National Assessment of Student Achievement 2023

MAIN REPORT

National Assessment of Student Achievement in Mathematics, Science, English and Nepali for Grade 10

Government of Nepal

Ministry of Education, Science & Technology

Education Review Office

Sanothimi, Bhaktapur, Nepal

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FOREWORD

The National Assessment of Student Achievement (NASA) plays vital role in assessing the learning achievements of students across Nepal. By providing actual evidence, NASA supports policymakers in formulating practical and implementable educational policies at both national and sub-national levels for driving essential educational reforms. This curriculum-based, large-scale assessment measures student learning outcomes using standardized tools, ensuring a comprehensive understanding of educational progress.

The second cycle report for Grade 10, part of thirteenth large-scale national assessments conducted by the Education Review Office, encompasses four key subjects: Mathematics, Science, English and Nepali. This report is based on the responses from a representative sample of 43,219 students across 1,800 schools in Nepal. Each subject was assessed with almost equal number of students and schools, considering the diverse educational landscape across the seven provinces.

Standardized test booklets, meticulously developed in alignment with National Curriculum, were utilized to ensure consistency and reliability in measuring student performance. The data analysis included overall mean scores, proficiency levels, and the relationship between achievement scores and various influencing factors, employing advanced methodology Item Response Theory (IRT). Comparative results with the NASA 2019 assessment are presented for Nepali, English, and Science, while Mathematics results are not comparable due to insufficient anchoring items compared to the 2019 assessment test. These results provide generalized evidence of learning levels across the defined population, offering valuable insights for educational stakeholders.

I would like to extend my gratitude to the numerous individuals and organizations whose contribution was invaluable to this assessment. The dedication and expertise of teachers, subject committee members and researchers were instrumental in the development of the framework and tools, test administration, data analysis and report writing.

I extend my gratitude to former Director General of ERO, all the directors, and ERO staffs for their involvement in various phases of this assessment. Moreover, I appreciate Dr. Hari Prasad Lamsal, Mr. Deepak Sharma, Mr. Baikuntha Prasad Aryal, and other distinguished personalities for their valuable comments on the report. I would like to appreciate the contribution of all the experts, writers, data analysts and Central Level Agencies. Similarly, I would like to appreciate the role of Ministry of Education, Science and Technology during entire research processes. My sincere gratitude also goes to the Ministers for Education, Science and Technology (MoEST) Hon. Sumana Shrestha, Hon. Bidya Bhattarai, Hon. Raghuji Pant and Secretory of MoEST Dr. Dipak Kafle and Mr. Chudamani Poudel for their valuable suggestions and guidance. I believe this report will be a milestone for policymakers, program designers, teachers, educators, researchers, and other stakeholders in improving students' learning and will serve as a foundation for enhancing the quality of school level education in Nepal.

Jayaram Adhikari
Director General

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ACRONYMS

CEHRD:	Centre for Education and Human Resource Development
CI:	Confidence Interval
CR:	Constructed Response
CRT:	Criteria-Referenced Test
CSS:	Clustered Sample Size
CTT:	Classical Test Theory
DPL:	Defining Proficiency Level
EAP:	Expected a Posteriori
EDCU:	Education Development and Coordination Unit
EMIS:	Educational Management Information System
ERO:	Education Review Office
GPCM:	Generalized Partial Credit Model
ICC:	Item Characteristic Curve
ID:	Identification
IEA:	International Association for the Evaluation of Educational Achievement
IRT:	Item Response Theory
LAF:	Language Assessment Framework
MCQ:	Multiple-Choice Questions
MoEST:	Ministry of Education, Science and Technology
MoS:	Measure of Size
N cases	Number of Cases/Students in the Population
NASA:	National Assessment of Student Achievement
NEB:	National Examinations Board
NRT:	Norm-Referenced Test
OECD:	Organization for Economic Co-operation and Development
OMR:	Optical Mark Recognition

PCAP:	Pan-Canadian Assessment Program
PCM:	Partial Credit Model
PISA:	Program for International Student Assessment
PPS:	Probability Proportional to Size
PRC:	Print-Ready Copy
PV:	Plausible Value
RWGT:	Replicable Weight
SAQ:	Short-Answer Questions
SE:	Standard Error
SES:	Socio-Economic Status
SPSS:	Statistical Package for Social Sciences
SR:	Selected Response
SRS:	Simple Random Sampling
SSDP:	School Sector Development Plan
SSRP:	School Sector Reform Plan
TAM:	Test Analysis Module
TIF:	Test Information Function
TIMSS:	Trends in International Mathematics and Science Study
TPD:	Teacher Professional Development
WLE	Weighted Likelihood Estimation
VIF	Variance Inflation Factor

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Executive Summary

The Education Review Office (ERO), established in 2010, under the Ministry of Education, Science, and Technology (MoEST) with the mandate to conduct independent performance audits of schools and institutions. Its primary goal is to assess student achievement levels to promote institutional accountability and enhance the quality of education. Similarly, ERO provides recommendations to the government and stakeholders based on research findings from the National Assessment of Students Achievement (NASA), performance audits of schools, and local-level assessments.

A nationwide representative assessment was conducted to assess the learning achievement of Grade 10 students in Mathematics, Science, Nepali, and English. The primary objectives of NASA 2023 for Grade 10 were to identify the current achievement levels in these subjects and to determine the personal, family, and school-related factors influencing these achievement. Additionally, NASA aims to provide actionable feedback to teachers, schools, curriculum developers, policymakers, program implementers and other stakeholders to facilitate necessary reforms. The primary goal of NASA is to provide accurate and reliable insights into the learning achievements of Grade 10 students. These insights serve as valuable feedback for the MoEST to reform policy.

To measure these objectives, the ERO conducted a nationwide assessment of Grade 10 students' academic performance in Mathematics, Science, English and Nepali in 2023. This assessment used standardized test items aligned with the curriculum and was carried out in 76 of the 77 districts, excluding Manang district due to their lower student population. A total of 43,219 students from 1,800 schools (1800 head Teachers and 1800 Subject Teachers) participated in this assessment.

The achievement scores for Science, English, and Nepali were calibrated using NASA 2019 scores, while the national achievement score for Mathematics was set at 500 due to insufficient anchoring items compared to the 2019. The results were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (independent sample t-test, ANOVA, and multiple linear regression). Various graphs were also used to present the achievement scores and the frequency of different variables.

National Level: The 2023 national assessment of grade 10 students in Nepal shows mixed results. The national average scores are 500 for mathematics, 504.83 for Science, and 515.11 for English, and 498.68 for Nepali. Compared to 2019, Science and English scores have increased by 4.83 and 15 points, respectively, while Nepali scores have decreased by 1.28 points. In mathematics, a significant finding is that 60% of students are at or below the proficient 1 level, indicating they do not meet the minimum expected goals of the curriculum and only about 40% of students meet the minimum grade standards.

Province Level: There are significant disparities in achievement scores across provinces. Bagmati and Gandaki provinces consistently show higher average scores, while Karnali and Sudurpaschim provinces lag behind. In mathematics, Bagmati leads with the highest mean score, while Karnali has the lowest. Similar trends are observed in Science, English, and Nepali.

Local Levels: Achievement scores are significantly lower among students from rural municipalities compared to those from urban municipalities. Urban municipalities have higher mean scores in all subjects, highlighting the need for targeted educational interventions in rural areas to bridge the achievement gap.

School Type: There is a significant difference in achievement scores between institutional and community schools. Institutional schools have higher mean scores across all subjects compared to community schools.

Gender: Notable gender disparities exist in achievement scores. Boys significantly outperform girls in mathematics, Science and English, while girls outperform boys in Nepali. These findings highlight the need for gender-sensitive educational strategies to address these disparities.

Home-School Distance: Students living near half an hour from the school have significantly better results in mathematics, Science and English. In Nepali, students living closer to the school (up to 15 minutes) achieve the highest scores, while those living more than two hours away have the lowest scores.

Home Language and Ethnicity: Students having Nepali as their home language achieve significantly better scores across all subjects. Students from Brahmin/Chhetri backgrounds consistently perform better, while those from Dalit backgrounds score significantly lower. These findings underscore the need for targeted educational interventions to address disparities based on language and ethnicity.

Ethnicity and Geography: Significant differences in achievement scores are observed across ethnic groups and geographic regions. Madhesi students have the highest scores in Mathematics, while Pahadi students lead in Science and Nepali. Himali students score the lowest in all subjects, highlighting the need for targeted educational interventions to address these disparities.

Parental Education: There is a positive correlation between parental education levels and student achievement. Students whose parents have higher education levels consistently achieve better scores across all subjects, highlighting the importance of parental education in influencing academic success.

Parental Occupation: Parental occupation significantly impacts student achievement. Students whose parents are involved in teaching and business achieve higher scores, while those whose parents are engaged in farming and housework score lower. This trend is consistent across all subjects.

Time Spent Out of School: Time management outside school significantly affects achievement scores. Students who spend 2-4 hours on TV/Internet/Mobile, minimal time on household chores, and more than four hours on study/homework perform best. Balanced time management is crucial for optimizing academic performance.

Study Support: Study support plays a significant role in student achievement. Students receiving tuition support, collaborating with friends, or engaging in self-learning achieve higher scores. Tailored support strategies are essential to optimize academic performance.

Home Facilities: Access to home facilities such as a study table, separate room for study, computer, internet, and other learning resources significantly boost student achievement. Students with better home facilities consistently achieve higher scores across all subjects.

School Engagement: Students who engage in playing and classwork/homework during leisure time achieve higher scores in Mathematics, Science, English and Nepali. Regular participation in extracurricular activities (ECA) is generally associated with better performance, although occasional participation sometimes yields the highest scores.

Teacher Activities: Regular feedback, consistent teacher presence, and effective classroom time management significantly improve student scores across all subjects. The use of digital resources and the internet in classroom activities also enhances performance.

Bullying at School: Students who do not experience bullying achieve higher scores in all subjects.

Learning Motivation: Frequent engagement in problem-solving, group work, and reviewing past exam questions significantly boosts achievement scores in Mathematics, Science and English. Positive attitudes towards learning Nepali and frequent engagement in related activities enhance performance in Nepali. Consistent engagement in effective study practices is crucial for improving academic performance across all subjects.

Recommendations

Province Level: Develop province-specific action plans for lower-performing provinces like Karnali and Sudurpaschim. Allocate additional resources and support, and facilitate the sharing of best practices from high-performing provinces like Bagmati and Gandaki. Organize inter-provincial workshops and training sessions for educators.

Local Levels: Increase investment in rural education infrastructure, including digital classrooms. Engage local communities and encourage parental involvement through awareness programs and workshops to create a supportive learning environment.

School Type: Provide additional funding and support to community schools, focusing on teacher training, infrastructure development, and student support services. Regularly monitor and evaluate these programs.

Gender: Implement gender-sensitive teaching strategies and promote gender equality through awareness programs and inclusive practices. Encourage girls to pursue STEM subjects with scholarships, mentorship programs, and role models. Provide additional support to help girls improve in subjects where they left behind.

School Distance: Support students who travel long distances by providing transportation services or establishing more schools in remote areas. Offer after-school programs and homework assistance to ensure adequate study time.

Home Language and Ethnicity: Develop multilingual education programs and culturally responsive teaching practices to support students whose home language is not Nepali. Provide additional resources to Dalit students and other underperforming groups to bridge the achievement gap.

