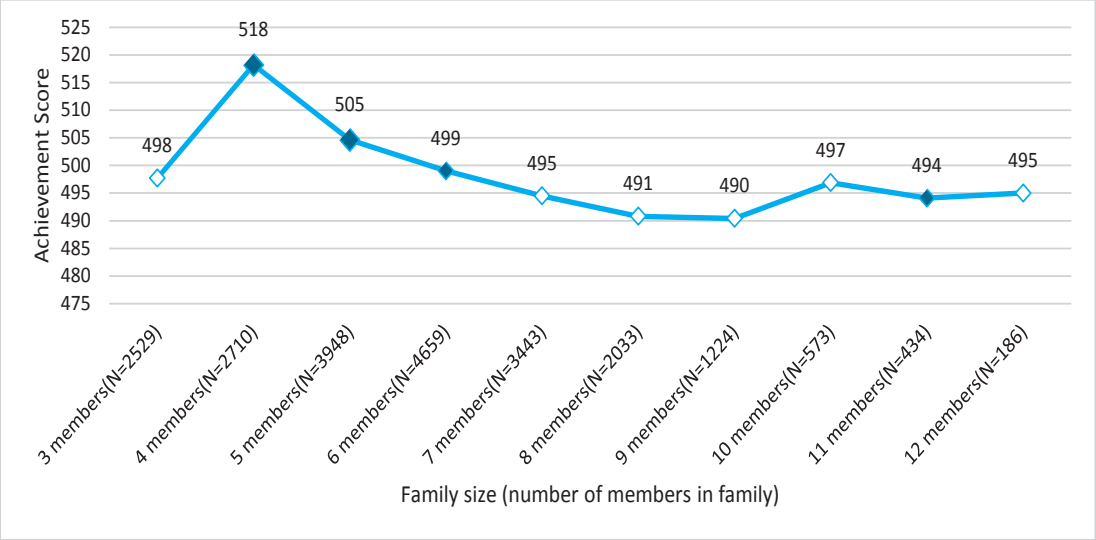
Quantitative information revealed that the learning achievement of children was lower than the national average(500) whose father used to work in agriculture & household (488), only household (485), work in other's home(479) and even in wage (497). The students of the remaining categories of occupation have achieved higher than the national average. Both students of teaching and other occupational categories have scored 521 which is the highest of all categories distinctly above the national average. Students whose fathers hold the job of work abroad (501), business (515), government job (515) achieved comparatively higher scores above the national average. Overall, the result shows that occupations of a father have a direct relation to the learning achievement of the students, and professions of more stable and income-generating nature have a positive effect.

3.2.21 Achievement by family size

Information from the literature shows that children from larger families are found to perform worse than children from smaller families (Lacovou, 2001). Parental attention by parents decreases as the size of family expands and later-born children

perform poorer than their earlier born siblings. So, the students were asked to mention the number of members in their families and a graph was plotted demonstrating the family size ranging from 3 members to 12 or more. Figure 57 points to the achievement of students according to the family size.

Figure 57 Achievement by Family size

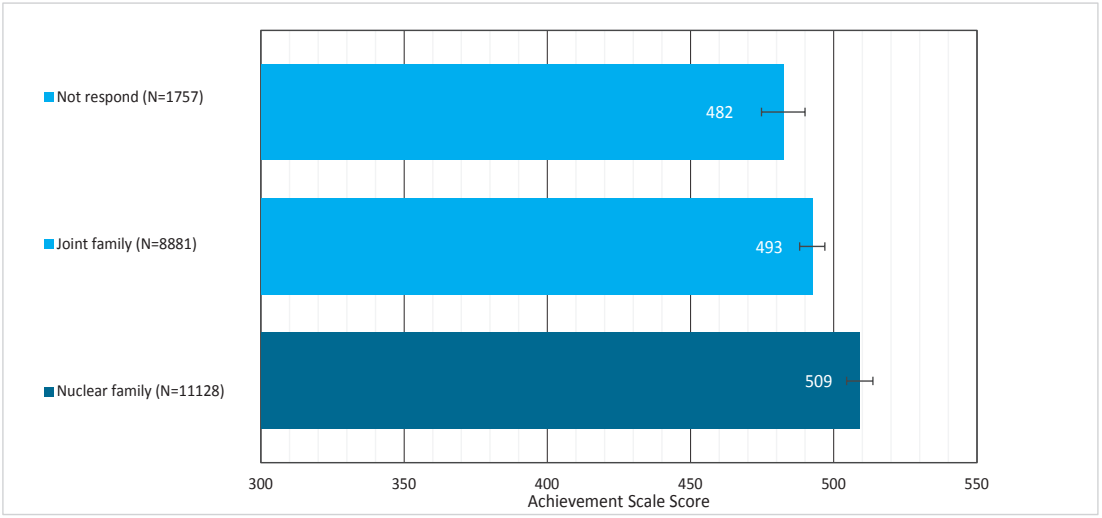


Graphic figure 57 reveals the effect of family size on student's learning achievement. Student achievement was highest (518) when the size of the family included 4 members. When the members in the family increased, the learning achievement of the students decreased as 5 (505), 6(499), 7 495), 8 (491) and, 9 (490) respectively. This trend continues up to 12 members. The graphic chart shows that the ideal number of family size is 4 to 5 members for better learning achievement in Science. When the number of families increases, the trend of learning achievement has a decreasing trend.

3.2.22 Achievement by type of family

The learning environment depends on the family type as well. Considering this fact, the type of family was asked to fill up the questionnaire to investigate the effect of the type of family on learning achievement. The details of their responses are presented in figure 58.

Figure 58 Achievement by type of family



Family types displayed in figure 58 indicate their impact on learning achievement of students in Science. As shown in the bar diagram, students in the nucleus family achieved 509 whereas students living in a joint family achieved 493. The gap between these two mean scores was 16 scale scores. The difference between these two mean scores is also statistically significant at 0.05. The result shows that nucleus family has a positive effect on the learning achievement of students in Science.

3.2.23 Availability of home possession by student-family for their use

Research shows that various supportive facilities for the study play a vital role in learning achievement. In this study, respondents were asked if their family possesses the facilities of a separate study room, study table, computer, child magazine, reference book, internet, and dictionary available for peaceful study. Table 37 presents the responses of students.

Table 37 Availability of home possessions by student- family

Home possession	Response (%)		
	I don't have	I have	Not respond
Table for study	43%	49%	8%
Separate study room	35%	57%	8%
Peace space to study	39%	53%	8%
Computer for school-work	78%	14%	9%

Home possession	Response (%)		
	I don't have	I have	Not respond
Children magazine, story/poetry and pictures	79%	12%	9%
Reference book for school work support	63%	29%	8%
Internet	73%	18%	9%
Dictionary	69%	21%	10%

Table 37explores the availability of different commodities as well as an appropriate learning environment in the home which may be an indicator of the achievement of the students. The Table shows that 79%, 78%, and 73% of students did not possess children's magazines, story/poetry, and pictures, computers for school work and internet respectively. Meanwhile, 57% and 53% of students had a separate study room and a peaceful space to study respectively. The number of home possessions was summed to get the total home possessions (Max 8). A correlation between total home possessions by student scores was calculated by using a replicate module of SPSS to calculate the weighted value of correlation. The weighted correlation r = 0.33, shows a high positive correlation with learning achievement. The above data shows that a significant number of students did not possess basic requirements for enhancing their performance such as availability of child magazines, story/ poetry, and pictures, computers for school work, and the internet.

3.2.24 Availability of home accessories

Materials' conditions determine the consciousness of learners in this age of consumerism. Television, computer, motorcycle, car, and permanent house building are supposed to be proxy indicators of family prosperity. Learning achievement can also be affected by these materials' possessions in the modern age. Students' possessing those home accessories in the data is presented in table 38.

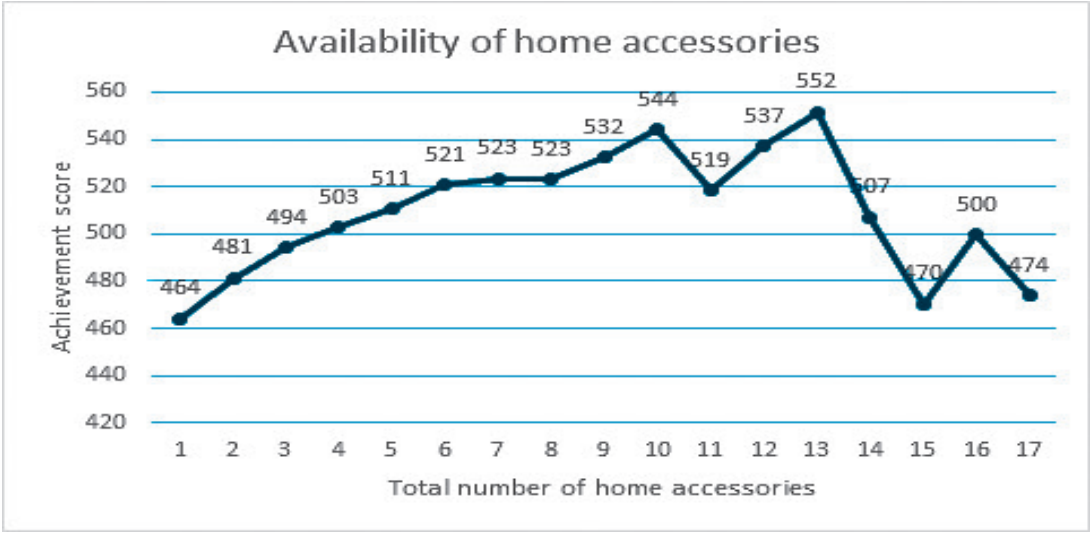
Table 38 Availability of home accessories

Home Accessories	Number of accessories possessed				
	none	one	two	three	not respond
Television	29%	52%	7%	2%	11%
Computer	58%	20%	2%	1%	19%
Motor-cycle	53%	23%	4%	2%	18%

Home Accessories	Number of accessories possessed				
	none	one	two	three	not respond
Car	73%	3%	0%	0%	23%
Permanent house	35%	43%	5%	2%	15%

Table 39 depicts the picture of home accessories available to students. As far as the possession of equipment for sources of information is concerned, 52% students have a television; however, 58% of the students lack a computer at home. Similarly, 53% students were found lacking motorcycles, and 73 % did not possess a car. Though 43% of the students live in their own permanent house, 35% of them were still deprived of their own house. Despite the importance of these home accessories in modern times, majority of students are still far from possessing them. These home accessories can have an effect on learning achievement of students as displayed in figure 59.

Figure 59 Achievement by home accessories



The graph depicts an increase in the trend of achievement among the students when the number of accessories is increased. Students possessing 1 to 3 accessories have scored 464 to 494 scores which are below the national average whereas students having 9-13 home accessories achieved scores ranging from 532 to 552. The correlation between the number of home accessories and the achievement score is found to have positive correlation. Thus, the number of accessories has a positive impact on the achievement of students.

3.2.25 Personal mobile phone of school student

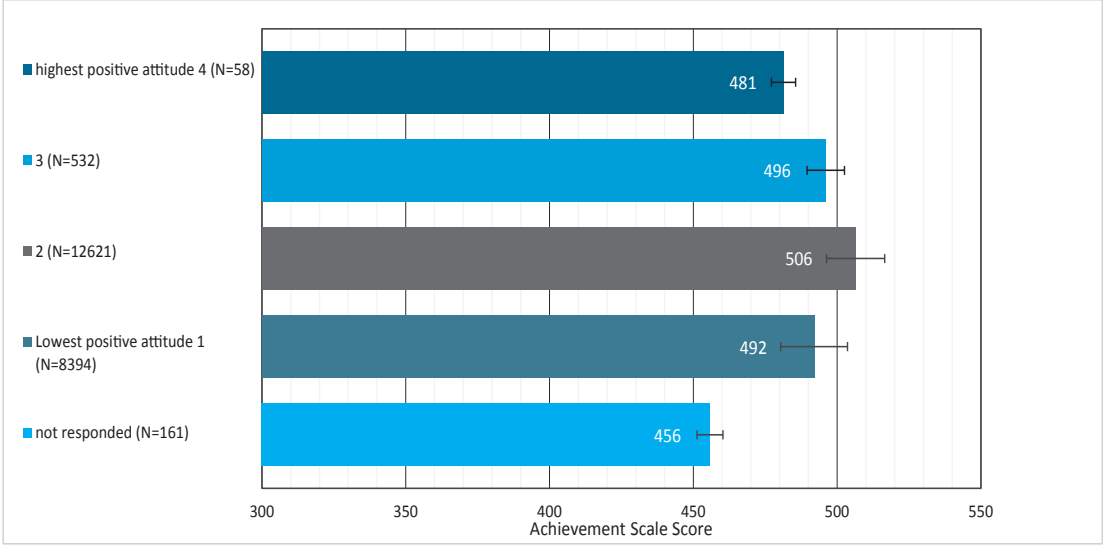
People believe that personal mobile phones with school students ruin their studies. To investigate this public belief, a question was asked to the students if they have a personal mobile phone and the way they use it. The data shows that 36.8% of students have their own mobile phone. Among them, 48.3% boys and 26.5% girls have their mobile phones.

3.2.26 Student attitude towards School, Teacher and Science

3.2.26a. Attitude of students towards their teachers

Positive attitude towards anyone can affect a person's life favourably in all areas. Students with a positive outlook can view life challenges and the situations they go through with confidence and are confident in dealing with them. Thus, students were asked to rate on given statements about their Science teacher. The responses in seven questions were coded 1 for lowest positive attitude and 4 as highest positive attitude. The sum of those seven responses was recorded into 1-8 = 1, 9-16=2, 17-24=3 and 24-32=4. Then the achievement against those responses was compared. The result is presented in figure 60.

Figure 60 Attitude towards school



There was a positive and significant relationship in students' attitude towards school. It was observed that principals, supervisors, teachers, parents and educational practitioners should be conscious of students' attitude towards school (Dagnew,

A. 2017). Students were asked to rate on given statements about their school. The responses in four questions were coded 1 for lowest positive attitude and 4 as highest positive attitude. The sum of those seven responses were recorded into 1-4 = 1, 5-8=2, 8-12=3 and 13-16=4. Then the achievement against those responses was compared. The result is presented in the table 39.

Table 39 Attitude of students towards Science teacher

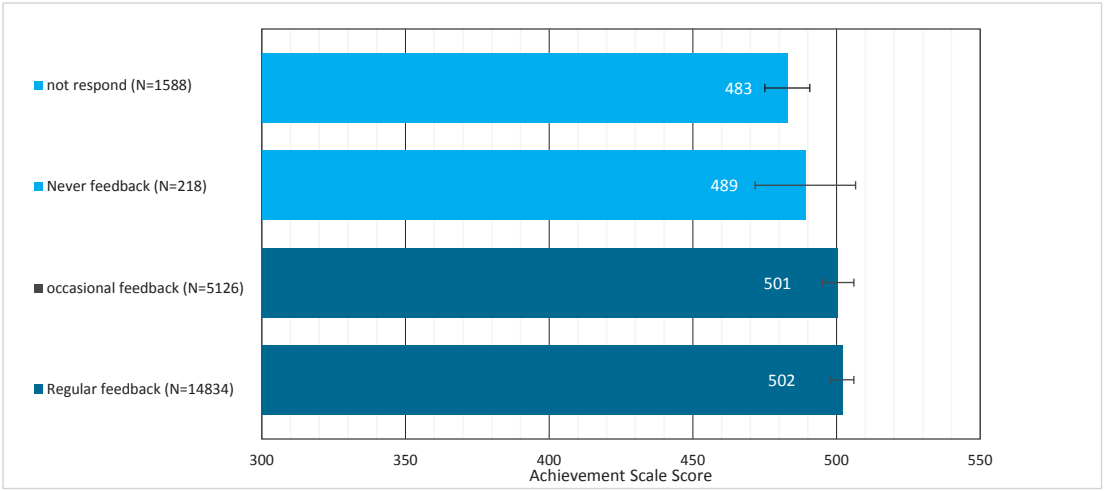
Categories of attitude towards School	Mean score	SE	Population	n_stu	n_sch	Confidence Interval	
						Upper	Lower
not responded	456	3.767	3099	161	126	471	441
Lowest positive attitude -1	492	1.233	162754	8394	884	497	487
Positive attitude - 2	506	1.139	244693	12621	896	511	502
Positive attitude - 3	496	3.102	10360	532	337	508	484
Highest positive attitude - 4	481	5.898	1106	58	54	504	458

The correlation between student's attitude categories and achievement (WLE) is near to zero, indicating no association of student attitude towards teacher with the learning achievement. Research reveal that attitude of teachers positively associates with student learning.

3.2.27 Achievement by feedback on homework in Science

Homework and teacher's feedback on homework has relation with the achievement of students. Research depicts that regularity of teachers' responses (check) or feedback on the students' classwork, homework, project work, and tests have a creditable role in improving students' learning performance (Dahal, 2019, p.76). Thus, a question was requested to respond: how often does your teacher give feedback on homework?. The response is plotted with the achievement score as shown in figure 61.

Figure 61 Achievement by feedback on homework in Science



The data presented in figure 61 reveals the positive relationship of regular checking and feedback of homework to students learning. The mean score of the students who received feedback on their homework was slightly higher 502 than the mean score of students who received occasional feedback on their homework (501). Contrary to this, the mean score of the students who never received feedback on their homework was 483. The difference between the highest mean score and the lowest mean score remained 19 scale score which is statistically significant at $p< 0.05$. In conclusion, regular feedback on homework has a positive impact on achievement in Science.

3.2.28 Regularity of the teacher in Science classroom

The regularity of the teacher in the classroom is also considered as an important factor for increasing achievement level of the students. This type of regularity can affect the achievement level of the student's directly and basically in difficult subject areas as Maths and Science. In this study, students rated the regularity of the teachers which is presented in table 40.

Table 40 Regularity of teacher's in Science classroom

Response type	How is the regularity of a science teacher?			
	No of students	Percent	Valid percent	Cumulative percent
Spends all time in the class	18712	86	86	86
Enters late and moves earlier	1028	4.7	4.7	90.7

Response type	How is the regularity of a science teacher?			
	No of students	Percent	Valid percent	Cumulative percent
Mostly does not appear in the class	681	3.1	3.1	93.8
Not responding	1345	6.2	6.2	100
Total	21766	100	100	

3.2.29 Comparison of achievement by teacher's regularity in Science classroom

Teacher's regularity in class also affects the learning achievement of students. It becomes easy to complete the prescribed course when the teacher becomes regular which ultimately affects student achievement. In this study, students were asked to mention the regularity of their teachers in Science classroom. Teacher's regularity was categorized as teacher spending full time in the class, teacher entering late and moving early out of the class, and teacher mostly not appearing in the class. The picture of students 'responses is presented in figure 62.

Figure 62 Comparison of achievement by teacher's regularity in Science classroom

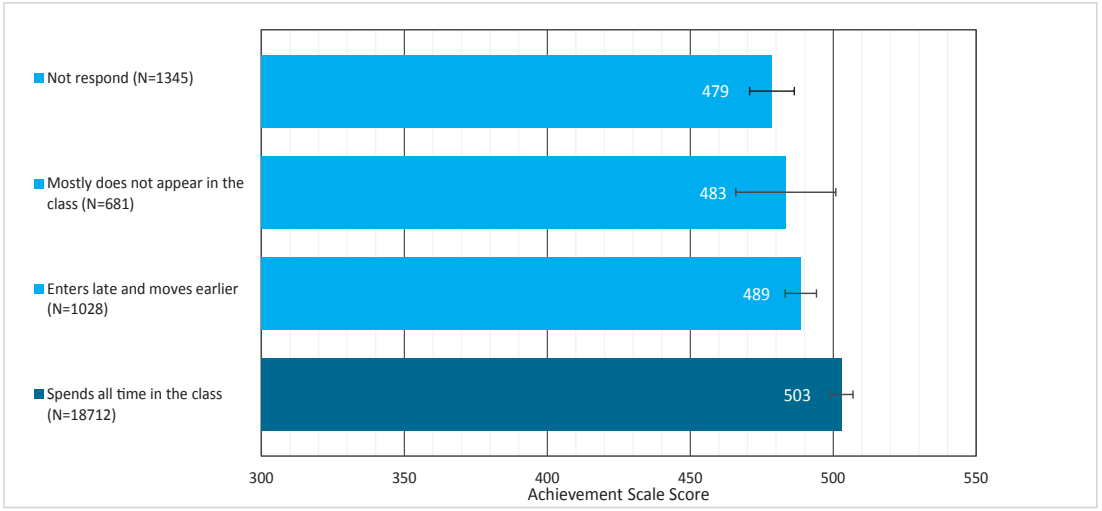


Figure 62 exhibits the effects of teacher's regularity and punctuality in Science class as responded by the students. The mean score of students who reported that their teachers spend all-time in the class was 503. Contrary to this, the students who reported that their teachers entered late and moved early and mostly did not appear in the classroom scored 489 and 483 respectively which were below the national

average. The variation ranged 20 scale score. Though the variation seems small, the result clearly points to the positive relation of teacher's regularity and punctuality with students' achievement in the classroom.

3.2.30 Use of textbook, old questions, guess paper and guides

Availability of support materials is necessary to prepare for the examination in relation to learning achievement of students. Students were asked about the types of resources they used during their study. These included Science textbooks, an old set of questions, guess papers, and guides. Table 41 presents the number and percentage of students utilizing different resources.

Table 41 Use of textbook, old questions, guess paper and guides in Science

Type of resources	Number of students (N)	N Percent
1. Math textbook	19953	91.7
2. Old set of questions	14355	66%
3. Guess paper	6920	31.8
4. Guides	5583	25.7

Table 41 discloses that a maximum 91.7% students used Science textbooks as their resource and only 25.7% used guides as their source. Meanwhile 66% of students used an old set of question papers as a significant resource and 31.8% used guess paper as their learning resource. This gives a clear picture that textbooks were the main source of their study despite the use of an old set of questions, guess paper, and guides.

3.2.31 Student's attitude on the utility of Science

Positive attitude on utilizing Science in everyday life helps students to boost their confidence in Science. It directly impacts on their learning achievement. Thus, students were given four choices to choose which were rated on a scale ranging from strongly agree, somewhat agree, somewhat disagree, and strongly disagree and their percentage is shown in table 42.

Table 42 Student's attitude on the utility of Science

Description	Number of students in percent			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. Science can help me to do household works	53.9	29.5	3.9	3.2
2. Learning Science enables me learn other subjects better	57.2	27.8	3.4	1.7
3. I like to learn Science	77.9	11.9	1.3	0.7
4. I have to do good in Science to get job	70.8	15.7	2.2	1.9

Table 42 explicitly provides information on student's attitudes toward Science subjects. As presented in table, 53.9% students strongly agreed that Science can help them to do household work. Similarly, 57.2 % strongly believed that Science helped them to learn other subjects as well. Out of 21766 respondents, 77.9% showed their willingness to learn Science whereas 70.8% hoped to get a job after learning it. Overall, 90% or above students agreed Science as a useful subject for household works. It helps to learn other subjects and even supports to getting a job; this means they have positive attitudes toward Science subjects.

3.2.32 Like and dislike of Science

Based on the utility of any subject, students can like or dislike it. In order to investigate the students' likes and dislikes in Science, questionnaire was prepared to rate their responses in a Likert scale of strongly agree, agree, disagree to strongly disagree. Five statements were determined viz: Generally, I do like Science better, I want to learn Science more, I enjoy learning Science, I can learn fast, and I feel learning Science is difficult. In the query of "How much do you agree or disagree with statements about Science?" credible responses were found as presented in table 43.

Table 43 Like and dislike of science subject

Description	Number of students in percentage form			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. Generally, I do Science better	77.2	12.8	1.3	0.6
2. I want to learn Science more	54.2	34.1	3.3	1.0

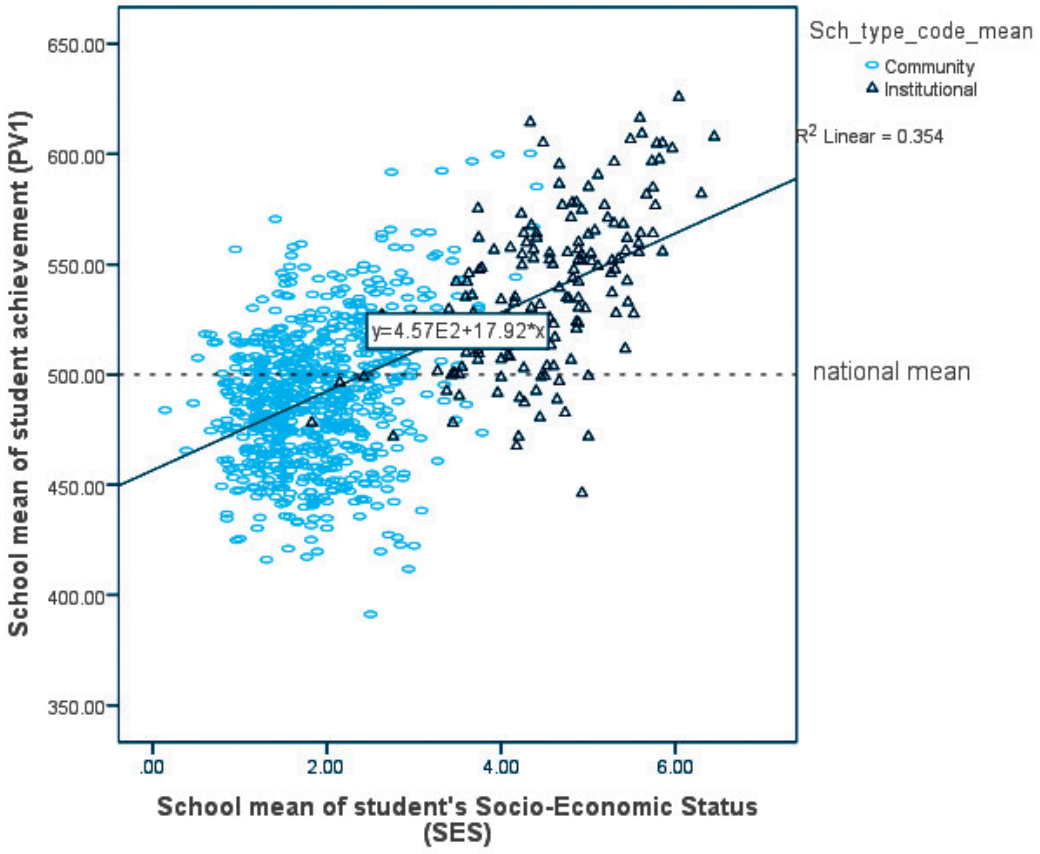
Description	Number of students in percentage form			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
3. I enjoy learning Science	72.1	16.5	2.0	0.7
4. I can learn Science fast	40.6	41.1	6.6	2.0
5. I feel learning Science difficult	18.3	36.3	14.7	20.3

Table 43 shows that 77.2% students generally had confidence that they can do better in Science and 54.2% exhibited their intention to learn Science. So far Science subject is concerned, 72.1% students enjoyed learning Science and 81.7%.6% had confidence that they can learn Science fast. However, 54.6% of the students agreed that they felt learning Science difficult. In brief, students prefer to learn Science even though many of them felt it as a difficult subject.

3.2.33 Achievement by Socio-economic Status (SES) in Science

Socio-economic factors are another influential factors affecting learning achievement of students. In this study, socio-economic variables are parents' education and occupation, home possessions, home accessories, and participation in community and institutional schools. Parents education - mother's grade 10 pass or above, father's grade 10 pass or above, home possessions - reading room, peaceful place to study, computer, children books, reference books, internet facility and dictionary were the other contributing factors . Out of these eight possessions, at least four possessions as home accessories are television, computer, motorcycle, car, permanent house. Those accessories could be of maximum 4 categories, making the maximum sum 20. Among 20 possibilities, at least 7 accessories were taken as higher SES. In parents' occupation, when parents are not involved only in agriculture or household, they are taken as higher SES. From those variables, seven dummy variables were prepared. Thus, the school mean of those seven dummy variables was taken as total SES. A scatter plot of socio-economic status against students' transformed latent ability (WLE) was plotted. The scatterplot is presented in figure 63.

Figure 63 Relation between SES and schools' mean score in Science



The scattered plot displayed in figure 64 presents the influence of socioeconomic status on the mean score of the students belonging to community and institutional schools. SES effects were seen 35% in the learning achievement in grade 10 Science. The gravity of community schools shown in the figure concentrated in low to medium levels indicates low SES whereas the concentration of private schools pointed in the figure, as shown in high to medium level, presents the high SES of private schools. These effects may be seen visible due to the low financial condition of parents of community schools. The provision of resources like books, reading peaceful space and room, computers, the internet, and TV was possible for parents of private schools whereas it may not be possible for parents of community schools.

The plot clearly shows that most of the private schools have high SES students compared to community schools indicating a need of students from LOW-SES families to be provided educational support to minimize the adverse SES effect.

Chapter 3.3
Nepali

3.3.1 Introduction

In this chapter, the results of the responses of 22,553 students who participated in NASA 2019 in Nepali subject from 75 districts and 1800 schools are analysed by using conquest 4.x. The results are presented in the form of proficiency levels, their description and comparison. Population estimates presented in this chapter are based on the five plausible values drawn from WLE. The comparisons are made on the basis of groups formed from background information variables such as students' family background, socio-economic status, ethnicity, gender, home language, school types, home environment, province etc.

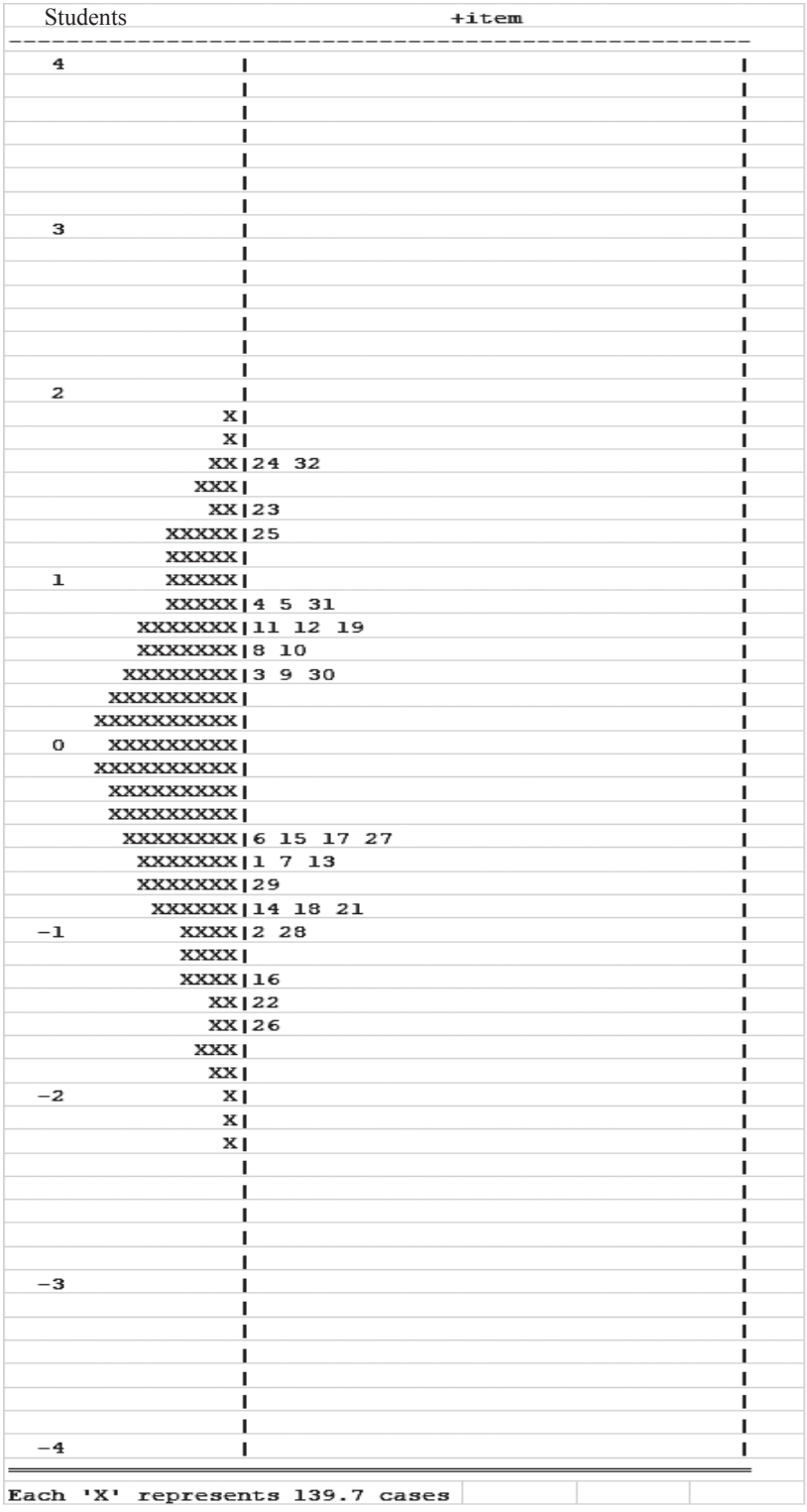
The students' achievement scores in all basic results were compared with the national mean score of 500 and 50 standard deviation with either standard error or at confidence interval. The test scores were first drawn from the sample students and analysed considering the sample weight. Population parameters were estimated at 95% confidence level in the whole population of grade 10.

3.3.2 Wright-map of Student Ability and Item Difficulty in Nepali

The wright-map is organized into two vertical histograms in which the candidates are shown on the left side and items on the right side. Distributions of measured ability of the candidates are presented in the left from most able at the top and least able at the bottom going down gradually. The items of the right-side map are distributed from the most difficult at the top and the least difficult at the bottom as shown in the figure 65.

In figure 65, to the left side, an 'X' represents 139 students; their latent ability is given in the logit scale ranging from -4 or less to +4 or more. The distribution of students against the items asked (item numbers are shown to the right side) reveals that most of the items were difficult for the students. Although items were pre-tested and based on the grade 10 curriculum and students distribution was almost normal, test was lacking medium difficult items. Items were either difficult or easy. For the next round, items difficulty should be improved more.

Figure 64 Wright- map showing persons and items in the same table



3.3.3 Plausible value - Standard Error

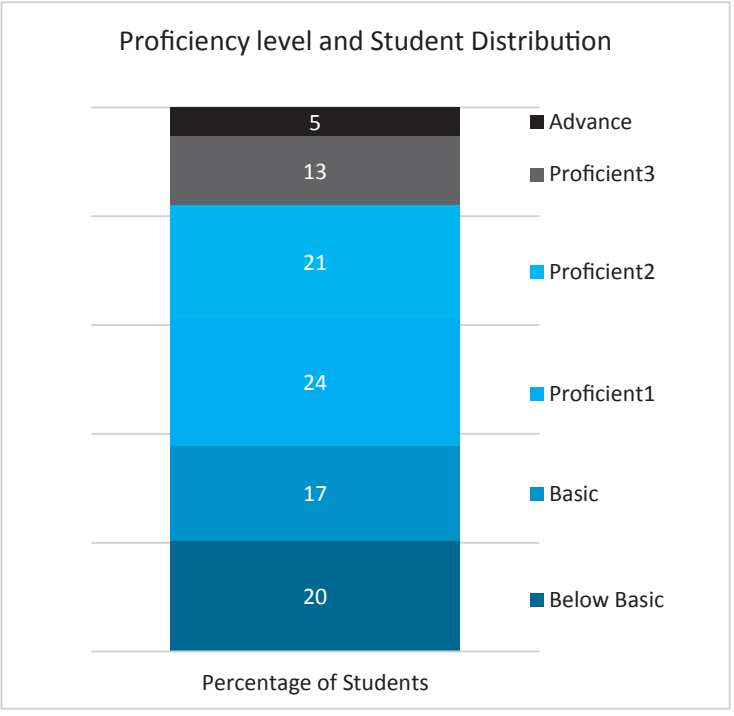
Table 44 Mean and Standard Error of five plausible variables in Nepali

SN	Plausible value	Mean	SE of plausible value	Sample Students	Population
1	MSSPV1	500.12	0.33467	22553	433423
2	MSSPV2	499.99	0.33296	22553	433423
3	MSSPV3	499.87	0.33233	22553	433423
4	MSSPV4	499.94	0.33214	22553	433423
5	MSSPV5	500.08	0.33261	22553	433423

3.3.4 Distribution of Students by Proficiency Level

Assessment framework for NASA 2019 had set students' proficiency standards into six different levels. Thus the figure presented below shows the overall distribution of sample students into six proficiency levels which are Below Basic, Basic, Proficient 1, Proficient 2, Advanced, and Advanced 2. The percentage of students including the six levels is shown in figure 3.3.2.