Ethnicity and Geography: Create region-specific educational programs that consider unique cultural and geographic contexts. Provide additional resources to underperforming regions like Himali areas and encourage collaboration between high-performing and low-performing regions.

Parental Education: Support parental education through adult education programs and literacy initiatives. Encourage parental involvement in their children's education through workshops and community programs to create a supportive learning environment at home.

Parental Occupation: Provide targeted academic support to students from lower-performing occupational backgrounds. Implement career counseling and vocational training programs for parents to improve their socio-economic status, positively impacting their children's education.

Time Spent Out of School: Encourage the students to balance the time management among study, leisure, and household responsibilities. Implement after-school programs and study groups, and educate parents and students about limiting screen time and encouraging productive activities.

Study Support: Tailor study support strategies to encourage self-learning and collaboration with friends. Prioritize support and offer structured study sessions and peer tutoring programs to enhance learning outcomes.

Home Facilities: Improve home facilities by ensuring access to study tables, separate rooms for study, and peaceful environments.

School Engagement: Encourage balanced participation in extracurricular activities and effective use of leisure time. Promote group work and classwork/homework during leisure time to improve student engagement and achievement.

Teacher Activities: Enhance teacher effectiveness through regular feedback, consistent presence, and effective classroom management. Incorporate digital resources and internet use in classroom activities. Focus on continuous professional development for teachers.

Bullying at School: Implement comprehensive anti-bullying programs to create a safe and supportive school environment. Provide counseling and support services for students who experience bullying and promote a culture of respect and inclusion.

Learning Motivation: Encourage frequent engagement in problem-solving activities and review of past exam questions. Incorporate regular problem-solving sessions and group work into lessons. Promote self-study using internet resources with proper guidance. Highlight the practical benefits of learning Nepali and integrate enjoyable Nepali-related activities into the curriculum to enhance student engagement and performance.

Conclusion

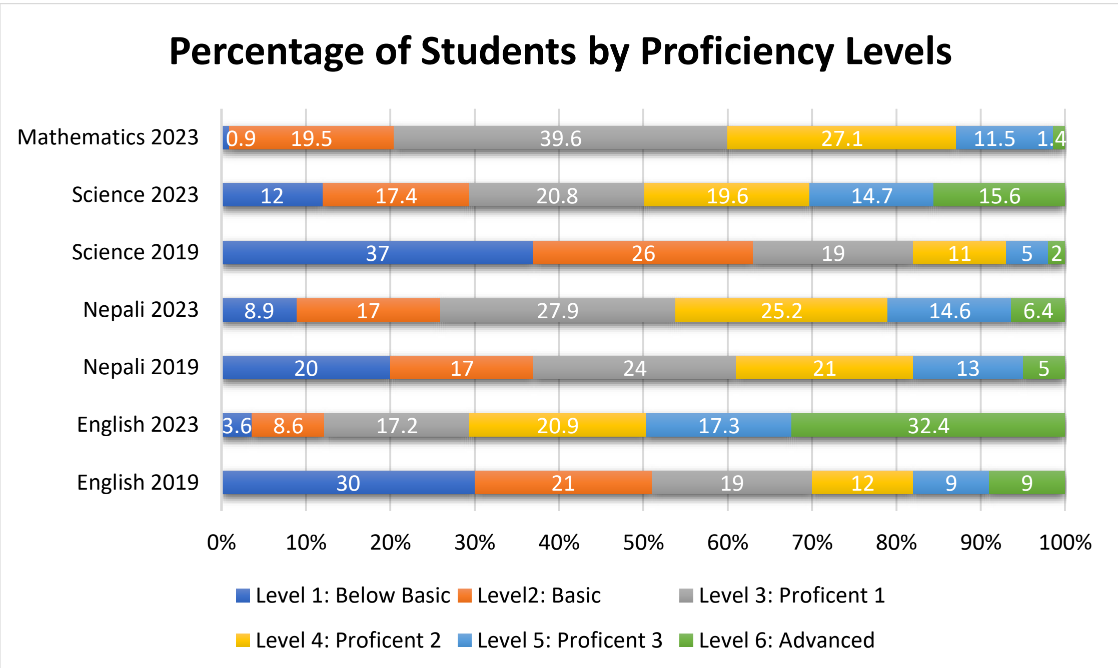
National assessment of student's achievement of grade 10, (2023) highlights the significant disparities in academic achievement across various factors. Nationally, while there have been improvements in Science and English scores since 2019, a substantial portion of students remain below the proficient level, particularly in

Mathematics. Provincial disparities are evident, with Bagmati and Gandaki provinces outperforming others, while Karnali and Sudurpaschim left behind. Urban students have consistently achieved higher scores than their rural counterparts, underscoring the need for targeted interventions in rural areas.

Institutional schools outperform community schools across all subjects, reflecting disparities in infrastructure and teaching quality. Gender disparities persist, with boys excelling in Mathematics, Science, and English, while girls outperform boys in Nepali. Proximity to school positively impacts performance, particularly in Nepali, where students living close to the school achieve the highest scores.

Students with Nepali as their home language and those from Brahmin/Chhetri backgrounds perform better across all subjects, highlighting the need for interventions to address ethnic and linguistic disparities. Parental education and occupation significantly influence student achievement, with higher parental education and professional occupations correlating with better student performance.

Effective time management outside school, tailored study support, and access to home facilities are crucial for optimizing academic performance. School engagement, particularly through balanced participation in extracurricular activities, and positive teacher activities, such as regular feedback and effective classroom management, significantly enhance student achievement. Addressing bullying is essential, as it negatively impacts performance in most subjects.



CHAPTER I

An Overview of the National Assessment of Student Achievement

Introduction

Education Review Office (ERO) administered a nationwide assessment of the academic performance of grade 10 students in Mathematics, Science, English and Nepali in 2023. This assessment utilized standardized test items aligned with the curriculum. The resulting report offers a comparative analysis of outcomes across different sections, emphasizing provincial results as distinct strata. Similarly, it implicitly considers other factors such as school type, gender, ethnicity and language. The findings are separated to offer a nuanced analysis of achievement patterns within each subgroup.

The assessment was carried out in 76 out of 77 districts, excluding Manang due to their lower student populations. A total of 1,800 schools and 43,219 students participated in the assessment. The primary objective of NASA is to furnish accurate and dependable insights into the learning achievements of grade 10 students. These insights serve as valuable feedback to the Ministry of Education, Science and Technology (MoEST) for policymaking purposes. NASA's specific goal is to provide actionable feedback to teachers, schools, curriculum developers, policymakers, and program implementers, facilitating necessary reforms. Through a recurring cycle, NASA generates evidence-based data on student learning trends and contextual factors, thereby informing the review and development of educational policies and programs.

National Assessment of Student Achievement

Large-scale assessments, often referred to as standardized tests, are standardized in terms of content, assessment, item, administration, timing, and scoring. This is particularly common in Anglo-Saxon countries and literature. Traditionally sample-based, there has been a shift towards a census-based approach in many countries over recent decades (Verger et al., 2018). These assessments can be conducted in schools or households, and may or may not align with the curriculum. Generally, teachers and schools have a vested interest in the outcomes, while the stakes for the test-takers are usually low or nonexistent (UNESCO, 2009). The aim of these internationally, regionally, and nationally conducted assessments is to produce evidence-based information to assist policymakers and stakeholders in diagnosing the performance of the education system and identifying contributing factors. Many large-scale assessments gather background information to contextualize the results. They are based on specific standards or learning goals set beforehand. Administered either to all students in the target grade (census-based assessments) or to a representative sample (sample-based assessments), these tests require all participants to answer the same set of questions (Clarke, 2011).

The primary focus of a national assessment is to describe and evaluate the quality of student learning outcomes produced by schools. It is important to note that national assessments differ from public (external) examinations – where the main focus is on individual students, certifying their achievement, and selecting them for further education. The information obtained in a national assessment can supplement information on inputs to an education system, such as information about educational resources and teacher qualifications, and on educational processes. Together, these types of information provide policy makers and education managers with evidence about their education system's achievements and successes, constraints it may be operating under, the problems experiencing all of which should provide a basis for proposals for remedial action (Postlethwaite & Kellaghan, 2008). Since it is difficult for an education system to plan for improvement without such information, national assessments can be considered as an essential component of the professional administration of any education system.

In the 1970s and 1980s, several industrialized countries established systems for conducting national assessments. By the early 1990s, many other countries, including developing nations, began to recognize the importance of regular national assessments. This growing awareness was significantly influenced by the final declaration of the World Conference on Education for All, held in Jomtien, Thailand, in March 1990. The declaration emphasized that access to education is meaningful only if students gain useful knowledge, reasoning abilities, skills, and values. The Dakar Framework for Action in 2000, marking the ten-year follow-up to Jomtien, reinforced this message and highlighted the necessity of clearly defining and accurately assessing learning outcomes (including knowledge, skills, attitudes, and values) to ensure quality education for all.

Likewise, according to Husén (1987), national assessment holds significant implications for various areas such as: (a) social and economic policy regarding the overall quality and performance of the education system, including its role in achieving social and economic objectives (for example: equality of opportunity, gender parity, and improving the performance of students from disadvantaged backgrounds); (b) the organization and management of an education system (for example: the provision of public and private education); and (c) learning conditions (for example: instructional time, resources, teacher education, and family support).

In Nepal, similar to prominent international assessments like PISA, TIMMS, and PIRLS, NASA functions as a crucial tool for evaluating curriculum achievement and pinpointing discrepancies between the intended and achieved curriculum. This role is instrumental in shaping policy decisions, particularly concerning resource distribution (EDSC, 2008). The NASA report furnishes policymakers with data on textbook availability, class sizes, and teacher training duration, cementing its status as a globally acknowledged approach for methodically assessing learning outcomes and steering policy formulation (EDSC, 2008; ERO, 2013; ERO, 2019).

Evolution of NASA in Nepal

Ministry of Education, Science and, Technology, Nepal decided to conduct large scale assessment at national level in the late 1980s, however the practice of national level assessment began from 1995. The assessment was conducted on a small scale before 2010. The Ministry of Education has been responsible for the administration of the large-scale NASA since 2011. NASA has concluded four cycles under the School Sector Reform Plan (SSRP), and five including NASA 2022, have been conducted under the School Sector Development Plan (SSDP), and NASA 2023 has been conducted under the School Education Sector Plan (SESP). NASA is regarded as a tool for evaluating the quality of education and holding educational institutions accountable for meeting educational objectives in both programs. NASA's investigations serve both predictive and reflective objectives. They are striving to establish a database that will facilitate the analysis of the strengths and shortcomings of educational policies and practices that affect student learning outcomes in a reflective manner (ERO 2018, 2019).

The following table highlights the progression of Nepal's assessment practices, from their inception in the late 1980s to the formal establishment of the National Assessment in 1995 and its subsequent expansion into the extensive NASA program. It emphasizes NASA's responsibility for assessing the quality of education and guaranteeing accountability in the education sector. Furthermore, it explores the ways in which NASA studies serve both predictive and reflective functions, thereby facilitating the analysis and enhancement of educational policies and practices.