Figure 65 Students' percentage by proficiency level in Nepali



"Below basic level" indicates students fall into this category of lowest ability; and they are facing difficulty in their study. On the other hand, "Advanced level 2" indicates the highest level of proficiency that can even cross the grade level in Nepali.

As the figure demonstrates, 20 percent of the sample students are at Below Basic level, and 17 percent are at Basic level; 24 percent are found in Proficient 1 level; similarly, 21 percent are in Proficient 2 level. In the same way, 13 percent are in Advanced level while the remaining 5 percent are in Advanced level 2.

The data reveals that 20% of the students are of lowest ability in Nepali. And, combining the Below basic and Basic levels of proficiency, 37 percent students have poor level competence in Nepali while the others have some acceptable level of proficiency. A small number of students (5%) have the highest level of proficiency and these students can even cross the grade level in Nepali.

3.3.5 Minimum Level of Achievement

NASA assessment 2019 had set six different proficiency levels of students. Table 46 presented below reveals the overall distribution of sample students into six proficiency levels which are level 1(Below Basic), Level 2 (Basic), Level 3 (Proficient 1), Level 4 (Proficient 2), Level 5 (Proficient 3), and Level 6 (Advanced). The percentage of students by the six levels is shown below.

Table 45 A summary of minimum proficiency level in all six levels

Proficiency Level	Score
Level 6 (Advanced)	555 or above
Level 5 (Proficient 3)	528-555
Level 4 (Proficient 2)	502-528
Level 3 (Proficient 1)	475-502
Level 2 (Basic)	449-475
Level 1 (Below basic)	449 and below

In the table 46, a summary of proficiency levels is presented in which the achievement scores 449 and below are categorized under level 1 (below basic). If the students' achievement scores are in between 450 to 474 , they are under level 2 (basic) and scores between 475 to 502 are in level 3 (proficient 1). Likewise, scores from 503 to 527 are in level 4 (proficient 2), score 528 to 554 are in level 5 (proficient 3) and 555 and above achievement scores are kept under level 6 (advanced). The students' achievements are compared under the sub headings on the basis of these classifications

assuming the national mean achievement 500.

Table 46 Proficiency level and students' typical capacity

Proficiency Level	Score	What students can typically do
Level 6 (Advanced)	555 above	अनुच्छेदमा व्यक्त भाव, सन्दर्भ र परिवेशको पूर्ण बोध गर्न, अनुच्छेदको मुख्य सार बुझेर सारांश लेख्न, व्याकरणिक कोटिका आधारमा पदसङ्गति मिलेका पदावली र वाक्य प्रयोग गरेर निर्देशित लेखन गर्न, आत्मपरक र वस्तुपरक शैलीका निबन्ध रचना गर्न सक्ने छन् ।
Level 5 (Proficient 3)	528-555	अनुच्छेदमा व्यक्त भाव, सन्दर्भ र परिवेशको सामान्य बो ध गर्न, अनुच्छेदका मुख्य सूचना टिपोट गर्न, सूचनाहरूलाई तुलना गर्न, पाठको मुख्य सार वा सन्देश पत्ता लगाउन, वस्तुपरक शैलीका निबन्ध रचना गर्न, आत्मपरक अनुच्छेद रचना गर्न, संवाद र व्यावहारिक पत्र तयार पार्न, कर्ता र क्रियाको सङ्गति मिलेका वाक्य लेख्न सक्ने छन् ।
Level 4 (Proficient 2)	502-528	अनुच्छेदबाट तथ्य, सूचना, कारण पत्ता लगाउन, पाठको मूल आशय पहिचान गर्न, पाठलाई आंशिक बोध (के, किन, कसरी) गर्न, अनुच्छेदका मुख्य सूचना टिपोट गर्न, बुँदा वा सूचनाका आधारमा विषयवस्तु वर्णन गर्न, पदसङ्गति मिले नमिलेको पत्ता लगाउन, उपयुक्त निर्देशित लेखन गर्न सक्ने छन् ।
Level 3 (Proficient 1)	475-502	अनुच्छेदबाट सरल र सोझो अर्थ लाग्ने साधारण तथ्य तथा सूचनाहरूको जानकारी लिन, बोधात्मक प्रश्नोत्तर (के, किन) को उत्तर खोजी गर्न, वस्तुपरक शैलीका सामान्य अनुच्छेद ले ख्न, दिइएका बुँदालाई पूर्ण वाक्य बनाउन, सामान्य स्तरको निर्देशित रचना गर्न, वचन, आदर र लिङ्ग सङ्गति मिले नमिलेको पत्ता लगाई वाक्य पुनर्लेखन गर्न सक्ने छन् ।
Level 2 (Basic)	449-475	अनुच्छेदका सरल र सोझो अर्थ लाग्ने साधारण शब्दको अर्थ पहिचान गर्न, अनुच्छेदमा प्रयुक्त सरल सूचनाको जानकारी लिन, दिइएका बुँदाका आधारमा दुई तीन सरल वाक्य लेख्न, के र को जस्ता बोधात्मक प्रश्नको उत्तर खोज गर्न सक्ने छन् ।
Level 1 (Below basic)	449 and below	अनुच्छेदका सूचना सही वा गलत के छन्, छुट्याउन, साधारण र सोझो सूचनामात्र ग्रहण गर्न, व्याकरण कोटिको निम्न स्तरको सरल लेखन दिइएका बुँदाका आधारमा एक वा दुई वाक्यमा गर्न सक्ने छन् ।

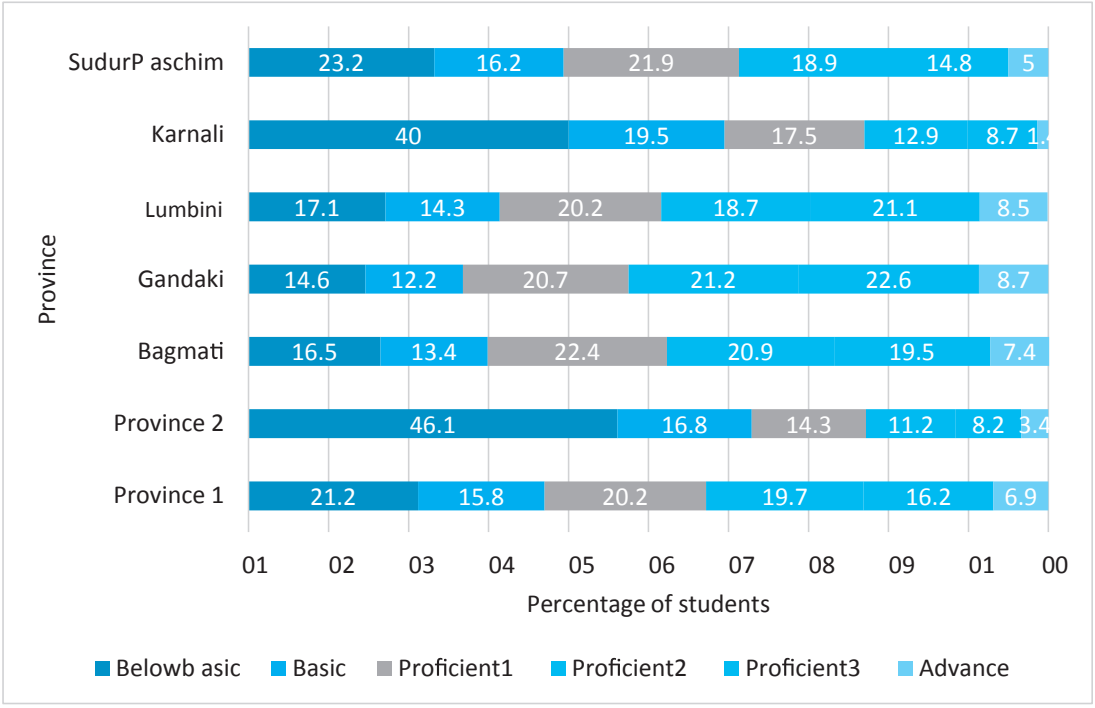
Table 47 illustrates students' skills on the basis of different six proficiency levels.

3.3.6 Overall Mean Score by Province

In the federal context, Nepal is splitted into seven provinces and 753 local government units. Provinces were treated as strata while selecting schools as Principal Sample Unit (PSU). The average score reported in this section is the transformed/scale score at 500 national average. National mean is adopted as a reference to compare the provincial mean. Those provinces whose average score is above the national mean score are considered as better performing whereas below 500 are assumed to be low performing provinces.

As a explicit strata, provincial results are generalized, ie, weighted results. As national level, students the distribution of students in various provinces were analysed and are presented in the figure 67. The below basic level is the lowest level and advance is the highest level of student proficiency.

Figure 66 Province wise distribution of students (%) in six proficiency levels in Nepali

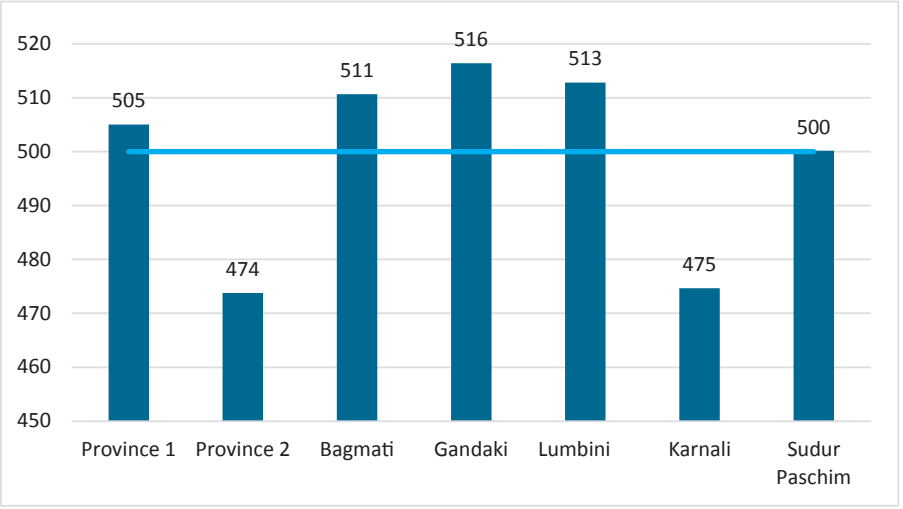


The figure 67 presents that province 2 (40%) and province Karnali (46.1%) belong the most number of students in the lowest proficiency level among all provinces. This reveals that the grade 10 Nepai curriculum (Reading and writing) was least effectively delivered or learnt in these areas where as Gandaki (14.6%) and Bagmati province

(16.5%) have the least number of students at below basic level and highest number of students in advance proficiency level students. This reveals that more than other province students have learnt the content of the Mathematics curriculum the most.

The mean score of achievement reported here is based on the plausible value as mentioned on the introduction chapter. In the figure 67 horizontal line indicates the national mean score of achievement and vertical bars represent the achievement score by provinces.

Figure 67 Provincial level mean achievement score in Nepali



The figure 67 reveals students' achievement in Nepali subject in each province in which Gandaki province is found to have the highest mean score 516. Lumbini, Bagmati and province 1 are distinctively above the national average with the achievement scores 513, 511 and 505 respectively whereas Sudur Paschim has just met the national mean, 500. Province 2 and Karnali are below the national average with the achievement score 474 and 475 successively. The score portrays that five provinces are equal or above the national average and two are below the national mean which needs to improve students' performance in Nepali subject.

3.3.7 Achievement by Gender

To achieve equal level of learning, both boys and girls should have equal opportunity and reinforcement in their study. In the background questionnaire, students had stated their gender. Among the total students, 11656 (52.81%) were girls and 10,413 (47.18%) boys.

Taking gender as an implicit stratum, a comparison of number of students in all six proficiency level is presented in figure The figure presents the distribution students in six performance level by sex are presented.

Figure 68 Sex wise distribution of students (%) in six proficiency levels in Nepali

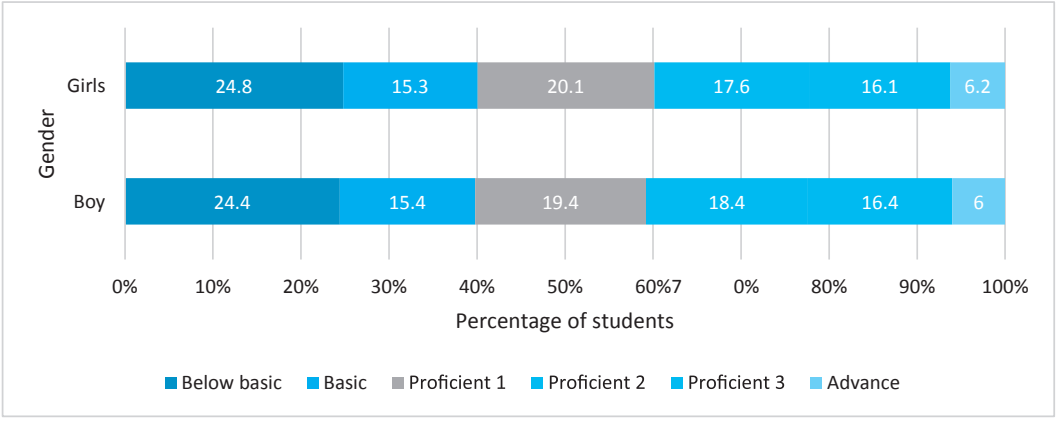
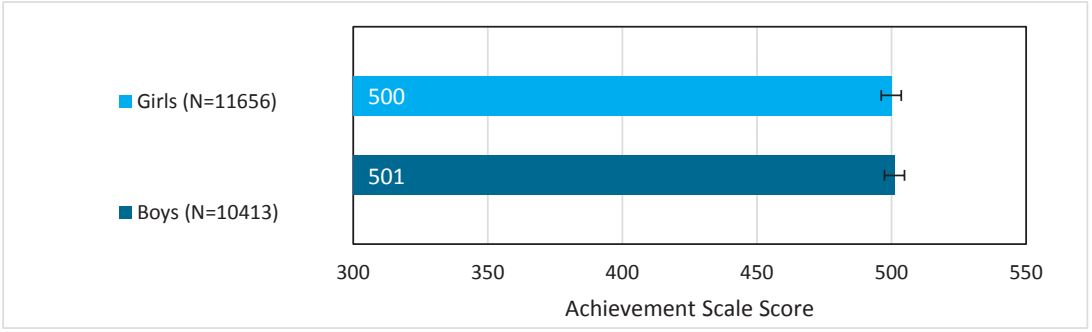


Figure 68 reveals that 23% girls and 24.4% boys were most disadvantaged among the students as they lie at the bottom - below basic level. Those students on this lowest proficiency level could not learn any one of the content matter adequately. Likewise, total 40.8% girls reached at upper adequate level (proficient 2, proficient 3 and advance) where as 30.9%% boys reached at that adequate level.

The overall weighted mean score is presented in figure 69.

Figure 69 Mean score in Nepali by gender at national level



The analysis of data from gender view point in figure 69 indicates that the mean score of boys (501) was slightly higher than the girl's students with 500 in Nepali. Data also implies that there is no significant difference in the achievement level on the basis of gender at 95% significance level.

The data shows that gender parity was maintained in grade 10 Nepali language and reveals that girls and boys have almost equal achievement in overall.

3.3.8 Achievement by caste/ethnicity

Caste/ ethnicity is an important factor that plays a role in social equity. Each caste/ ethnic group has their unique cultural traits which influence educational achievement. The comparative achievement scores in Nepali that stand on caste/ ethnicity is displayed in this section.

The proportion of students from different caste/ethnic located in six proficiency level is presented in figure 70.

Figure 70 caste/ethnicity wise distribution of students in six proficiency levels in Nepali

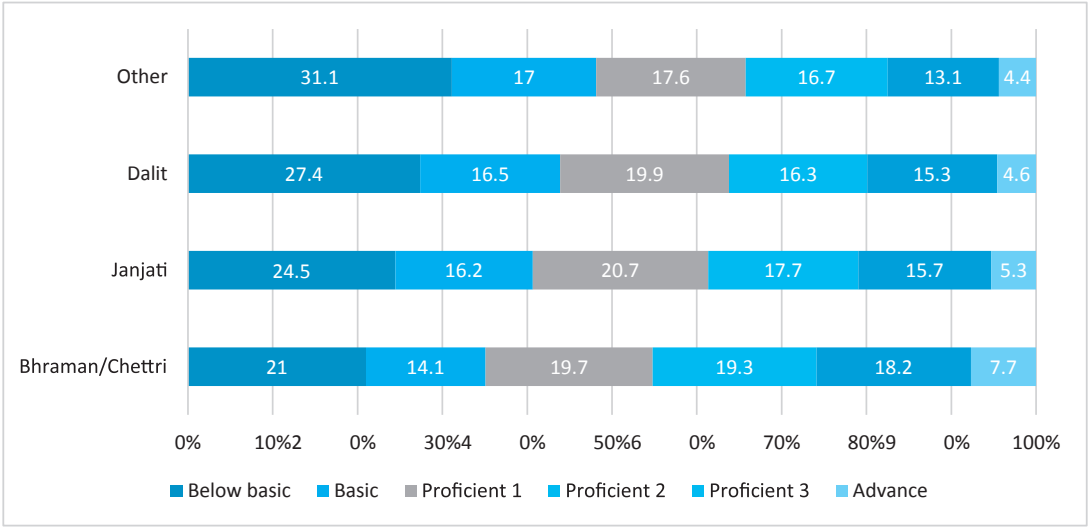


Figure 69 presents that Brahman/chhetri lie lowest (21%) in below basic level where Dalit (25.4%) and other category (31.1%) and in the same way, at the advance level, Brahman/chhetri are at the highest proportion where as other are less than Brahman/chhetri.

While comparing the achievement score, similar scenario was found as shown in figure 71.

Figure 71 Mean score in Nepali by caste/ethnicity

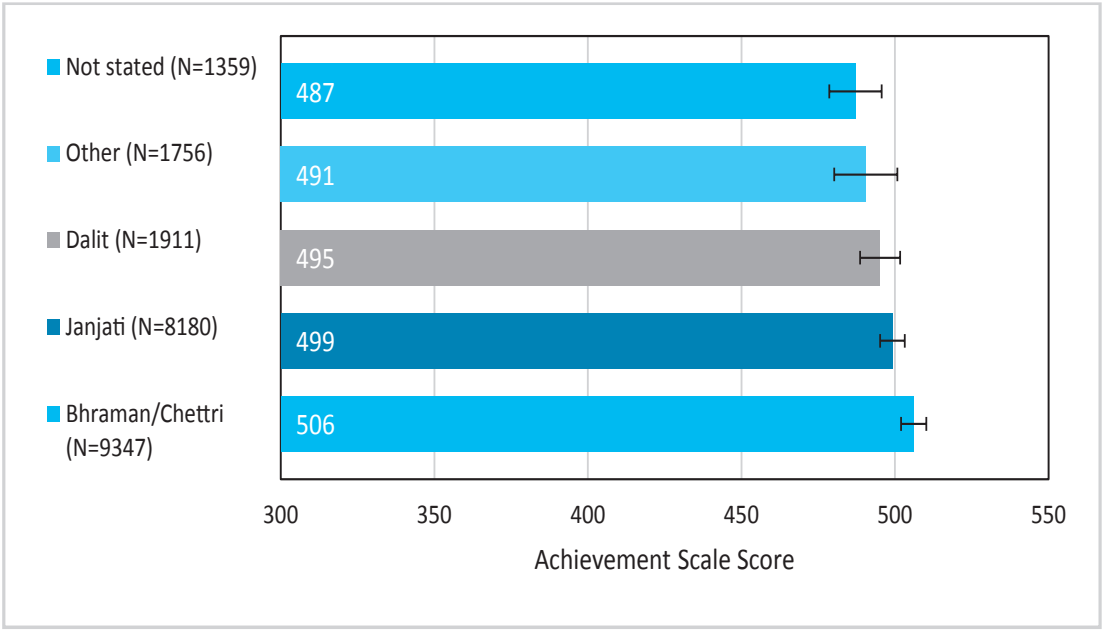


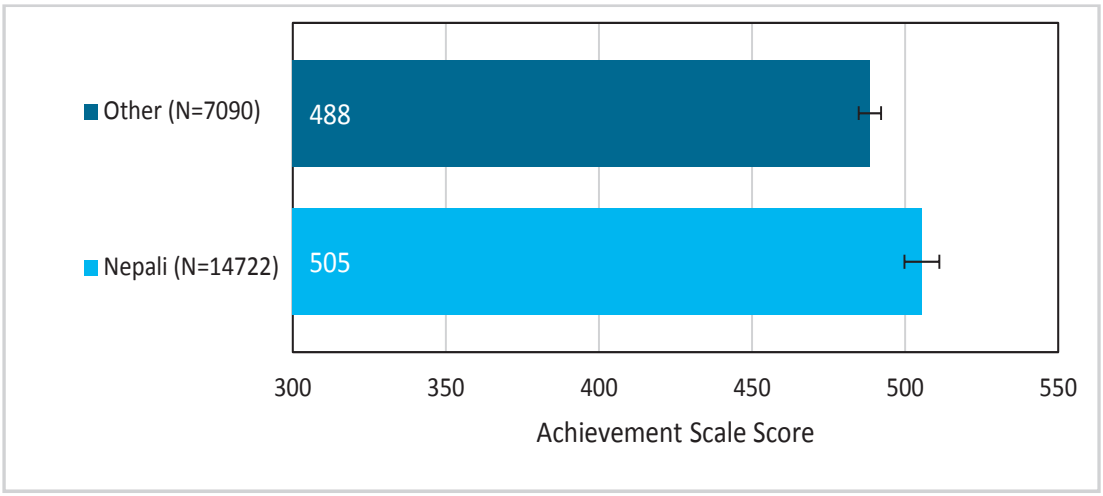
Figure 71 portrays the mean score in Nepali achieved by Brahmin/Chhetri student which was found slightly higher than the score achieved by the other caste/ethnic categories. Students from Brahmin/Chhetri had achieved the highest score 506 whereas all the other groups were found to have lesser than national average scores. Those who did not mention their caste/ethnicity was found to have the least score 487. Janajati and Dalit had 499 and 495 scores respectively.

This fact indicates that Brahmin/Chhetri are comparatively better in Nepali subject in their achievement than any other caste/ ethnic groups.

3.3.9 Achievement by home language

Home language was one of the issues asked to students. Their response disclosed that 67.49 % spoke Nepali language in their home whereas 32.5% reported that they have other languages at home . Based on the students' response, the achievement score is presented below.

Figure 72 Mean score in Nepali by home language



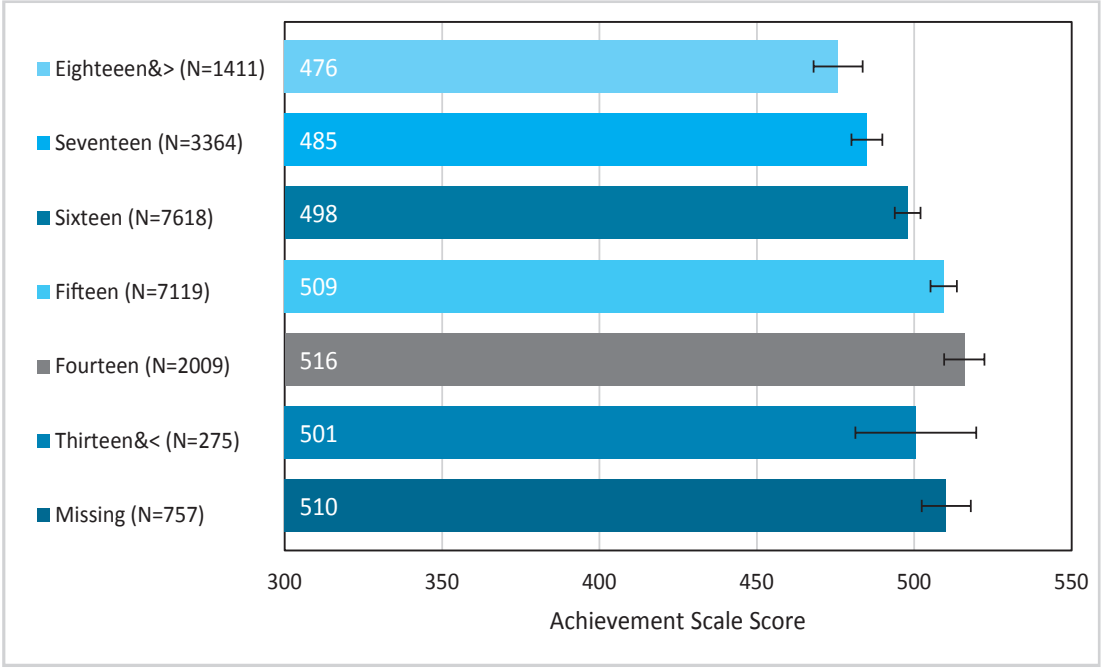
The figure 72 shows that there is variation in the mean score in terms of linguistic background. The students with Nepali language speaking at home scored higher than the students whose home language was other than Nepali. The mean score of the students who spoke Nepali at their home was 505 whereas the students with other (non-Nepali) language at home scored 488 which is lower than the national weighted mean achievement score. The difference between the mean achievement in between Nepali speaking and other language speaking students was statistically significant at 95% confidence level.

Students speaking Nepali languages as their home language can achieve better scores in Nepali subject.

3.3.10 Students Learning Achievement by Age Group

Students were asked to mention their age as a background variable to analyse the relationship between age and their educational achievement. The data shows that they were grouped into six different age strata: less than 13 or equal. 14, 15, 16, 17 and 18 or above. Students learning achievements were found different as shown in figure 73.

Figure 73 Mean score in Nepali by age groups



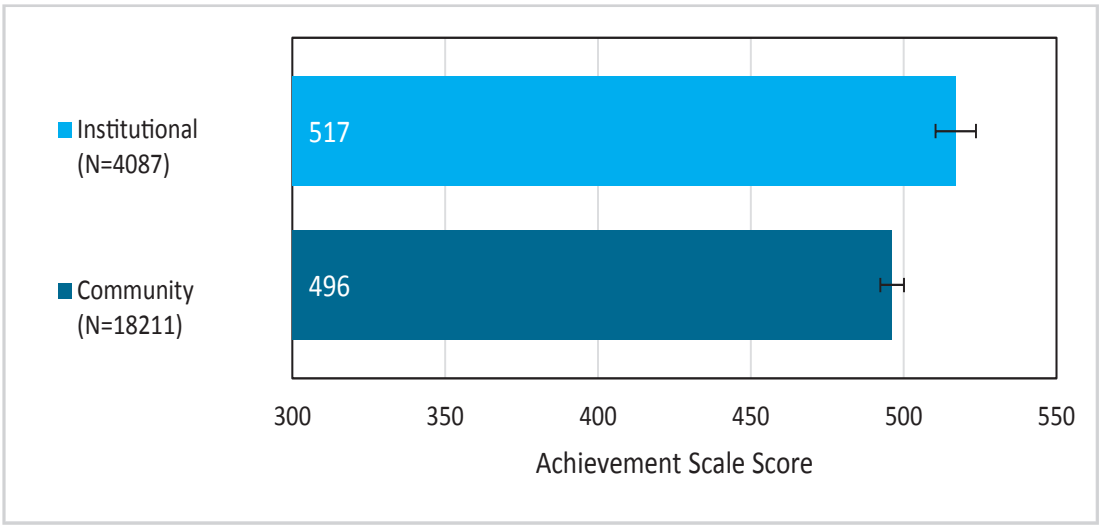
The figure 72 presents that students at the age of 14 year and 15 year age group achieved the highest (516 and 509 respectively) which are above the national mean where other age group students achieved lower than National mean. This indicates that maintaining the net enrolment at proper age group (14 year or 15 year) can have positive effect in the learning Nepali language in grade 10 students.

This implies that the students with the appropriate age group (14 and 15 years) scored higher than the younger and the older age group students.

3.3.11 Achievement by School types

There were 18211 sample students who participated in this test from both community schools and institutional schools. The achievement score on the basis of school's types is found different as presented in figure 74.

Figure 74 Mean score in Nepali by the types of school



The mean score found in community school is 496 and institutional school is 517. The score in the community school was found slightly lower than both the national average (not significant) and the score of institutional schools was above the national mean.

These facts are indicative in that community schools have to make further efforts to achieve the national average score.

3.3.12 Parents' Education and Achievement

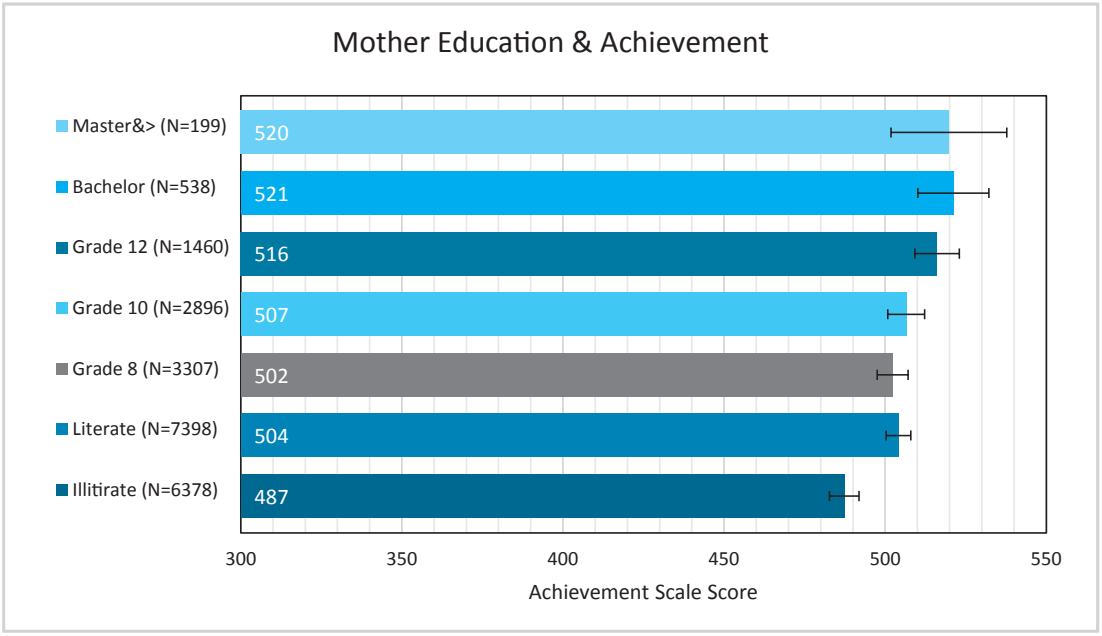
Home is the first school and parents are the first teachers for children. Education begins from the family for the kids. Parents' education and motivation play a vital role for the better learning achievement of children. The students were asked to indicate their parents' education in the background questionnaire. Multiple options (illiterate, literate, Grade 8, Grade 10, Grade 12, Bachelor and Master) were given to choose.

3.3.12a. Mothers' Education and Achievement

Out of the total students, 6378 reported that their mothers were illiterate and 7398 were just literate. Similarly 3307 mothers had basic level education and 1460 mothers had the education of Grade 12. Only a few (538) were Bachelor and 199 mothers had Master level educational qualification.

The figure 75 has clearly indicated the relationship of parents' education in the performance of students.

Figure 75 Mean score in Nepali by mothers' education



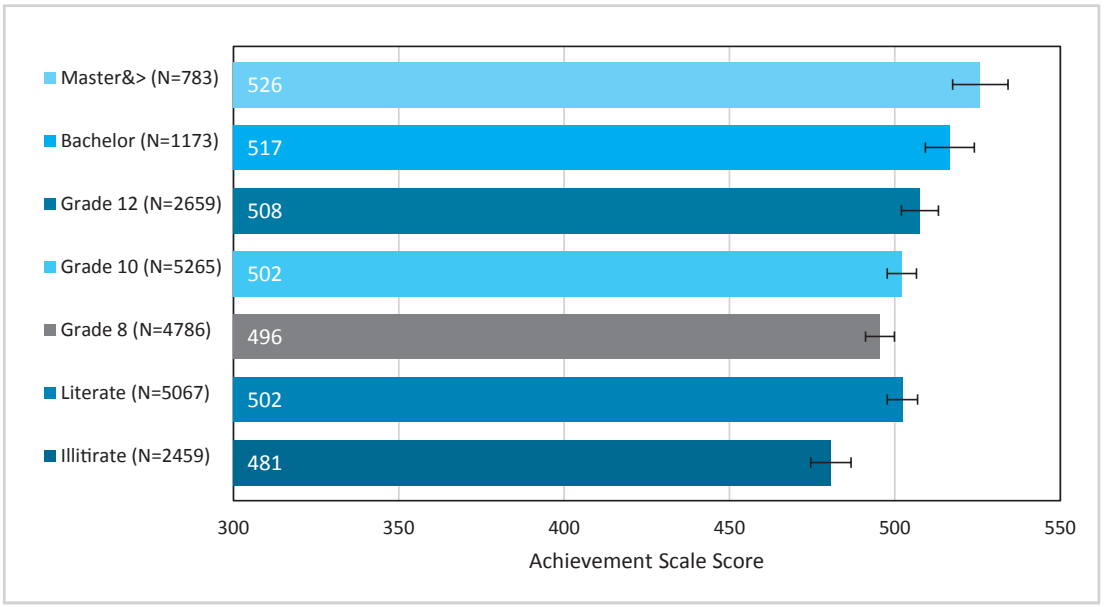
The figure 75 depicts that the group of students whose mothers were illiterate scored the least (487) and mean achievement score had gradually increased along with the increment in their mothers' education. The students with their mother Bachelor and Master had scored 521 and 520 respectively. All the students whose mothers were educated by any categories were above the weighted mean achievement score. The difference in achievement based on different levels of mothers' education was significant at P value less than 0.05. The significant cut-point was seen whether mother is literate or illiterate because group of just literate mother's children achieved 504 which is higher than the national mean.

The data indicates an educated mother's role is important to guide and create a better environment at home for their children.

3.3.12a. Fathers' Education and Achievement

Like mothers' education, fathers' educational level and their children's' learning achievement was also analysed. The figure 76 shows the comparative results of the impact of father's education on their children's achievement.

Figure 76 Mean score in Nepali by Fathers' Education



The figure 76 portrays that the achievement of students was the highest (526) when fathers had an education of Masters or above degree and the achievement was poor (481) when fathers were illiterate. Likewise the achievement scores were awesome when fathers had an education of Grade 12 (508) and Bachelor (517). The significant cut-point for father's education was grade 10.

The difference in mean achievement was up to 45 scale score which is statistically significant at 95% confidence level. This gives a clear picture that a well educated father can contribute better in their childerns' learning achievement and children perform poorly to those whose father is illiterate.

3.3.12 Parents Occupation and Achievement

Parents' occupation determines the socio-economic status of the family which has also an effect in their learning achievements. To analyse the impact, the students were asked to report their parents' occupation on multiple options (government service, business, teaching, foreign employment, labor work in others house, household, agriculture and other). The achievement scores are analysed by considering parents' occupation of the students separately.

3.3.12a. Mother's Occupation and Achievement

The greatest number of mothers (13,203) were found involved in agriculture; 4911 engaged in only household work and 1669 were associated with business. Similarly, the mothers involved in teaching were 599 and the mothers involved in other categories (labour, foreign employment, work in other houses, government service and other) were below 500 in number.

Figure 77 illustrates the impact of mothers' occupation on their children's' learning achievement.