Table 1 NASA cycles and progress

SSRP				**SSDP**					**SESP**
2011	**2012**	**2013**	**2015**	**2017**	**2018**	**2019**	**2020**	**2022**	**2023**
Grade 8	Grades 3 and 5	Grade 8	Grades 3 and 5	Grade 8	Grade 5	Grade 10	Grades 3 and 8	Grade 5	Grade 10

A comprehensive cycle of NASA spans over three years, with each year dedicated to specific tasks. During the first year, activities include developing test items, conducting pre-tests, and analyzing results. In the second year, the final NASA assessment is administered. Finally, in the third year, tasks including data analysis, report writing, disseminating assessment results, and providing feedback for policy adjustments are carried out.

The ERO adheres to internationally recognized standards for conducting national assessments, recognizing that while the circumstances may differ across countries, there are common practices observed in most national assessment programs (ERO, 2019). Drawing from a comprehensive examination of national assessment practices worldwide, the ERO has adopted specific procedures to ensure effectiveness and consistency as stated below:

- The ERO, operating within the MoEST system, holds sole responsibility for conducting the national assessment.
- The ERO collaborates with key stakeholders, including subject experts, teachers, and policymakers, to develop and periodically review assessment policies and frameworks.
- The MoEST determines the grade level and specifies the subject areas (e.g., literacy, numeracy, Science, Mathematics, or English) to be assessed.
- The implementing agency, which in Nepal is the ERO, delineates and elaborates on the areas of achievement testing, defining both the content and cognitive skills to be evaluated. It also designs test items, develops supporting questionnaires, and creates manuals for test administration.

Assessment Process

The ERO undertakes several crucial tasks to ensure the effectiveness and integrity of the assessment process:

- **Piloting Test Items:** The ERO conducts pilot tests to refine assessment items, seeking input from external experts to evaluate their validity, appropriateness, and sensitivity to factors like gender, ethnicity, and culture.
- **Ensuring Reliability and Validity:** Through pilot item analysis, the ERO ensures that assessment instruments are reliable and valid.
- **Sample Selection and Communication:** The ERO selects sample schools, coordinates the printing of test papers and materials, and communicates with schools and teachers regarding test administration.

- **Orienting Test Administrators:** The ERO provides training and guidance to test administrators, including focal persons, supervisors, and administrators, and oversees the administration of tests and surveys in the selected schools.
- **Data Collection and Analysis:** The ERO collects test scores and relevant data, cleans the data as needed, and conducts a thorough analysis of the data to get comprehensive results.
- **Drafting Reports:** The ERO prepares draft reports, which are reviewed by subject committee members and external experts.
- **Dissemination:** The ERO disseminates final reports through various channels, including publication and mass media.
- **Policy Feedback:** Finally, the reports are studied by the MoEST, the implementing agency, and other stakeholders to identify key areas for policy and practice reforms.

This structured approach to conduct NASA ensures a comprehensive and reliable assessment process that guides improvements in the educational quality in Nepal.

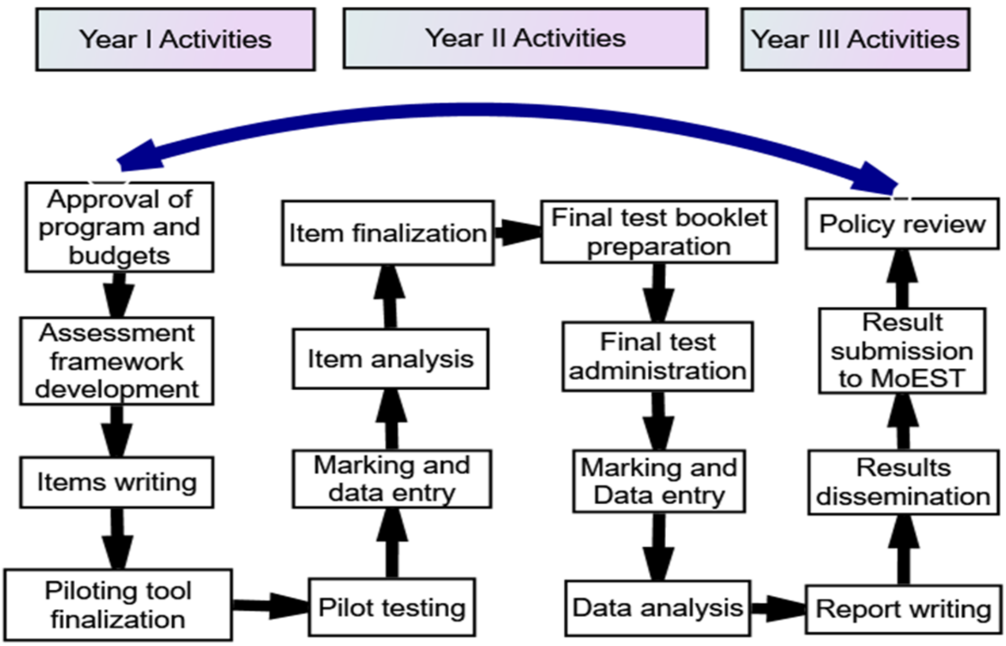


Figure 1 NASA Cycle

Figure 1 illustrates the comprehensive steps involved in the NASA assessment process, which begins with the approval of the necessary budget and program. This process encompasses a series of detailed assessment procedures, starting with the development of the assessment framework, criteria, and standards. Following this, test items and questionnaires are created and then piloted, analyzed, and selected based on their effectiveness.

The next steps include designing the test booklets and administering the test to the selected participants. After the administration of the tests, the next process involves scoring and preparing the data, followed by data cleaning, calibrating items, and equating the tests to ensure consistency and reliability.

The final stages involve analyzing the results, setting proficiency levels, and ultimately reporting and disseminating the findings to the MoEST, and other stakeholders. This structured approach ensures a thorough and reliable assessment cycle.

Objectives of NASA 2023

The purpose of this assessment is to provide feedback to the Ministry of Education, Science, and Technology to enhance the quality of school education. This report in particular does not report the performance of individual students or compare the proficiency levels of each student and school. Instead, it presents results at the national and provincial levels, highlighting differences in achievement scores related to various influencing factors such as socio-economic status, home language, geographical identity, student attitudes towards school subjects, and experiences with bullying. Specifically, NASA 2023 aims to achieve the following objectives:

- To identify the current level of Grade 10 students' achievement in Mathematics, Science, English and Nepali.
- To identify variations in student achievement based on factors such as gender, province, and type of school, ethnicity, home language, and socio-economic status.
- To explore factors that influence student achievement.

Features of NASA 2023

Item Response Theory (IRT) was employed to evaluate students' underlying abilities, incorporating various contextual factors to explain these latent traits. This assessment employed advanced methods to ensure rigorous data analysis, allowing for the results to be generalized at both national and provincial levels through the use of seven explicit strata and several implicit strata. Examples of these advanced procedures included the use of the Replicate Model for estimating population parameters and weighted likelihood estimation (WLE) for analyzing and reporting individual student levels.

Furthermore, improvements have been made in sampling methods. A probability proportional to size (PPS) sampling procedure was used to select schools as the primary sampling unit (PSU), which were the school clusters. Student achievement at the provincial and national levels were reported on a transformed scale with a mean of 500 and a standard deviation of 50, using a specific formula:

$$\text{Achievement score} = 500 + (\text{plausible value} \times 50)$$

Distinct features of this report include:

- **Learning-level descriptors** created through a rigorous analysis.
- **Presentation of gaps in learning** between the written curriculum and the taught curriculum, shown as achieved curriculum using the defining proficiency level (DPL) method.
- **Enhanced reliability of the results**, the sample size answering an item has been doubled compared to previous years. This was achieved by combining two subject test papers for each student. Consequently, each subject's test item set has fewer items, but the number of test booklets has increased.

Organization of the Report

This report has been organized into seven chapters. Each chapter focuses on a specific area of study.

Chapter one introduces the National Assessment of Student Achievement (NASA), detailing its historical context and outlining its objectives.

Chapter two covers the methodological procedures including sample selection, item analysis, sample weight calculation, and data analysis. It also discusses contextual variables such as geography, ethnicity, gender, language, and economic status, along with the tools and technologies utilized throughout the study.

Chapter three presents the findings in the Mathematics assessment

Chapter four presents the findings in the Science assessment.

Chapter five presents the findings in the English assessment.

Chapter six presents the findings in Nepali assessment.

Chapter seven presents the conclusion and recommendations based on the findings.

In this way, the seven chapters in the report ensure a clear and comprehensive presentation of the assessments' objectives, methodologies, subject-wise findings, and policy and practice recommendations.

CHAPTER II

METHEDOLOGY

First, this chapter begins by defining the target populations for the study, specifying the criteria for inclusion and exclusion. It details the demographic and geographic characteristics of the populations considered, ensuring a comprehensive understanding of the study's scope. Second, the chapter then explains the sampling design, including the rationale behind the chosen methods. It describes the sampling procedures in detail, outlining how the samples were selected to ensure representativeness. This includes the steps taken to avoid bias and ensure that the sample accurately reflects the larger population. Third, the chapter delves into the assessment framework, which serves as the foundation for the study. It explains the theoretical and conceptual underpinnings of the framework, detailing how it guides the development and implementation of the assessment tools.

Fourth, this chapter describes the meticulous process of developing the assessment tools. It covers the initial design phase, the selection of appropriate measures, and the iterative process of refining these tools. The features of the tools used in the study are highlighted, emphasizing their relevance and applicability.

Fifth, before finalizing the tools, piloting procedures are conducted to test their effectiveness. This section details the pilot studies, including the sample size, methodology, and key findings. It explains how the results of these pilots informed the refinement of the tools.

Sixth, this chapter focuses on ensuring the reliability and validity of the assessment tools. This section outlines the procedures used to confirm these attributes, including statistical tests and other validation methods. It provides evidence of the tools' accuracy and consistency.

Seventh, after confirming reliability and validity, the tools are finalized. This section describes the finalization process, including any adjustments made based on pilot study results and validation tests. It ensures that the tools are ready for deployment in the main study.

Eighth, in the final step, the chapter details the statistical tools and techniques employed in data analysis. It explains the methods used to analyze the data, including descriptive and inferential statistics. This section ensures that the data analysis is robust and capable of yielding meaningful insights.

By elaborating on these sections, the chapter provides a thorough understanding of the study's methodological rigor and the steps taken to ensure the reliability and validity of its findings.

Population

The study population encompasses community and institutional schools of grade 10. However, specific inclusion and exclusion criteria were applied to define the population. Schools that did not have grade 10 students, those with fewer than 10 students, and special schools such as Gurukuls, Madrasas, and Gumbas were excluded from the population.

After applying these exclusions, the target sampling frame for this study was determined based on the 2021A.D. school data. This refined sampling frame included a total of 469,563 students from 9,585 schools, representing the target population for the study. This approach ensured that the study focused on a relevant and representative sample of grade 10 students across the country.

Sampling Procedure

Sampling is the method used to select a subset of data from a larger population (Rahi, 2017). It involves choosing individuals from a predefined sample frame. Specifying the sampling strategy in advance is crucial, as it can significantly impact the estimation of the sample size (Krause et al., 2011; Martinez-Mesa et al., 2014).

For this study, a multi-stage sampling process was employed. Initially, a comprehensive list of all 9,585 schools was compiled, including their unique IDs (school EMIS codes) provided by the Centre for Education Human Resource Development (CEHRD). This list served as the target population for developing the sampling frame.