Figure 77 Mean score in Nepali by Mothers' Occupation

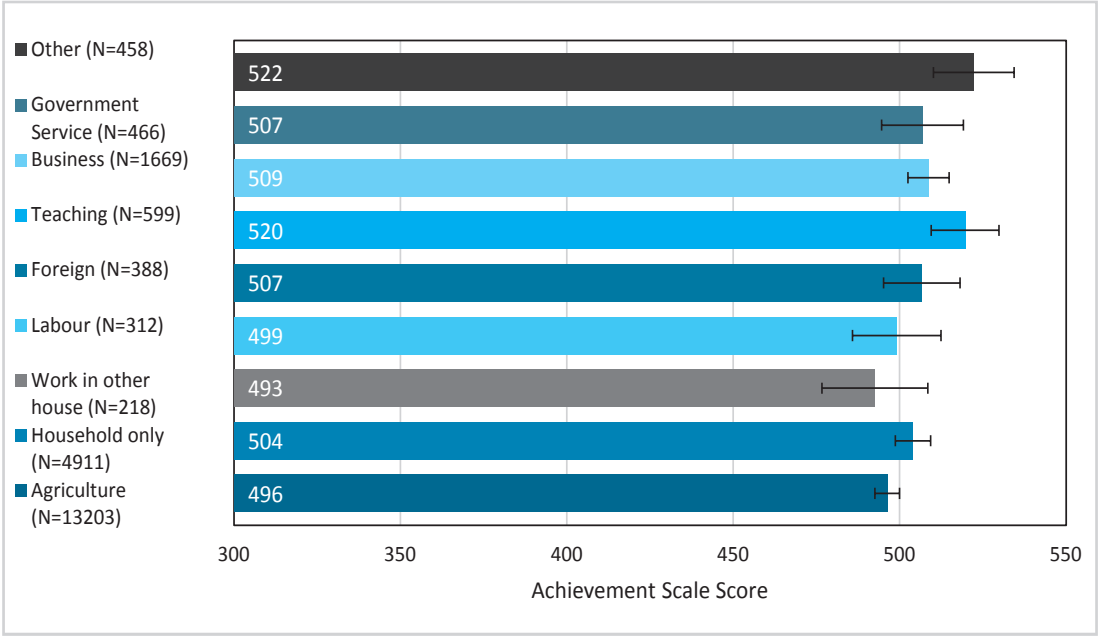


Figure 77illustrates that students having the mothers with occupation of teaching and business achieved scores 520 and 509 respectively. Similarly, the mothers with government service as well as foreign employed, achieved the same score 507. Contrary to this, the students had achieved 493 with the mothers who worked in others' homes. The students whose mother I was involved in agriculture had achieved 496 and mother with labour work scored 499.

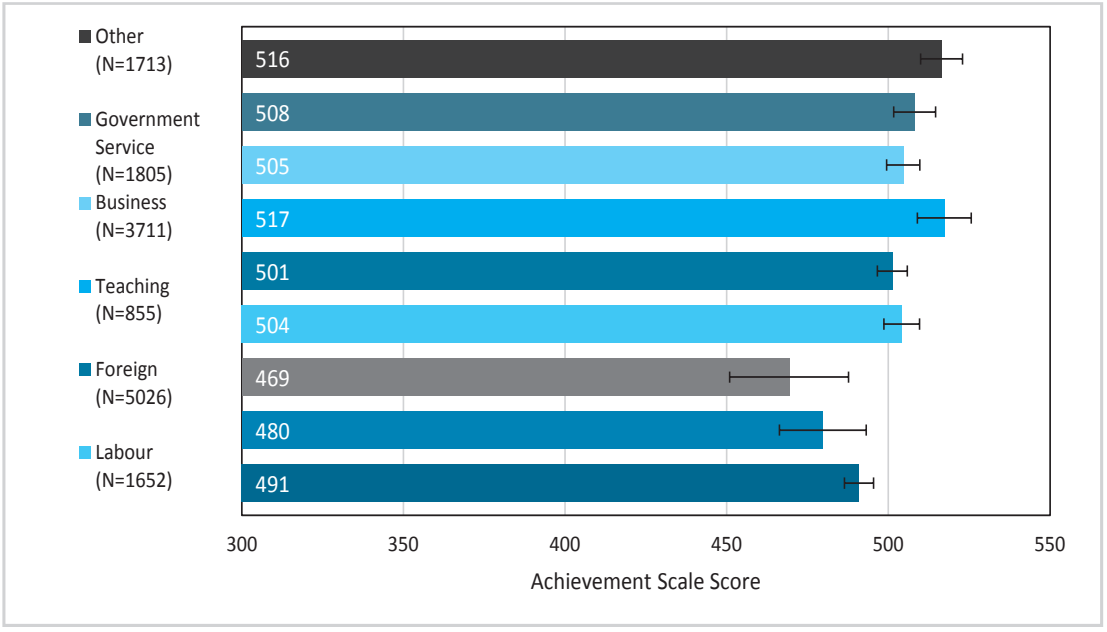
Mother's occupation also indicates the socio-economic status of the family. This correlation discloses that the mothers with regular and better income have better effect on students learning. Overall, a remarkable difference between the highest and the

lowest scoring variables is noticed and this difference is statistically significant at 95% confidence level.

3.3.12b. Father's Occupation and Achievement

Like mother's occupation, the impact of father's occupation on their children's learning achievement was also compared. The figure 78 shows the comparative results of fathers' occupation in children's' achievement.

Figure 78 Mean score in Nepali by father's occupation



The figure depicts that there is positive relationship between father's occupation and student learning. Children whose father is working in government service, business, teaching and working in a foreign country are performing better than those whose parents are labor.

3.3.13 Relationship of Out-of-School Activities with Achievement

Learning is not limited to just school premises and school hours. The students need after-school support to improve their learning achievement. Based on this assumption, they were asked how they spent their time at home. The major seven involvement areas of students included in the questionnaire were TV, internet and computer; play with friends; involve in home chore; study and do homework; work for wage; reading

other books and help brother/sister for study. The time intermissions was given as a. I don't give time b. less than one-hour c. 1-2 hour d. 2-3 hours and e. 4 hours or more. Based on the students' response categories table 47 shows students involvement and time spent in out of school activities.

3.3.13a. Involvement of students in out-of-school activities and the time spent

Table 47 Students involvement and time spent in out of school activities

Out-of-School Activities	Percent of students in the sample according to amount of time spent					
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	<= 4 hour	Not responded
TV, internet, mobile, computer	18.8	54.3	15	2.2	1.1	8.7
Play with friends, chat	14.5	56.4	16.1	2.9	1.1	9
Involve in home chore	6.9	32.8	34.2	13.3	4.6	8.1
Study and do homework	3.1	7.5	20.6	33.3	25.9	9.6
Work for wage	59.3	9.9	5	2.9	3.7	19.1
Reading other books	10.9	47.6	21.7	6.7	2.7	10.5
Help brother/sister for study	13	40	27.6	8.1	2.1	9.4

The table 47 shows the fact that 59.3% students never participated in the work for wage. The activities for which the students spent less than one hour were: 56.4% in playing or chatting with friends; 54.3% on the internet, TV, computer and mobile phone; and 47.6% engaged in reading other books. Similarly 34.2% students were involved in home chore; 27.6% helped brother and sister for study; 21.7% were engaged in reading other books and 20.6% spent one to two hours on their study and for homework. Likewise, 33.3% students provided two to three hours' time for their study and homework which remained 25.9% up to four hours.

This clarifies that one-fourth students only were engaged for about four hours on their study and homework. Rather than to study the textbooks, their choice was to read other books, to play with friends and to spend time on TV , internet , mobile or chat.

3.3.13b. Comparison of students' achievement by time spent by students in out-of-school activities

While asking the question to the students in the issue of their involvement in seven different out-of-school activities, and their time allocation, their learning achievement was found influenced by their time and activities. The table 48 shows the following in this regard:

Table 48 Time spent in various activities and their relationship with learning achievement

Out-of-School Activities	Achievement scale score				
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	>= 4 hour
TV, internet, mobile, computer	499	503	508	503	478
Play with friends, chat	507	504	496	493	483
Involve in home chore	495	507	503	497	485
Study and do homework	466	478	499	508	512
Work for wage	512	481	481	483	485
Reading other books	501	507	503	488	476
Help brother/sister for study	508	506	501	490	479

Table 48shows that the students who did not give time or gave more than four hours had achieved less score than national mean, 499 and 478 respectively whereas students who spent on these devices for one to two hours had achieved better scores (508). Those students, who did not spend time or spent less than one hour in playing, had scored 507 and 504 respectively. Students who did not give time or gave less than two hours, achieved below the national average. None of the students who worked for wages had achieved the level of national mean score. Those who did not give time for their study and homework achieved the least score (466) whereas the students who gave four hours and more had achieved the highest (512) score. And those who spent four hours or more reading other books had achieved very less (476) scores.

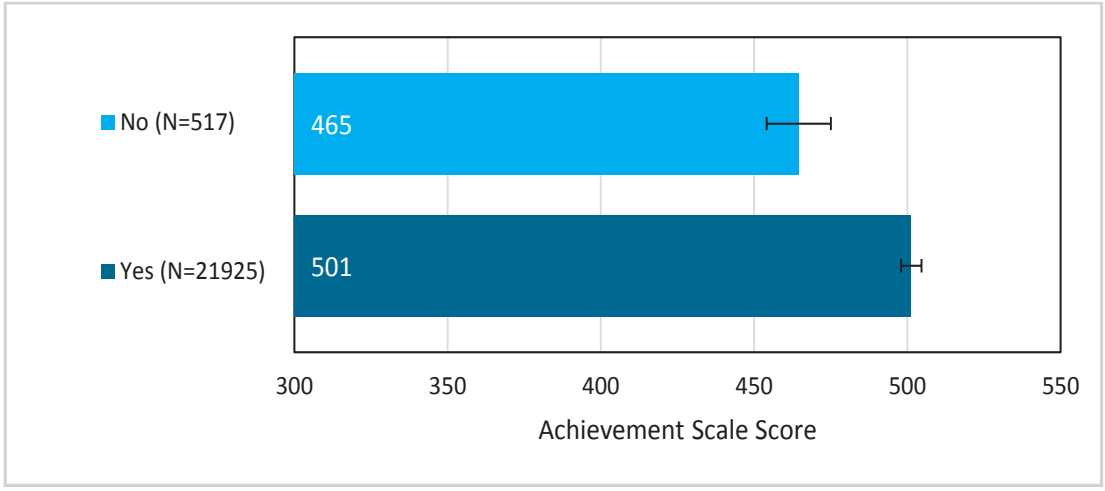
Thus, TV, internet, mobile, computer; involving in home chore up to 2 hours, reading books and helping brother or sister in study are the positive activities that support better learning of the students as in most of those case students achieved above of the national mean. However, working for wage has the negative impact with the student learning as those who involve for wage making works have achieved below the national mean. Data also shows that students should study more than 2 hours a day

to achieve the better score.

3.3.14 Result by the Availability of Textbook

Textbooks are the main source of study materials in high school level. There is a compulsion to have a textbook. Majority of the students were found to have Nepali textbook in the study. A very few sttudents (N = 517, about 4%) had reported that they did not have textbooks. The response of the students and their corresponding achievement score is shown in the figure 79 below.

Figure 79 Mean score in Nepali by availability of textbook



The results as presented in figure 79 point out that the students who did not have textbooks achieved 465score which looks remarkably lower than the national mean score. But the students who had textbooks were able to achieve 501, which is slightly higher than the national mean score. Akyuz (2004) also states that the conceptual textbook's text supports a positive attitude and increases achievements.

The difference between the two groups in mean score is found statistically significant at 95% significant level. This implies the greater importance of textbooks in high school level for better learning achievement.

3.3.15 Results by feedback provided on students' Homework

The students were asked to mention how often their teachers provide them homework and how often their teachers provide them feedback on their homework.

3.3.15a. Homework and Achievement

70.16% students reported that their teachers provide homework regularly and 28.54% students reported that the teachers provide homework occasionally. A very few students (0.66%) did not respond to this question. The achievement scores of the students receiving regular feedback on their homework is higher than the score of the students who did not receive such feedback from their teachers.

Figure 80 Mean score in Nepali by teacher's feedback on students homework

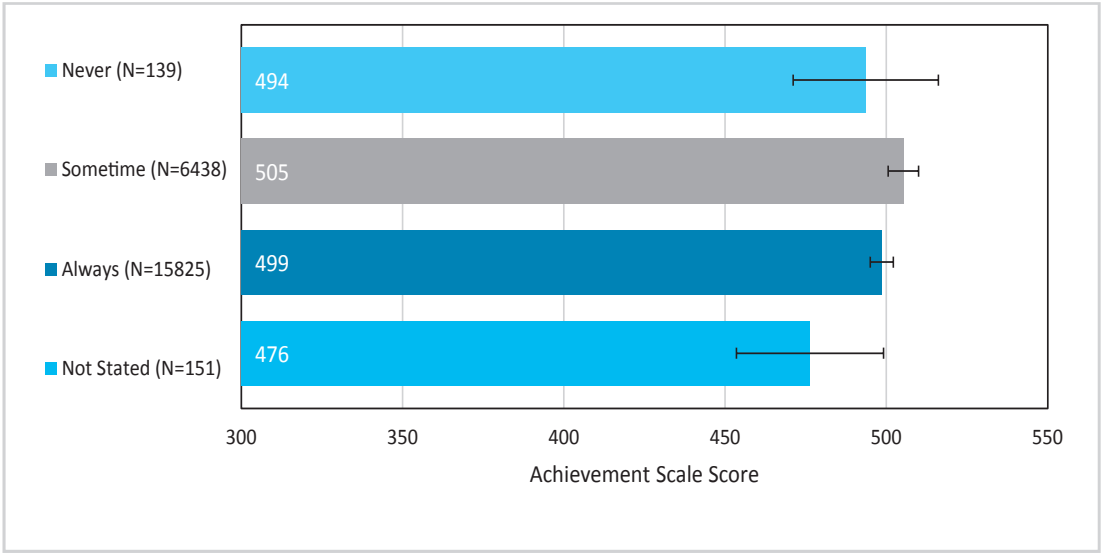
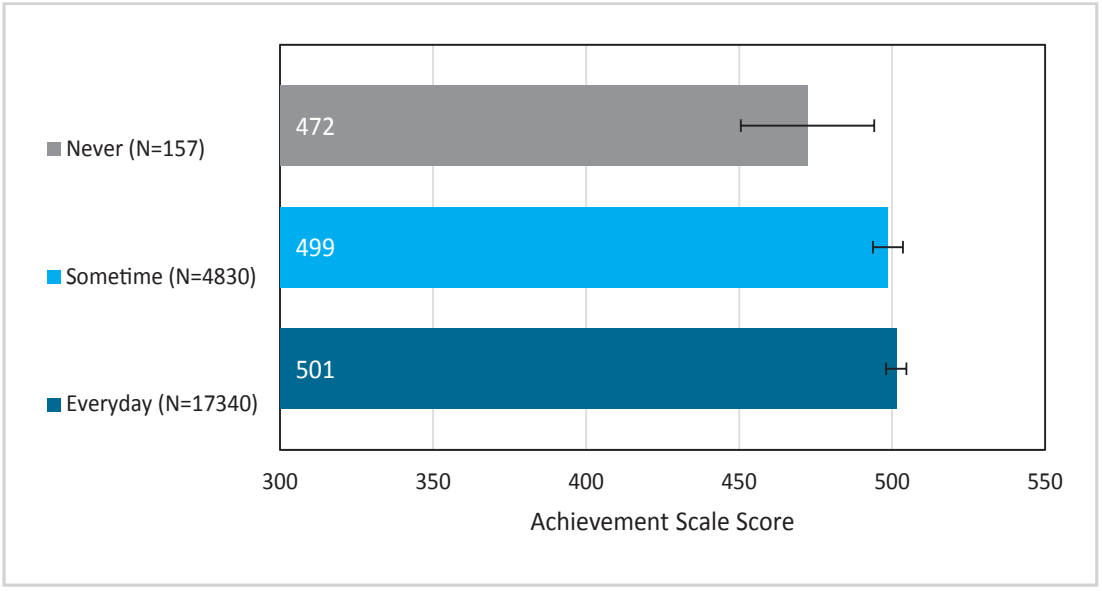


Figure 80 presents that the students who did not state and never got homework and its feedback had achieved the score 476 and 494 respectively. The students who sometimes got homework scored (505) above the national average. Interestingly those who always got homework achieved below the national mean (499) although it is not significantly lower than national level.

3.3.15a Feedback and Achievement

The students were asked to mention the teachers' feedback on their homework. There were the three alternatives to choose by the students- everyday, sometimes and never. The figure 81 clarifies the impact of teachers feedback on students' learning achievement.

Figure 81 Mean score in Nepali by teachers' feedback on students' homework



The data presented in Figure 81 shows that the mean score of the students who received feedback from their teachers regularly was found to be higher (501) than those who never received feedback (472), with the difference of mean score of 29 points. The difference is significant ($P<0.05$).

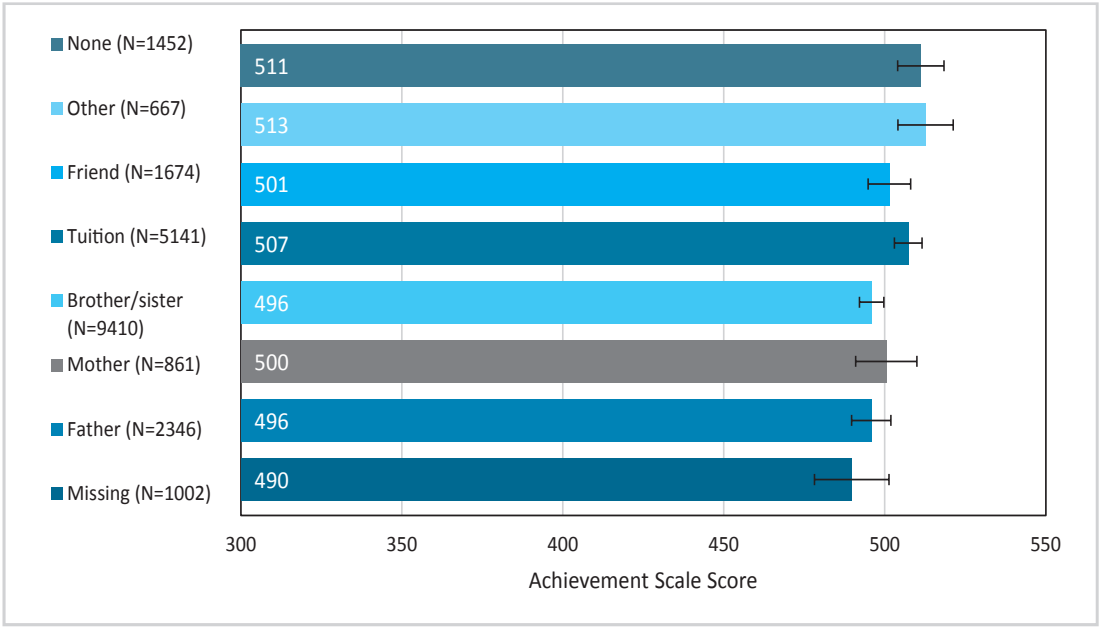
Like this finding, many researchers have found a positive relation between homework and learning achievement. Cooper and Valentine (2001) explains that homework is strongly associated with learning achievement in secondary grades.

This clearly depicts that regular homework and feedback to students by their teachers strengthen the learning achievement.

3.3.16 Result by Home Support in Study

Home support to the students in their study plays an important role to increase the learning achievement. Based on this hypothesis, the students were asked about the persons who support them at home in their study. Out of the total 22,553 students, the largest number of students (9410) reported getting support from their siblings. Getting support from tuition teachers was reported the second largest number (5141) and from father was 2346. Likewise 1674 students got support from friends and a few students got support from their mothers and others whereas 1452 students did not get support from anyone.

Figure 82 Mean score in Nepali by home support in study



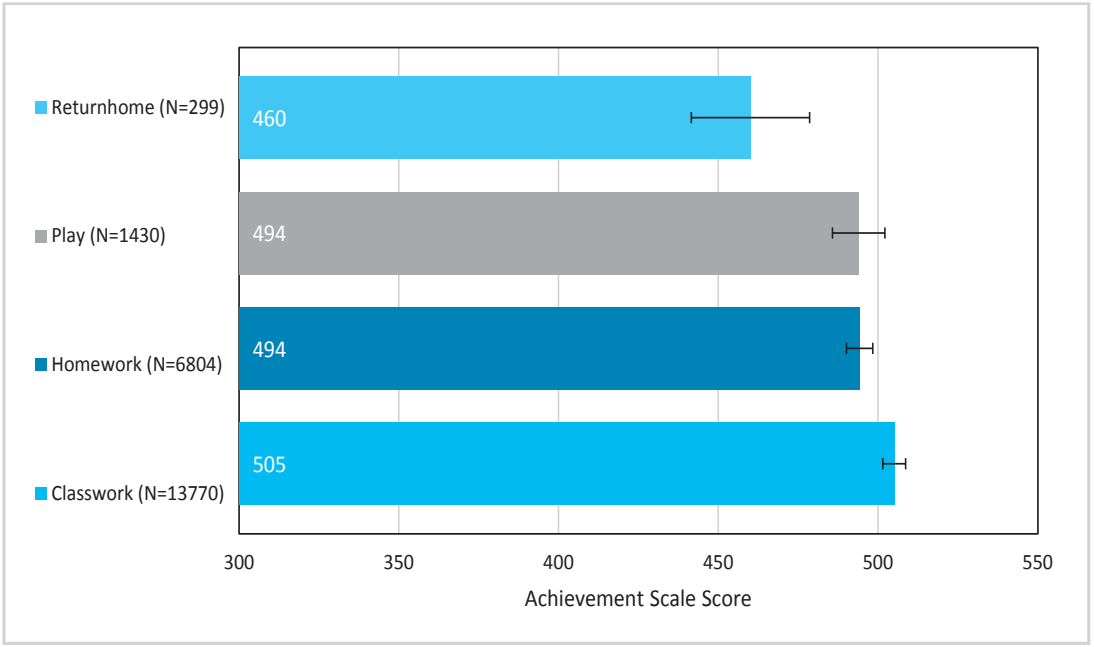
Regarding the learning achievement, the figure 82 proclaims that the students who got support from others achieved high mean (513) and the students who did not get support from any one achieved the mean 511. The support from tuition, friends and mother were also remarkable as the students achieved higher or equal to the national average. The support of father and siblings seemed not much effective in the students' learning achievement as the scores are below the national average.

Besides the school's teaching, home support plays a vital role for the better learning achievement but exceptionally few and capable students do not need any support or they can find the supporting personals themselves and get better scores.

3.3.17 Results by the Use of Leisure time at School

The students were asked to mention how they use their leisure time at school. The figure 3.3.18 shows that most of the students (13,770) involved in classwork activities in their leisure time and they had achieved the high score (505). Both types of students who enjoyed their leisure time by doing homework (6804) and playing (1430) achieved the score 494, which is lesser than the national weighted mean score. And the students who returned home at their leisure time shockingly achieved the least mean score (460).

Figure 83 Mean score in Nepali by the activities in the leisure time at school



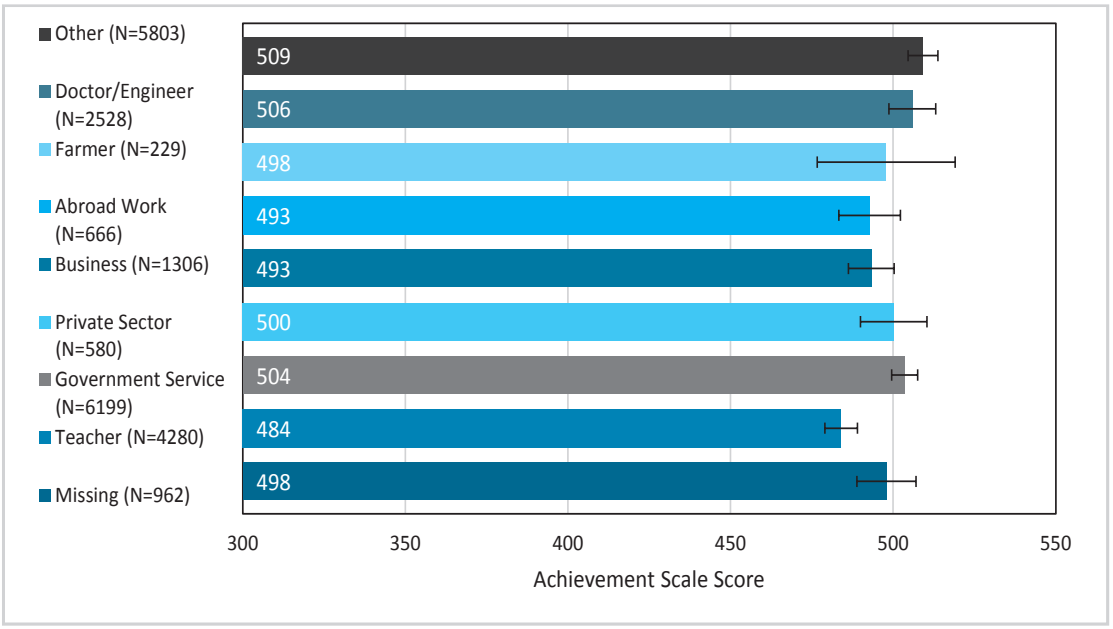
There was a difference with a 45 score and statistically significant learning achievement score between the students engaged in doing classwork and returning home at their leisure time and it is 95% confidence level.

The fact shows that to engage students in class work activities is more productive and to return home is harmful for learning achievement in their leisure time.

3.3.18 Achievement by the Student-Imagined Future Aim

The students in this assessment were asked to mention what they wanted to be in future. Out of the total 22,553 students, 27.48% aimed to be involved in government service, 18.97% decided to be teachers and 11.20% mentioned to be doctor/engineer in the future. The students had shown less interest in farming (1.01%), private job (2.57%) and abroad work (2.95%).

Figure 84 Mean score in Nepali on the basis of students' future aim



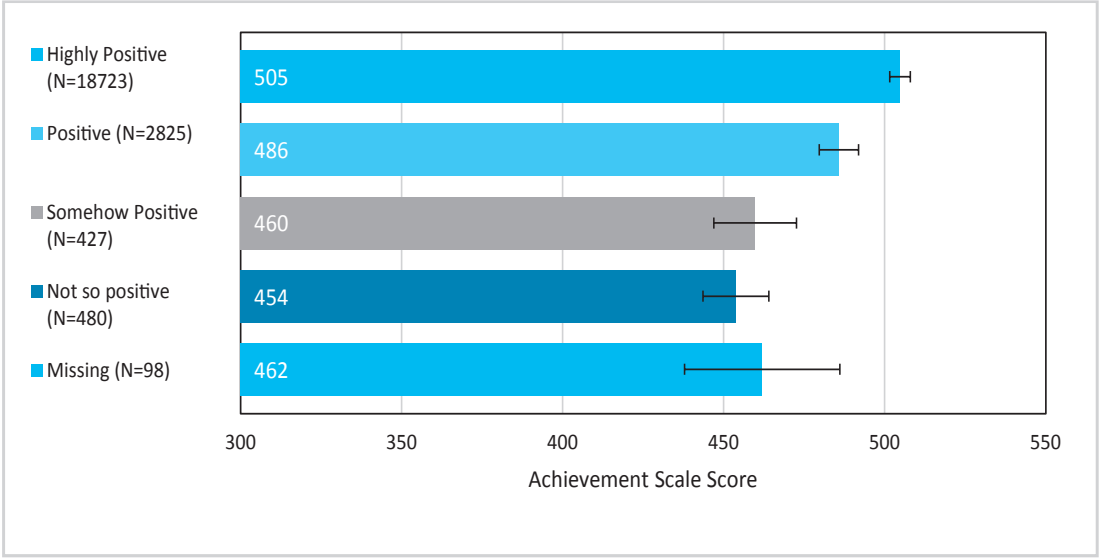
The figure 84 illustrates that The students got higher scores than the national average whose aim was to be doctor/engineer (506), government service (504), private sector (500) and other jobs than the given alternatives (509). The students who targeted to be farmer, abroad workers and businessmen achieved lesser scores than the national mean. Interestingly those students, who wanted to be teachers, had achieved the least score (484) only in this assessment.

This picture indicates that the students' aim is different from the conventional job; and those who want to be a capable person in future do hard work and achieve better scores.

3.3.19 Result by Attitude towards Teacher

The students' attitude towards teachers is a prime factor that influences their learning achievement. To analyse this presumption, students were asked to mention their perception towards teachers on multiple options (highly positive, positive, somehow positive and not positive). Out of the total (22,553) students, 83.01% students reported that they were highly positive, 12.52% were positive, 1.89% were somehow positive and 2.12% students reported that they were not so positive towards teachers.

Figure 85 mean score in Nepai by the students' attitude towards teacher



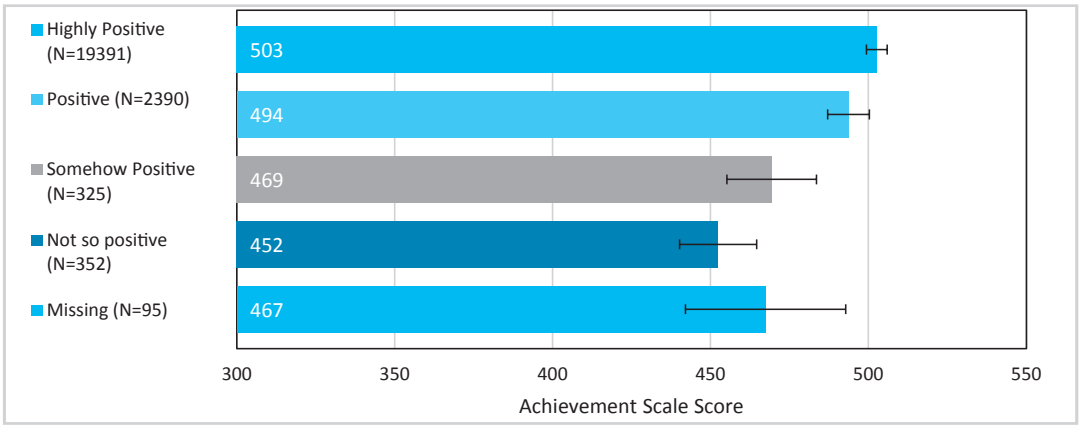
The students who were highly positive towards their teacher, achieved the highest score (505) and those who chose rest of the option achieved below the national mean score. The students having not so positive attitudes towards teachers, achieved the least mean (454). Overall, a remarkable difference between the highest and the lowest scoring variables(with 51 points) is noticed and this difference is statistically significant at 95% confidence level.

This clearly indicates that the students must be highly positive to secure better scores in their learning achievement.

3.3.20 Result by Attitude towards School

The students attitude towards school was also analysed thinking that it is one of the major influencing factors in learning achievement. Based on the students' response, 85.97% students were highly positive and achieved a high score (503). Similarly 10.59% students were positive who achieved 494score and 1.44% students were somehow positive who achieved 469 scores. A few (1.56%) students who were not so positive towards school achieved the least scores (452). As the difference between the two mean, the highly positive and not so positive was 51 score, it was statistically significant at $P<0.05$.

Figure 86 Mean score in Nepali by the students' attitude towards school



Only the students who had a highly positive attitude towards school achieved above the national mean. When the students' attitude tended towards the negative side, their achievement level also degraded gradually.

The facts clearly point out that students' attitude towards school must be highly positive for the quality enhancement in learning.

Classroom time/ECA/Family type/ and other relevant variables.

3.3.21a. Achievement by the Frequency of Extracurricular Activities

Extra-curricular activities help to develop the students social and emotional skill and leadership. Thus the analysis of the frequency of conducting extracurricular activities in the school and students involvement was analysed to compare the educational achievement here.

Figure 87 Achievement by frequency of extra-curricular activities

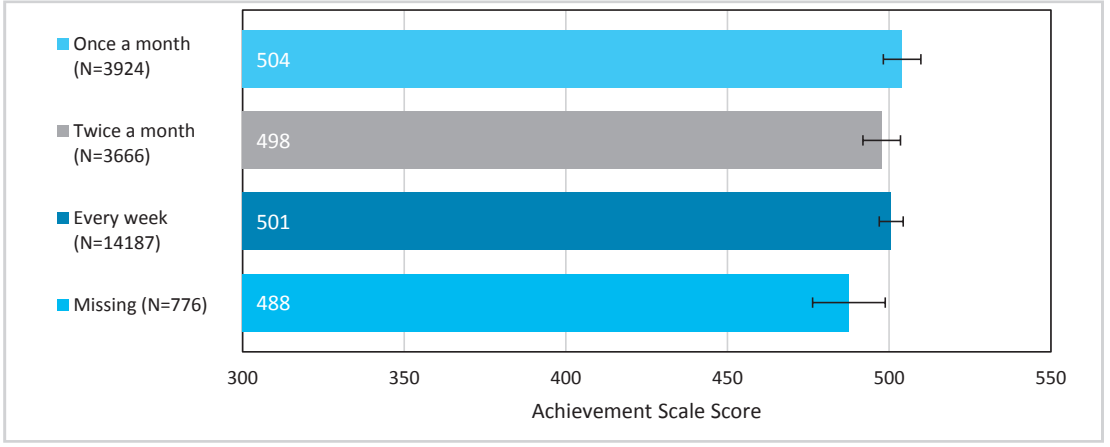
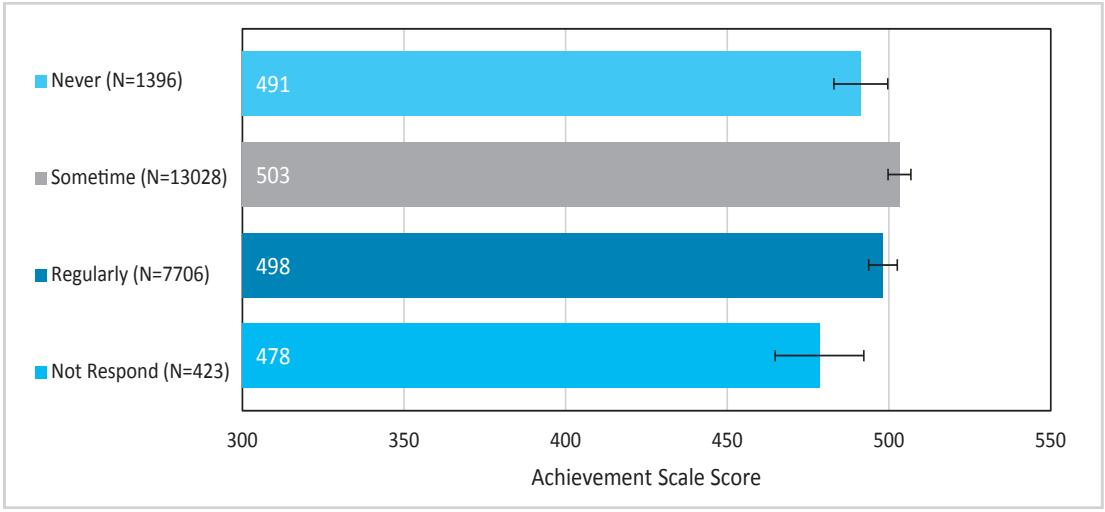


Figure 87 illustrates that the students involved once a month in extra-curricular activities had a high (504) achievement score in comparison to twice in a month or every week and the students who were involved every week achieved 501. The students who participated twice a month in extracurricular activities achieved lower scores than the national mean.

3.3.21b. Achievement of students by Frequency of involvement in Extracurricular Activities

The students were asked to mention their frequency in the participation in extracurricular activities. They were said to choose options- never, sometime and regularly to find their participation in extracurricular activities. 57.75% reported that they participated sometimes, 34.16% participated regularly and 6.18% reported that they were neve participated in extracurricular activities.

Figure 88 Achievement of students by frequency of involvement in extracurricular activities

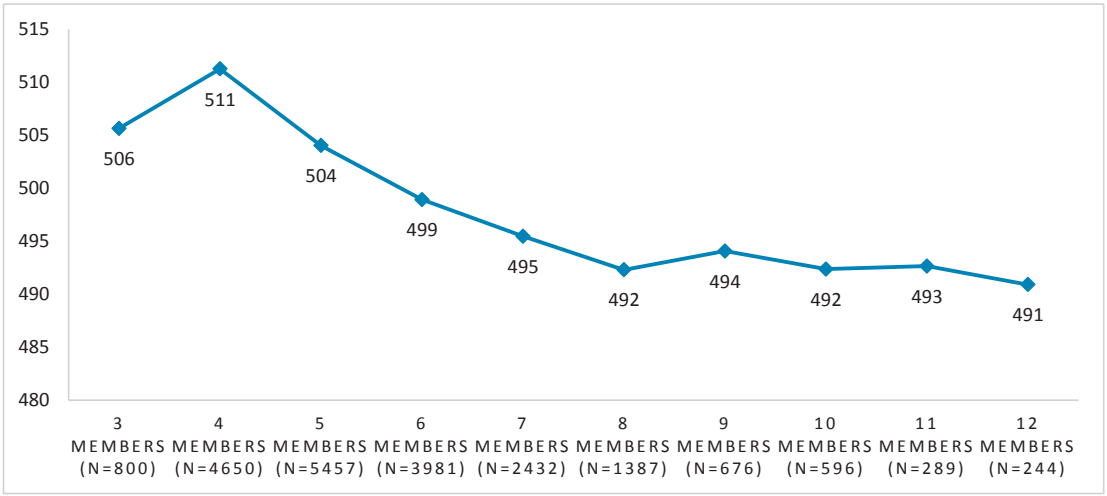


The data presented in the figure 88 provides a clear picture of frequency of students participation in extracurricular activities. The bar diagram shows that students who participated sometimes in extracurricular activities achieved higher (503) than the national mean as well as the students who participated regularly (498) and never participated (491). As never participated students in extracurricular activities achieved the least score, it proved the importance of extracurricular activities in learning achievement. Thus the focus should be given to conduct extracurricular activities in school.

3.3.21c. Result by the size of Family and Achievement

Family size is one of the factors that has a direct relation in the care, health, opportunity, facilities and study of children. The students were asked the number of family members and the children were grouped into 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 members' families. In the figure 3.3.23 the x-axis represents the size of the family and y-axis shows the achievement scale. The line graph indicates the achievement score of the children of different family sizes.

Figure 89 Family size and achievement



On the basis of family size, the largest number of children had five member families and a few of them had twelve member families. Children with four member families achieved the highest score (511), three member families scored 506 and five member families scored 504. The children from the rest of the other family size from six to twelve members, had achieved below the national average score. The scores also seem to have decreased slightly along with increasing size of families and the children from twelve member families achieved the least score (491).

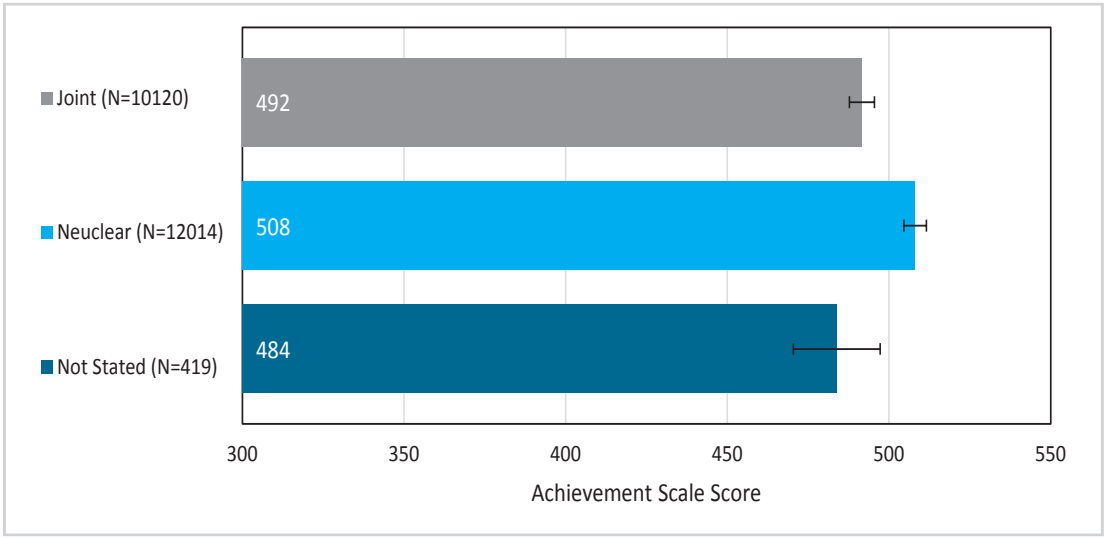
This clearly shows that small sized families can give a proper care environment and opportunity to study for children. When the family size increases, students' quality decreases.

3.3.21d. Result by the Types of Family

With the assumption of effect of family size in the students' achievement, the students were asked to mention their family type in the questionnaire. According to their responses 44.87% students mentioned joint family, 53.27% nuclear family and

1.85% students did not mention their family type.

Figure 90 Mean score in Nepali by types of family



The students who belonged to nuclear family, achieved a 508 score and students from joint families achieved below the national average (492). The score of students from the joint family had remained significantly lower than both the national mean and students from nuclear families. Students from nuclear families were distinctly above the national mean. With the difference of 16 scale scores, the gap between the two types of students was significantly different $p<0.05$.

3.3.22 Availability of Home Possession with Family-student

Students require various kinds of supportive facilities for better learning achievement. These home possessions play a significant role in their learning. In this study the students were asked whether they had different eight items at their home. The responses of the students are analysed in table 49.

Table 49 Availability of home possession with family-student

Home possession	Response (%)		
	I don't have	I have	Not respond
Table for study	40.4	58.4	1.2
Separate study room	35	64	1
Peace space to study	39	60	1

Home possession	Response (%)		
	I don't have	I have	Not respond
Computer for school-work	82	16	2
Children magazine, story/poetry and pictures	81	17	2
Reference book for school work support	63	36	1
Internet	77	21	2
Dictionary	69	29	3

The table shows that 58.4% students have tables for study, 64% have separate rooms and 60% have a peace place for study at their home. But interestingly 82% students have no computer for school-work; 81% have no children magazine, story, poetry and picture books; 77% have no internet; 69% have no dictionary and 63% have no reference books.

The facts locate that the majority of the students do not possess the basic requirements like a dictionary, computer for school-work, internet, reference books and children magazine.

3.3.23 Availability of home accessories

Some accessories are supportive for the students in their study. The students were asked to mention if they have different accessories such as permanent house, car, television, motor-cycle and computer in the test. Their responses are analysed in the table 50.

Table 50 Availability of home accessories

Home Accessories	Number of accessories possessed				
	none	one	two	three	not respond
Television	30	56	8	2	5
Computer	62	22	3	1	12
Moter-cycle	57	25	5	2	11
Car	79	4	1	0	17
Permanent house	37	48	5	2	8

The table manifests that 79% students have no car, 62% have no computer and 57% students have no motor-cycle. But 66% students reported that they had television and 55% have their permanent house. The percentage of non-response rate is also

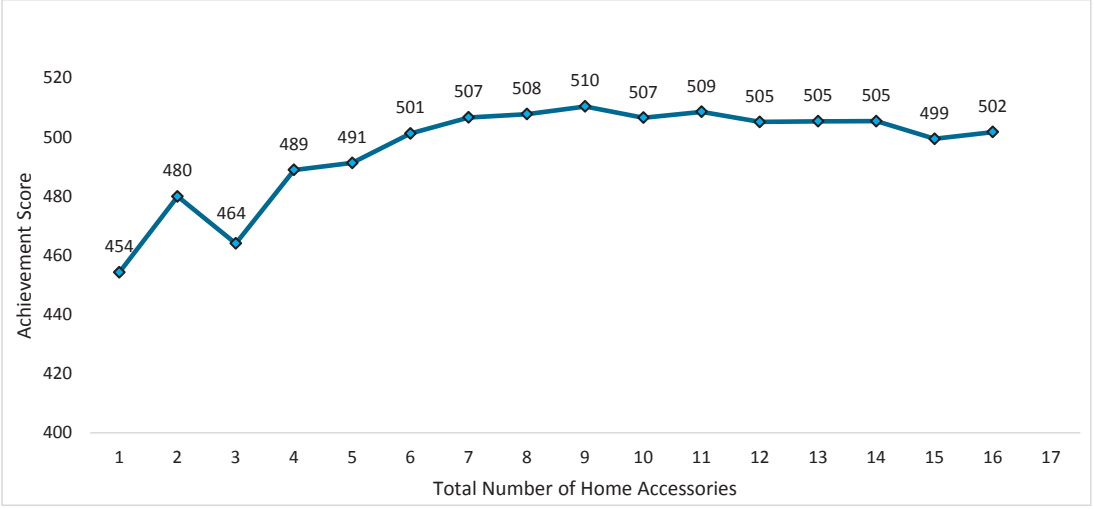
high here. If they are also included in not having such accessories, the majority of the students may not have, except television and house.

Data reveals that majority of Nepali people have very limited access to car, computer and motorcycle.

3.3.24 Achievement by the Availability of Home Accessories

Home accessories are convenient in the students' learning achievement. The line graph 91 reveals the relationship of learning achievement with home accessories. Based on the students' responses, the number of home accessories are shown in the x-axis and the learning achievement of students is shown in the y-axis.

Figure 91 Impact of home accessories in learning achievement



The line graph presents that the students who had only one accessory achieved the least score (454) and the students having up to five accessories had achieved below the national average. This seems to increase in mean score from the students having six (501) to nine (510) accessories and then it goes in decreasing order. Students having fifteen or more, also seem at the range of national average.

Home accessories are supportive for students' learning achievement but many accessories do not mean that they go on increasing their achievement score.

3.3.25 Students response on regularity of Nepali Teacher

Teachers' regularity plays a vital role to improve the quality of students. Regular teachers apply more effort to enhance the learning achievement. Keeping these

assumptions in mind, the students were asked to reveal the condition of teachers' regularity and punctuality.

Table 51 Regularity of Nepali teacher

Response type	How is the regularity of a Nepali teacher?			
	No of students	Percent	Valid percent	Cumulative percent
Spends all time in the class	20953	92.9	93.7	93.7
Enters late and moves earlier	692	3.1	3.1	96.8
Mostly does not appear in the class	716	3.2	3.2	
Not respond	192	0.9		
Total	22553	100	100	100

In table 51, it shows that 93.7% teachers spent full time in the class, 3.1% interred late and left the class earlier and 3.2% teachers were mostly irregular in class. This shows that most of the teachers are punctual, regular and dedicated.

3.3.26 Teachers' Timing and Achievement

In the Nepali context, teacher is the main source to deliver knowledge even today. As the teacher best utilizes time in the classroom, the students' learning achievement improves obviously. To test this argument, students were asked to report their teachers' time utilization in the classroom.

Figure 92 Achievement by Teachers' timing in Nepali

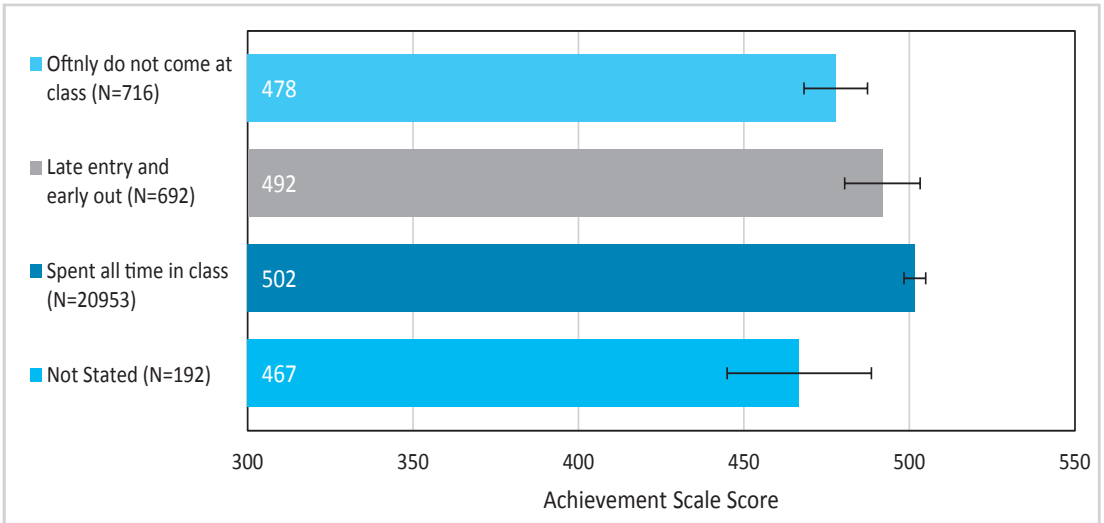


Figure 92 presents that 92.90% teachers spent all time in class and the students achieved (502) higher than the national average. But both the teachers who entered in class late and left the class earlier; and the teachers often did not go to class had poor performance of students, 492 and 478 respectively, which are significantly below the national average. There is a remarkable difference between the lowest and highest scoring variable with 24 points and this difference is statistically significant at 95%confidence level.

The teachers who spend all the time in class obviously involve in delivering knowledge and engage the students in the subject; as a result the learning achievement improves.

3.3.27 Additional Materials

Besides text books, additional materials support the students to achieve better scores in learning. The students were asked to report if they have old questions, guess paper and guide books. The below table analyses the availability and use of such additional materials by the students.

Table 52 Additional Materials, old questions, guess paper and guides

Type of resources	Number of students (N)	N Percent
Old set of questions	15667	69.5
Guess paper	7034	31.2
Guides	6393	28.3

Table 52 presents 69.5% students reported having old set of questions, 31.2% had guess paper and 28.3 had guide books. These facts clearly show that more than two-third students follow the old set of questions to score better in achievement.

3.3.28 Students' Attitude on Utility of Nepali

Nepali is not just a subject; it is an official language of Nepal. The enhancement in Nepali subject makes the students' life easier. To find out the students' attitude in Nepali, Likert scale was used to explore the degree of agreement and disagreement; in the issues such as the use of this subject in daily life; Learning Nepali supports the other subjects; students interest and involvement in the subject related t tasks; and supportive for job in future.

Table 53 Student's attitude on utility of Nepali

Description	Number of students in percent			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. Nepali can help me to daily life	83.3	13.6	1.2	0.7
2. Learning Nepali enables me learn other subjects better in school	71.7	20.7	3.1	2.3
3. I like to exercise Nepali (story, poem, debate)	74.2	18.8	2.8	2.1
4. I have to do Nepali good to get job in future	72.4	18.7	3.5	3

Table 53 shows that 83.3% students strongly agreed that the subject had helped them in their daily life. 74.2% students strongly enjoyed doing exercise and involving subject related activities such as story, poem, debate etc. Likewise 72.4% students had strong hope to get job in future if they do good. In Nepali and 71.7% students strongly believed that learning Nepali enables them to learn other subjects better in school.

By the above facts we can draw the conclusion that about three-fourth students have a very much positive attitude towards Nepali subject. They are eager to participate in subject related activities; this subject has supported them in their daily activities and has hoped to get a good job in future.

3.3.29 Like and Dislike of Nepali

Like or dislike of any subject depends on its use in daily life. To explore the likes and dislikes of Nepali subject, a questionnaire was made and administered to the students. The options were given to the students to choose the scale of strongly agree, somewhat agree, somewhat disagree and strongly disagree.

Table 54 Students' opinion about like and dislike Nepali

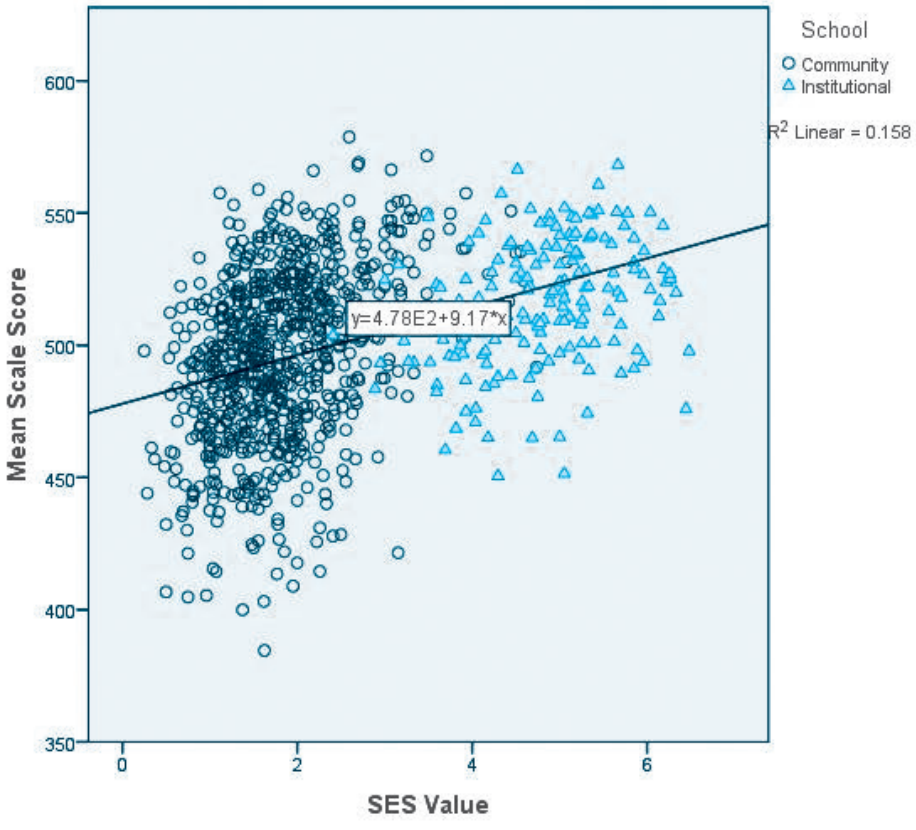
Description	Number of students in percent			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
Generally, I do better in Nepali	71.2	23.9	2.4	1
I want to learn more Nepali	79	16.2	2.1	1
I enjoy learning Nepali	81.9	12.8	2.2	1.2
I feel difficult to learn Nepali	11.1	28.3	17.7	37.6

The table 54 reveals that 71.2% students strongly agreed and 23.9% somewhat agreed that they do better in Nepali generally. 79% students strongly agreed and 16.2% students somewhat agreed in the option that they want to learn more about this subject. Similarly, 81.9% students strongly agreed and 12.8% somewhat agreed that they enjoyed learning Nepali. In the Nepali subject, a few students (11.1%) felt much difficult as well as 28.3% felt somewhat difficult to learn. This result clearly shows that maximum students feel easy and enjoy the Nepali subject.

3.3.30 Achievement by Socio-Economic Status

Socio-economic factors are important factors that affect the learning achievement of students. These factors are parents' education and occupation; home accessories; home possessions etc. In the given figure x-axis shows the SES values and y-axis indicates the mean scale score and line graph shows the students' learning achievement. The achievement of community school and institutional schools are portrayed clearly with separate symbols.

Figure 93 Achievement by socio-economic status in Nepali



The scattered plot displayed in figure 93 shows that socio-economic status has a great effect in learning achievement in high school level students in Nepali. The schools with high SES concentrated more on relatively medium and high mean scores, but the schools with low SES spread from low score to high scores. However there are some cases of high SES schools having relatively low mean scores. This plot also indicates that most of the institutional schools have high SES students compared to the community schools. Despite all SES, One interesting fact found in the data was that top achieving ranking 1st, 2nd and 3rd are community schools in Nepali subject.

Chapter 3.4
English

3.4.1 Introduction

In this chapter, the results of the responses of 22,217 students who participated in NASA 2019 in English subject from 75 districts and 1800 schools are analysed by using conquest 4.x. The results are presented in the form of proficiency levels, their description and comparison. Population estimates presented in this chapter are based on the five plausible values drawn from WLE. The comparisons are made on the basis of groups formed from background information variables such as students' family background, socio-economic status, ethnicity, gender, home language, school types, home environment, province etc.

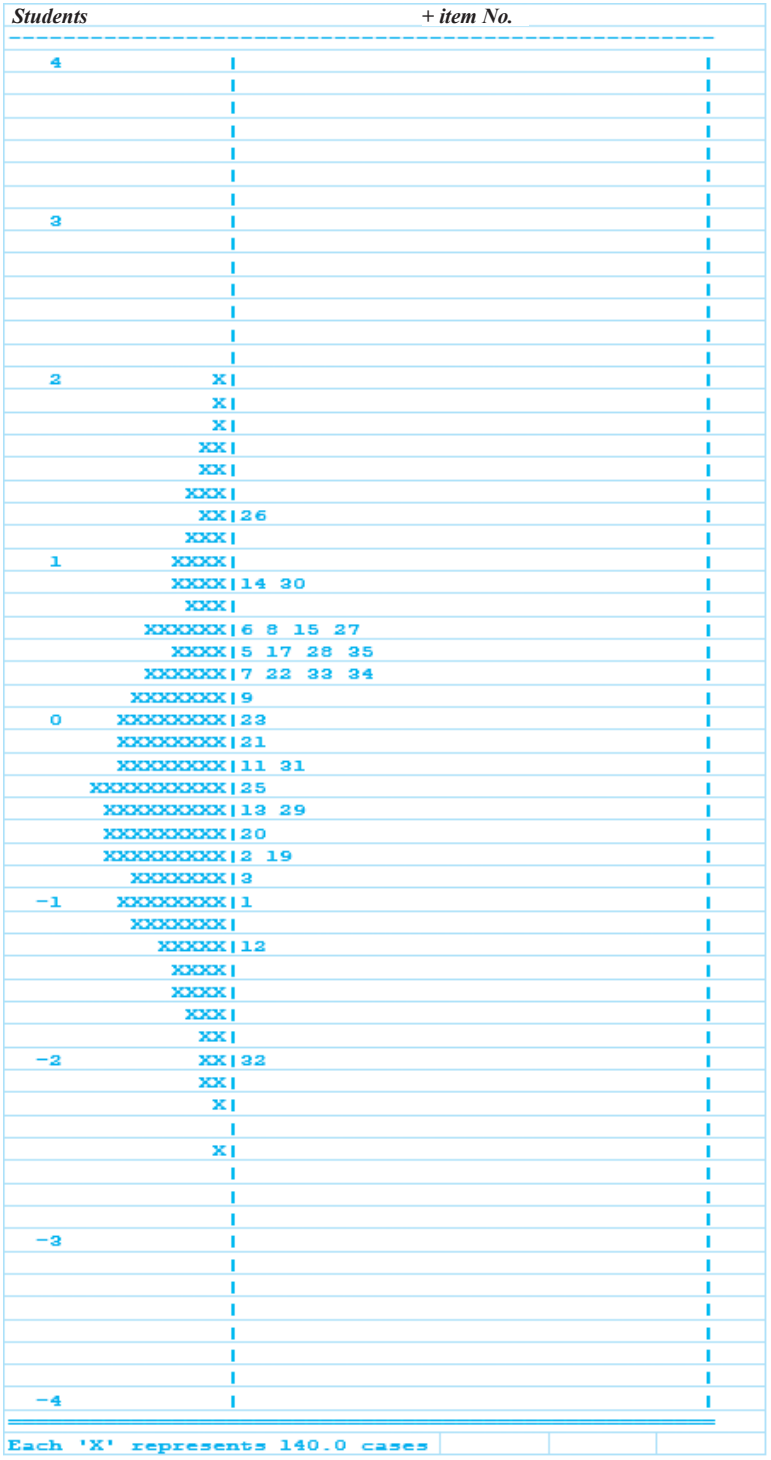
The students' achievement scores in all basic results were compared with the national mean score of 500 and 50 standard deviation with either standard error or at confidence interval. The test scores were first drawn from the sample students and analysed considering the sample weight. Population parameters were estimated at 95% confidence level in the whole population of grade 10.

3.4.2 Wright-map of Student Ability and Item Difficulty in English

simple and powerful graph used in psychometrics termed is Wright Map, which presents the location of both respondents and items on the same scale. Wright Maps are commonly used to present the results of dichotomous or polytomous item response models. This map is plotted from person estimates (latent ability) and item parameters produced by an item response analysis.

The Wright-map is organized as two vertical histograms. The left side shows candidates and the right side shows the items. The left side of the map shows the distribution of the measured ability of the candidates from most able at the top to least able at the bottom. The items on the right side of the map are distributed from the most difficult at the top to the least difficult at the bottom. In the following figure, student ability (θ) in the left and NASA 2019 items to the right are plotted in the same scale. When a person and an item lie at the same level, probability of responding that item by the particular person is 50%. Figure Below presents the NASA 2019 English Wright-map.

Figure 94 Wright-map in English subject

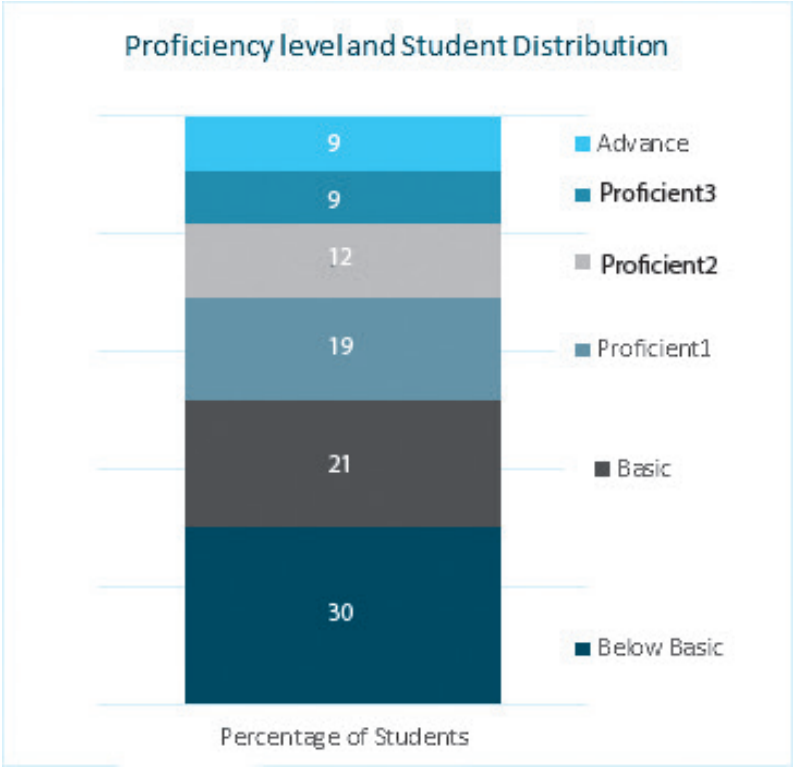


3.4.3 Plausible value - Standard Error

SN	Plausible values	Mean	SE of plausible value	Sample Students	Population
1	MSSPV1	499.8966	0.33515	22217	432205
2	MSSPV2	500.0053	0.33584	22217	432205
3	MSSPV3	500.246	0.33477	22217	432205
4	MSSPV4	500.0104	0.33589	22217	432205
5	MSSPV5	499.8417	0.3356	22217	432205

3.4.4 Students' Proficiency levels in English

Assessment framework for NASA 2019 has set students' proficiency standards into six different levels. For this purpose, proficiency levels were decided by dividing six proficiency levels. The figure presented below shows the overall distribution of sample students into the six proficiency levels which are Below Basic, Basic, Proficient 1, Proficient 2, Advanced, and Advanced 2. The percentage of students falling into the six levels is depicted in the figure below.



From "Below basic level" it is indicated that the students falling into this category are of lowest ability; and they are facing hard time for struggle in the classroom. On the other hand, saying "Advanced level 2" means the highest level of proficiency that can even cross the grade level in English.

As the figure demonstrates, 30 percent of the sample students are at Below Basic level, and 21 percent of them are found at Basic level. 19 percent of them are found in Proficient 1 level; similarly 12 percent are in Proficient 2 level. In the same way, 9 percent are in Advanced level while the remaining 9 percent are in Advanced level 2.

On the whole, from the study of data, the achievement level of students shows that 30% of them are of lowest ability in English. And, combining the Below basic and Basic levels of proficiency, 51 percent of students have poor level competence in English; while the others have some acceptable level of proficiency. A small number of students (9%) have the highest level of proficiency; and these students can even cross the grade level in English.

3.4.5 Proficiency level descriptors in English

Level	Score	Reading descriptors	Writing descriptors
Level 1: below basic level		Understand very short, simple texts and can find specific, information such as facts, vocabulary, dates, times, and location in simple everyday material such as advertisements, prospectuses, menus and timetables.	• Contains rudimentary structure, basic vocabulary and limited grammatical accuracy • Contains deviated ideas or contents on the topic • Includes erroneous mechanics • Contains less creativity/ originality • Contains inappropriate format and layout
Level 2: basic level		Understand the straightforward meaning of the text, such as facts, vocabulary, dates, times, and locations and combine information from various parts of the text.	• Contains noticeable structural and mechanical errors that cause some comprehension problems • Presents only few ideas without much supporting details • Presents the ideas vaguely which are not coherently organized

Level	Score	Reading descriptors	Writing descriptors
			• Contains sig nificant problems in layout and format • Includes limited use of vocabulary (repetition of vocabularies)
Level 3: Proficient 1		• Understand the text that contains the information which is not explicitly stated. • Identify the logical order of the various parts of a text. • Combine the meaning of the text with their own knowledge and intuitions. • Suggest the most suitable title for the text (passage, story, poem, dialogue, etc.)	• Contains noticeable structural and mechanical errors that may not cause some comprehension problems • Presents some original ideas relevant to the topic with supporting details • Contains coherently organized ideas but with mostly inappropriate cohesive devices • Depicts very little originality/ creativity of ideas • Contains minor problems in layout and format that does not affect the writings. • Uses good range of vocabulary with some issues in appropriate use
Level 4: Proficient 2		• Make sensible predictions based on their understanding of the reading texts. • Relate the meanings drawn from the texts to their everyday life events and experiences. • Identify central idea of the texts of various types	• Uses a wide range of structures with minor grammatical and structural errors. • Uses cohesive devices but at times there is under and over use • Depicts some originality of ideas related to the topic. • Selects appropriate layout and or format. • Shows correct and appropriate use of adequate range of vocabulary

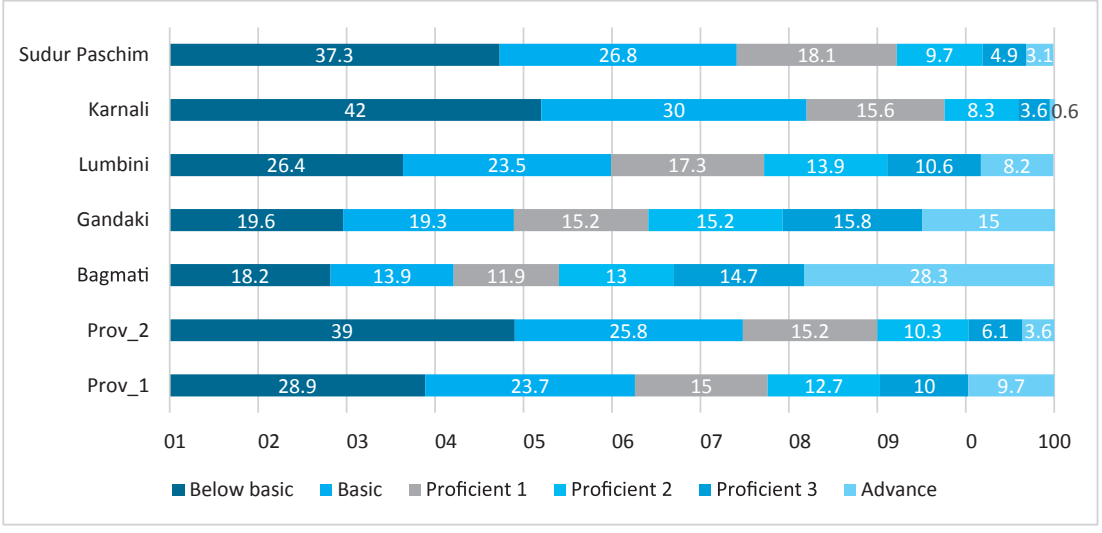
Level	Score	Reading descriptors	Writing descriptors
Level 5: Proficient 3		• Understand the meaning of the text with reference to their background knowledge of the related themes. • Interpret both literal and literary meaning of texts. • Justify arguments based on the text and related issues.	• Demonstrates mastery in the use of grade-appropriate cohesive devices • Demonstrates good orthographical (spellings, handwriting, punctuation) • Control throughout with rare structural and mechanical error. • Uses the ideas which are mostly original and they are relevant to the topic. • Selects appropriate layout and/ or format leading to the smooth flow of ideas. • Depicts correct and appropriate use of wide range of vocabulary.
Level 6: Advance		• Identify the issues raised in the reading texts and discuss their relevance in their lives. • Show comprehensive understanding of the text.	• Shows excellent capability in the use of wide range of structures with grammatical accuracy. • Shows perfect command over the structural and mechanical aspects • Demonstrates excellent linkage and smooth logical flow of the ideas without any structural and semantic errors. • Possesses outstanding command in the use of cohesive devices/ connectors and selects appropriate layout and/or format. • Depicts exceptional originality of ideas. • Discusses ideas creatively with supporting details. • Depicts natural use of wide range of vocabulary.

3.4.6 Achievement by Province

The Federal Democratic Republic of Nepal has been divided into seven provinces and 753 local units. These provinces were regarded as strata and schools were picked out as Principal Sample Unit (PSU) for the comparative study on achievement by province. The average scores described in this section are the transformed /scale score at 500 national average. National mean is taken as a reference to contrast with the provincial mean. Those provinces exceeding average scores are acknowledged as better performing and below 500 are considered as low performing provinces.

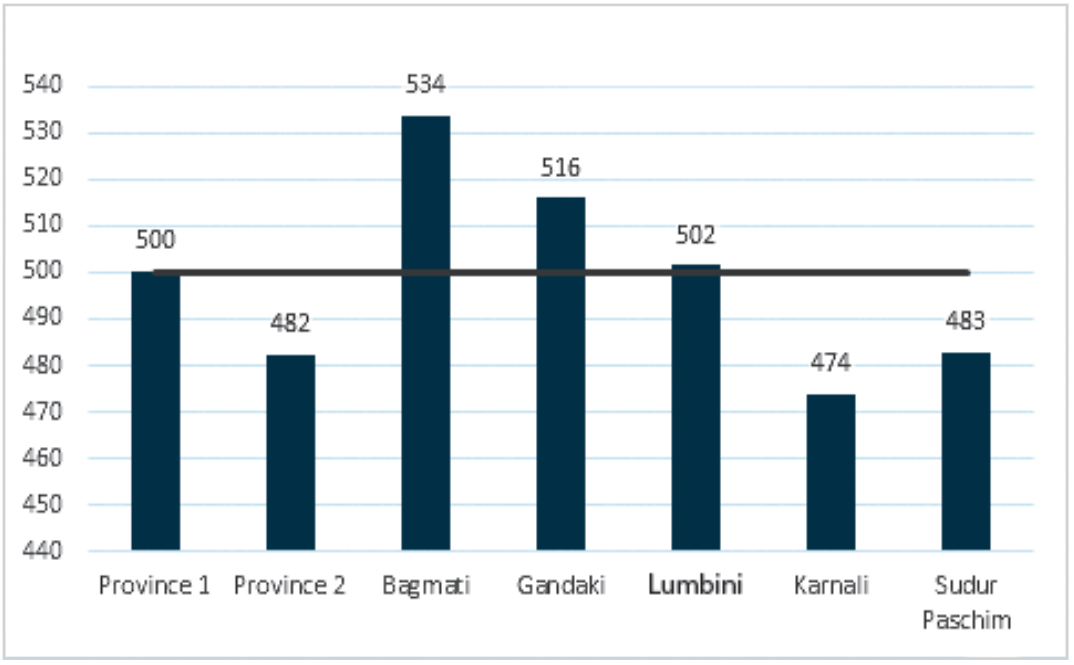
As an explicit stratum, provincial results were generalized, i.e., weighted results are reported like in national level. The distribution of students in various proficiencies by province were analysed and are presented in figure 95. In the figure, below basic level is the lowest level and advance is the highest level of student proficiency. In the figure, higher the number in lower level of proficiency, poorer the result and in contrast, higher the number of students in the upper level, better the result.

Figure 95 Province wise distribution of students (%) in six proficiency levels.



The figure illustrates that three provinces students – 42% in Karnali, 39% in Province 2 and 37.3% in Sudur Paschim were not able to grasp even lower grade skills, so were not able to learn basic skill in English. But those lagging behind level (below basic) students are little lower in other provinces – 28.9% in province 1, 26.4% in Lumbini, 19.6% in Gandaki and 18.2% in Bagmati. Interestingly, highest level of learning (Advance level) students were found in Bagmati by 18.2%, Gandaki 15%, Province_1 9.7%.

Whether the students from various parts of the country have made achievement in a balanced way or not is also the next concern for NASA study. With this consideration, there has been an attempt to see the achievement of students across the 7 provinces of the country. For this purpose, the scores of students in a particular province were calculated together and their achievement was compared against the achievement of students in other provinces. Accordingly, the chart below has depicted the situation of students' achievement in the 7 provinces of the country.



Reading the data in this chart, we can see that the achievement scores of the students from Province 1, Province 2, Bagmati Province, Gandaki Province, Lumbini, Karnali Province and Sudur Paschim Province have achieved 500, 482, 534, 516, 502, 474 and 483 points respectively. The highest achievement score in English is seen in Bagmati Province, followed by Gandaki, Lumbini, Province 1, Sudur Paschim, Province 2 and Karnali. Thus, students from Karnali have scored the lowest among the 7 provinces.

The data clearly depicts the situation that only students from 4 provinces have crossed the National Mean (500) score; and these provinces are: Province 1, Bagmati, Gandaki and Lumbini. The remaining 3 provinces were found unable to reach the National Mean point.