The sampling frame included detailed information about each school, such as the name, location (province, district, geography, and municipality), ID (code), school categories (institutional and community). These data were sourced from the IEMIS, which is collected annually through a national school census.

By using this multi-stage sampling process, the study ensured a representative and comprehensive selection of schools, allowing for an accurate and reliable analysis of the target population. The detailed information collected through the IEMIS system ensured that the sampling frame was comprehensive and up-to-date, reflecting the current state of the education system in Nepal.

Sampling Design

The multistage sampling design is essential for managing the logistical complexities of large-scale national assessments (Roy, 2016). Initially, the seven provinces were used as strata to effectively capture geographical characteristics. This stratification ensured that the unique features of each region were adequately represented in the sample.

In the first stage of sampling, the Probability Proportional to Size (PPS) method was applied. This method ensured that larger schools, which likely had more diverse student populations, were proportionally represented in the sample. By doing so, the PPS method enhanced the precision and reliability of the findings (Skinner, 2014). Larger schools were more likely to be selected in the sample, which helped in capturing a wide range of student experiences and outcomes.

In the second stage, a combination of simple random sampling and the inclusion of all students from classes with 25 or fewer students was employed. This approach ensured that every student had an equal chance of being selected, thereby maintaining the representativeness of the sample. Including all students from smaller classes helped in mitigating biases that could arise from uneven class sizes, ensuring that the data collected was comprehensive and reflective of the entire student population.

Overall, this multistage sampling design not only addressed the logistical challenges but also ensured that the sample was representative and the findings were robust and reliable.

Stratification by Provinces

By dividing the sample frame into provinces, the study provided a more detailed and precise understanding of regional variations in educational performance. This method allowed for the identification of specific challenges and achievements unique to each province. For instance, certain provinces might have faced distinct educational hurdles due to factors such as socioeconomic conditions, availability of resources and cultural influences. Conversely, other provinces might exhibit particular strengths or successful educational practices that could serve as models for other regions.

Stratifying by provinces ensured that these regional characteristics were adequately represented in the study, providing valuable insights to policymakers and educators. This detailed regional analysis aided in the development of targeted interventions and policies that might address the unique needs and circumstances of each province. Ultimately, this approach enhanced the overall effectiveness of educational strategies and contributed to a more equitable and informed educational system.

Probability Proportional to Size (PPS) Sampling

In the initial stage of sampling, the Probability Proportional to Size (PPS) method was employed to select schools. This method took into account the varying sizes of schools, larger schools having large number of the students have a higher probability of being chosen. This approach was essential for obtaining a representative sample of the student population.

By using PPS sampling, the likelihood of selecting schools was directly proportional to their size. Larger schools, which typically had more students, were more likely to be included in the sample. This ensured that the sample accurately reflected the actual distribution of students across different schools. Consequently, the results of the study could be generalized to the entire student population with greater confidence.

Employing PPS sampling helped to capture the diversity and complexity of the student population. It ensured that schools of various sizes were proportionally represented, which was crucial for understanding the broader educational landscape. This method enhanced the reliability and validity of the findings, providing a robust basis for drawing conclusions about the educational outcomes and needs of students across the country.

Primary Sampling Unit (PSU)

In this study, the school was designated as the primary sampling unit (PSU). By selecting schools as the initial sampling units, the study ensured that a variety of school-level factors were incorporated into the sample. These factors included the type of school (e.g., public or private), the geographical location (e.g., urban and rural), and the infrastructure available at each school (e.g., classroom facilities, availability of learning materials, and technological resources).

This approach was crucial for capturing the diverse dynamics presented within different schools. By including a wide range of school types and locations, the study accounted for the varying conditions under which students learned. For instance, schools in urban areas might have different resources and challenges compared to those in rural or remote areas. Similarly, public schools might face different constraints and opportunities compared to private schools.

By considering these diverse factors, the study provided a comprehensive picture of the educational setting across the country. This holistic view was essential for understanding the broader context in which education occurred and for identifying specific areas that might require targeted interventions or support. Ultimately, this method ensured that the findings of the study were robust and reflective of the actual conditions in which students were educated, thereby offering valuable insights for policymakers and educators.

Simple Random Sampling within Schools

In the second stage of sampling, students from the primary sampling units (PSUs), which were the schools, were selected using a simple random sampling method. Specifically, twenty-five students from grade 10 were chosen randomly from each school. This approach was employed to ensure that every student had an equal chance of being selected, thereby avoiding any potential bias.

When there were more than 25 students in grade 10, simple random sampling was used to randomly select 25 students. This method ensured that the selection process was fair and unbiased, giving each student an equal opportunity to be included in the sample. On the other hand, if a school had 25 or fewer students in grade 10, all students were included in the sample. This approach guaranteed that smaller schools were fully represented in the study.

By combining these two methods, the study maintained the randomness and unbiased nature of the sampling process. This dual approach ensured that the sample was both adequate and representative, capturing a comprehensive and accurate picture of the student population across different schools. This methodology was crucial for obtaining reliable and valid results that could be generalized to the broader population of grade 10 students.

Sample Size Determination

Educational survey research studies suggest that to achieve precise sampling, a simple random sample (SRS) of 384 students is required for the primary criterion variable (Cohen et al., 2007). This sample size ensures a 95% confidence interval for the student-level estimate with a 3% margin of error (Krejcie & Morgan, 1970). However, achieving perfect random sampling in a large-scale national assessment is challenging due to various logistical and practical constraints.

To overcome these challenges, the sampling design incorporated a combination of techniques at different stages, such as stratification, clustering, and random selection of students. Stratification involved dividing the population into distinct subgroups (strata) to ensure that each subgroup was adequately represented. Clustering involved grouping the population into clusters, such as schools or classes, and then randomly selecting clusters for inclusion in the sample. Within each selected cluster, students (grade 10) were then randomly chosen to participate in the assessment.

Given the complexities of multistage sampling, it was essential to calculate and adjust for the design effect when determining the sample size. The design effect accounted for the increased variance that could result from using a multistage sampling approach compared to simple random sampling. In this assessment, the actual sample size was determined using multistage sampling methods, which involved estimating the intra-class correlation (r or ICC) from data collected in previous assessments, such as NASA 2020. The intra-class correlation measured the degree of similarity between students within the same cluster, which helped in adjusting the sample size to ensure accurate and reliable results.

By employing these advanced sampling techniques and adjustments, the study aimed to achieve a representative and precise sample that reflected the broader student population, thereby enhancing the validity and reliability of the assessment findings.

With an intra-class correlation (ICC) of 0.5 and a school cluster size (C) of 25, the design effect (Deff) was calculated using the appropriate formula as below:

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

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 (ICC)

To calculate the clustered sample size (CSS), the following formula was used:

$$CSS = ESS \times Deff$$

Where ESS is the effective sample size.

This approach ensured that the sample size was adjusted for the design effect, providing a more accurate and reliable representation of the student population.

Sampling Frame

The sampling frame for this study encompassed all schools that offered education up to Grade 10, totaling 9,585 schools distributed across 76 districts. To ensure a comprehensive and representative sample, the sampling frame was stratified by the seven provinces. This stratification captured regional educational variations, ensuring that the unique characteristics and educational contexts of each province were adequately represented in the study.

In the first stage of sampling, schools were selected using the Probability Proportional to Size (PPS) method. This method ensured that larger schools, which had more students, had a higher probability of being included in the sample. This approach helped to accurately reflect the distribution of students across different schools, enhancing the representativeness of the sample.

In the second stage, students from the selected schools were chosen using simple random sampling methods. This technique ensured that every student within the selected schools had an equal chance of being included in the study, thereby maintaining the randomness and unbiased nature of the sampling process. However, in cases where a school had 25 or fewer students in Grade 10, all students from that school were included in the sample. This approach ensured that smaller schools were fully represented, preventing any potential bias that could arise from excluding them.

By combining these sampling methods, the study ensured a robust and comprehensive representation of the student population across different regions and school types. This methodological rigor enhanced the validity and reliability of the study's findings, providing valuable insights into the educational outcomes and needs of Grade 10 students nationwide. The Figure 2 gives the complete picture of sample and sampling procedures.

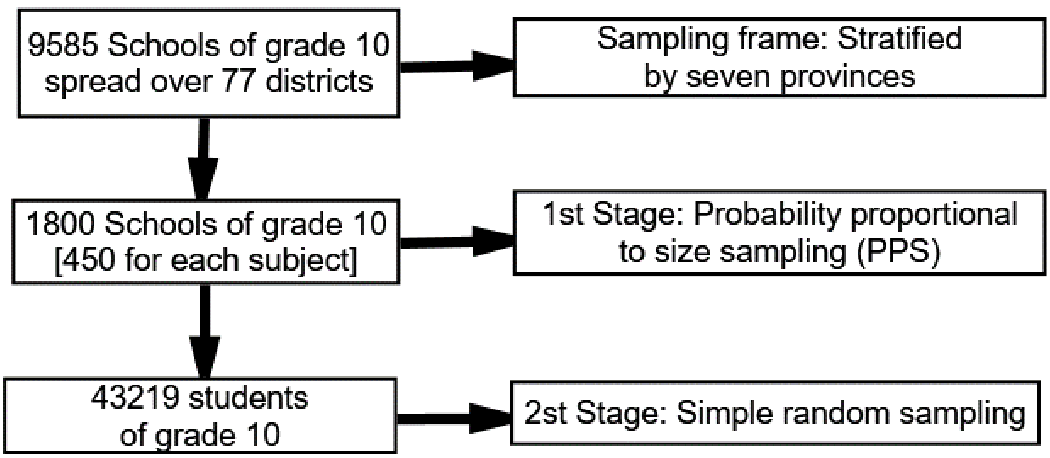


Figure 2 Sampling Frame

Data Weighting

To generalize the findings of the survey at the national level, the sample was weighted using two parameters: school weight and student weight. These weights were calculated separately to ensure accuracy.

School Weight: This parameter accounted for the probability of each school being selected in the sample. Larger schools, which had a higher chance of being included due to their size, were assigned a specific weight to reflect their representation in the overall population.

Student Weight: This parameter considered the probability of each student being selected within the sampled schools. It ensured that the individual characteristics of students, such as their distribution across different schools, was accurately represented.

After calculating these weights separately, a final combined weight was determined by taking the product of the school weight and the student weight. This combined weight ensured that both the school-level and student-level probabilities were appropriately factored into the analysis.

The findings of the survey were based on this weighted sample, which allowed for more accurate and reliable generalizations to be made about the national student population. By applying these weights, the survey results could better reflect the true distribution and characteristics of students across the country, providing valuable insights for policymakers and educators.

Weighting Parameters

School Weighting

This parameter ensured that various schools were fairly represented in the sample. It guaranteed that schools with larger student populations had a proportionate impact on the overall results. For instance, if School A had twice as many students as School B, each student from School A might be assigned half the weight of a student from School B to equalize their representation. The weight for each school was determined based on factors like total student enrollment, school type (community/institutional), geographic location, and more.

To ensure fair representation of various schools in the sample, this parameter adjusted the influence of each school based on its size and other characteristics. Schools with larger student populations were given a proportionate impact on the overall results, ensuring that their data did not disproportionately skew the findings. For example, if

School A had twice as many students as School B, the weight assigned to each student from School A might be half that of a student from School B. This adjustment equalized their representation in the analysis.