Disparity in achievement at the provincial level was further wider in English. The achievement of Bagmati (534),Gandaki (516) and Lumbini (502) were above the

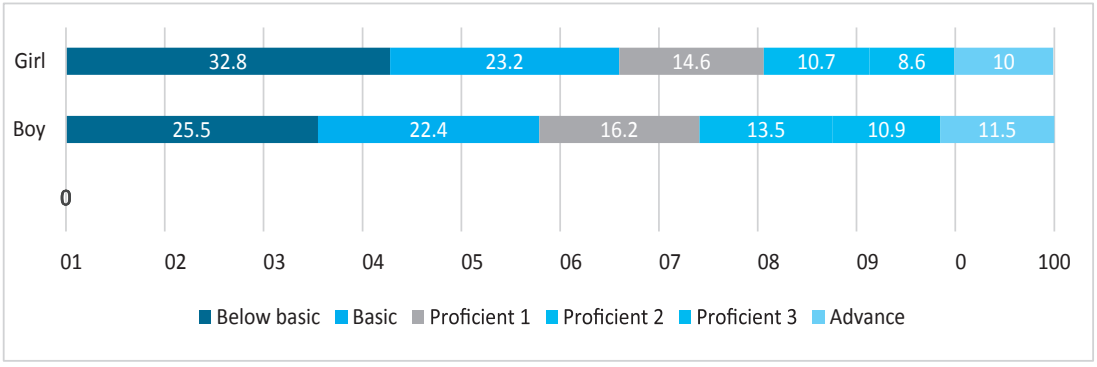
national average. The performance of province 1 was found exactly on the line of national mean. But in the case of province 2, Karnali and Sudur Paschim it was found distinctly lower than national mean in English - which deserves special intervention in policy, practice and resource management.

3.4.7 Achievement by gender, Ethnicity, home language

In this section, the analysis of students' achievement is presented in terms of their gender, ethnicity and home language - as given below in the bar charts one after another. Accordingly, the achievement of students on the basis of gender is given first of all.

3.4.7a Achievement by Gender

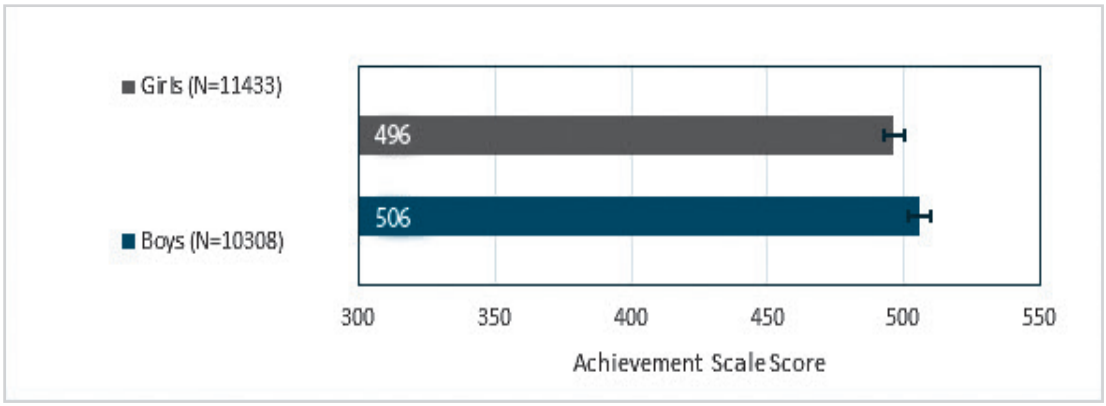
Looking at the percentage of boys and girls in different learning levels, there is inequality in learning. Figure …. Shows the distribution of students in all six proficiency levels.



Major disparity was found in lowest level achieving group – as below basic and basic level students are summed, lagging back girls were 56% girls were falling in those level where as 48% boys were falling in this group. This proves that very large number of students were not able to learn in grade 10 English. However, 10% girls and 11.5% boys were able to achieve advance level who cross even the grade 10 level skills in English.

From the perspective of gender, the analysis of students' achievement was also found significantly different in grade 10 English, which is presented in the bar diagram below.

Figure 96 Achievement of students by gender in English



As we can imagine the occurrence of proper learning among students, ideally girls and boys should have equal opportunity in their study. In the framework of the questionnaire, students had disclosed their gender. Accordingly, analysis was done seeing the achievement of girls and boys separately. As the data shows, there were 10308 (47.41%) boy students and 11433 (52.59%) girl students participated as the samples in this study. After grouping the scores gained by boys and girls separately, comparison of girls' and boys' achievements are depicted separately above. It shows that girls have achieved 496 while boys have achieved 506. Two points can be highlighted regarding this data. First, there is the difference between girls and boys by 10 scale score in their achievement. Second, boys' achievement is found above the National Mean (500) by 6 scale score, while girls' achievement is below the National mean (500).

A very large population (more than half) students were not able to learn the language skills in English. While comparing achievement score with respect to gender, boys have outperformed girls in a notable way; there is a gender difference in the scores of students in English subject in NASA 2019. Indicating that gender has influenced the performance of students in some notable way.

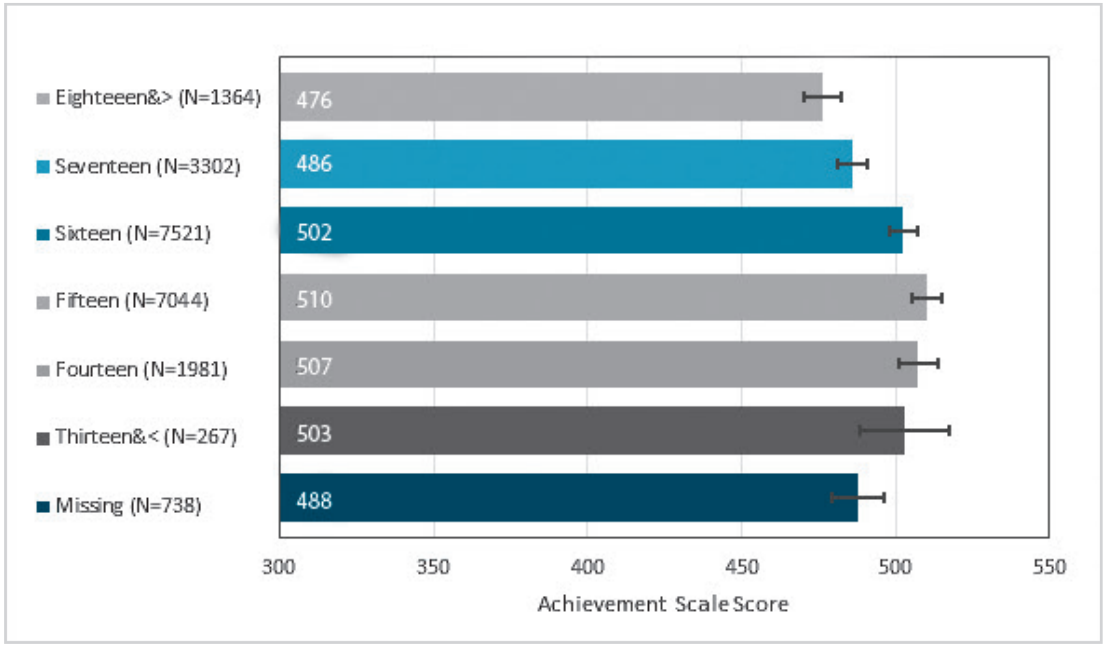
3.4.7b Achievement by Age of students in English

Students' age can be considered one of the important variables influencing students' learning in general and language learning in particular. From this consideration, there comes the issue of what age students scored how much in the test. So, from the perspective of age, the analysis of students' achievement is given in the bar diagram below.

Altogether 7 different categories were found in the data from the point of view of

students' age. There were student samples ranging from 13 years to 18 years of age; so they were students' categories of: (i) 13 years old, (ii) 14 years old, (iii) 15 years old, (iv) 16 years old, (v) 17 years old,) 18 years old. Some of the students had not mentioned their age in the questionnaire, and 738 such students are categorised as 'Missing' category in this study. The diagram below also shows how many students were included under each category of age; and the achievement of each category is presented on the right hand side in the bars respectively.

Figure 97 Achievement by Age of students in English



From the study of data, we can see that the students in the age groups of 13 years, 14 years, 15 years, and 16 years have the achievement above the National Mean (500), and the remaining all 3 groups' achievement is below the National Mean. The highest record is found in the age group of 15 years (with 510 point), followed by 14 years (507 point). The poorest achievement is seen in the age group of 18 years (with 476 point); and the students in the age group of 17 years have scored 486 points.

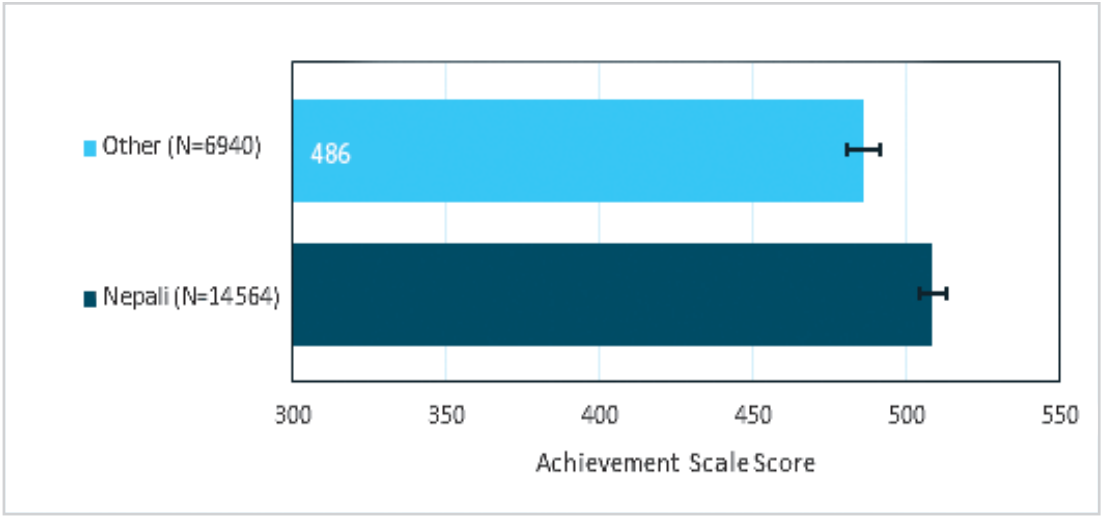
In this way, we can say that students in the age group of 14 or 15 years have achieved distinctly higher than the students of other age groups. On the other hand, the old age students in the age of 17 or 18 years have the achievement far below the National Mean. This shows how the factor of students' age has played role in students' achievement in NASA. Among the age groups ranging from 13 to 18 years, the data

has given a clear indication that learning achievement in English is found increasing up to 15 years, and then it has started declining every year - the older the age, the poorer the level of students' achievement.

3.4.7c Achievement from Home Language Perspective

One of the important perspectives to see the data of English language achievement among students is their home language. In this NASA study, the sample students were asked to mention their home language (mother tongue) in the questionnaire. They were instructed to mention whether they use Nepali as mother tongue or some other language at home. According to their responses, the students were categorized into two groups: (i) those having Nepali as mother tongue spoken at home, and (ii) those who use a language other than Neplai as mother tongue. The number of sample students in these two categories and their achievement in English is presented in the bar chart below.

Figure 98 Achievement from Home Language Perspective



There were altogether 14564 (67.7%) sample students having Nepali as their mother tongue; and the number of those having other mother tongue were 6940 (32.3%). From the study of data depicted above, we are informed that the achievement of the students having a mother tongue other than Nepali is far below the line of National Mean (500), while the students having Nepali as their mother tongue have achieved above the National Mean. The data shows that the students with their home language other than Nepali have scored only 486 points in the English subject in NASA. But those with Nepali home language have been able to score above National mean significantly.

In this way, from this situation one can say that English achievement has been higher or lower based on the students' home language as well. Compared to the achievement of the students having Nepali as the home language, the situation of students with non-Nepali home language background have gained poorer achievement in English subject.

3.4.7d Achievement from Ethnicity Perspective

In NASA study, one of the concerns has been students' ethnicity background and its relation to achievement. Here, on the basis of the dara, it has been attempted to see the achievement of the students who have different ethnic background. Broadly, 3 important ethnicities have been considered for study with importance - which are Brahman/Chherti, Janjati and Dalit. The students' ethnicities not falling into these three categories have been recognized here as 'Other' category.

Accordingly, there were 9249 Brahman/Chhetri students, and 8059 Janjati students who participated in the study as samples. Similarly, the number of Dalit students was 1874; and altogether 1718 students of 'other' category were included in the sample. However, 1317 students did not explicitly mention their ethnic belongingness. The distribution of students by ethnicity and the proficiency level in which they belong is presented below.

Figure 99 comparison of distribution of number of students (%) by ethnicity in six proficiency levels

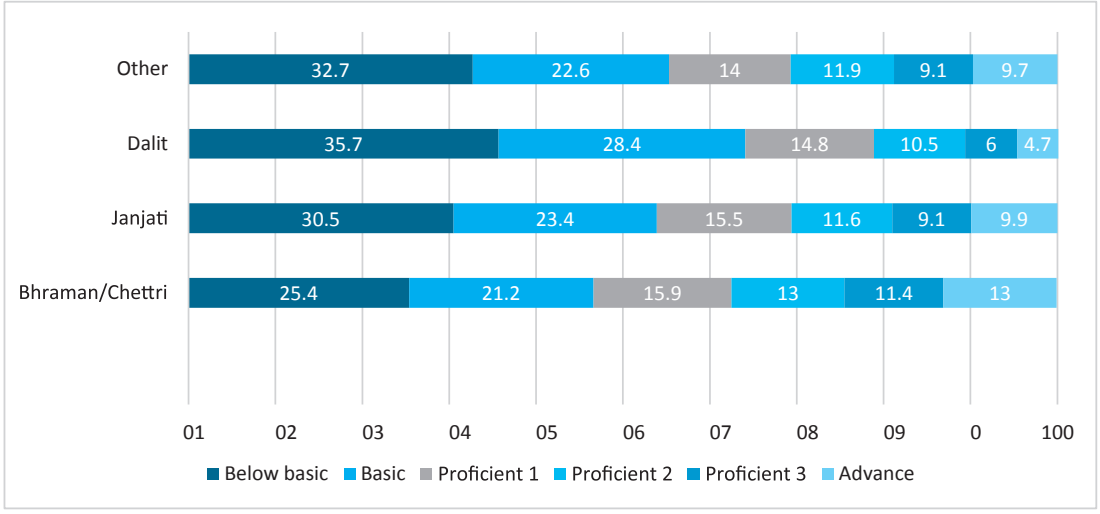
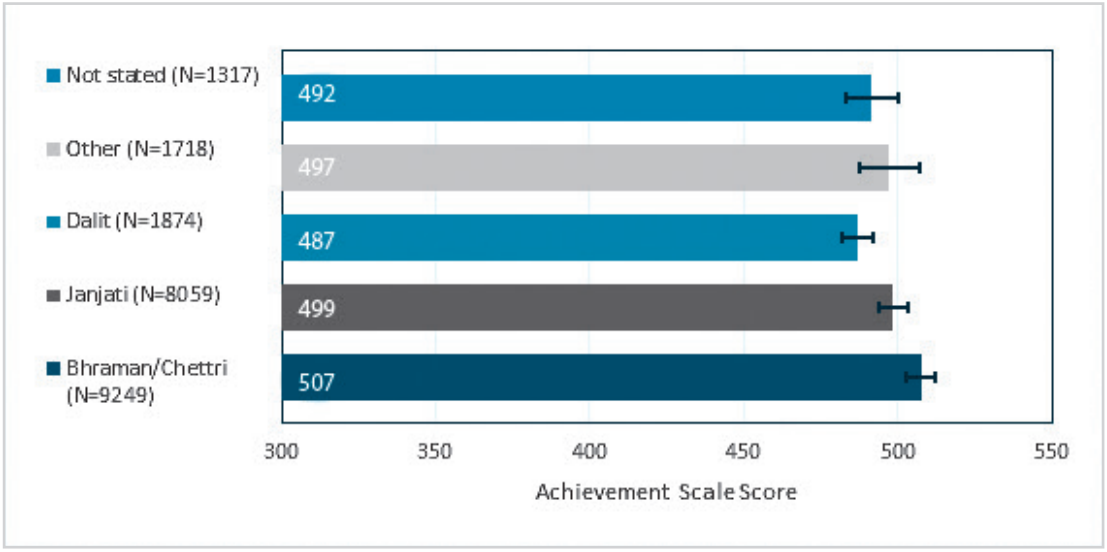


Figure 98 presents that students from Dalit ethnicity were most advantaged, as

35.7% of those students were lagging on below basic level and in contrast only 4.7% could achieve advance level. In contrast, Brahman/Chhetri were lowest number 25.4% in below basic level and 13% in advance level.

Student ability scale score were also compared by ethnicity. Their achievement scores are depicted below in the bar chart.

Figure 100 Achievement from Ethnicity Perspective in English



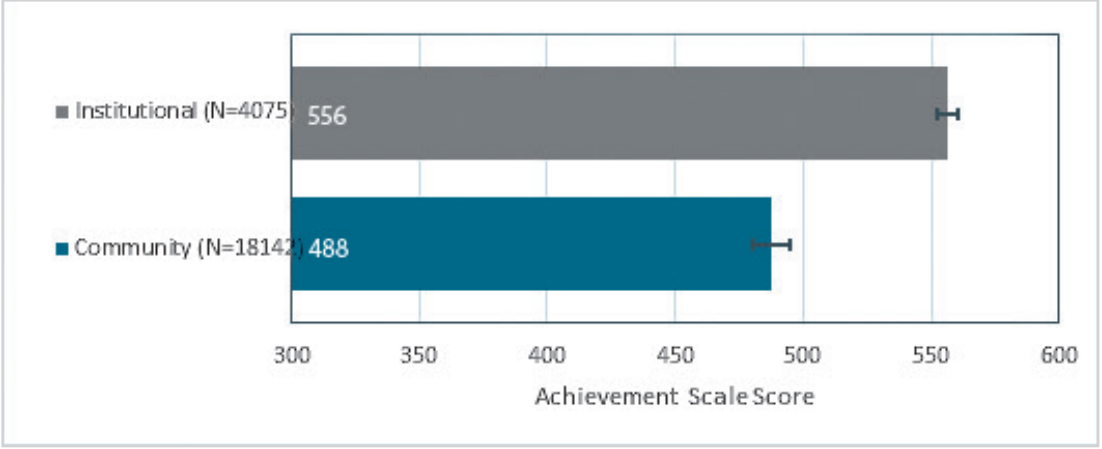
From this depiction, it is known that the achievement of Brahman/Chhetri students, Janjati students, Dalit and 'Other' categories of students was found to be 507, 499, 487 and 497 respectively, while the students who did not state their ethnicity had scored 492 points. The data clearly shows that the students of Brahman/ Chherti ethnic group have achieved higher than the national mean and this achievement is greater than the achievement of the students from all other categories. The achievement of Janjati students is very close to the National Mean (slightly lower than the 'Mean line'). All the remaining groups' achievement is lower than that of Janjati students; and the lowest achievement is seen in the case of 'Dalit' students.

Thus, we can say from this situation that achievement in English subject has been higher or depending upon the students' ethnicity to some extent, whereby compared to the achievement of the students from Brahman/Chhetri ethnic group, the other groups of students have scored poorer. Dalit students are still poor in achievement - with the lowest level of achievement.

3.4.8 Achievement by Schools types

In NASA study, one of the concerns is related to the comparison between two types of schools in the learning achievement in English subject as well. Accordingly, the achievement scores of the students from community schools and institutional schools were calculated separately then presented in the bar chart below.

Figure 101 Achievement by type of school in English



The number of students sampled for NASA study in English from community schools was 18142, while those from institutional schools were 4075. When we see the achievement, it is seen that the students from community schools have achieved below the National Mean, while those from institutional schools have achieved distinctly above the National Mean. The score of the two categories of schools is 488 and 556 respectively - whereby a very high disparity is noticed between the two.

Thus, data suggests the reality that students from institutional schools have a higher level of competence in English compared to the National Mean, while the students from community schools are poor scorers.

3.4.9 Achievement by Parents' education

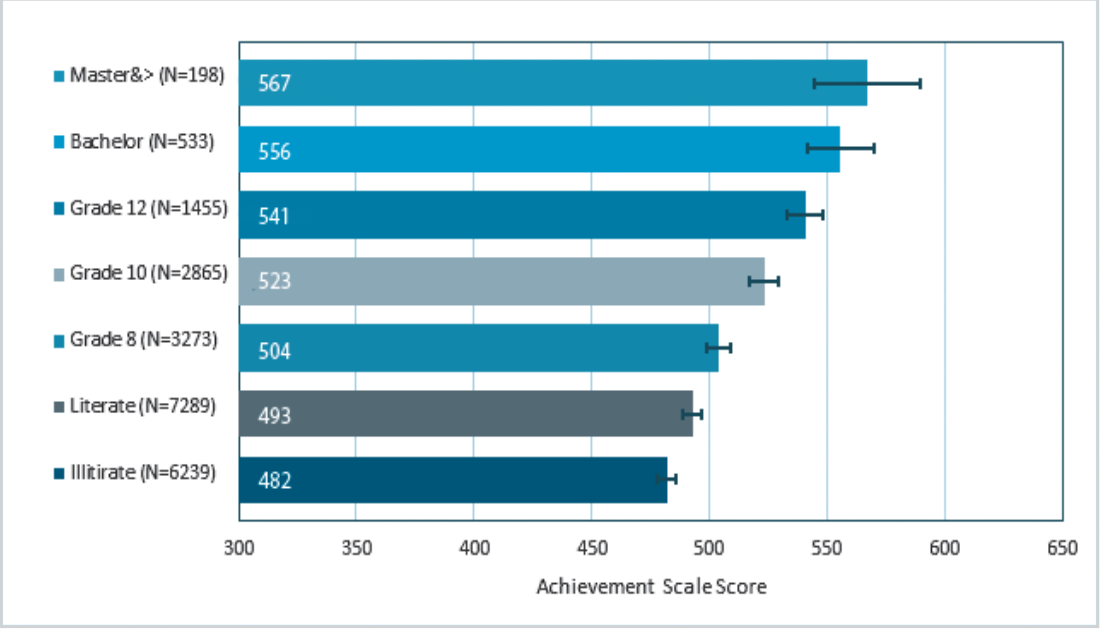
In the study of NASA, one of the key concerns has been to see how far the family-related factors including parental education and their occupation have been associated with the students' learning achievement. Accordingly, the data have been studied from this angle in the students' achievement in English subject as well. Here, first of all, the association of parental education in students' achievement is studied, and the role of parental occupation is presented thereafter.

In the attempt of seeing the role of parental education in students' achievement, it is attempted to see the role of mother's education and that of father's education in the achievement separately - as given under the following sub-headings.

3.4.9a. Mother's Education

One of the interests in the analysis of data has been to see whether (and how far) any difference is seen in the students' achievement depending upon the level of mother's formal education. Accordingly, 7 different layers/categories of mother's education have been established as per the information derived from the responses given by sample students in the questionnaire. These categories are: 'Illiterate', 'Literate', 'Grade 8', 'Grade 10', 'Grade 12', 'Bachelor's', and 'Master's and above'. The achievement of students having mothers of these various categories is depicted in the bar chart below.

Figure 102 Achievement by mother education in English



As we can see in the chart, there were 6239 students having illiterate mothers, while the mothers of 7289 students were just literate. In the same way the number of students having mother's qualification of Grade 8, Grade 10 and Grade 12 were 3273, 2865 and 1455 respectively. Altogether 533 students' mothers had the qualification of Bachelor's degree and those of 198 students had Master's degree or above.

To see the students' achievement, it is seen that the students having illiterate and just literate mothers have achieved the points below the National Mean (500), though the

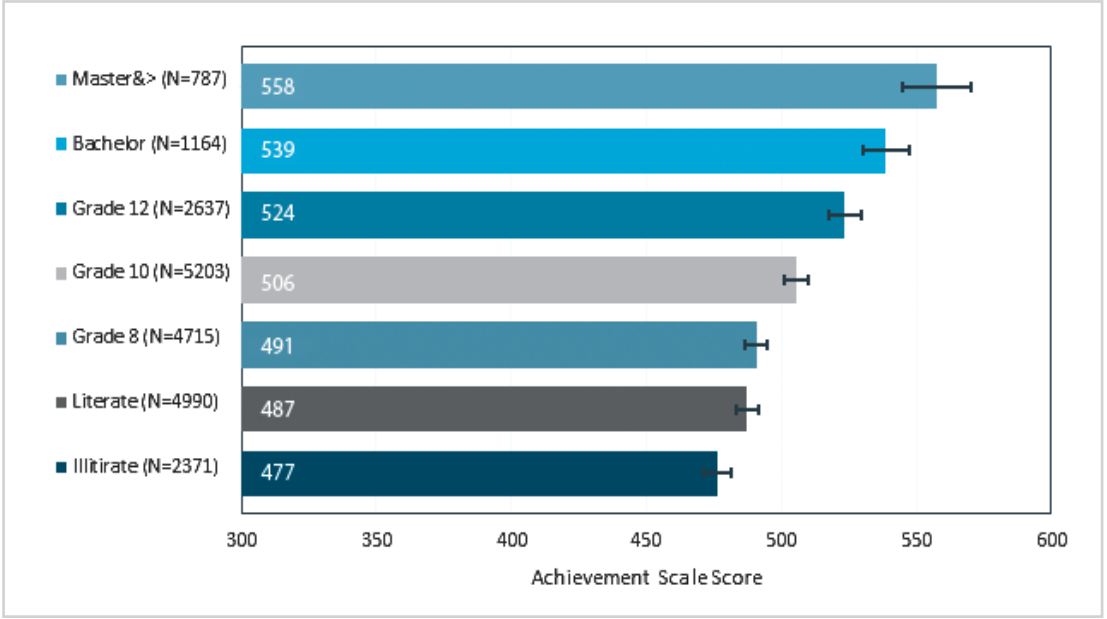
achievement gained by the students having literate mothers is higher than that gained by the students whose mothers are illiterate. The students of all the remaining groups have achieved the point above the National Mean. Importantly, the highest achievement is found in the students who have mothers with the qualification of Master's degree or above; similarly the second highest achievement is found among those having mothers with the qualification of Bachelor's degree, followed by the students with 12 class pass mothers, then 10 class pass mothers. The lowest achievement is seen in the student whose mothers are illiterate.

On the whole, data has given a very clear indication that mother's education has a direct association with the students' achievement in English subject - the higher the educational qualification of mothers, the greater the students' achievement. This tendency has been applicable without exception in all the categories of students.

3.4.9b Father's Education

Father's education is also important in relation to students' achievement; so this has been considered for data analysis in relation to English subject as well. Like in the case of analyzing data considering mother's education, 7 different categories of father's education have been established for data analysis, which are: 'Illiterate', 'Literate', 'Grade 8', 'Grade 10', 'Grade 12', 'Bachelor's', and 'Master's and above'.

Figure 103 Achievement by father education in English



The chart depicts that 2371 students had illiterate fathers, and fathers of 4990 students were just literate. The number of students having father's qualification of Grade 8, Grade 10 and Grade 12, Bachelor's, and Master's or above was 4715, 5203 and 2637, 1164 and 787 respectively.

When we see the students' achievement, it is found that the students having illiterate fathers, just literate fathers and the fathers having the qualification of Grade 8 have achieved the points below the National Mean (i.e. below 500). Though, the achievement of students having literate fathers is higher than that gained by the students whose fathers are illiterate. In the same way, the students with fathers having a qualification of grade 8 had a bit higher achievement than the achievement of students having fathers who are just literate.

The students of all the remaining groups (father with the qualification of Grade 10, Grade 12, Bachelor's degree, and Master's degree or above) have achieved the point above the National Mean. Like in the case of mother's education (discussed above), the highest achievement is found in the students who have fathers with the qualification of Master's degree of above; and the second highest achievement is found among those having fathers with the qualification of Bachelor's degree, then comes the achievement of students with 12 class pass fathers, then 10 class pass fathers. Going downwards in the hierarchy in this way, the lowest achievement is seen in the students whose fathers are illiterate.

Overall, data clearly depicts the reality that father's education has been associated with the students' achievement in a meaningful way in English. The higher the educational qualification, the greater is the achievement - like in the case of mothers. This tendency has been applicable to the students in any of the categories.

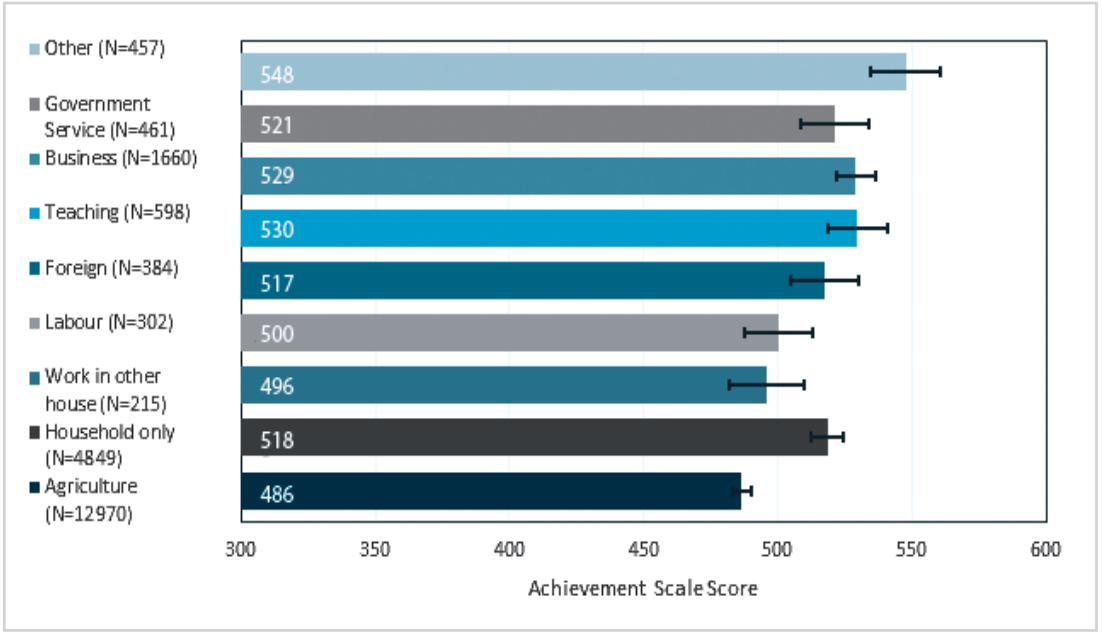
3.4.10 Parental Occupation

In NASA study, students' learning achievement is considered for analysis from the perspective of parental occupation as well. Accordingly, the achievements of students having mothers engaged in various occupations were studied. In the same way, the association between father's occupation and students' achievement has also been analyzed in the sub-headings that follow.

3.4.10a Mother's occupation

Mother's occupation has been an important consideration in NASA study in relation to students' learning achievement; so this has been considered for data analysis in relation to English subject as well. For this purpose, altogether 9 different categories of mother's occupation have been established for data analysis, which are: 'Agriculture' (12970 samples), 'Household work' (4849 samples), 'Work in other's house' (215 samples), 'Labourer' (302 samples), 'Foreign employment' (384 samples), 'Teaching' (598 samples), 'Business' (1660 samples), 'Government service' (461 samples), and 'Other' (457 samples)categories. According to the responses given by sample students, the number of students having mothers of these various categories are indicated in the bar graph below, and the achievement of each and every group is also indicated inside the bar.

Figure 104 Achievement by mother's profession in English



As depicted in the chart, two categories of students have achieved below the National Mean in English. They are: the students having mother's occupation in farming (agriculture) and those whose mothers work in other people's house. Interestingly, the achievement of the students having mother working in agriculture (486 in the achievement scale score) have achieved poorer than the ones whose mothers work in other persons' houses (496 in the scale); and thus, the children of the mothers working in agriculture have achieved the poorest score among all the 9 categories of

students. Still more interesting figure is noticed to see the achievement of students whose mothers' occupation is 'other' than the rest categories of specified occupations (with the score of 548 in the scale). The students having mothers who are engaged in business are in the second top position (with the score of 529 in the scale) and third position is occupied by those who have mothers involved in teaching profession (score = 528). Similarly, the fourth and fifth positions are held by the students having mothers who work in government service and involved only in the household works (score = 518), respectively. Children whose mothers are in foreign employment have achieved in the sixth position (score = 517). The children of laborers have scored just in the line of National Mean (500).

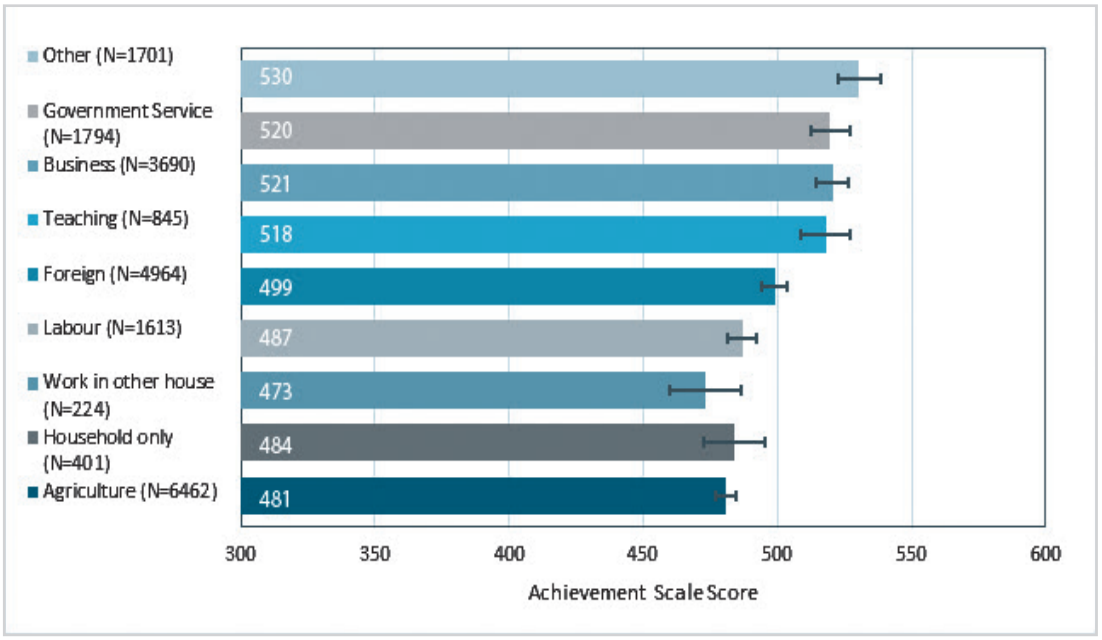
Thus, it seems mother's occupation has some association with students' achievement in English subject as well - whereby the data clearly depicts that children with mothers working in the farmland (agriculture) have made the poorest achievement, while the achievement of the children of the mothers involved in business and teaching looks encouraging. The achievement of 'Other' category of students is highest among all groups of students. Since 'other' category is unspecified, it becomes a need to see what occupations are associated with this extent of achievement.

3.4.10b Father's occupation

Like mother's occupation, data have also been studied by considering father's occupation in NASA study in relation to students' learning achievement - seeing how far this is applicable in English subject. Using the same frame of reference as done in studying the data from the point of view of mother's occupation, students were grouped into 9 different categories on the basis of their mother's occupation.

According to the data, 'Agriculture' group involved 6462 samples, and 'Household only' group involved 401 samples. Similarly, the number of samples in the categories of 'Work in other's house', 'Labourer', 'Foreign employment', 'Teaching', 'Business', 'Government service', and 'Other' categories were 224, 1613, 4964, 845, 3690, 1794 and 1701 respectively - as given in the bar chart below.

Figure 105 Achievement by father's occupation in English



Like in the case of mother's occupation, it is seen that the students having fathers doing 'Other' kinds of occupation (other than agriculture, household work, work in other people's houses, labourers, foreign employment, teaching, business, and government service) have yielded the highest achievement (which is 530 points in the scale). To the other extreme, the lowest achievement is seen among the students who have fathers working in the house of other people (and the score in this case is 473 points). Such a vast difference is noted when we see the discrepancy across the categories from the point of view of father's occupation.

From the study of data, we know that students who have fathers working in business and in the government service have similar achievements (with the score of 521 and 520 in the scale respectively, followed by the students with fathers involved in teaching profession (who have scored 518 in the scale).

To state a bit precisely, we can see that only 4 categories of students considered from the point of view of father's occupation have achieved above the National Mean score. These occupational categories are 'government service ', 'businesses, 'teaching', and 'other' category. All the remaining categories of students have achieved lower than the National Mean. And these categories are 'foreign employment', labourer, household workers, those working in others' houses, working in own house and in agriculture.

3.4.11 After School activity

In the process of data collection, it was attempted to seek information from the sample students regarding what sort of activities they are involved in when they spend time out of school hours. According to the responses given by them, the various activities they are involved in and the length of time spent by them in those activities are presented in the table below.

Table 55 Percentage of students devoting their time in out-of-school activities in English

Out-of-School Activities	Percent of students in the sample according to amount of time spent					
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	<= 4 hour	Not responded
TV, internet, mobile, computer	18.7	54.5	15	2.2	1.1	8.5
Play with friends, chat	14.4	56.5	16.1	2.9	1.1	8.9
Involve in home chore	6.9	33	34.3	13.2	4.6	8
Study and do homework	3	7.4	20.6	33.6	26	9.4
Work for wage	59.7	9.9	5	2.9	3.7	18.9
Reading other books	10.8	47.8	21.7	6.7	2.7	10.2
Help brother/sister for study	13	40.1	27.6	8.1	2	9.1

In this way, students were found involved in various activities as given in the table. Moreover, the length of time given to the activities is also given in terms of percentage of sample students. As given in the table, the activities they are engaged in are: engagement in TV, internet, mobile, computer; Play with friends, chat; Involve in home chore; Studying and doing homework; Work for wage; Reading other books; and Helping brother/sister for study.

Importantly, in NASA study, students' learning achievement is also seen by considering their out of school activities, with the view to see whether any such activity is associated with learning achievement or not: and if associated at all, how strong is the association. Accordingly, the achievement of students in English according to their involvement in out of school activities is presented in the table as given below.

3.4.12 Out-of-school activities and student achievement

The data regarding students' achievement according to their time spent in various activities out of school are presented in the table below.

Comparison of achievement of students according to their time spent in out-of-school activities.

Table 56 Achievement of students according to their time spent in out-of-school activities

Out-of-School Activities	Achievement scale score				
	I don't give time	less than 1 hr	1-2 hour	2-3 hour	>= 4 hour
TV, internet, mobile, computer	488	500	526	529	510
Play with friends, chat	507	501	501	509	502
Involve in home chore	514	512	497	491	482
Study and do homework	474	487	499	507	507
Work for wage	512	482	480	481	476
Reading other books	513	505	499	491	479
Help brother/sister for study	521	505	496	486	481

The data reveals the fact that, in the case of watching TV, internet, using the mobile phone and doing works in the computer, the students spending time for 1-3 hours have achieved higher than those who have not given time for these activities, or compared to those who have spent 4 hours or more in these activities. Interestingly, the students not giving any time in these activities have achieved below the National Mean, while those giving some time (more or less time) have achieved above the National Mean.

In the case of playing and chatting with friends, all categories of students have achieved above the National Mean; but the students who gave 2-3 hours' time have achieved a bit more than others. Their achievement is 509, followed by those who spent no time in these activities (507).

In the case of students' involvement in home chores, only the students in 2 categories have achieved above the National Mean – those who are not at all involved in such chores (514) and those who are engaged in these activities less than 1 hour a day (512). All the students involved in these activities for more than 1 hour a day have achieved lower than the National Mean. That too, the achievement of those who are involved in these activities for 4 hours or more every day is the poorest of all (482).

Regarding the activity of 'Study and do homework', it was found that the students spending time 2-3 hours or 4 hours (or more) a day have achieved higher than the National Mean, while the achievement of other categories of students is lower than National mean. As the data reveals, the less the time they spent in studying and doing homework out of school, the poorer is found the students' achievement.

So far as the activity of 'Work for wage' is concerned, data shows that only the students not at all engaged in such activities have achieved higher than the National Mean – with the achievement of 512 score. All others have achieved lower than this line; and it was found that long time engagement (4 hours or more) in such activities has resulted in the poorest achievement (476).

Concerning the activity of 'reading other books' (other than the course materials), data shows the reality that the students who never study other books have achieved the highest score, followed by those who study such books less than 1 hour a day (with the score of 513 and 505 respectively). Data shows that the more they are engaged in such activities the less they have achieved in English.

When data are examined regarding the students' help in the study of their brothers/sisters, it is noticed that the students who have not spend time in helping them have achieved the highest (521) among all groups, followed by those who have spent less than 1 hour a day (505). All the remaining groups of students have achieved lower than the National Mean. Further, the longer the time they spent in helping their brothers/sisters, the poorer the achievement they have.

3.4.13 Bullying

Bullying is considered as one of the factors negatively contributing to students' learning achievement. In NASA study, one of the considerations is related to how far the students have faced the incidents of bullying in schools; and consequently how their experience of bullying has affected their achievement. For this, the sample students were asked whether they faced bullying, and, how many incidents of bullying they faced (if faced at all). The following table presents the data based on their responses.

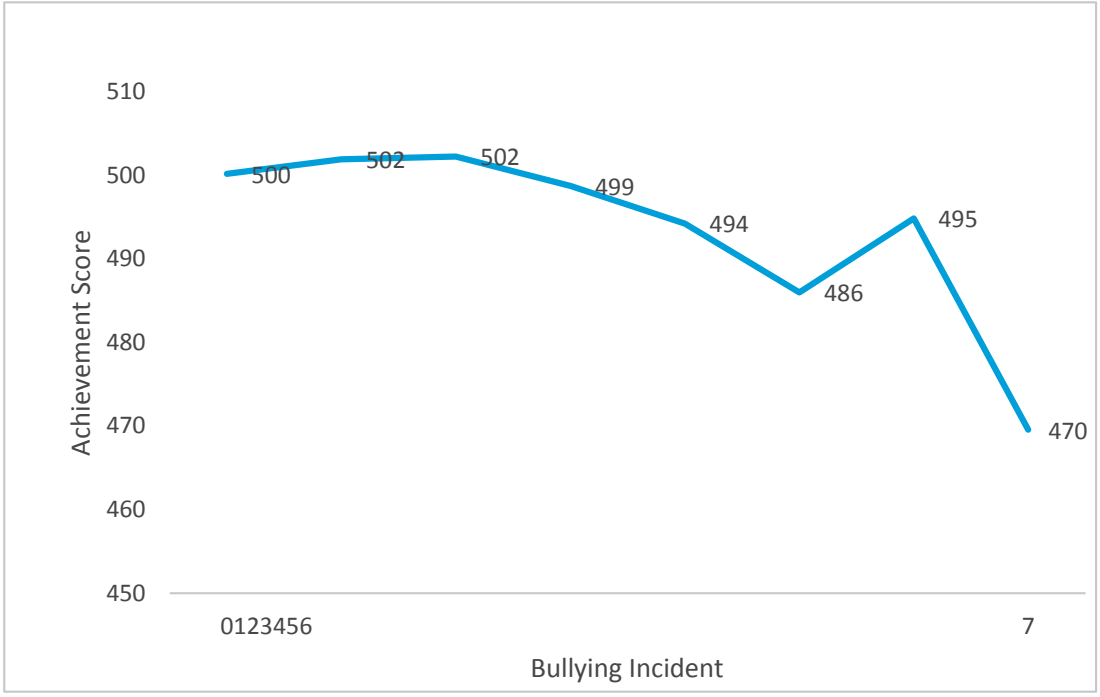
Table 57 Experience of Frequency and type of bullying by students

Feel Bullying incident	Frequency	Percent
No bullying	11481	51.7
One kind of Bullying	5350	24.1

Feel Bullying incident	Frequency	Percent
Two kind of bullying	2651	11.9
Three kind of bullying	1445	6.5
Any four kind of bullying	641	2.9
Any five kinds of bullying	312	1.4
Any six kinds of bullying	123	0.6
All seven kinds of bullying	90	0.4
Not Stated	124	0.6

Thus, among the total sample population of students, it was found that 51.7% of them did not face any sort of bullying incident in school. The students facing one kind of bullying were 24.1%, while 11.9% of them had faced two kinds of bullying. In the same way, the students facing 3,4,5,6 and 7 different kinds of bullying in the school were 6.5%, 2.9%, 1.4%, 0.6%, and 0.4% respectively. A small fraction of sample population (0.6%), however, did not state whether they faced the incident of bullying or not.

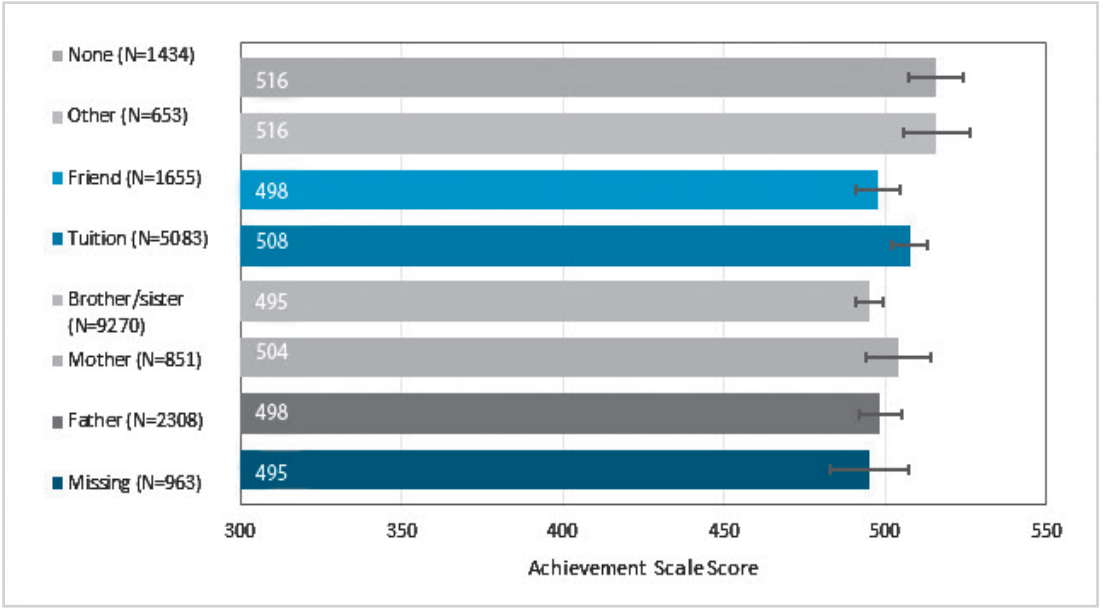
The comparison of the student score with the extent of bulling shows that bullying has negative effect This result is shown below:



3.4.14 Support from Other Persons in Study and Achievement

One of the concerns of investigation in NASA study has been to see how far the support given by various persons contributed to the students' learning achievement. In English subject, accordingly, altogether 1434 sample students had reported in the questionnaire that nobody had supported them, while 2308 had reported the support from their fathers. Similarly, the number of students who received support in their study from mothers, sisters/brothers, tuition, friends and others were 851, 9270, 5083 and 653 respectively. Though, 963 samples were 'missing' as they did not respond in the question of who supported them in the study. The bar chart given below depicts the composition of sample students in these different categories, as well as their learning achievement in English subject.

Table 58 Student score by the person who provides support in study at home



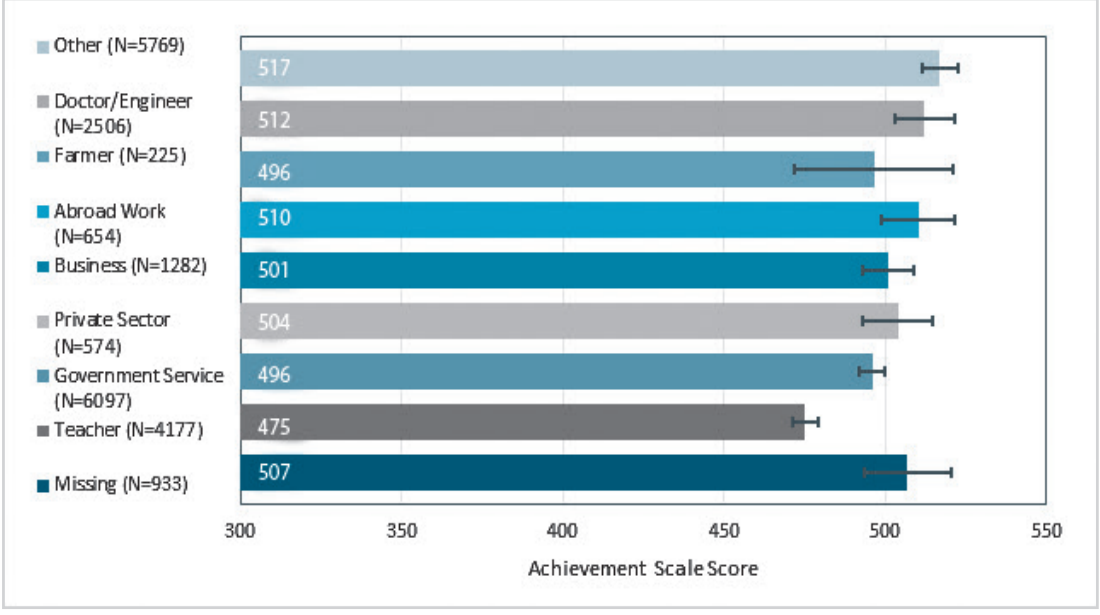
As depicted here, the students supported by none of the persons, mothers, tuition, and 'other' persons were able to achieve the scores above the National Mean; and all the remaining categories of samples achieved below the National Mean. Interestingly, the highest achievement is seen in the case of students who were supported by nobody in their study (with the score of 516), or those who were supported by people other than father, mother, sisters/brothers, or fathers (the score remaining the same - i.e. 516). The poorest achievement score is seen in the case of students supported by brothers and sisters - with the score of 495.

In this way, students were found achieving higher in English subject in the case of being supported by nobody or someone other than their close family members or friends.

3.4.15 Achievement by the student-imagined future aim

The students' achievement in NASA has been studied with reference to their future aim also. As informed from the responses given by the sample students in the questionnaire, the number of students in 8 different categories has been calculated together and their achievements have also been calculated accordingly in English. These categories include: Teacher, Government service, Private sector, Business, Abroad work, Farmer, Doctor/Engineer and Others. The number of sample students in these various categories was 4177, 496, 574, 1282, 654, 225, 2506, and 5769 respectively. In addition, altogether 933 samples did not explicitly mention their future aims, so they have been considered as 'missing'. The achievement of students grouped under these various categories according to their future aims-achievement are projected in the bar chart below.

Table 59 Comparison of student's future aim and achievement



As depicted above, the highest achievement has been made by the students whose ambition is other than doctor/engineer, farmer, abroad work, business, private sector, government services or teacher. Students of this category have achieved 517, followed

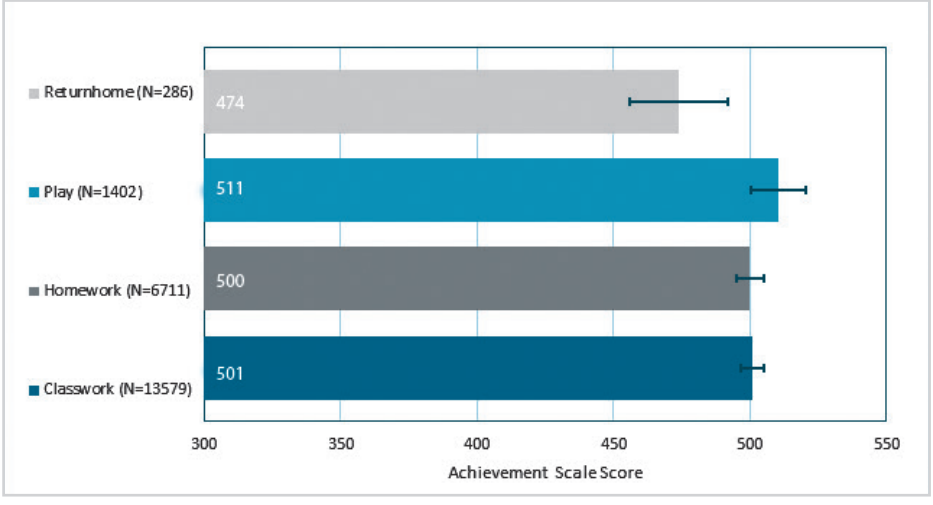
by those who have expressed their future ambition to become doctors/engineers (who have achieved 512). The third position is occupied by those who have aspired to work in the foreign countries, followed by the 'missing' students (with a score of 507) who did not mention their special aspirations. In addition, the students who want to do business (achieving 501) or want to be involved in private sector employment (504) have achieved above the National Mean. But the achievement of 3 categories of students has been below the line of National Mean - those aspiring to be farmers (with the score of 496), government service holders (also 496), and teachers (475).

In this way, in English subject, data shows that compared to the students aspiring to become teachers in the future, the achievement of those who wanted to be doctors/ engineers or wanted to work in foreign countries has been found higher.

3.4.16 Leisure Time Activity and Students' Achievement

In NASA study, one of the concerns has been to relate the students' achievement with their leisure time in school and, thereby, to see whether the leisure time activities are related to their achievement in some way. With this concern, the students were asked what they mostly do during their leisure time in the school. As per the responses given by them in the questionnaire, there are 4 groups of students: (i) those who return home in leisure, (ii) those who engage in playing, (iii) those who do their home work, and (iv) those who do class work. The number of sample students grouped into these 4 categories along with their achievement in NASA is presented in the bar graph that follows.

Figure 106 Leisure time activity and students' achievement in English



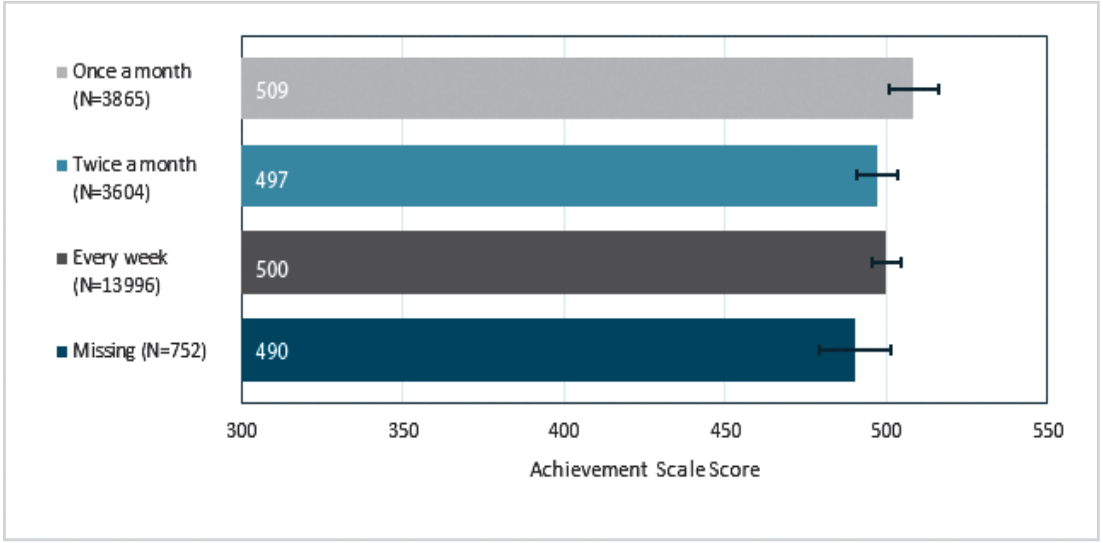
According to the data presented above, it is found that the students who are engaged in playing during the leisure in school have achieved the highest score (511) followed by those who are engaged in classwork (501) and homework (500) in the leisure. In this way, the achievement of these 3 groups of students is seen above the National Mean, while the students who return home in the leisure have achieved far below the National Mean (with the score of 474).

Thus, whatever the activity the students are engaged in, the data indicates that students who remain in the school during the leisure have achieved higher than those who return home in the case of leisure.

3.4.17 Achievement according to extra-curricular activities in school

It was also attempted to seek information from students regarding how often their schools organize the events of ECAs (Extra Curricular Activities) in school; and accordingly, the achievement scores have been calculated for 4 different categories of students, which include: (i) those studying in schools that organize such activities once a month; (ii) those studying in schools which organize the events twice a month; (iii) those studying in schools which organize the events of ECA every week; and (iv) the 'Missing' category that includes the students who did not respond. The number of sample students and their achievements are depicted in the bar chart that follows.

Figure 107 Achievement according to frequency of happening extra-curricular activities of schools in English



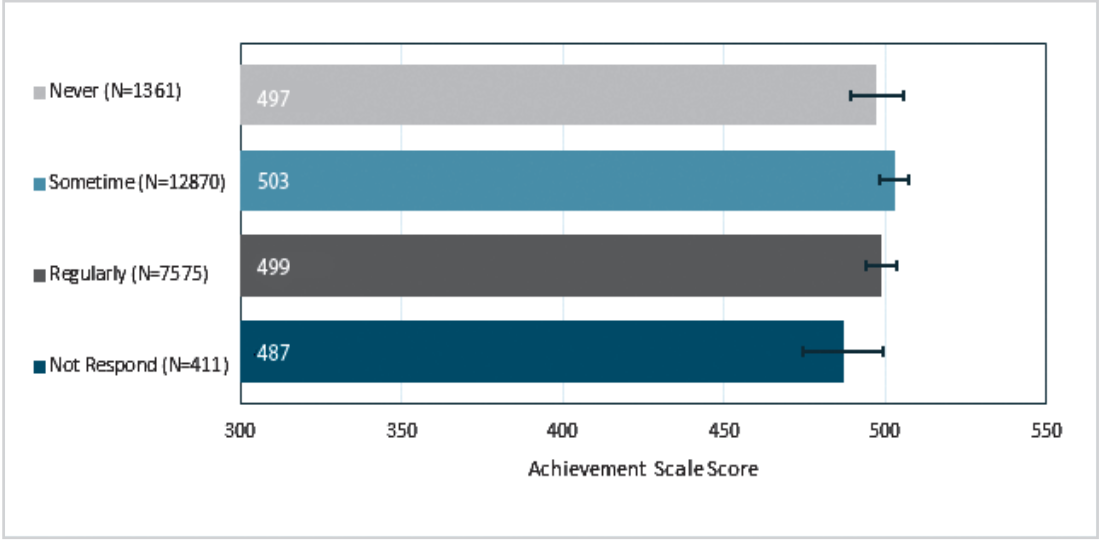
From the data depicted above, students in schools that organize ECAs once a month have achieved the highest among the 4 categories of students - with the score of 509. The second highest achievement is in the case of students in schools that organized ECAs every week (with the score of 500). However, the achievement scores of students in the schools organizing such events twice a month and the 'missing' category of students have achieved below the National Mean.

Thus, the achievement of students in schools where ECAs are organized once every month was found higher than in the schools where such activities are organized twice a month or every week. It shows that frequent ECAs may not have ensured higher achievement in English.

3.4.18 Achievement according to students' participation in extra-curricular activities

In addition to the organization of ECAs in school, information was sought from students regarding how often they themselves had participated in such activities. According to the information they furnished in the questionnaire, 4 groups of students were categorized: (i) Never participating, (ii) sometimes participating, (iii) regularly participating, and (iv) those who did not respond. The number of sample students and their achievement in each of these categories are depicted in the bar chart below.

Figure 108 Achievement by frequency of participation in extra-curricular activities and achievement



As informed from the data just depicted, we know that the students who have

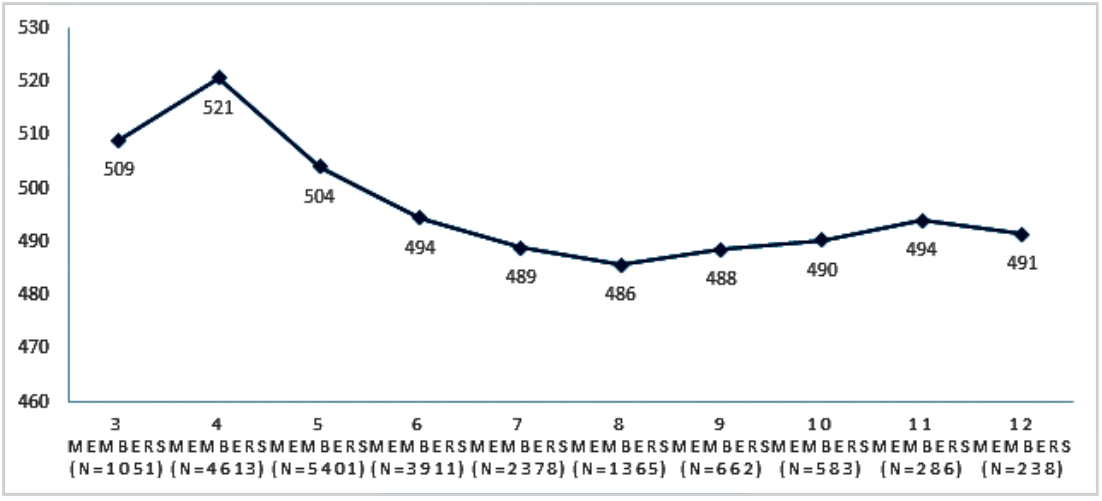
sometimes participated in the ECAs have made the highest achievement (503). The lowest achievement is seen in the case of students who have not responded (487). The students who have regularly participated in ECAs as well as those who never participated could not achieve the National Mean.

The data suggests that some involvement of students in ECAs has been somehow fruitful in student achievement in English subject, compared to much involvement or absence of involvement in such activities.

3.4.19 Achievement by family size

In the attempt of studying the factors associated with student achievement, an attempt was made to see whether there was the influence of family size in students' learning achievement. According to the information sought from students through the questionnaire, students were categorized as having 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 members in the family. The number of students belonging to these various categories and the achievement made by students in each of these categories are presented in the figure below.

Figure 109 Achievement with respect to number of family members



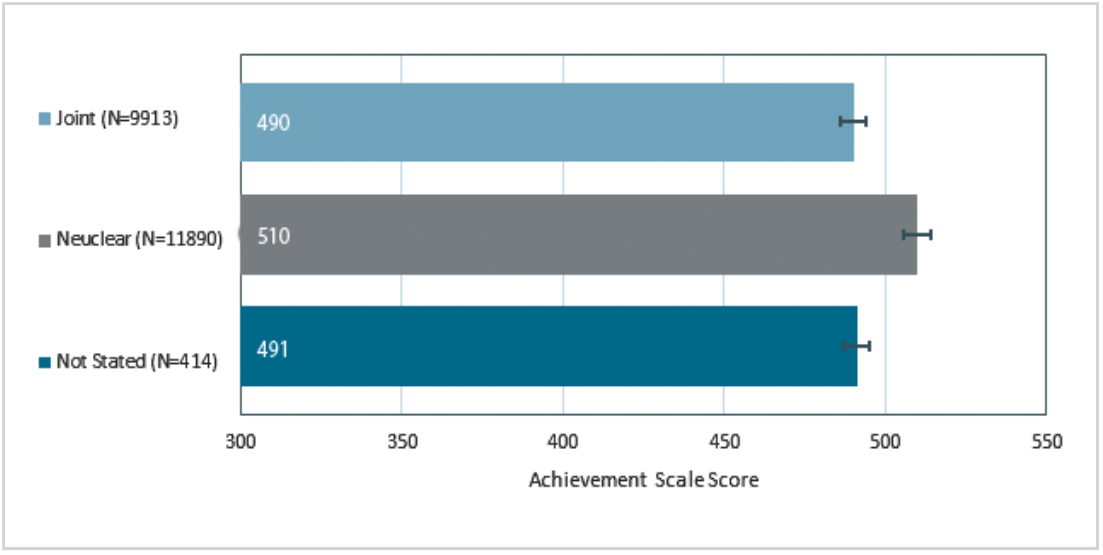
As we are informed from data, only 3 categories of students have achieved above the National Mean, which are: those having 3 members (score = 509), 4 members (score = 521), and 5 members (score = 504). While the score in the case of 4 family members has been the highest, the lowest score is seen in the case of 8 members (486). The achievement score of students with the family size ranging from 6-12 members has been between 486 and 494.

The data clearly demonstrates that having the family size of 5 members has been most favourable for the students in their learning achievement. Students with 3 or 5 members have also achieved above the National mean. But having a family with 6 or more members has not been so encouraging for their achievement in English subject.

3.4.20 Achievement by family type

Family type and its relation with learning achievement was another consideration in the study of data. Accordingly, achievements of the students living in a joint family and nuclear family have been calculated separately and projected in the bar chart given below.

Figure 110 Achievement by type of family belonginess



From the study of data just depicted, it is quite clear that students living in nuclear families have achieved higher than those living in the joint family. The achievement of the students in the nuclear family is above the National Mean, while those in the joint family have achieved below the National Mean.

3.4.21 Home possession and student achievement

Based on the information given by students, data are tabulated below regarding the various possessions found in their homes. Accordingly, the table presents what home possessions they had or did not have.

Table 60 Availability of home possession with family of student in English

Home possession	Response (%)		
	I don't have	I have	Not respond
Table for study	40	59	1
Separate study room	35	64	1
Peaceful space to study	39	60	1
Computer for school-work	82	17	2
Children magazine, story/poetry and pictures	81	17	2
Reference book for school work support	63	36	2
Internet	77	21	2
Dictionary	68	29	3

The table presents the situation of home possessions of the sample students regarding the availability of; Table for study, Separate study room, Peaceful space to study, Computer for school work, Children magazine, story/poetry and pictures, Reference book for school work support, Internet, and dictionary. Students' responses against each of these items have been calculated in percentage and depicted by indicating what percentage of them have or do not have the items.

From the data tabulated above, we know that the number of students having table for study, separate study room and peaceful space is larger than those who do not have these facilities. On the other hand, the students having computer, children's magazine/ story/poetry/pictures, reference books, internet and dictionary are less in number compared to those who have these facilities.

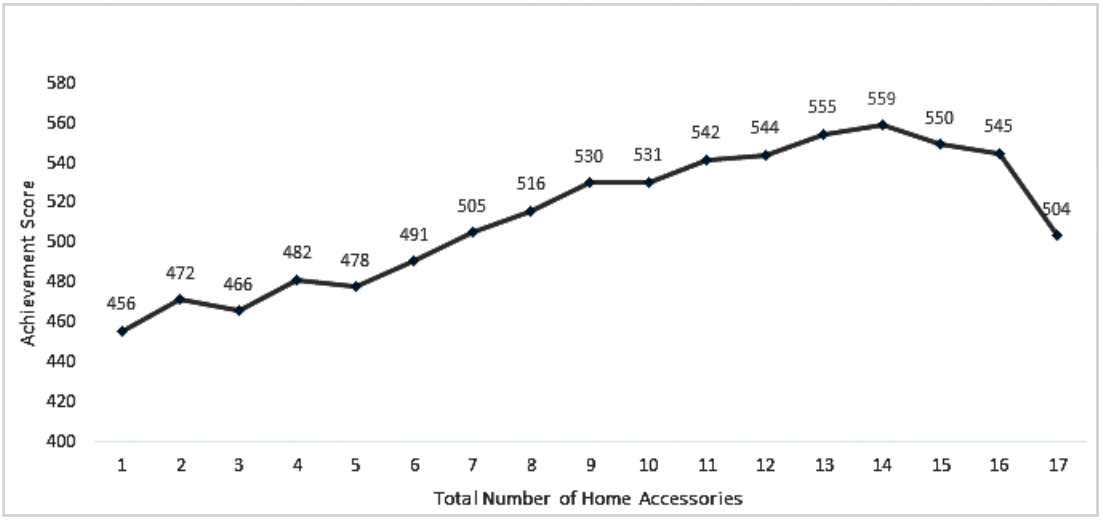
Availability of home accessories and student achievement

As informed by students in the questionnaire, data are tabulated below regarding the various accessories found in their homes - indicating what accessories they had or did not have. The items of accessories include: Television, computer, motor-cycle, car and permanent house. Then the percentage of sample students having different number of these items is also mentioned therein. In addition, the graph given after the table depicts the situation of the students' achievement having different number of home accessories.

Home Accessories	Number of accessories possessed				
	None (%)	One (%)	Two (%)	Three (%)	not respond (%)
Television	30	56	8	1.7	5
Computer	62	22	3	0.8	12
Moter-cycle	57	25	5	2	11
Car	79	4	1	0.3	16
Permanent house	37	49	5	1.7	8

The achievement score by availability of home possession is presented in figure 110.

Figure 111 Achievement by availability of home possessions



From the study of data just depicted, we are informed that the achievement of the students having 1 to 17 items of possessions available in home have achieved the scores 456, 472, 466, 482, 478, 491, 505, 516, 530, 531, 542, 544, 555, 559, 550, 545 and 504 respectively. The lowest score remaining 456 and the highest score of 559, such a big difference of 103 is noted here.

On the whole, the data demonstrates the reality that students having at least 7 or more home possessions have always achieved the scores above the National Mean, while the students with 6 or less number of accessories have achieved below the line of National Mean. In general, the achievement has increased along with the increase in the number of home possessions in the case of students having 7-14 home possessions, but the achievement has decreased when the number of possessions is 15 or more. In

the case of 1-6 home possessions, the achievement does not show consistent figure (sometimes increased achievement is noticed with the increase in accessories, while sometimes it is not found so.).

Barring a few exceptions, as such, increase in the number of home possessions has resulted in the corresponding increase in student achievement as well. Though, this trend has not been applicable in the case of too many home possessions – such as 15 or more.

3.4.22 Availability of Personal Mobile Phone

The personal mobile phone of school student also varies, 36.2% students possess their own mobile phone.

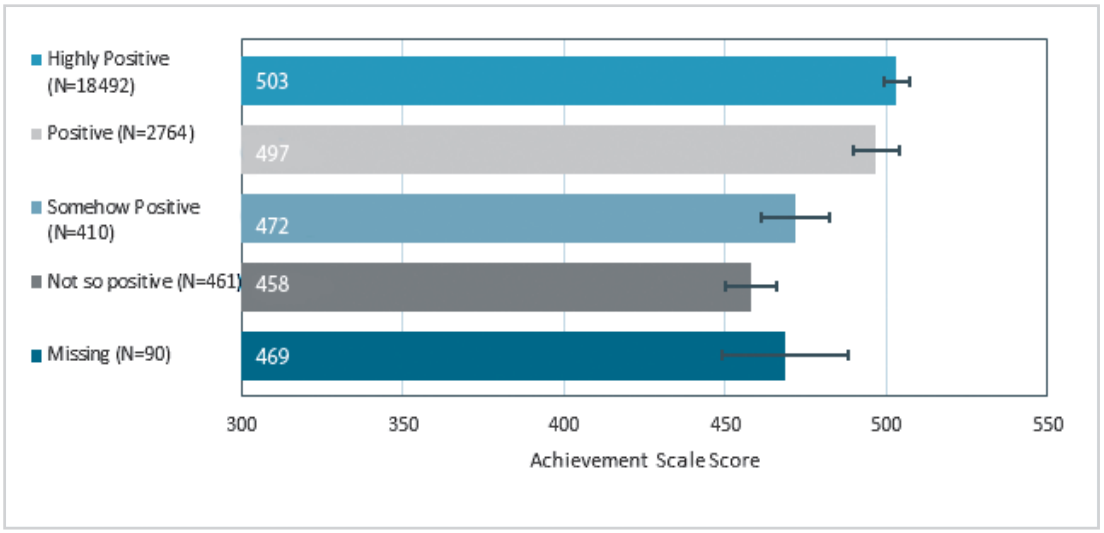
Table 61 availability of personal mobile phone with the students

bq21 D you have your own mobile phone?					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	No	13860	62.4	63.3	63.3
	Yes	8047	36.2	36.7	100
	Total	21907	98.6	100	
Missing	System	310	1.4		
Total		22217	100		

3.4.23 Student attitude towards Teacher and English

Teaching-learning is a process that involves the interaction between teacher and student. One of the concerns in NASA study has been to see whether the attitude of students towards their teachers has some relation with the student achievement. Thus, an attempt was made to record how positive (or negative) was the students' attitude towards teachers. Accordingly, their attitude was tallied with their achievement. The result is depicted in the bar chart below.

Figure 112 Achievement by attitude towards teacher in English



From this estimation, it appears that there were altogether 18492 sample students who responded that they were 'highly positive' towards their teachers in attitude, while the attitude of 2764 students was 'positive'. Altogether 410 of them were 'somehow positive'; and 461 students were 'not so positive'. In data collection, 90 students were 'missing' - who did not explicitly indicate their attitude towards teachers.

The students having a highly positive attitude towards teacher were found achieving above the National Mean (with the score of 503), while all the remaining categories of students could not achieve up to that line. From the study of data, it seems quite obvious that the students having 'not so positive attitude' towards teachers have achieved the lowest score. As they have become more positive, they have achieved higher.