The weight for each school was determined by considering several factors:

Total Student Enrollment: Schools with more students were assigned weights that reflected their larger size, ensuring that their data was proportionately represented.

School Type: Different types of schools, such as community or institutional schools, might have varying characteristics and resources. The weighting accounted for these differences to provide a balanced representation.

Geographic Location: Schools located in different regions might face unique challenges and opportunities. The weighting ensured that schools from diverse geographic locations were fairly represented in the sample.

By incorporating these factors into the weighting process, the study ensured that the sample accurately reflected the diversity and complexity of the school population. This approach enhanced the validity and reliability of the findings, providing a robust basis for drawing conclusions about the educational outcomes and needs of students across the country.

For the selection of the schools, school-level base weights were calculated for all the sample schools by using the following formula:

$\mathrm{BW}_{\mathrm{sc}}^{\mathrm{i}} = \frac{\mathrm{N_{pop}}}{\mathrm{n_{sc}} \times \mathrm{N_{mos}^{i}}}$, where N_{pop} was the total number of students (population size), n_{sc} was the total number of schools sampled within each explicit stratum, and N_{mos}^{i} was size assigned to the school.

Base weights at the school level were computed for all sampled schools meeting the criteria for eligible student participation in the study. To address the possibility of non-response by the schools, the school-level non-response adjustment was calculated separately for each explicit stratum by using the following formula: $Sc_{adj} = \frac{n_{sc}}{n_{pc}}$, where n_{sc} was the total number of sampled schools, and n_{psc} was the actual number of participated schools.

The final step involved adjusting the base school weight to account for non-participation, resulting in the final school weight. This final weight was obtained by multiplying the school's base weight by the non-participation adjustment.

$W_{sc} = BW_{sc}^{i} \times Sc_{adj}$.

Student Weighting

This parameter ensured that individual students within each school were fairly represented, preventing students from larger schools from disproportionately influencing the results. By assigning appropriate weights to each student, the study could balance the representation of different groups within the school.

For example, if a school had a higher number of male students compared to female students, each female student might be assigned a slightly higher weight. This adjustment ensured that the representation of female students was balanced with that of male students, providing a more accurate reflection of the student population.

Each student's weight was determined by considering several factors:

- **Gender**: To ensure gender balance, weights were adjusted so that both male and female students were fairly represented.
- **Socioeconomic Status**: Students from different socioeconomic backgrounds might have different educational experiences and outcomes. Weights were adjusted to ensure that these differences were fairly represented in the sample.
- **Other Factors**: Additional factors, such as ethnicity, language spoken at home, and special educational needs, might also be considered to ensure a comprehensive and equitable representation of the student population.

By incorporating these factors into the weighting process, the study ensured that the sample accurately reflected the diversity and complexity of the student population within each school. This approach enhanced the validity and reliability of the findings, providing a robust basis for drawing conclusions about the educational outcomes and needs of students across the country.

For schools containing 25 grade 10 students, the student base weight was set at 1. For schools with over 25 students or fewer, the base weight was determined using the following formula:

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

Where N_{st}represents the overall count of Grade 10 students in the selected school, while n_{st}denotes the number of students sampled from the class. An adjustment for student non-participation was computed for schools where at least one eligible student, who was sampled, opted out of the test for some reason. This adjustment was determined using the following formula:

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

Where n_{st}represents the count of sampled students and n_{pst}denotes the number of students who took part in the specific school. The final student weight for a given school ($^{\text{Ith School}}$) is subsequently determined by multiplying the student based weight by the non-participation adjustment as below:

$$W_{st}^{i} = BW_{st}^{i} \times St_{adj}.$$

The final weight is thus the adjustment between the product of the school and student final weights

$$W_i = W_{sc}^{i} \times W_{st}^{i}$$

After calculating the individual weights for both schools and students, these weights were combined to produce a final weighted value for each respondent. This process involved multiplying the weight assigned to the school by the weight assigned to the student for each participant. By doing so, the method took into account both school-level and student-level factors, ensuring that each respondent's representation in the survey dataset was accurate.

The survey's findings were then based on this weighted sample. In this context, a "weighted sample" meant that each response was adjusted according to the previously described factors, such as school and student weights, rather than treating all responses equally. By applying these varying weights, the survey reflected the diversity within the sample, providing results that were more representative of the overall population rather than just the surveyed individuals.

Weighting the sample based on school and student parameters allowed the survey results to more accurately generalize to the national level. This was because the weighted sample more closely mirrored the demographic and population characteristics of the entire country, rather than just those of the individuals surveyed. Incorporating both school and student weights ensured a more comprehensive representation of the population, leading to more robust and reliable generalizations from the findings.

This approach enhanced the validity of the survey results, making them more applicable to the broader population. It ensured that the diverse characteristics of different schools and students were adequately represented, providing a more accurate and nuanced understanding of the educational landscape. By reflecting the true diversity of the population, the weighted sample might help policymakers and educators to make decisions based on the reliable data.

Sample Distribution

The sample distribution for the subjects of, Mathematics, Science, English, and, Nepali had been carefully stratified by province to ensure an accurate representation of the geographical diversity among students. This stratification process was crucial for providing a balanced representation across different provinces, which allowed for meaningful comparisons of educational outcomes and the identification of region-specific patterns or issues.

By stratifying the sample by province, the study was able to capture the unique educational contexts and challenges faced by students in different regions. This approach ensured that the findings were not biased towards any particular area and that the diverse educational experiences of students across the country were adequately represented.

The number of schools selected from each province for the four subjects was proportional to the total student population in each province. This meant that provinces with larger student populations contributed more schools to the sample, while those with smaller populations contributed fewer schools. This proportional representation was essential for ensuring that the study's findings were applicable to the entire population of Grade 10 students in the country.

By using this method, the study provided insights that were relevant and generalizable to all Grade 10 students, regardless of their location. This approach also allowed for the identification of specific educational strengths and weaknesses within each province, enabling targeted interventions and policy decisions that address the unique needs of different regions.

The actual distribution of the sample for the four subjects by province has been detailed in Table 2, which provides a clear overview of how the sample was allocated across the various provinces. This table helps to illustrate the careful planning and consideration that went into ensuring a representative and balanced sample for the study.

Table 2 Province wise distribution of population and sample of students

Provinces	**English**		**Mathematics**		**Nepali**		**Science**		**Population**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Koshi	1243	11.7	1541	14.3	1831	16.7	1476	13.6	81200	17.3
Madhesh	1697	16.0	1694	15.7	1434	13.1	1730	15.9	81766	17.4
Bagmati	1765	16.7	1644	15.3	1774	16.2	1989	18.3	88566	18.9
Gandaki	1357	12.8	1367	12.7	1436	13.1	1259	11.6	41886	8.9
Lumbini	1717	16.2	1780	16.5	1736	15.8	1851	17.0	84347	18.0

Provinces	English		Mathematics		Nepali		Science		Population	
	N	%	N	%	N	%	N	%	N	%
Karnali	1334	12.6	1407	13.1	1345	12.3	1256	11.5	38062	8.1
Sudurpashchim	1479	14.0	1344	12.5	1414	12.9	1319	12.1	53736	11.4
Total	10592	100.0	10777	100.0	10970	100.0	10880	100.0	469563	100.0

Tools Development

The development of the assessment tools was meticulously guided by the approved 2019 assessment framework developed by the Education Review Office (ERO). This framework was crafted by a team of subject experts and assessment specialists, ensuring a high level of expertise and precision. The drafting process involved a series of discussions and feedback sessions, allowing for thorough review and refinement. The framework was finalized in a meeting with the concerned subject committee members, ensuring that all relevant perspectives were considered.

The framework included detailed subject-specific guidelines and objectives, clearly defining the content domain for each subject. It also established criteria and standards for student proficiency levels, cognitive domains, and item development (ERO, 2019). These elements provided a comprehensive blueprint for the assessment tool, ensuring that it accurately measured the intended learning outcomes.

In addition to outlining the domains and constructs to be assessed in Mathematics, Science, English and Nepali, the framework provided a detailed process for the National Assessment of Student Achievement (NASA) 2023. This process included the sampling frame, sampling procedures, tool development procedures, test piloting and analysis, test administration, data collection, and data analysis procedures. By detailing each step, the framework ensured a systematic and rigorous approach to the assessment.

The assessment tool itself consisted of three parts:

1. **Background Questionnaire**: This section included questions that were generally common to all subjects, gathering essential background information about the students.

2. **Subject-Specific Background Questionnaire**: This part included questions tailored to each specific subject, providing additional context relevant to the subject being assessed.

3. **Subject-Specific Test Items**: These were the actual test questions designed to measure students’ knowledge and skills in each subject area.

By following this comprehensive framework, the development of the assessment tool was thorough and methodical, ensuring that it effectively measured student learning outcomes and provided valuable data for educational improvement.

Table 3 Specification table for item selection in Mathematics

Content domain	Criteria	Weightage (%)	Marks allocation
Arithmetic	2. Solution of daily life problems related to profit and loss with VAT and discount. 3. Calculation for the payment of various bills including electricity, water supply, telephone, and meter taxi. 4. Solution of daily life problems related to money exchange. 5. Solution of simple problems involving compound interest (Note: start with simple interest). 6. Solution of the simple problems related to population growth and compound depreciation.	12	10
Mensuration	7. Solution of the problems on area and cost (carpeting, painting, gardening). 8. Calculation of the area and volume of solid objects; triangular prism, cylinder, sphere, hemisphere and cone. 9. Solution of the problems of area and volume of pyramid and combined object.	14	11
Algebra	18. Finding the H.C.F. and L.C.M. of algebraic expressions by factorization method (at most trinomial expression). 19. Solution of the problems related to simple radical surds including four basic operations of Mathematics. 20. Simplification and solution of the algebraic expressions related to indices.	23	18

Content domain	Criteria	Weightage (%)	Marks allocation
	21. Simplification of algebraic fraction. 22. Solution of the verbal problems on simultaneous linear equations and quadratic equation.		
Geometry	10. Construction of triangle and quadrilateral having equal area and investigation of relations hip between them. 11. Examination of the relations hip between area of triangle and quadrilateral having same base and between same parallel lines. 12. Verification of the relation between the angles at the center and circumference of a circle. 13. Establishment of the arc angle relationship of the circles and solution of related problems.	26	21
Set and Trigonometry	1. Solution of the daily life problem related to cardinality of sets using relation between 2 or 3 sets. 14. Calculations of the area of triangles and quadrilaterals using trigonometric formula. 15. Solution of the problems related to height and distance using trigonometric ratio.	11	9
Data and Probability	16. Finding mean, median and quartiles of grouped data (Continuous series) by using the formula. 17. Analysis of data using central values (First Quartile, median and third quartile of grouped data from ogive).	14	11

Content domain	Criteria	Weightage (%)	Marks allocation
	23. Finding the probability of mutually exclusive events using addition and multiplication laws. 24. Solution of the problems related to probability of dependent and independent events.		
Total		100	80

Note:

(1) The weightage of items in each content domain should be around as SR- 50% and CR - 50%.
(2) The weightage of items in each set should be around as follows: Level 1: 10%, Levels 2, 3, 4 & 5 each: 20%, and Level 6: 10%.
(3) The percentage of cognitive level are: Remembering: 10%, Understanding: 35%, Applying: 35%, and Reasoning: 20%.

Table 4 Specification table for item selection in Science

Area	**Criteria**	**Weightage**	**Mark**
Physics	1. Explanation of Newton's law of gravitation, free fall and weightlessness.	30	24
	2. Explanation of Pascal’s law, Archimedes principle, law of floatation and atmospheric pressure.		
	3. Explanation of different sources of energy and energy crisis.		
	4. Explanation & measurement of heat and temperature.		
	5. Identification of lens and its uses in optical instruments.		
	6. Explanation of the current electricity, its uses, precautions and electric device based on electromagnetic induction.		
Chemistry	7. Introduction of periodic laws and explanation of the position of different elements in the periodic table.	30	24
	8. Classification of different types of chemical reaction and identification of the balanced chemical		

Area	Criteria	Weightage	Mark
	equation along with the factors affecting rate of chemical reaction.		
	9. Introduction of acid, base and salt with their properties and explanation of neutralization reaction.		
	10. Explanation of the process of lab preparation and properties of carbon dioxide and ammonia gases along with their test and uses.		
	11. Explanation of major metals like iron, aluminium, copper, gold and silver with their physical properties and uses in our daily life.		
	12. Identification of the structure of some simple types of hydrocarbons and their compounds (methane, alcohol, glycerol, glucose) and explain their uses.		
	13. Explanation of cement, glass, fibre, ceramic, plastic, soap, detergent and pesticides along with their uses and description of chemical pollution with its causes and effects in our environment.		
Biology	14. Explanation of life cycle & the utilities of the silkworm and honey bee.	30	24
	15. Introduction of Nervous and Glandular system in human body and their functions.		
	16. Explanation of Human Blood Circulatory System and its functions of each component.		
	17. Description of chromosomes & the process of sex-determination.		
	18. Description of Reproduction system of Living beings		
	19. Introduction of Mendel's laws and the causative factors of inheritance.		
	20. Explanation of causes, effects and preventive measures of Environmental Pollution.		
Geology and Astronomy	21. Explanation of history of the Earth and interpretation of fossilization fuel.	10	8
	22. Explanation of atmospheric layers, greenhouse effect and climate change.		

Area	Criteria	Weightage	Mark
	23. Explanation of solar system including artificial satellites.		
	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 the 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.
3. 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%.

Table 5 Specification table for item selection in English

Content domain	Criteria No.	Weightage (%)	Marks	Weightage for items of various standards
Reading		60%	48	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 the 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.

Table 6 Specification table for item selection in Nepali

Content domain	Criteria No	Weightage	Marks	Weightage for items of various standards
Reading (with vocabulary)		60%	48	Level 1: 10%, Levels 2: 20%, Level 3: 20%, Level 4: 20%, Level 5: 20%, Level 6: 10 %
Writing (vocabulary and functional grammar and spelling)		40%	32	
Total		100%	80	

Note:

1. The total number of SR (Selected Response) items (MCQ) 1 mark each 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, CR items carrying 2, 3 or 4 marks each should be 16 to 24 depending upon the 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.

Piloting of the test items (NASA 2023)

Before the full-scale sample assessment was conducted, a pilot test was carried out to evaluate the accuracy, reliability, and consistency of the assessment items. This pilot test served as a crucial preparatory phase to identify and address any potential issues or challenges that might arise during the actual assessment administration. The following steps were meticulously followed in selecting the items for the final NASA assessment:

1. **Development of Items Based on Assessment Framework**: The initial step involved developing assessment items grounded in the established assessment framework. This framework provided clear guidelines and objectives for each subject, ensuring that the items were aligned with the intended learning outcomes.
2. **Drafting and Approval of Tools**: Subject experts drafted six sets of tools for each subject. These drafts were then reviewed and approved by the respective

subject committees. This review process ensured that the tools were comprehensive and met the required standards of quality and relevance.

3. **Pilot Testing**: Upon approval, the six sets of tools were used in a pilot test involving approximately 300 students, with one set administered per subject. This pilot test was essential for testing the practical application of the tools and gathering initial data on their performance.
4. **Analysis of Responses**: The responses from the pilot test were analyzed to determine the discrimination, reliability and difficulty levels of each item. This analysis helped identify which items were effective in distinguishing between different levels of student ability and which items needed revision. Based on these analyses, items were selected to create three sets of questions from the original six sets for each subject.
5. **Preparation of Assessment Booklets**: Finally, assessment booklets were prepared, incorporating the selected items and relevant background information. These booklets were designed to be user-friendly and to facilitate smooth administration during the full-scale assessment.

This structured approach ensured that the final NASA assessment was both robust and effective. By rigorously testing and refining the assessment tools through the pilot phase, the study was able to produce reliable and valid measures of student learning outcomes, providing valuable data for educational improvement.

Reliability and Validity of the Tools

The reliability and validity of the assessment tools were rigorously evaluated following the pilot testing phase. The results, as shown in Table 7, indicate the reliability coefficients for each subject:

Table 7 Reliability and validity of the tools

Subjects	Mathematics	Science	English	Nepali
Reliability Coefficients (Cronbach's alpha)	0.91	0.78	0.88	0.86

The reliability coefficients, which ranged from 0.78 to 0.91, demonstrated the consistency and dependability of the assessment tools. A reliability coefficient closer to 1 indicates a higher level of internal consistency. The high reliability scores for Mathematics (0.91), English (0.88), and Nepali (0.86) suggested that these tools were highly consistent in measuring student performance. The Science tool, with a reliability coefficient of 0.78, also showed acceptable reliability, though slightly lower than the other subjects.

While the table specifically lists reliability coefficients, the validity of the tools was also thoroughly assessed during the piloting phase. Validity refers to the extent to which the tools accurately measure what they are intended to measure. The assessment framework ensured that the items were aligned with the curriculum and learning objectives, providing content validity. Additionally, the analysis of pilot test responses helped confirm that the items effectively discriminated between different levels of student ability, supporting construct validity.

Overall, the high reliability coefficients and the rigorous validation process indicated that the assessment tools were both reliable and valid. These tools were well-suited for accurately measuring student learning outcomes in Mathematics, Science, English, and Nepali, providing robust data for educational evaluation and improvement.

Test Administration and Supervision

The Education Review Office (ERO) meticulously prepared a roster of test administrators based on specific guidelines. These guidelines required that administrators had at least a bachelor’s degree and were not currently involved in the teaching profession. This criterion ensured that the administrators were qualified and unbiased.

Once the test administrators were selected, they underwent comprehensive training on NASA test administration guidelines. This training was crucial to ensure that all administrators adhered to the standardized procedures of the National Assessment. The training covered various aspects of test administration, including the handling of test materials, interaction with students, and the maintenance of test integrity.

For oversight and inspection purposes, personnel from the Ministry of Education, Science, and Technology (MoEST), the Education Development and Coordination Unit (EDCU), and the ERO were involved. Their presence ensured that the test administration process was conducted smoothly and according to the established guidelines.

The key aspects of the test administration process are summarized as follows:

Subject Participation: Each school participated in only one subject to maintain focus and clarity. This approach helped to streamline the administration process and reduce the burden on schools and students.

Teacher Involvement: Subject teachers were not permitted inside the test administration hall to prevent any potential bias or influence. Instead, they assisted in filling out the Teacher's Background Information Questionnaire, providing valuable context for the assessment.

Student Instructions: Clear instructions were given to students to encourage them to put forth their best effort in a low-stakes testing environment. This approach aimed to reduce anxiety and ensure that students' performance accurately reflected their abilities.

Head teacher Responsibilities: Head teachers were assigned to complete a background information questionnaire. This information provided additional context about the school environment and resources.

Confidentiality Measures: To safeguard the confidentiality of test items, strict measures were implemented. These included prohibiting the copying or photographing of test papers and ensuring that test papers were not retained in schools. These measures were essential to maintain the integrity of the assessment.

Post-Administration Procedures: After the test administration, the test booklets were collected by the test administrators and sent to the EDCU, and then to the ERO. Each school also submitted monitoring reports, test administrator reports, and lists of participating and non-participating students/schools. These documents were crucial for further evaluation and analysis, ensuring that the data collected was accurate and comprehensive.

`This structured and well-supervised approach to test administration ensured that the National Assessment was conducted with the highest standards of integrity and reliability. The involvement of trained administrators and oversight personnel, along with stringent confidentiality measures, contributed to the overall success and credibility of the assessment process.

Data Management Procedure

Data management in this study involved four stages—database merge, data cleaning, variable coding and decoding, and final analysis in the IBM SPSS software.

Database Merge: Three booklets of questions were administered to gather data. Each booklets captured different aspects of the survey objectives. Following administration, the responses from all three sets were consolidated into a single database using Excel. This merging process facilitated centralized data management and ensured that all responses are analyzed collectively. By combining the data into one database, it became easier to manage and analyze the information holistically.

Data Cleaning: Once the data were merged, a thorough data cleaning process was conducted using Excel. This involved identifying and rectifying any errors, inconsistencies, or anomalies in the dataset. Common tasks included handling missing or erroneous data entries, resolving formatting issues, and standardizing variable names and formats. Data cleaning was crucial to ensure the accuracy, reliability, and integrity of the dataset before proceeding with analysis.

Variable Coding and Recoding: The cleaned dataset was then imported into IBM SPSS (IBM Statistical Package for the Social Sciences) for further analysis. In SPSS, variables were coded and recoded as necessary to facilitate analysis. This process involved assigning numerical codes to categorical variables and transforming or aggregating variables to create meaningful analytical constructs. Additionally, variables were transformed or aggregated to create meaningful analytical constructs. Variable coding and recoding helped streamline the analysis process and ensured compatibility with statistical procedures.

Final Analysis in SPSS: With the dataset prepared and variables coded, the final analysis was conducted using IBM SPSS version 29. The IMB SPSS version 29 offered a comprehensive suite of statistical tools and techniques for data analysis, including descriptive statistics, inferential statistics, and regression analysis. These analyses aimed to explore relationships, patterns, and trends within the dataset, providing insights into the survey findings. By leveraging the capabilities of the IBM SPSS version 29, the study was able to produce robust and reliable results that could inform decision-making and policy development.

Data Analysis Techniques

The data analysis in this study encompassed several key steps, including the execution of a hybrid IRT model, the calibration of anchor items, the computation of student proficiency in each subject, and the assessment of student achievement across these subjects.

Utilization of Hybrid IRT Model: The data analysis involved the application of various statistical models, with Item Response Theory (IRT) playing a central role in assessing student performance. IRT was used to compute the latent abilities of students based on a range of items designed to measure their performance across different domains. A hybrid IRT model was employed, integrating the 2-parameter logistic model (2PL) and the partial credit model (PCM). This hybrid model effectively nested the PCM within the 2PL, allowing for a comprehensive assessment of student abilities across different parameters.

Bootstrap Sampling for Robustness: To ensure the robustness of the analysis, a bootstrap sample comprising 225 iterations was used to generate the latent abilities. Bootstrap sampling was a resampling technique that helped in estimating the distribution of a statistic by repeatedly sampling with replacement from the data. This method enhanced the reliability of the computed latent abilities by accounting for variability in the data.

Derivation of Plausible Values: To extend the findings to a national level, 10 plausible values of latent ability were derived for each student. Plausible values were multiple imputed values that represented the range of possible scores a student might achieve, considering the inherent variability in their performance. These values helped in making more accurate and generalizable inferences about the student population.