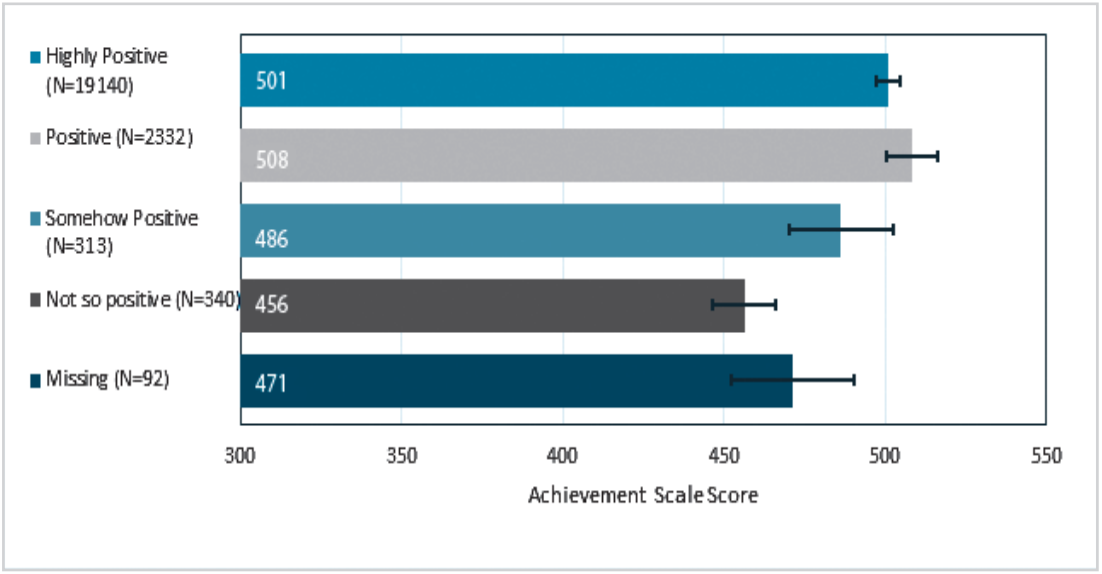
As such, students' attitude towards teachers has been associated with the level of their achievement in a strong way, in the case of English subject - the more positive the attitude, the higher has been their achievement.

3.4.24 The attitude of students towards their School

As the process of teaching-learning takes place in school and students are the ultimate stakeholders of learning, one of the concerns in NASA study has been to see how positive (or negative) the students were towards their school. And, importantly, NASA has attempted to see the relation between the students' attitude towards school and their learning achievement. Thus, an attempt was made to record how positive (or

negative) was the students' attitude towards the school. Then students' attitude was tallied with their achievement. The result is depicted in the chart below.

Figure 113 Achievement by attitude towards school in English



From the data just depicted, it has been quite clear that the students who were found 'positive' and 'highly positive' towards their school have achieved above the National Mean (with the score of 508 and 501 respectively), while those remaining 'somehow positive' or 'not so positive' have achieved below this line. The students with 'not so positive' attitude are found achieving the lowest (score remaining 456). The students with highly 'highly positive' attitude achieving a bit lower than those with 'positive' attitude seems, though, somehow surprising.

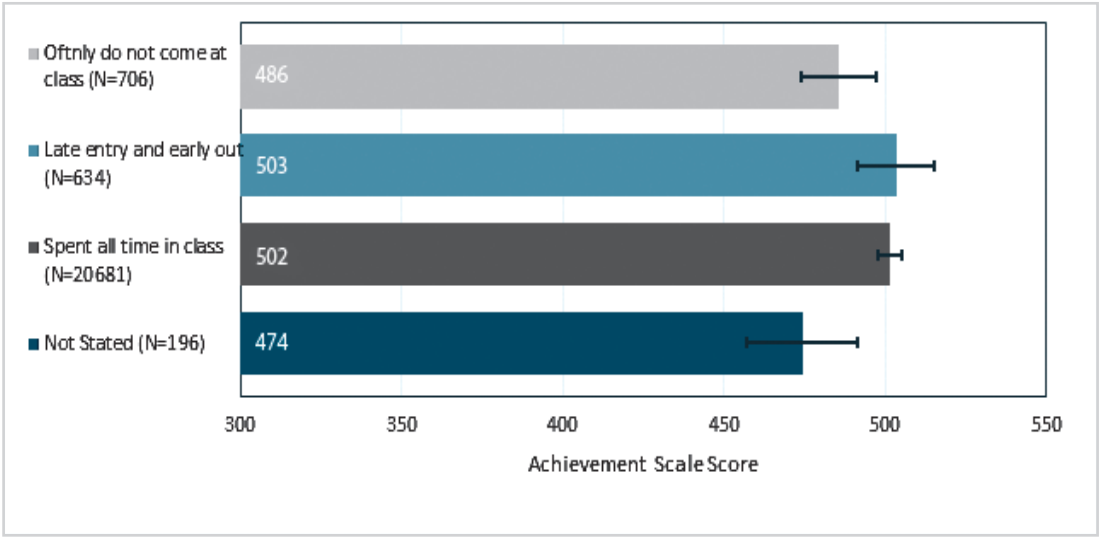
3.4.25 Regularity of teacher in the English classroom

One of the important concerns in teaching-learning business is the regularity of teacher in the class; and more particularly this phenomenon is related to the issue of the length of time spent by teachers in class. In this concern, English teacher's regularity and the time given in the class was recorded as per the information given by sample students in the questionnaire. Accordingly, the table below will present an account of the regularity of English teacher in the class; and the bar chart depicts the achievement of students who had teachers of different categories according to the presence of teachers in the class.

Table 62 Regularity of teacher in the English classroom

Response type	How is the regularity of a English teacher?			
	No of students	Percent	Valid percent	Cumulative percent
Spends all time in the class	20681	93.1	93.1	93.1
Enters late and moves earlier	634	2.9	2.9	96
Mostly does not appear in the class	706	3.2	3.2	99.2
Not respond	196	0.9	0.9	0.9
Total	22217	100	100	

Figure 114 Achievement by regularity of teacher in English



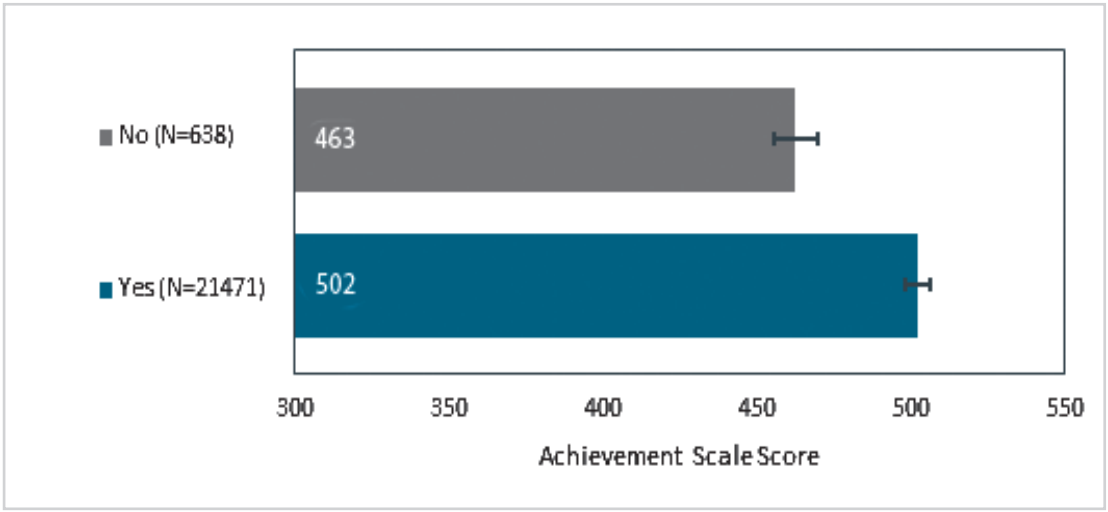
Seeing the information just depicted, we are informed that altogether 706 sample students had reported that their teachers often do not come to class. In the same way, 503 students had reported that their teachers enter the class late and go out of the class very soon. However, the teachers of 20681 students were regular and spent the entire time in the class. Some students did not furnish this information - without indicating the behaviour of teachers regarding teacher's presence in class.

As the data depicts the situation, the students whose teachers often do not attend the class have achieved below the National Average, while others have achieved below the average. Though, there is not much difference in achievement between the students whose teachers have spent the whole time period in class and those whose teachers come to class late and leave the class before the end of class period.

3.4.26 Availability of text English book

Textbook is considered an essential material for teaching-learning. In NASA study, the sample students were asked in the questionnaire whether they had the textbook for study or not. Accordingly, the achievements of students having textbook and having no textbook were calculated separately then presented in the bar chart given below.

Figure 115 Achievement by availability of English textbook



According to the information furnished by students, there were 638 students not having the textbook of English subject, while 21471 students had the textbook. The achievement result shows that only the students having the textbook have achieved above the National Mean - with 502 in the achievement scale score. The achievement of the students having no textbook is far below the line of National Mean - with the score of 463. Such a remarkable difference was found in achievement between the two categories of students in English subject.

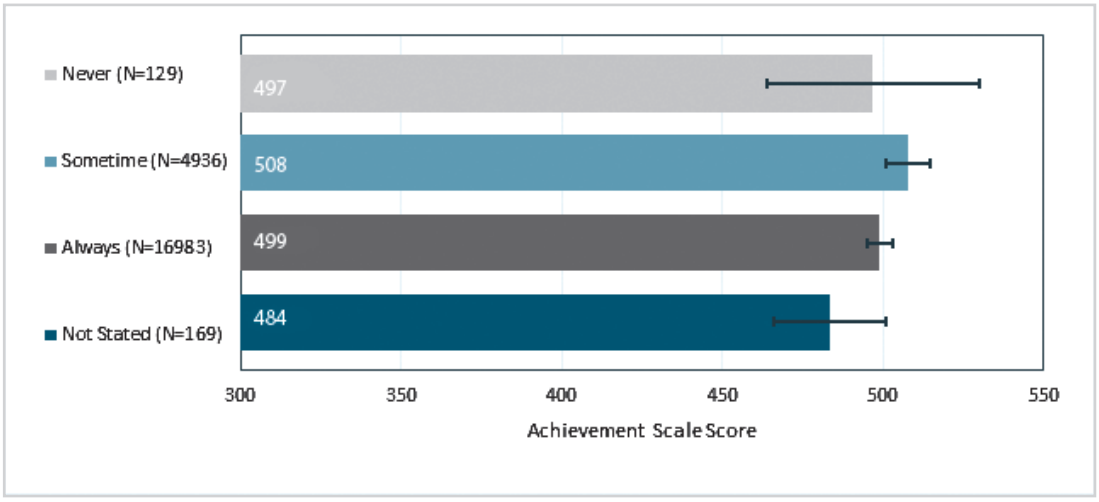
Thus, a clearly noticeable difference was found in the students' achievement in English subject due to the presence or absence of textbook in their possession: While the students with textbook achieved a bit higher than National Mean, those without it achieved far below the National Mean.

3.4.27 Homework/feedback

An important consideration in teaching-learning is the practice of giving home-works to students and feedback to them by teachers based on their writing. In NASA study, the sample students were asked how far their teachers give feedback to them

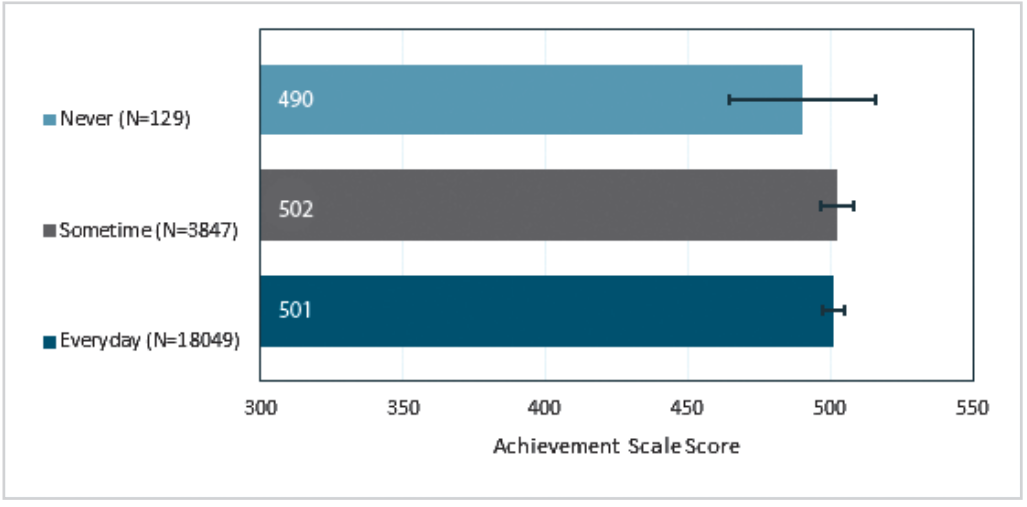
based on their homework. Accordingly, three categories of students were identified: (i) those who receive feedback from teachers in their home-works every day; (ii) those who receive feedback sometimes; and (iii) those who never receive feedback in homework. The number of sample students in the three categories were 18049, 3847 and 129 respectively.

Figure 116 Achievement by providing homework to the students in English



It is interesting to see if providing feedback to students in English is effective. Students' response on how often teacher does provide feedback on students' homework and corresponding achievement is presented below.

Figure 117 Achievement by Regularity of feedback provided



From the study of achievement as demonstrated in the bar chart above, it appears that the students who received feedback from their teachers (whether everyday and sometimes) have achieved above the National Mean, while those who do not receive feedback in homework have lagged behind and their achievement is distinctly below the National Mean. However, there is not much difference in achievement between the students receiving feedback everyday and those who receive sometimes.

In this way, the influence of feedback in homework is clearly noticed in the achievement of students in English subject - whereby the students receiving feedback from teachers have scored higher than those who did not get the opportunity of feedback in homework.

3.4.28 Use of support materials

Students are found having the tendency of using various materials in learning, including the questions asked in the exams previously, guess papers (the possible questions that can be asked in exam from the course) and guides (which contain the solution to the problems/questions in the exercises of textbook). In NASA, the sample students were asked in the questionnaire to respond regarding their practice of using these materials. Accordingly, the number of students making use of the materials in English subject was calculated. The calculation is presented in the table below.

Table 63 Type of support materials used by students

Type of resources	Number of students (N)	N Percent
Old set of questions	16028	72.1
Guess paper	6891	31.0
Guides	5136	23.1

As presented in the table, altogether 72.1% students were found using old sets of questions as part of their practice in English subject. In the same way, the students making use of Guess papers and Guides were 31% and 23.1% respectively.

3.4.29 Attitude of students on utility of English

NASA had also attempted to see the attitude of students regarding how far the English language would be useful for them. So, students were asked to respond in the questionnaire against some statements related to the utility of this language in their life. The table below summarizes what they were asked and how they responded on the utility of English.

Table 64 Student's attitude on utility of English

Description	Number of students in percent			
	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree
1. English can help me in daily life	86.1	11	1	1
2. Learning English enables me learn other subjects as well	77	17	2	1
3. I like to do English activity (speech, stroy, narration etc.)	67	26	4	2
4. I have to do better in English to get better job	86	9	2	1

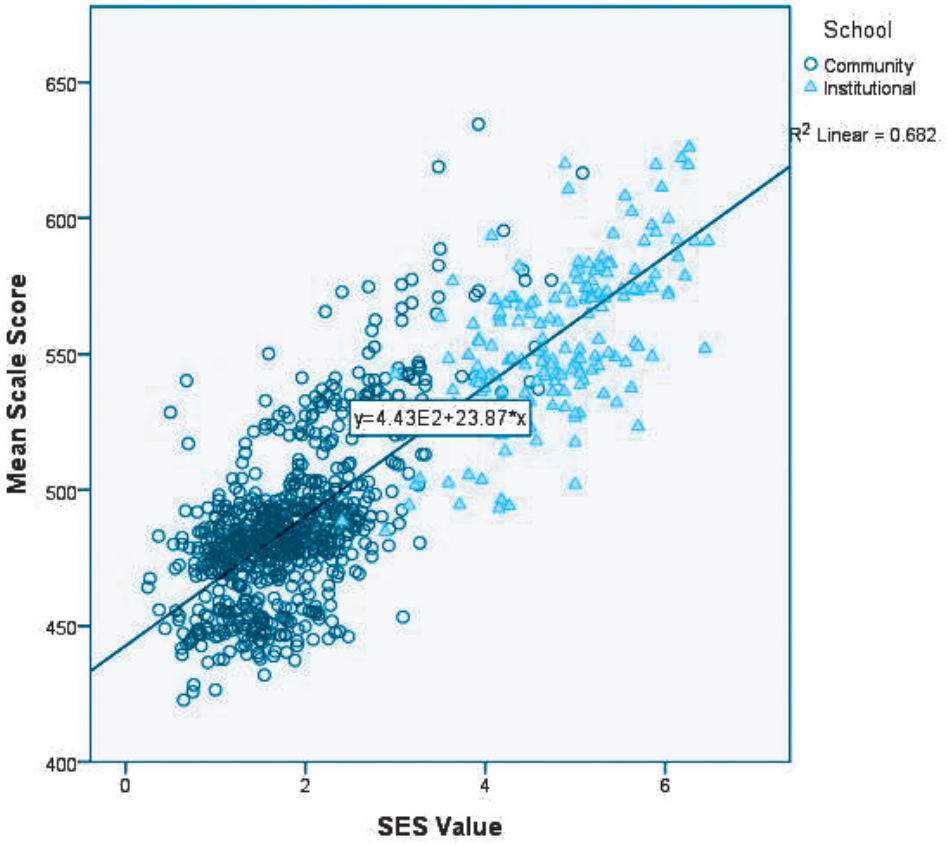
As demonstrated by the table, 86.1% students strongly agreed that English can help them in daily life. Similarly, 77% of them strongly agreed that learning English enables them to learn other subjects as well. Altogether 67% of them strongly asserted that they liked to do the activities in English such as speech, story telling, narration etc. Moreover, 86% students also strongly agreed that they need to do better in English to seek a better job. In this way, the majority of students were found having a highly positive attitude regarding the utility of English.

3.4.30 Achievement by Socio-Economic Status

In this study, socio-economic variables are parents education and occupation, home possessions, home accessories, participation in institutional schools, parents education - mother grade 10 pass, father grade 10 pass, home possessions - reading room, peaceful place to study, computer, children books, reference books, internet facility, and dictionary. Out of these eight possessions, at least four possessions: home accessories as television, computer, motorcycle, car, permanent house are considered of good contributing quality. Those accessories could be a maximum of 4 categories, so the maximum sum will be 20. Among 20 possibilities, at least 7 accessories were taken as higher SES. In parents' occupations, when parents are not involved only in agriculture or household, they are taken as having higher SES. From those variables, seven dummy variables were prepared. Thus, the school mean of those seven dummy variables was taken as total SES.

A scatter plot of socioeconomic status against students' transformed latent ability (WLE) was plotted. The produced scatterplot is presented in the following figure.

Figure 118 Relation between SES and school's mean score in English



The scatter plot presents that socio-economic status of the family and student learning has high positive correlation and its effect in student achievement is 68% in English. This high effect of SES indicates the importance of parents education, family income, availability of reference and support materials in home and type of schools they chose to provide school education. Figure illustrates that most of the students who study in institutional schools (triangle shaped) come from high SES family and only few community educate the children of high SES family. The circular shaped symbol represent the community schools, who are serving the low SES family children. Interesting fact shown by the scatterplot is that highest mean achievement score was achieved by community school in NASA 2019. With the best efforts, community schools can achieve the highest result though the highest achieving community school also was serving for relatively higher SES family children.

Chapter 4

Advanced Analysis on Numeracy and Literacy

4.1 Introduction

Numeracy and literacy skills are considered important for school children because these skills provide foundation to learning. In other words, they are required to learn other skills, participate in day to day life and in workforce, enhance productivity and improve social and health outcomes. In this report, an advance level analysis to draw significant conclusions has been conducted by focusing only in Numeracy (Mathematics) and Literacy (Nepali).

For the advanced analysis to draw conclusion, regression is a common method used by scholars. Regression analysis sorts out most impact giving variables from the data as predicators of the output variables. Thus, in NASA studies, this analysis helps to identify most influencing variables for the policy making process and variables that can be ignored as less important according to the magnitude and the statistical significance of the coefficients associated with those variables and those variables' interaction with other variables depending upon the model created.

4.2 Determinants of learning outcomes

In this sub-section, we explore factors associated with student learning by estimating the education production function, which assumes that student learning outcomes are determined by school inputs, teacher inputs, student inputs, and household inputs while national, community, and school contexts act through the school process (Bhatta and Sharma, 2019).

The analyses of the determinants of learning outcomes are performed using an educational production function where student assessment scores are a function of student's household characteristics (Hi), student characteristics (Ci), and school and teacher level characteristics (Si) of the school attended by the student:

$$A = h(H, C, S)$$

Assuming linear relationship, the following regression model can be used to capture the above functional relationship:

$$A_{i,} = \alpha + \beta_1 H_{i,} + \beta_2 C_{i,j} + \gamma S_j + \varepsilon_{i,j} \qquad \varepsilon_{i,j} \sim_N (0, \sigma^2)$$

where $A_{i,j}$ is the achievement score for student i from school j, $H_{i,j}$ and $C_{i,j}$ represents a set of household and child level characteristics, $_{Sj}$ represents a set of school and certain context variables, and $\varepsilon_{i,j}$ is a random error term that includes unobserved factors such as household motivation, child motivation and child ability. Ordinary Least Squares (OLS) regressions that adjust for data clustering at the school level are used to empirically estimate the above equation. Note that with the observational data we have, it will not be possible to estimate causal relationship between learning and explanatory variables included in the right-hand side. Therefore, we will refer to only associations and correlations between learning outcomes and the explanatory or contextual factors included in the regressions.

4.3 Key variables used in the regression analysis:

Dependent or outcome variable (A): scale score for mathematics and Nepali

Student and family characteristics (X):

- *Student input:* age, gender, ethnicity, days present in school
- *Family input:* education of father, education of mother, whether someone helps student with homework, socio-economic status, language spoken at home, availability at home of computer, internet access, dictionary and other books useful in school

School and teacher characteristics and broader context (S):

- *School*
  Context: school type (community or institutional school), location of school (urban/rural; province); seriousness of grade 10 students late to school, absent in school or leave school in the middle of the class period
  Input: whether the school has its own permanent building
  Process: whether school rewards teachers
- *Head teacher*
  Input: tenure status, gender, satisfaction level with the profession,
- *Teachers*
  Input: educational qualifications, tenure status, has an education degree

The regression results of the determinants of student learning are summarized in Tables 65 and 66. The regressions in these tables use scale scores for math or Nepali as the dependent variable, and the various student, household, teacher and school

characteristics discussed above as explanatory variables. Estimates from four models are presented in each table. The first model includes only school characteristics as explanatory variables. The second model includes both school and teacher characteristics while the third model includes only student and household characteristics. The fourth model, the most comprehensive one, includes student, household, school, and teacher characteristics in the regression equation.

4.4 Finding

4.4a Finding for Math subject

As mentioned in earlier sections, institutional school students perform, on average, much better than community school students in math. Similar conclusions can be derived from the regression estimates. Even after controlling for other observable school and household characteristics, institutional school students do a lot better in math than community school institutions and the difference is statistically significant. Note that this is not a causal relationship. It is possible that higher ability students or children with more motivated parents largely self-select into institutional schools.

Similarly, there is a lot of variation in performance of students by province. Grade 10 students from Gandaki are performing better than others in mathematics, even after controlling for other variables, while students in Karnali are performing the worst in math. Students in schools where the headteacher is permanent, on average, have higher scores in math. Furthermore, schools that have their own permanent buildings also appear to contribute to improve student learning in math. Students in schools where the math teachers are permanent are also doing, on average, better than students where math teachers are not permanent. This is perhaps an indication that these teachers can focus more on teaching and not worry about other aspects related to their tenure status. In addition, the number of years of teaching experience of a math teacher does not seem to be correlated with the student's academic achievement.

Female students are, on average, faring worse in math than boys, and the difference is both substantial in magnitude and statistically significant. The reasons behind such disparity are worth exploring further so that effective interventions to reduce gender differences in math can be devised. Similarly, student age and math scores are negatively correlated. It is most likely an indication that many older students have repeated grades. Unfortunately, the data on whether the student had repeated grades is not available. Compared to Brahmin and Chhetri students, Dalit students are doing significantly worse in math. For other ethnicities, the difference is not statistically significantly after statistically controlling for other contextual factors. The relationship

between socio-economic status and math scores are positively correlated, but the magnitude is much smaller than for that for a variable indicating institutional schools.

We also explored the relationship between availability at home of computers, internet access, dictionary and other books useful for study. When only household and student level characteristics were controlled for, the estimates on all these variables were positive and statistically significant. However, once school and teacher level factors were also included in the regression equation, availability of computers and internet access at home did not predict student learning. The influence of dictionary and other books, on the other hand, was still positive and statistically significant.

There are some surprising findings as well. For example, there does not appear to be statistically significant relationship between mother's education level and student's scores in Math. However, there is expected relationship between father's education level and the child's achievement in Math. After controlling for other factors, children whose fathers have completed grade 8 or higher have higher scores in math and this difference is statistically significant. Interestingly, children who have no one to support academically at home are performing, on average, better than those with academic support. The reasons behind this unusual result need to be delved further.

4.4b Findings for Nepali subject

We proceed next with presenting regression results for Nepali subject (Table 66). Unlike in Math where we find large institutional school effect, there is no institutional school effect in Nepali. One can argue that both students and schools focus more on subjects such as Math at the expense of subjects such as Nepali. This is a topic worth exploring further. As in Math, the scores in Nepali also vary across provinces. However, provinces where students are performing better in math are not necessarily doing well in Nepali. For example, students in Province 2 are faring worst in Nepali. Students in Bagmati and Lumbini are, on average, doing better than others.

Students in schools where headteacher is a secondary level appointee are performing better than others and the difference is statistically significant. Similarly, students in schools that have instituted initiatives to reward teachers have also performed better in Nepali. Such relationship, however, did not exist in the case of math. Unlike for math, the headteacher's satisfaction level and the school having its own permanent building had no statistically significant relationship with the student's scores in Nepali. Similarly, none of the teacher level characteristics included in the regression equation were statistically significant for Nepali.

With regards to child level characteristics, female students are doing worse than male students in Nepali, but the magnitude of the difference is substantially lower than in math. Similarly, age of the student and Nepali scores are negatively correlated, a finding consistent with math. The ethnicity variable is correlated with academic performance in Nepali when only household and child level characteristics are included in the regression. However, this variable is also not statistically significant once we also control for school and teacher level characteristics. As with math, students who have no academic support at home are, on average, surprisingly doing better than those with others who can help them academically. Similarly, there is no clear relationship between parent's education and child's academic success in Nepali. In relation to other potentially conducive environment at home, there is statistically significant negative relationship between performance in Nepali and having computer and internet access at home, but positive relationship with regards to having a dictionary and other educational reference books at home. The positive coefficient for dictionary and other educational reference books may be a proxy for these households prioritizing education.

4.5 Regression Coefficients

The regression results for Math and Nepali hints on the fact that factors that are important for success in Mathematics may be different from those factors that predict success in Nepali subject. This divergence also suggests that interventions or programs to improve Nepali and Math subject learning may need to be different.

Table 65 OLS regression results for determinants of student performance in grade 10 math

VARIABLES	(1)	(2)	(3)	(4)
Province 2 vs. Province 1	11.84**	12.59**		12.07**
Bagmati vs. Province 1	23.45***	23.06***		16.78***
Gandaki vs. Province 1	31.17***	29.45***		19.87***
Lumbini vs. Province 1	11.80*	13.31*		10.98*
Karnali vs. Province 1	-2.721	-3.735		-7.050
Sudur Paschim vs. Province 1	8.440	11.34*		8.883*
Whether it is an institutional school	52.35***	51.36***		27.06***
School is in Gaupalika	-3.617	-1.121		-0.182
The headteacher is a female	5.903	8.858		8.557

VARIABLES	(1)	(2)	(3)	(4)
Headteacher teaches secondary level	9.492***	7.298*		3.710
Headteacher is permanent	11.14***	11.96***		8.187**
School rewards good performing teachers	4.745	6.573*		5.243
Head teacher is satisfied with their profession	4.163	4.956		5.232*
The school has its own permanent building	6.184*	6.498*		8.081**
Students late to school is a serious problem	-12.68*	-9.346		-13.15*
Student absenteeism is a serious problem	2.482	5.147		6.683
Students leaving school in the middle of the day is a serious problem	1.906	0.157		-2.424
The subject teacher has masters level of education		0.364		-0.179
The subject teacher is permanent		8.893**		7.470**
The subject teacher's years of teaching experience		-0.258		-0.317
The subject teacher has an education degree		1.022		-3.168
The student is female			-18.49***	-19.99***
The student's age in years			-3.416***	-3.643***
Ethnicity is Janajati vs. Brahmin/ Chhetri			0.211	-1.249
Ethnicity is Dalit vs. Brahmin/ Chhetri			-5.728***	-5.894**
Ethnicity is other vs. Brahmin/ Chhetri			4.313*	2.040
Nepali language is spoken at home			3.101**	2.862
Mother has some education vs. illiterate			0.862	-0.444

VARIABLES	(1)	(2)	(3)	(4)
Mother has 8 to 11 years of education vs. illiterate			0.747	-1.950
Mother has 12+ years of education vs. illiterate			-0.209	-2.216
Father has some education vs. illiterate			3.405**	3.101
Father has 8 to 11 years of education vs. illiterate			4.138**	4.885**
Father has 12+ years of education vs. illiterate			6.071***	9.667***
Household's socio-economic status			8.554***	4.236***
Household has computer for study at home			3.468**	-0.896
Household has other books useful in school			3.229***	4.321**
Household has internet access at home			7.673***	3.167
Household has a dictionary at home			15.59***	12.95***
There is no one to support academically at home			10.13***	6.864***
Constant	455.1***	451.2***	536.1***	521.5***
Observations	9,593	7,965	12,768	4,555
R-squared	0.228	0.218	0.293	0.354

*** p<0.01, ** p<0.05, * p<0.1; Source: Authors' estimates using NASA 2019 data

Table 66 OLS regression results for determinants of student performance in grade 10 Nepali

VARIABLES	(1)	(2)	(3)	(4)
Province 2 vs. Province 1	-29.15***	-29.96***		-26.37***
Bagmati vs. Province 1	10.56**	9.843*		11.30**
Gandaki vs. Province 1	11.48*	-2.142		1.307
Lumbini vs. Province 1	12.92**	19.42***		22.89***

VARIABLES	(1)	(2)	(3)	(4)
Karnali vs. Province 1	-21.21***	-17.68**		-15.89*
Sudur Paschim vs. Province 1	-3.691	-2.009		2.016
Whether it is an institutional school	0.926	1.642		-5.214
School is in Gaupalika	-5.971*	-3.445		-1.566
The headteacher is a female	-4.913	-9.435		-8.651
Headteacher teaches secondary level	13.97***	13.00***		10.82***
Headteacher is permanent	7.091**	2.237		4.214
School rewards good performing teachers	8.374***	10.20**		9.241**
Head teacher is satisfied with their profession	-0.551	4.064		2.574
The school has its own permanent building	-1.446	-2.360		-2.209
Students late to school is a serious problem	-0.516	1.906		0.0475
Student absenteeism is a serious problem	-8.953*	-6.639		-4.577
Students leaving school in the middle of the day is a serious problem	8.414	5.130		8.661
The subject teacher has masters level of education		4.278		3.167
The subject teacher is permanent		2.856		0.270
The subject teacher's years of teaching experience		0.168		0.0550
The subject teacher has an education degree		2.468		1.542
The student is female			-2.356***	-3.764**
The student's age in years			-7.509***	-7.065***
Ethnicity is Janajati vs. Brahmin/ Chhetri			-0.971	-2.354
Ethnicity is Dalit vs. Brahmin/ Chhetri			-3.583**	-1.173

VARIABLES	(1)	(2)	(3)	(4)
Ethnicity is other vs. Brahmin/ Chhetri			-8.108***	1.342
Nepali language is spoken at home			8.165***	1.444
Mother has some education vs. illiterate			9.501***	6.136***
Mother has 8 to 11 years of education vs. illiterate			2.238	0.501
Mother has 12+ years of education vs. illiterate			3.546*	0.590
Father has some education vs. illiterate			14.85***	11.34***
Father has 8 to 11 years of education vs. illiterate			5.065***	3.354
Father has 12+ years of education vs. illiterate			5.299**	9.233**
Household's socio-economic status			3.379***	1.427**
Household has computer for study at home			-5.093***	-9.364***
Household has other books useful in school			6.914***	5.088***
Household has internet access at home			1.876	-1.363
Household has a dictionary at home			16.20***	16.90***
There is no one to support academically at home			13.75***	9.554***
Constant	487.2***	479.3***	589.8***	579.5***
Observations	9,738	6,814	18,674	5,562
R-squared	0.149	0.138	0.155	0.240

*** p<0.01, ** p<0.05, * p<0.1; Source: Authors' estimates using NASA 2019 data

Chapter 5
Findings, Conclusions and Recommendations

5.1 Findings

Students are struggling to acquire even minimum learning. Majority of students are not able to learn what is taught in all subjects. The majority of the students have achieved or mastered less than 50% of the curriculum in all subjects. Most of the students could not solve Higher Order Thinking items. Since similar conclusions were also drawn from previous administrations of NASA grade 5 and grade 8 assessments, one can argue that there are problems in the teaching-learning strategy, remedial actions and the role of headteachers. On average, students in institutional schools have massively outperformed students in community schools. However, it is worth noting that average scores for students in some community schools were the highest among all schools in all subjects. Deeper analyses of the reasons behind their success should be considered as they can provide valuable lessons for other community schools and policymakers alike.

Province level

The comparative study of province wise achievement in Mathematics shows variation in the achievement level of the students. The achievement of students in Bagmati (521), Gandaki (513), and Lumbini (503) was, on average, better than other provinces and was above the national average (500). Similarly, Bagmati (525), Gandaki (515), and Lumbini (507) were high performing provinces in Science. The achievement in Nepali of province 1 (505), Bagmati (511), Gandaki(516), and Lumbini (513) students was distinctly above the national average. The disparity in achievement by province was much wider in English. The achievement of Bagmati (534), Gandaki (516),and Lumbini (502) students was above the national average. The performance of provinces 1, 2, Karnali, and Sudur Paschim was lower in all four subjects than the national average.

Gender

Learning disparity between boys and girls was one of the major findings in the study. There was a statistically significant difference between the achievement of boys (510) and girls (492) in Mathematics. The difference in the achievements of boys and girls in Science and English also was significant but there was no visible difference

in the achievement in Nepali as boys scored (501) and the girls scored (500). The achievement of boys was above the national average in Science, Maths, and English whereas girls performed below the national average in these subjects except in Nepali.

Age

A distinct variation in achievement was seen by age group as well. Students aged between 13 to 19 years participated in the assessments. Among them, students aged 14 and 15 years were the highest scorers in all four subjects assessed. Achievement scores for students aged 16 years or more was lower, on average. This result was consistent in all four subjects.

Home language

There was a significant difference in the achievement of the students who use Nepali as their home language compared to the achievement of the students who use other languages as their home languages. The gaps between achievements of the students who used Nepali as a home language and other languages as home language were in scale scores of 11 in Maths, 17 in Science and Nepali, and 19 in English.

School type

The comparative study of achievement showed a vast gap between community schools and institutional schools. The institutional schools topped the community schools by 49 scale scores in both Maths and Science, 21 scale scores in Nepali, and 68 scale scores in English subject in their achievement. The achievement of the community schools was below the national average whereas the achievement of the institutional schools was distinctly above the national average.

Achievement by the career aspirations of the students

Based on the future goal, the study showed that students desiring to be doctors/ engineers, civil servants, and working abroad where in-depth learning is required had higher achievement than the achievement of the students longing to be farmers, teachers and employees in private sectors in subjects like Maths and Science.

Parental education

Parent's educational level has a direct positive association with children's achievement in all subjects assessed. Based on the achievement, it can be said confidently that higher the educational qualifications of father or mother, greater the scores of the children has on average. Educated father and mother contributed significantly to their children's learning achievement whereas children whose father or

mother was illiterate performed comparatively lower. The achievement significantly differs from illiterate to literate parents and lower qualification to higher qualification of the parents. This result is consistent with the study carried out by Kainuwa & Yusuf (2013) who stated that children of father or mother with university degrees perform considerably well and get the highest degree in education.