Standardization of Latent Abilities: The latent abilities typically ranged from -4 to +4, which necessitated a transformation process to standardize them for comparative analysis. Standardization involved converting the raw scores into a common scale, making it easier to compare and interpret the results across different subjects and groups.

Calibration of Anchor Items**:** Anchor items were specific test items used to link different test booklets and ensure consistency in scoring. The calibration of these items involved analyzing their performance across different test booklets to ensure they accurately measured the intended constructs. This step was crucial for maintaining the validity and reliability of the assessment.

The results of the NASA 2023 assessment for grade 10 were calibrated using anchor items from both NASA 2019 and NASA 2023 to ensure comparability. This calibration process was applied to the subjects of, Science, English and Nepali. However, the Mathematics results were not calibrated due to insufficient anchoring items and a significant amount of differential item functioning (DIF), which indicates that the items performed differently across various groups of students. Calibration process followed these steps:

1. **Anchor Items:** Anchor items were specific test questions used to link different test administrations, ensuring that the results were comparable over time. For the calibration of NASA 2023 results, anchor items from NASA 2019 were used.

2. **Parameters α and β:** Two key parameters, α (discrimination) and β (difficulty), were calculated from the NASA 2019 data. These parameters were then fixed to the anchor items in NASA 2023.

Discrimination (α): This parameter indicated how well an item could differentiate between students with different levels of ability.

Difficulty (β): This parameter indicated the level of ability required to have a 50% probability of answering the item correctly.

The IRT model was used to measure the latent abilities of students for each item through the Item Characteristic Curve (ICC). The ICC shows the probability of a correct response to an item based on a latent trait, denoted as "theta" (θ). The higher the theta value, the higher the level of the student's ability.

For example, item N1q1a has a theta value of -1.26, indicating that it is relatively easier for students (see Figure 3). The theta value at which there is a 50% probability of a correct response indicates the difficulty level of the item. Item N1q5c has a theta value of 0.148, indicating that it is more difficult than N1q1a. The steepness of the curve represents the discrimination power of the item. Although both items have similar discrimination power, N1q5c has a slightly better ability to differentiate between students of varying abilities (Figure 3).

By calibrating the results using these methods, the study ensured that the assessment outcomes were reliable and comparable across different years. This process helped in accurately measuring student performance and identifying trends over time.

***Computation of Student Proficiency and Achievement*:** Finally, the student proficiency in each subject was computed based on the standardized latent abilities. This involved calculating the overall achievement levels of students in Mathematics, Science, Nepali, and English. The assessment of student achievement provided insights into their performance and helped identify areas for improvement.

Through mean centering, these abilities were adjusted to a mean of 500 with a standard deviation of 50 using the following formula:

$$\textit{Achievement score} = 500 + (\textit{average of plausible value} \times 50)$$

Table 8 shows the sample of theta value, true score, ten plausible values, and average plausible values of grade 10 Nepali.

Table 8 Sample of theta value, true score and plausible values in Nepali

theta	rue_score1	pv1	pv2	pv3	pv4	pv5	pv6	pv7	pv8	pv9	pv10	averagepv
-0.021	18	-0.709	0.646	0.982	1.698	0.688	0.323	1.501	-0.463	0.536	0.386	0.559
-0.992	9	-1.786	-0.725	-1.797	-1.454	-0.398	-0.345	0.191	-1.324	1.353	-0.526	-0.681
-1.673	5	-2.641	-2.308	-2.685	-1.734	-2.694	-0.558	-2.520	-2.174	-1.696	-0.998	-2.001
-0.447	5	-0.309	-1.926	1.672	-0.236	0.361	-1.488	-0.306	0.033	0.520	0.366	-0.131
0.490	8	0.862	0.596	0.293	0.512	2.562	-0.686	-0.450	0.413	1.488	0.256	0.585
-0.325	5	2.064	-0.855	-1.897	0.914	1.178	-0.418	-0.334	0.034	0.165	0.310	0.116
0.805	12	-0.176	-1.107	1.879	1.180	1.006	0.916	0.917	0.779	-0.001	1.808	0.720
1.088	13	1.927	3.130	-0.962	2.144	-0.634	2.243	0.952	-0.318	-1.192	0.829	0.812
1.392	31	-0.594	0.086	0.787	2.065	1.902	1.854	1.416	1.617	0.934	2.210	1.228
1.469	26	1.657	1.936	-0.575	1.095	1.558	2.072	1.113	0.561	2.286	1.367	1.307
0.499	20	1.482	-0.433	1.799	0.100	0.167	0.780	-1.136	0.967	-1.046	1.865	0.454
1.930	34	1.112	2.539	1.205	2.556	1.803	0.658	2.461	1.433	1.952	3.447	1.917
0.403	25	1.215	-1.081	-0.299	-1.419	-1.339	0.287	0.160	-0.283	1.808	-0.092	-0.104
-0.304	17	-1.396	-0.766	-0.230	0.192	-0.545	0.864	-0.294	0.073	-1.304	-1.600	-0.501
0.936	15	2.671	1.596	1.071	-0.909	0.188	1.082	0.557	1.051	1.601	-1.008	0.790
0.831	13	1.720	0.818	-0.256	2.318	1.388	1.834	2.924	1.207	0.718	1.813	1.448
0.749	11	0.325	1.270	1.576	0.461	-1.518	0.271	0.154	0.621	1.622	2.006	0.679
-0.500	8	-0.845	-0.991	-0.055	0.210	-0.030	0.102	-0.776	-0.315	-0.945	-0.761	-0.440
1.810	16	0.244	0.317	1.821	3.096	2.693	2.011	1.139	4.714	2.148	2.169	2.035
1.007	10	-0.384	-0.189	1.439	1.593	2.058	0.593	1.214	3.053	1.889	0.070	1.134

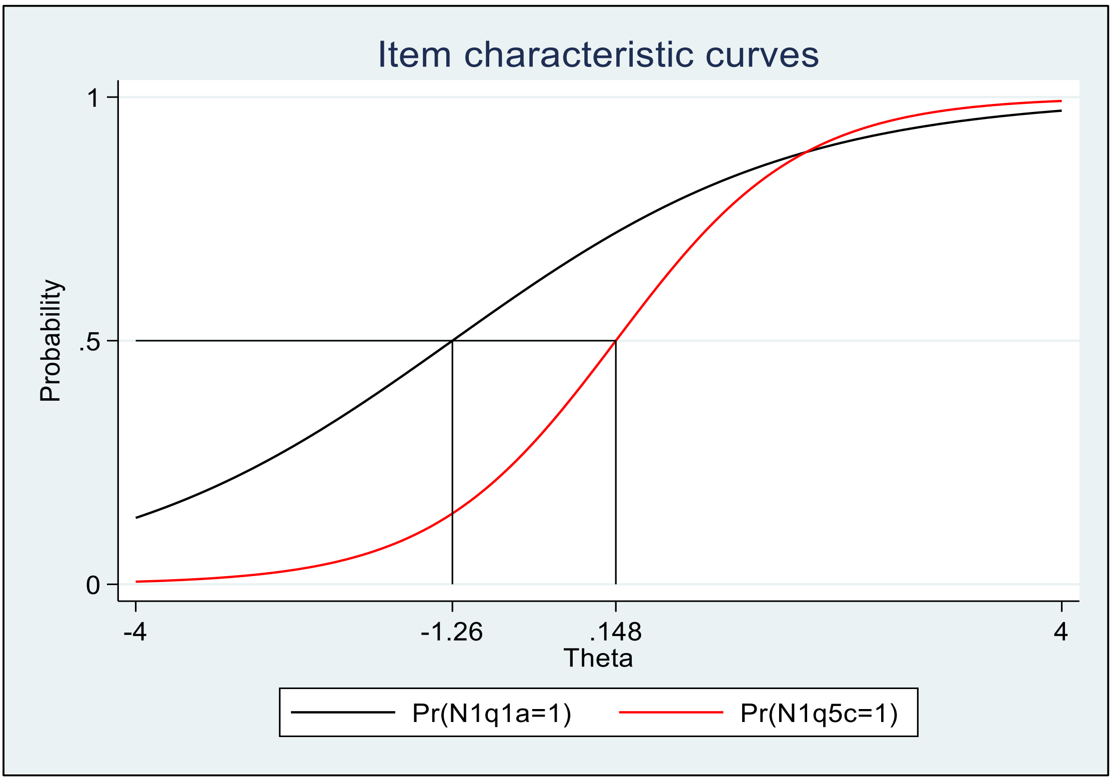


Figure 3 A sample of item characteristics curve for the item in Nepali

Proficiency

After obtaining the achievement scores, the next crucial step involved categorizing students into distinct proficiency levels based on these scores. This process helped in understanding the varying levels of student performance and identifying areas that may need improvement. The proficiency levels were divided into six categories: Below-basic, Basic, Proficient 1, Proficient 2, Proficient 3, and Advanced (see Table 9).

Proficiency Levels for Nepali, Science, and English: For the subjects of Nepali, Science, and English, NASA 2023 used the proficiency level standards developed in NASA 2019. This approach ensured that the results were comparable with those from NASA 2019, allowing for a consistent evaluation of student performance over time. The proficiency levels were defined based on specific criteria and standards that align with the curriculum and learning objectives for each subject.

Proficiency Levels for Mathematics: In the case of Mathematics, the anchored items from NASA 2019 exhibited large Differential Item Functioning (DIF), meaning that the items did not perform uniformly across different groups of students. Due to this inconsistency, the proficiency levels for Mathematics were determined based on the student ability parameter, denoted as theta (θ).

Determining Proficiency Levels Based on Theta (θ): The achievement scores, represented by the theta values, were divided into six equal intervals to establish the proficiency levels. Theta values typically ranged from -4 to +4, with higher values indicating higher levels of ability. By dividing this range into six equal parts, the study categorized students into the following proficiency levels:

1. Below-basic: Students in this category had the lowest achievement scores and required significant support to meet the basic learning objectives. These students had scores 403 or below in Mathematics, 448 or below in Science, 449 or below in Nepali, and 432 or below in English (Table 9).
2. Basic: These students had achieved a foundational level of understanding but still needed improvement to reach proficiency. These students had scores between 403 and 456 in Mathematics, 448 and 475 in Science, 449 and 475 in Nepali, and 432 and 458 in English (Table 9).
3. Proficient 1: Students in this category demonstrated a satisfactory level of understanding and could perform basic tasks independently. These students had

scores between 456 and 509 in Mathematics, 475 and 502 in Science, 475 and 502 in Nepali, and 458 and 485 in English (Table 9).

4. Proficient 2: These students showed a good level of understanding and could handle more complex tasks with some guidance. These students had scores between 509 and 562 in Mathematics, 502 and 529 in Science, 502 and 528 in Nepali, and 485 and 512 in English (Table 9).
5. Proficient 3: Students in this category exhibited a high level of proficiency and could perform complex tasks independently. These students had scores between 562 and 615 in Mathematics, 529 and 556 in Science, 528 and 555 in Nepali, and 512 and 538 in English (Table 9).
6. Advanced: The highest proficiency level, where students demonstrated exceptional understanding and could apply their knowledge and skills in various contexts. These students had scores between 615 and above in Mathematics, 556 and above in Science, 555 and above in Nepali, and 538 and above in English (Table 9).