Parental occupation

While analyzing relationship between parental occupation and student learning, student's performance was highest for those whose parents were teachers. Students whose parents were involved in government jobs, business, and handling only household works also had higher scores. Children whose father and mother were involved in agriculture and households, working in other's homes and handling the only households had, on average, lower scores.

Family size

The family size was also seen to be an important predictor in learning achievement of students. Students residing in households where the family size was 4-6 members had higher achievement scores. Beyond that, achievement decreased with additional family members.

Teacher's regularity

Regularity of a teacher in the classroom depicts both dedication and awareness about the importance of deliverance of quality education to shape the bright future of students. Teacher can give an in-depth knowledge regarding the subject matter and it eases the teacher to complete the curriculum in time and therefore, it is an important predictor in students' achievement. Thus, considering the findings above, teachers who were dedicating all their time in the classroom were successful in improving students' achievement. Meanwhile, teachers who would come late and go earlier or do not come to class at all had pessimistic performances.

Interest in subjects assessed

Developing a strong interest in a subject encourages the student to work harder in the subject which helps boost their achievement in that subject. The finding shows that majority of students who enjoyed different subjects mentioned here wanted to learn and excel in those subjects.

Homework and Feedback

Based on the analysis of data, any feedback after homework has boosted student's performance. In addition, feedback given on regular basis was found to be more helpful. The difference in performances of the students who received regular feedback in their homework was higher than those who never received feedback. The achievement was found in scale score of 6 in Maths, 17 in Science, 11 in Nepali, and 11 in English respectively indicating the importance of receiving feedback regularly. There was a slight difference in favour of the scores receiving regular feedback. The difference in Science and Nepali was statistically significant in the mean score.

Home possession

Variation was seen in the home possession of proxy indicators of material goods such as permanent house, car, motorcycle, TV and computer. For instance, out of 22385 students in Mathematics, 51 % have TV at home and only 43% students have permanent houses whereas 57% did not have computers, 52% did not have motorcycles, and 72% students did not have cars at home. Similar findings were observed in other subjects as well.

Prioritizing the most influencing variables

The magnitude of the coefficients from the multiple regression analysis provides insights on variables that have strong relationship between different contextual factors and student achievement. Since the analysis controls for other household, student, school and teacher level characteristics, the relationship is likely to minimize bias. Some key finding summarizing the overall findings in a priority basis in Numeracy (Math) and Literacy (Nepali) are provided below:

Important variables related to Mathematics

Students in institutional school students perform, on average, much better than community school students in math. Though this is not a causal relationship, there are many who believe that institutional schools are more effective than community schools in improving student learning. Similarly, the relationship between socio-economic status and math scores are positively correlated, but the magnitude is much smaller than for that for a variable indicating institutional schools.

Female students are, on average, faring worse in math than boys, and the difference is both substantial in magnitude and statistically significant. Similarly, student age and math scores are negatively correlated. Compared to Brahmin and Chhetri students,

Dalit students are doing significantly worse in math. There is expected positive relationship between father's education level and the child's achievement in Math. After controlling for other factors, children whose fathers have completed grade 8 or higher have higher scores in math and this difference is statistically significant.

There are some school level variables that are also important. For example, students in schools where the headteacher is permanent, on average, have higher scores in math. Similarly, students in schools where the math teachers are permanent are also doing, on average, better than students where math teachers are not permanent. This is perhaps an indication that these teachers and headteachers can focus more on teaching or administrative duties and not worry about other aspects related to their tenure status.

Findings for Nepali subject

Unlike in Math where we find large institutional school effect, there is no institutional school effect in Nepali. One can argue that both students and institutional schools focus more on subjects such as Math at the expense of subjects such as Nepali that, unfortunately, are not valued greatly both by parents and higher education institutions.

Students in schools where headteacher is a secondary level appointee are performing better than others and the difference is statistically significant. Similarly, students in schools that have instituted initiatives to reward teachers have also performed better in Nepali.

With regards to child level characteristics, female students are doing worse than male students in Nepali, but the magnitude of the difference is substantially lower than in math. Similarly, age of the student and Nepali scores are negatively correlated, a finding consistent with math. There is a positive relationship with regards to having a dictionary and other educational reference books at home. The positive coefficient for dictionary and other educational reference books may be a proxy for these households prioritizing education.

Conclusion

An educational system covers input, process, and output in education. Curriculum, pedagogy, teaching, and learning practices and assessment are at the centre-stage of attention for the formation, implementation, and monitoring and evaluation of educational policies. Rigorous research and evidence-based findings are the pillars for assessing the overall system of education. NASA has been making endeavour to

assess the educational output of school education since its establishment as one of its core activities in Nepal.

The main objective of this assessment was to prepare the baseline data for the School Sector Development Plan (SSDP) as well as compare the learning achievement of 2019 with the previous cycle of NASA (2015) to analyse how quality education in the school system has evolved over time. The study, as before, shows variation in the performance of province-level achievement in Maths, Science, Nepali, and English. Bagmati, Gandaki, and Lumbini are high performing provinces whereas provinces 1, 2, Karnali, and Sudur Paschim are low performing ones. The disparity seems deeper in gender-based achievement as boys have performed higher than girls.

The most appropriate age for learning grade 10 seems to be 14 or 15 years (starting grade 1 while in age 4 or 5) as students in this age group, on average, achieved higher scores than other age groups. Students older than 15 years scores lower, perhaps a reflection that these children are repeating grades or that children, presumably with less conducive learning environment at home, are starting school later.

A substantial difference in achievement has been observed based on the home language. The children, whose home language is Nepali scored higher than those whose home languages were other than Nepali language. This important finding has a notable influence on the use of classroom pedagogy and achievement of students, even in earlier grades.

The achievement of institutional schools is comparatively far better than community schools. Despite the investment of huge resources from the government, the achievement of community school students remained below the average level. Uplifting the quality of community schools has been one of the greatest challenges.

There is a difference in the achievement based on the future goal of children. Students who wished to be teachers, farmers, or to work in private businesses have lower levels of achievement compared to those who aspire to be doctors /engineers or civil servants or work abroad. One could argue that this is partly a reflection of occupations such as doctor, engineering and civil service being valued by the society at the cost of other civilian professions. There is need for occupations such as farming, teaching, and private business to be made dignified professional areas.

There is remarkable difference in the achievement of children from illiterate and literate parents -- there is positive relationship between student achievement and

parents with at least grade 8 of education. Similarly, parental profession as well has a positive influence on the achievement of students. Scores were lower for students whose parents were involved in agriculture, household works, and working for other households.

Children from a nucleus family, on average, have achieved higher score than those from a joint family. Data shows that the greater the number of family members, the lower the achievement of students. Similarly, students with positive attitude have succeeded in excelling in their academics by scoring good grades in various subjects. Likewise, teachers who were dedicating all their time in the classroom were successful in improving the students' achievement.

Similarly, providing feedback on homework is leading to improvement in achievement of students. The availability of a table for study, separate study room, computer for school work, internet, child magazines, story/ poetry, and pictures, dictionary, reference books, and so on at home contributes to boosting their learning performance. Lastly, permanent head teacher and teachers are associated with higher achievement scores. Similarly, permanent school building and infrastructures also similarly positively influence learning as shown by the data.

5.3 Recommendations

1. A large number of students are at below grade level and alarming gap exists between Intended and achieved curriculum.

While considering the proficiency levels of students in achievement, the results show their low level of ability as 32% in Maths, 37% in Science, 20% in Nepali, and 30% in English are below the basic level. Furthermore, 59% in Maths, 63% in Science, 37% in Nepali, and 51% in English of students are below basic and basic levels of proficiency and these levels indicate poor competence level. Only a small number of students have the highest level of proficiency. The majority of the students have achieved or mastered less than 50% of the curriculum in all subjects. This evidence indicates an alarming gap between intended and achieved curriculum.

Recommendation

The overall gaps of intended and achieved curriculum demands a radical change in the policy, resource management, curricular design and implementation process and monitoring and evaluation strategies. Policy reformation, allocation of required volume of budget, activity based curriculum, emphasis on pedagogical delivery, resource management are some of the strategies the government should implement instantly for

removing the gaps between intended and achieved curriculum. Moreover, given that below grade level learning is already pronounced by grade 5 as previous administration of NASA at grade 5 has amply demonstrated, remedial education should be seriously considered in earlier grades. Furthermore, training curricula for Teacher Professional Development (TPD) should be re-oriented to better equip teachers to identify, and provide tailored instruction to, students entering particular grade with knowledge below grade level (Schaffner, Glewwe and Sharma, 2020). More specifically, a campaign of "No child is left below minimum level of learning" is highly recommended at the school level. In this campaign, Curriculum Development Centre is advised to initiate to define the minimum level of learning (learning standards)with the technical coordination with ERO; CEHRD is advised to prepare teacher training guidelines in focus with this campaign and NEB to prepare a guideline to evaluate such learning.

2. Wide gaps in achievement between provinces.

The study shows variation in the performance of province-level achievement in Maths, Science, Nepali, and English. A huge gap between the high performing and low performing provinces in achievement has a scale of 45 in Maths, 43 in Science, 42 in Nepali and 60 in English. Bagmati, Gandaki, and Lumbini are high performing provinces whereas provinces 1, 2, Karnali, and Sudur Paschim are low performing ones

Recommendation

To address the wide gap between high performing and low performing provinces, justified distribution of resources is a necessity. In Province 1, Province 2, Karnali and Sudur Paschim, policy reformation, special emphasis on budget allocation, development of human resource, contextualization of curriculum and close monitoring and evaluation of educational programmes are suggested areas of primary intervention by the government. A minimum standard of infrastructure, learning opportunities, resources, incentives and retention of good teachers and identification of learning difficulties along with remedial teachings are supportive activities to enhance learning and increase students' achievement. Specific curricula and instruction methods that can be embodied in daily teaching guides and related instructional materials can be developed, and distribution of these guides and materials and the teacher training can be packaged together to improve student learning (Schaffner, Glewwe and Sharma, 2020). In addition, small-scale policy experiments should be designed and analysed to help improve the implementation aspects so that programs have a high success probability.

3. Huge disparity in achievement by type of schools

A huge disparity in achievement between community and institutional schools may create a two-tiered society in upcoming days. A huge gap is seen in achievement between institutional and community schools with a range of scale score of 51 in Maths, 49 in Science, 21 in Nepali, and 68 in English.

Recommendation

The gap should be fulfilled by upgrading community schools through strategic interventions in school education. It is imperative to identify malfunctions in input, process, and output of community school mechanism and reform policy for the improvement in the existing condition. A comprehensive analysis of better performing institutional and community schools is sorely needed to explore how poor-performing community schools can be improved. The local governments also have an important role to play in improving the quality of public education.

4. The use of home language also brought a remarkable gap in the achievement.

A remarkable gap has been revealed by the use of home language that ranges in scale score of 11 in Maths, 17 in Science, 17 in Nepali and 68 in English.

Recommendation

This gap can be narrowed by using the home language of children by teachers in the classroom, even in the earlier grades. Teachers need at least a basic level language learning package for their students or language of the community surrounding the school. Teachers have to be able to communicate in community language, and they have to teach translating, changing codes, using trans-language strategy, and empowering those children who use languages other than Nepali at home. A comprehensive language learning package for teachers for their professional development deserves incorporation in TPD.

5. There is a visible gap in the learning achievement between boys and girls

The study shows a visible disparity between boys and girls in their achievement. The gap ranges in scale scores of 18 in Maths, 16 in Science, and 10 in English though normally there is no gap in Nepali.

Recommendation

The reasons behind such disparity in learning between boys and girls are worth exploring further so that effective interventions to reduce gender differences in learning

can be devised. Suggested interventions include teachers paying attention to student-friendly (more focused on girls) behavior and teaching and learning activities in the classroom, including remedial education. Affirmative action such as scholarships and additional incentives to girls may reduce gender disparity in achievement. Regular interactions with female role models may also help. Apart from these, teachers should create a suitable learning environment for girls by being sensitive in terms of their needs, interest, voices, and providing equal opportunity for classroom participation. Parents are to be encouraged for their roles to support their children's education on equality basis.

6. Students at appropriate age performed better

Students studying in grade 10 at the age of 14 and 15 scored higher than the students of underage and overage studying at the same level. The similarity in the age group among students may have encouraged them to share and discuss their education related problems thereby enabling them to excel in their academics. The gap in the achievement of the students' aged 14 or 15 compared to other age groups has been in scale scores of 28 in Maths, 35 in Science, 40 in Nepali, and 34 in English.

Recommendation

If the student is below age 14 while in grade 10, the child was in grade 1 at or before age 4. Similarly, if the child is aged 16 or above in grade 10, it is most likely an indication that they have repeated grades or started grade 1 in a less conducive environment. In addition to encouraging children to enrol on time, teachers should be trained on formative assessments in earlier grades and remedial education so that they do not fall behind in studies and repeat grades.

7. The relationship between students' academic performance and socio-economic status is substantial, but its magnitude varies by subjects

The socio-economic status of a student's family has varying effects on their achievement. Many students have performed better in Nepali language with satisfactory performance in Mathematics and Science despite their low socio-economic status. This situation was reversed in English language. This depicts that the socio-economic background of the students does not entirely decide their academic performance.

Recommendation

Though the socio-economic status of students has varying effects on their achievement, it is not only the major deciding factor. Students can excel and achieve

better if they focus more on the study and practice well despite the minimum resources available to them. Despite the different levels of socioeconomic status of students, if the schools provide, for example, sufficient learning materials, library facilities, manage students' clubs, and study programs to the students they can perform well irrespective of their SES.

8. The achievement on assessment of Janajati and Dalit children is lower than other ethnicities

Ethnicity has influenced the achievement of students in Nepali and English. The differences on achievement between Brahmin/ Chhetri and Janajati and Dalit were in scale score of 7 for Janajati and 11 for Dalit in Nepali and 8 for Janajati and 20 for Dalit in English . Students from Brahmin /Chhetri communities are, on average, high achievers whereas students from Dalit communities are achieving lower.

Recommendation

The achievement score of students from Janajati communities and Dalit communities are below the national average compared to students from communities of Brahmin and Chhetris. The differences may have been caused by medium of instruction, language background, contents of the curriculum, teachers and cultural background. To reduce these gaps, inclusive curriculum, remedial teaching, incorporation of local ideologies in the curriculum, inclusiveness in teaching profession, change of learning culture in Janajati and Dalit students need to be seriously considered.

9. Teacher regularity and availability of study resources have positive relations with learning achievement

Teachers who were dedicating all their time in the classroom were successful in improving students' achievement. Meanwhile, teachers who would come late to class and leave early or do not come to class at all had negative performances. Similarly, availability of study resources such as textbooks, question banks, guides, and reference materials and other supportive resources has positive influence on learning achievement.

Recommendation

School administration should maintain a strict code of conduct for teachers to be regular in the school and it should be made as one of the criteria for their performance evaluation. Regular teachers should be rewarded with incentives. Similarly, government or non-government agencies, supporting students through scholarships or any other

incentives, should consider the availability of basic study resources to the students. Parents also should consider making these essential resources available to meet the primary needs of their children.

10. Decreasing patterns on achievement and consistency of NASA results

One-third of students in Maths and Science and nearly half of the students in English scored below the national average. The consistently weak performance of students in NASA 2012, 2015, and 2018 indicate a low return to the investment made by the government in education The recurring trend underscores the need for ensuring sufficient government intervention to enhance quality education.

Recommendation

Time has already come to carry out a diagnostic study to identify the challenges in the educational system with a focus on teaching-learning process. The critical factors that hinder the achievement and quality education should be investigated and immediate steps have to be undertaken to recover the educational loss. Pedagogical intervention in the delivery system deserves exploration and adoption of activity based, learner-centered, problem solving, critical thinking, developing 21st century skills and research based learning approaches in teaching with close monitoring and evaluation has now become a necessity. The involvement of parents and community members should be ensured in making the schools accountable for their students' low achievement.

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Appendix

1. Mathematics: Item level description and parameters

SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
1	M1Q1	D	SR	Arithmetic	Indices	Calculate indices (grade 7)	Understanding	4253	69.2	0.39	-1.9
2	M1Q2	C	SR	Arithmetic	Number pattern	Grade 5 level	Understanding	4253	54.78	0.43	-1.14
3	M1Q3	B	SR	Geometry	Pythagorus	Condition for right angle triangle (Pythagoras)	Applying	4253	58.9	0.44	-1.26
4	M1Q4	D	SR	Geometry	Property of triangle	Find the value of x (grade 8)	Reasoning	4253	20.67	0.1	1.18
5	M1Q5	A	SR	Geometry	Area	Find area when perimeter is given (Grade 8)	Reasoning	4253	33.81	0.44	0.21
6	M1Q6	D	SR	Arithmetic	Arithmetic	Discount	Remembering	8791	79.15	0.3	-2.78
7	M1Q7	B	SR	Mensuration	Mensuration	Select radius of circle	Remembering	8791	61.69	0.36	-1.5
8	M1Q8	C	SR	arithmetic	Arithmetic	Select population at present	Applying	8791	50.92	0.42	-0.7
9	M1Q9	A	SR	Data and Probability	Data	Select mean of 6 nos.	Understanding	13321	46.73	0.47	-0.58
10	M1Q10	D	SR	Geometry	Geometry	Central angle in a circle	Understanding	8791	42.67	0.52	-0.17
11	M1Q11	A	SR	Data and Probability	Probability	Select probability of dice	Remembering	4253	42.04	0.36	-0.2
12	M1Q12	C	SR	Algebra	Algebra	Select the root of surd	Remembering	4253	45.85	0.35	-0.42
13	M1Q13	B	SR	Mensuration	Mensuration	Area of trapezium	Understanding	4253	35.62	0.35	0.11

SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
14	M1Q14	B	SR	Arithmetic	Arithmetic	Loss, SP	Applying	4253	33.98	0.44	0.21
16	M1Q16	2	CR	Arithmetic	CP/MP	MP is 40% above CP, if MP is 2100, find CP.	Applying	8783	14.08	0.56	1.07
17	M1Q17	2	CR	Statistics	Mean	Find a term if mean and items ara given (grade 8)	Applying	8783	30.19	0.65	0.03
18	M1Q18	2	CR	Algebra	Solve	Two variable quadratic equation (grade 8)	Applying	8783	25.88	0.53	0.37
19	M1Q19	2	CR	Geometry	Geometry	Draw Cyclic Qd and relation of opposite angles	Applying	8791	26.65	0.64	0.11
20	M1Q20	1	CR	Set and Trigonometry	Trigonometry	Height and distance	Applying	8791	30.67	0.53	0.01
21	M1Q21	2	CR	Algebra	Algebra	Rational equation verbal	Reasoning	8791	13.19	0.58	1.32
22	M1Q22	1	CR	Mensuration	Mensuration	Volume of square base pyramid	Understanding	4253	21.44	0.52	0.79
23	M1Q23	1	CR	Geometry	Geometry	Angle in Cyclic quad.	Applying	4253	11.5	0.41	1.59
24	M1Q24	2	CR	Algebra	Algebra	Prove : Indices equation	Reasoning	4253	8.83	0.5	1.5
25	M2Q1	C	SR	Arithmetic	Arithmetic	Change $ into Rs	Understanding	9061	66.82	0.44	-1.78
26	M2Q2	C	SR	Arithmetic	Mensuration	Volume of hemisphere	Remembering	9061	53.35	0.43	-0.87
27	M2Q3	A	SR	Geometry	Geometry	angle of rt angle triangle	Understanding	9061	51.74	0.52	-0.8
28	M2Q4	C	SR	Algebra	Algebra	Value of x	Understanding	9061	48.66	0.54	-0.64
31	M2Q12	A	SR	Set and Trigonometry	Trigonometry	Select costheta	Understanding	4538	23.36	0.29	0.37

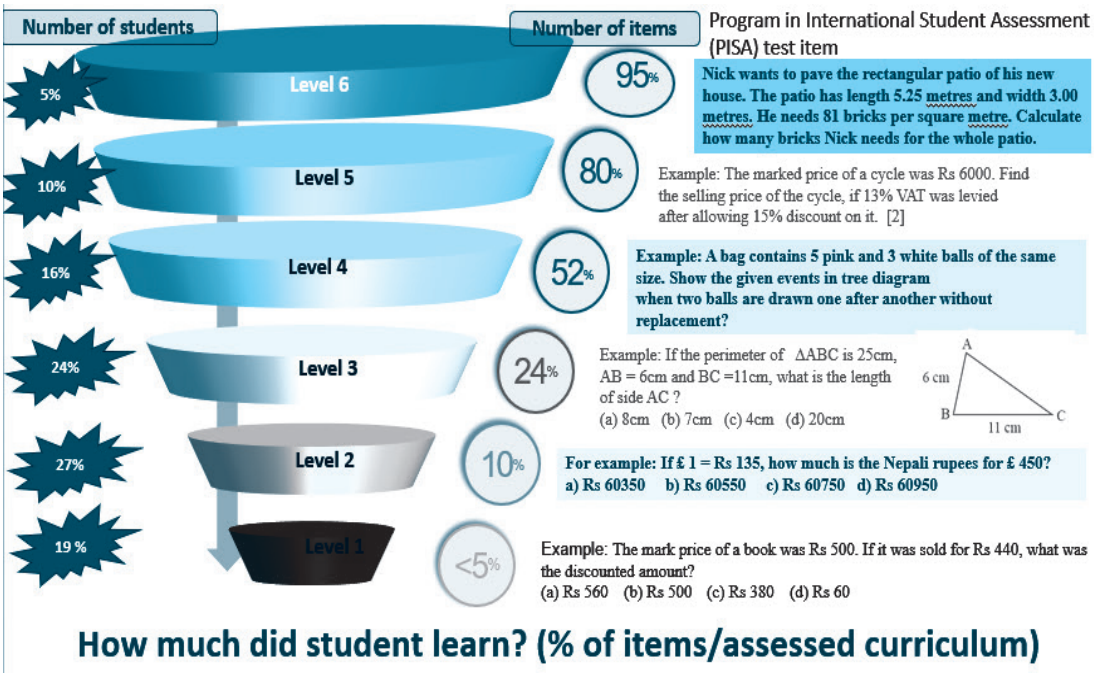
SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
32	M2Q13	D	SR	Arithmetic	Arithmetic	SP with VAT	Understanding	4538	25.58	0.38	0.28
33	M2Q14	A	SR	Arithmetic	Arithmetic	Popn growth	Understanding	4538	36.56	0.31	-0.03
34	M2Q15	C	SR	Data and Probability	Data	First quartile if indiv. Series	Applying	4538	17.14	0.25	1.05
35	M2Q16	2	CR	Algebra	Algebra	Rational simplification	Applying	9061	27.63	0.64	0.4
36	M2Q17	2	CR	Arithmetic	Arithmetic	Which shop is cheaper?	Applying	4538	19.9	0.64	0.56
37	M2Q18	1	CR	Mensuration	Mensuration	Area of tr. Prism	Applying	9061	11.25	0.47	1.7
38	M2Q22	1	CR	Data and Probability	Probability	Tree diagram	Applying	4538	28.07	0.52	0.09
39	M2Q23	2	CR	Algebra	Algebra	Find LCM if HCF and an expression is given	Reasoning	4538	12	0.49	1.28
40	M2Q24a	1	CR	Geometry	Mensuration	Find the area of ABCD in a farm house	Applying	9061	28.04	0.54	-0.42
41	M2Q24b	1	CR	Geometry	Mensuration	Find the side of joining mid point of two sides of triangel (Farm house)	Applying	9061	25.53	0.52	-0.18
42	M2Q24c	1	CR	Geometry	Mensuration	Find number of bricks	Reasoning	9061	25.67	0.56	-0.13
43	M3Q6	A	SR	Geometry	Geometry	Identify equilateral tr.	Remembering	4523	63.12	0.38	-1.68
44	M3Q7	C	SR	Data and Probability	Probability	Probability of odd no. in dice	Understanding	4523	38.62	0.49	-0.1
45	M3Q8	A	SR	Mensuration	Mensuration	Select radius of base of cylinder	Understanding	4523	64.01	0.41	-1.57
46	M3Q9	C	SR	Algebra	Algebra	Evaluate indices	Remembering	4523	50.17	0.53	-0.59

SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
47	M3Q10	B	SR	Set and Trigonometry	Sets	A union B	Understanding	4523	47.03	0.43	-0.37
49	M3Q12	B	SR		Geometry	Area of triangle (median relation)	Understanding	9045	40.81	0.36	-0.18
50	M3Q13	C	SR	Mensuration	Mensuration	If r = h, find V	Applying	9045	33.33	0.37	0.14
51	M3Q14	D	SR	Arithmetic	Arithmetic	Cost price	Applying	9045	23.77	0.28	0.87
52	M3Q15	C	SR	Mensuration	Mensuration	Identify lateral height of prism	Understanding	9045	20.3	0.42	1.2
53	M3Q20	2	CR	Geometry	Geometry	Find angle in circle	Applying	4523	14.3	0.54	1.1
54	M3Q21	2	CR	Data and Probability	Data	Third Quartile	Reasoning	4523	6.33	0.35	2.29
55	M3Q22	1	CR	Arithmetic	Arithmetic	Which bank gives more interest?	Reasoning	4523	10.61	0.21	1.86
56	M3Q23	1	CR	Algebra	Algebra	Find unknown number if 6 added to the square of a number and 31 is added to it.	Reasoning	4523	36.9	0.63	-0.5
57	M3Q24	2	CR	Geometry	Arithmetic	Experimental verification - Cyclic Quadrilateral	Applying	4523	27.7	0.62	-0.1
58	M4Q1	A	SR	Set and Trigonometry	Sets	Value of x in Venn diagram	Understanding	4522	67.23	0.33	-1.99
59	M4Q2	C	SR	Data and Probability	Data	Data point of third quartile	Remembering	4522	55.84	0.43	-1.24

SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
60	M4Q3	A	SR	Data and Probability	Trigonometry	Hypotenuse length	Applying	4522	46.59	0.48	-0.69
61	M4Q4	C	SR	Geometry	Geometry	Identify angles	Remembering	4522	42.17	0.38	-0.33
63	M4Q6	C	SR	Geometry	Geometry	Identify the shape	Remembering	4522	33.26	0.4	-0.12
64	M4Q7	C	SR	Mensuration	Mensuration	Area of rt. Triangle	Understanding	4522	37.59	0.52	-0.1
65	M4Q8	B	SR	Algebra	Algebra	Select LCM	Understanding	9052	27.2	0.32	0.5
66	M4Q9	B	SR	Geometry	Geometry	Median to choose	Remembering	9052	26.57	0.45	0.76
67	M4Q10	B	SR	Algebra	Algebra	Evaluate indices	Remembering	9052	53.9	0.37	-0.8
68	M4Q16	1	CR	Data and Probability	Data	Read ogive	Understanding	4522	30.03	0.41	-0.15
69	M4Q17	2	CR	Geometry	Geometry	Theorem, inscribed angles	Applying	4522	10.13	0.48	1.46
70	M4Q18	1	CR	Algebra	Algebra	Verbal : Quadratic Equation	Understanding	4522	37.39	0.61	-0.58
71	M4Q19	2	CR	Geometry	Geometry	Experimental verification - Cyclic Quadrilateral	Applying	4522	27.5	0.6	-0.15
72	M4Q20	2	CR	Algebra	Algebra	Rational simplification	Applying	4522	13.12	0.56	1.03
73	M4Q21	2	CR	Algebra	Algebra	Solve rational equation	Applying	9052	26.83	0.61	0.22
74	M4Q22	1	CR	Data and Probability	Probability	Multiplicative law of independent events	Applying	4522	11.17	0.49	1.6
75	M4Q23	2	CR	Mensuration	Mensuration	Capacity of a tank	Reasoning	4522	10.34	0.53	1.33
76	M4Q24	2	CR	Arithmetic	Arithmetic	SP with VAT	applying	4522	33.02	0.56	-0.09
77	M5Q1	C	SR	Arithmetic	Arithmetic	Price including VAT	Understanding	4530	60.75	0.42	-1.32
78	M5Q2	D	SR		Geometry	Identify tangent	Remembering	4530	57.28	0.41	-1.03

SN	Label	Key	Type	Domain	Content	Sub-content	Mental Process	N	P (% correct ans)	Item-Rest Corr.	Delta
79	M5Q3	A	SR	Set and Trigonometry	Trigonometry	Trigonometric ratio of tan alpha	Remembering	4530	43.97	0.45	-0.33
80	M5Q4	A	SR	Mensuration	Mensuration	Perimeter	Understanding	4530	56.07	0.44	-1.07
81	M5Q5	C	SR	Arithmetic	Arithmetic	Depreciation	Understanding	4530	51.28	0.36	-0.78
82	M5Q9	B	SR	Mensuration	Mensuration	Compare area of 3 rect.	Applying	4530	39.8	0.43	-0.01
84	M5Q13	B	SR					4530	39.65	0.16	-0.34
85	M5Q14	A	SR	Arithmetic	Arithmetic	Convert $ into pound	Applying	4530	36.78	0.48	0.01
86	M5Q19	1	CR	Algebra	Algebra	Write in the form of indices	Remembering	4530	29.38	0.4	-0.37
87	M5Q20	1	CR	Data and Probability	Probability	1-9 number spinner prob.	Understanding	4530	31.48	0.6	-0.04
88	M5Q22	1	CR	Geometry	Geometry	Tangent related angle	Applying	4530	8.94	0.48	1.79
89	M5Q23	2	CR	Mensuration	Mensuration	Area of shaded part	applying	4530	14.23	0.51	0.98
90	M5Q24	2	CR	Algebra	Algebra	Simplification of Indices	Applying	4530	18.27	0.6	1.76

2. Example of student performance in various levels in Mathematics.

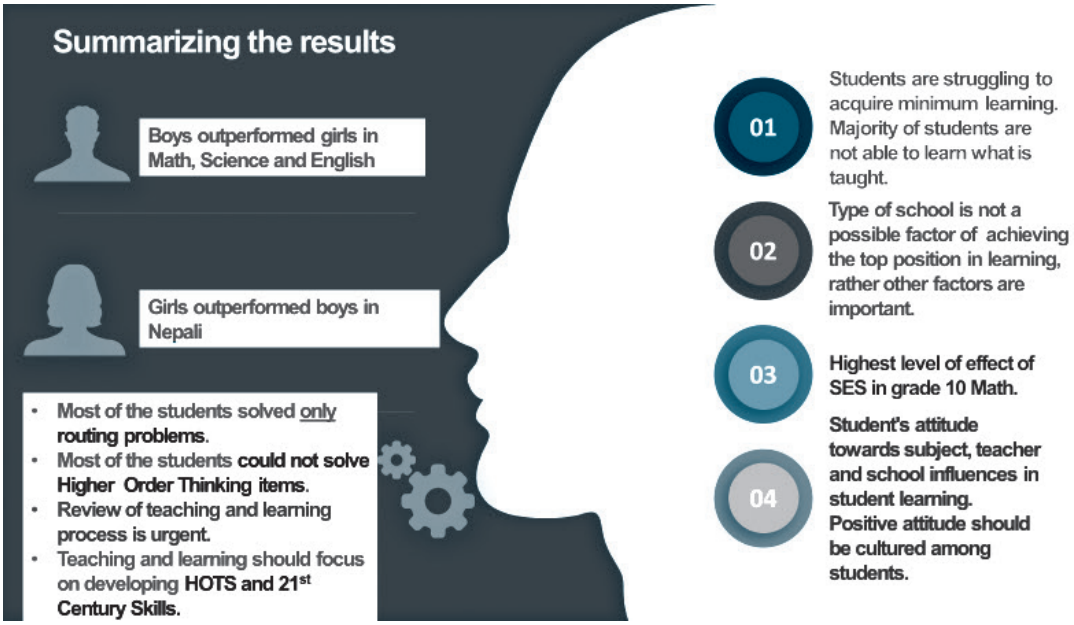


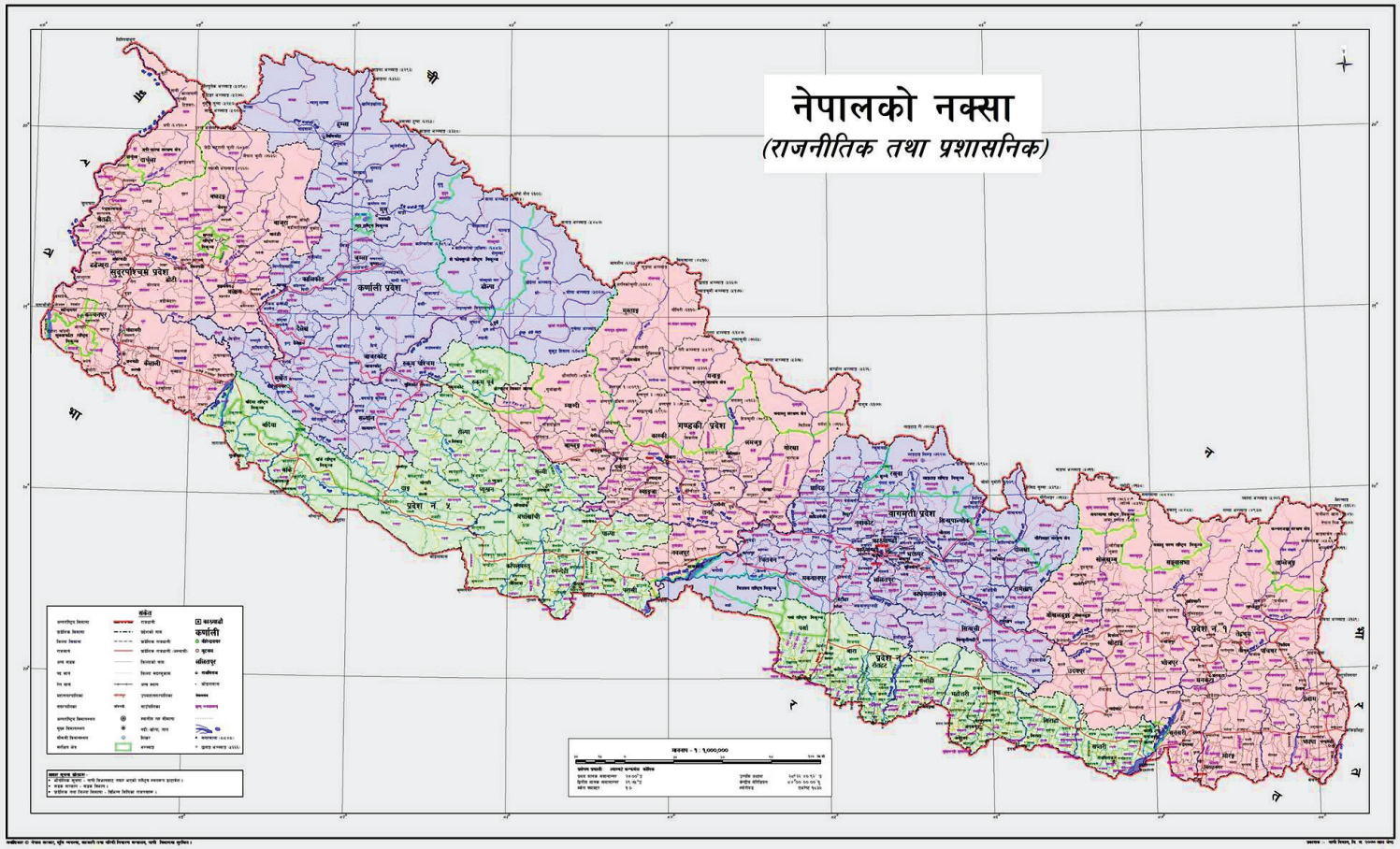
Comparison of all subject student performance

Comparison of student distribution

Level ↓ Subject →	Math	Science	Nepali	English	Interpretation	
Level 6: Advance	5%	2%	5%	9%	High and above grade level	
Level 5: Proficient 3	10%	5%	13%	9%	grade level	← Expected level
Level 4: Proficient 2	16%	11%	21%	12%	grade level low	
Level 3: Proficient 1	24%	20%	23%	18%	Borderline/ minimum	← Minimum level
Level 2: Below Basic	27%	26%	17%	21%	Low	
Level 1: Below Basic level	19%	37%	20%	30%	Low	← Below than Expected level

Summarizing the results




नेपालको नक्सा
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गण्डकी प्रदेश
लुम्बिनी प्रदेश
प्रदेश नं. १
प्रदेश नं. २
बागमती प्रदेश
प्रदेश नं. ५
प्रदेश नं. ६
प्रदेश नं. ७
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धनगढी
मापदण्ड - १ : १,०००,०००