By categorizing students into these proficiency levels, the study provided a detailed and nuanced understanding of student performance. This information was valuable for educators and policymakers to identify strengths and weaknesses in the education system and to develop targeted interventions to support student learning.

Table 9 Ranges of proficiency levels of each four subjects

Proficiency Levels	Mathematics	Science	Nepali	English
Below-basic	403 and below	448 and below	449 and below	432 and below
Basic	403-456	448-475	449-475	432 - 458
Proficient 1	456-509	475-502	475-502	458 - 485
Proficient 2	509-562	502-529	502-528	485 - 512
Proficient 3	562-615	529- 556	528-555	512 - 538
Advanced	615 and above	556 or above	555 or above	538 and above

Statistical Techniques Used in Data Analysis

The data analysis process utilized a variety of statistical methods, such as descriptive statistics, inferential statistics, analysis of self-reported attitudes, and predictive analysis.

Descriptive Statistics: Mean score was the average score of the students' achievement or ability scores. It provided a central value around which the data points were distributed. Whereas, standard deviation measured the amount of variation or dispersion in the students' scores. A low standard deviation indicated that the scores were close to the mean, while a high standard deviation indicated a wider range of scores. Likewise, percentage values were used to express the proportion of students falling into different proficiency levels or demographic categories.

Inferential Statistics*:* Independent sample t-test compared the means of two independent groups (e.g., male vs. female students) to determine if there was a statistically significant difference between them. One-way ANOVA (Analysis of Variance) was performed to compare the means of three or more independent groups to see if there was a significant difference among them. It was followed by Post-hoc Tests to determine exactly which groups differed from each other. Common post-hoc tests included Tukey's HSD (Honestly Significant Difference) and Bonferroni correction.

Analysis of Self-Reported Attitudes**.** Mean Composite Scores were calculated by averaging the responses to various items related to attitudes towards schools, teachers, bullying activities, subjects, learning activities, etc. This computation provided an overall measure of students' attitudes in each area.

Predictive Analysis**.** Step-wise Multiple Linear Regression analyses were performed to identify the most significant predictors of student performance. It involved adding or removing predictors based on their statistical significance in explaining the variance in the dependent variable (achievement score).

Software Used: MS Excel was used for basic data manipulation, visualization, and some statistical analysis. Python was utilized for more advanced data analysis and visualization. STATA was a powerful tool for further analysis of the achievement data to confirm results from other tools. The statistical tool R was used for statistical computing and graphics including IRT. In most part of the data analysis, IBM SPSS version 29 was used for descriptive and predictive analysis. These methods and tools together provided a comprehensive approach to analyzing student achievement and proficiency levels, allowing for both descriptive insights and inferential conclusions.

CHAPTER III

Student Performance in Mathematics

This chapter presents the results of student performance in Mathematics. These results have been discussed as National Mean Achievement, Proficiency Levels, and Student Achievement based on different demographic variables.

National Mean Achievement Scores in Mathematics

The national mean score of students in Mathematics is 500. The scores vary from 350.96 to 677.55 with standard deviation 50.00. In fact, seven items were common in NASA 2019 and 2023, however three items showed uniform in the differential item functioning analysis. The remaining items were too few to compare the result with NASA 2019 (Hambleton, et al., 1991; Kolen & Brennan, 2014). Therefore, the result of NASA 2023 does not show the trend of achievement scores in Mathematics. Figure 4 indicates that most students scored between 450 and 550. However, the slight positively skewed curve indicated that majority of the students achieved below the average score 500.

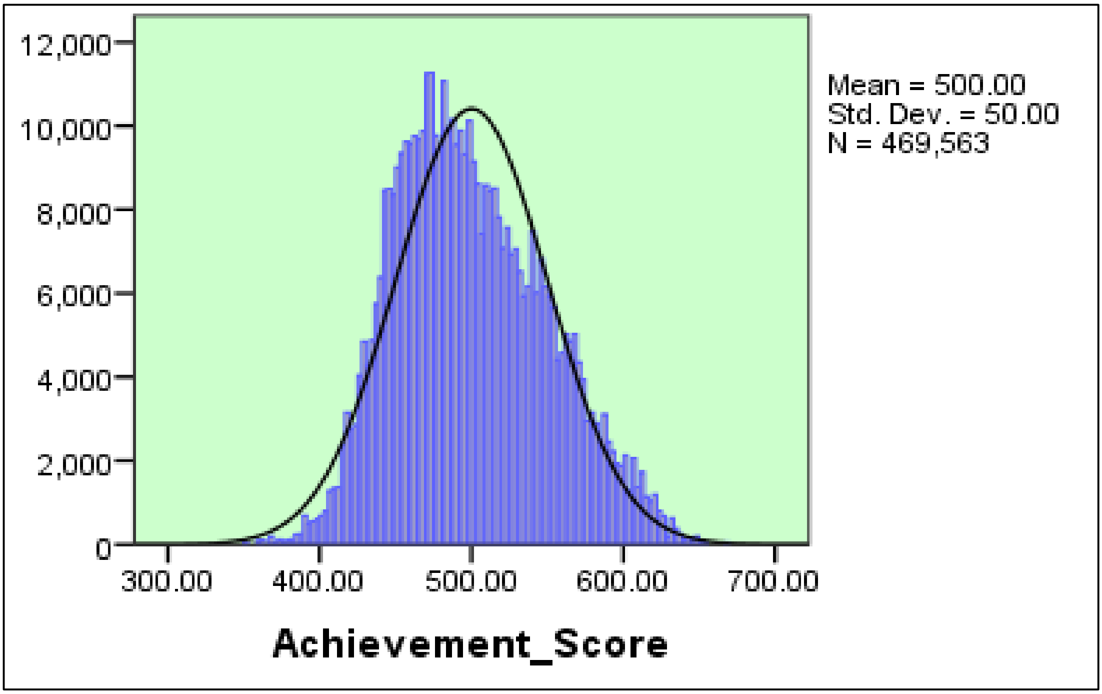


Figure 4 Distribution of achievement scores in Mathematics

Proficiency Level of the Students in Mathematics

The assessment framework of NASA 2023 was developed based on the six level of standards as the proficiency level of students in Mathematics. Thus, the achievement scores of students were also analyzed dividing the scores into six proficiency levels: Below-basic, basic, and proficient 1, 2, 3, and advanced. These levels were determined based on the student ability (θ). The table 10 shows score range and percentages of students in each proficiency level.

Table 10 Distribution of the students based on proficiency levels in Mathematics (N=469563)

Proficiency Levels	Score range	Percent
Level 1: Below-basic	403 and below	0.9
Level 2: Basic	403-456	19.5
Level 3: Proficient 1	456-509	39.6
Level 4: Proficient 2	509-562	27.1
Level 5: Proficient 3	562-615	11.5
Level 6: Advanced	615 or above	1.4
Total		100

In the assessment of Achievement of the Students in Mathematics, students scoring 403 or below were classified as Level 1 (below basic), comprising 4,439 students, or 0.9% of the total sample of 469,563 students. Those with scores between 403 and 456 were categorized as Level 2 (basic), representing 19.5% students of the sample. Level 3 (proficient 1) included students scoring between 456 and 509 as 39.6% of the sample. Students scoring between 509 and 562 were placed in Level 4 (proficient 2), accounting for 27.1% students, of the sample. Level 5 (proficient 3) encompassed students with scores between 562 and 615, numbering 11.5% students, of the sample. Finally, Level 6 (advanced) included students scoring 615 or above, with 1.4% students, of the sample. This distribution indicates that a significant majority of students, approximately 60%, performed at Level 3 (proficient 1) or lower, and only about 13% of students performed at level 5 or above, highlighting the need for targeted interventions to improve mathematical proficiency.

Proficiency Levels of Students in Mathematics by Province

Figure 5 presents the proficiency levels of students in Mathematics among the seven provinces.

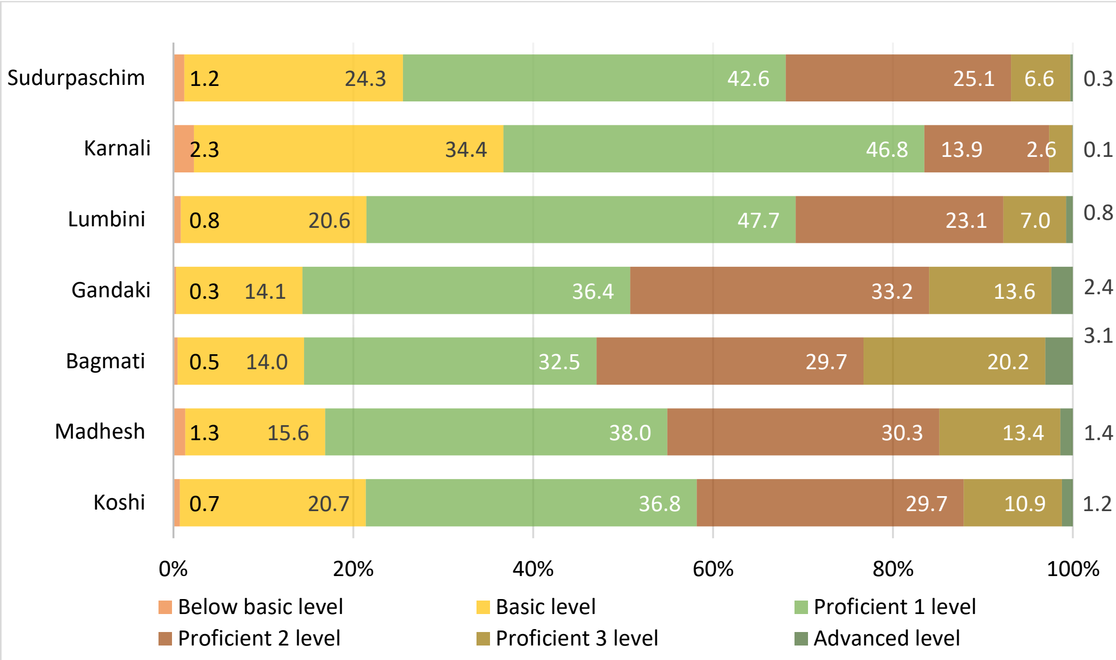


Figure 5 Proficiency level of students based on provinces

The results showed that the highest percent of below basic performance was Karnali (2.3%) followed by Madhesh (1.3%). The highest percent of the basic level performance was also in Karnali (34.4%) that is followed by Sudurpashchim (24.3%). Likewise, the percent of proficient 1 was also highest for Karnali (46.8%) followed by Lumbini (47.7%). At the upper end, the highest percent (at the advanced level was only 3.1% the students from the Bagmati province attained this level and this is the highest in all provinces. The highest percentage of the students fall on the proficient 1 level in all provinces.

Mean Achievement Scores of Students in Mathematics by Province

Figure 6 illustrates the mean scores, standard deviations, and significance values across various provinces. The results show that Bagmati, Gandaki, and Madhesh performed higher than the national average of 500, with Bagmati achieving the highest mean score of 517.17, followed by Gandaki at 510.70, and Madhesh at 505.00. Koshi's performance was almost at the national average with a score of 499.39. In contrast, Lumbini, Sudurpashchim, and Karnali scored below the national average, with Lumbini at 491.42, Sudurpashchim at 489.77, and Karnali having the lowest mean score of 472.28. This comparison highlights the disparities in performance across the provinces, with Bagmati leading and Karnali lagging the most.

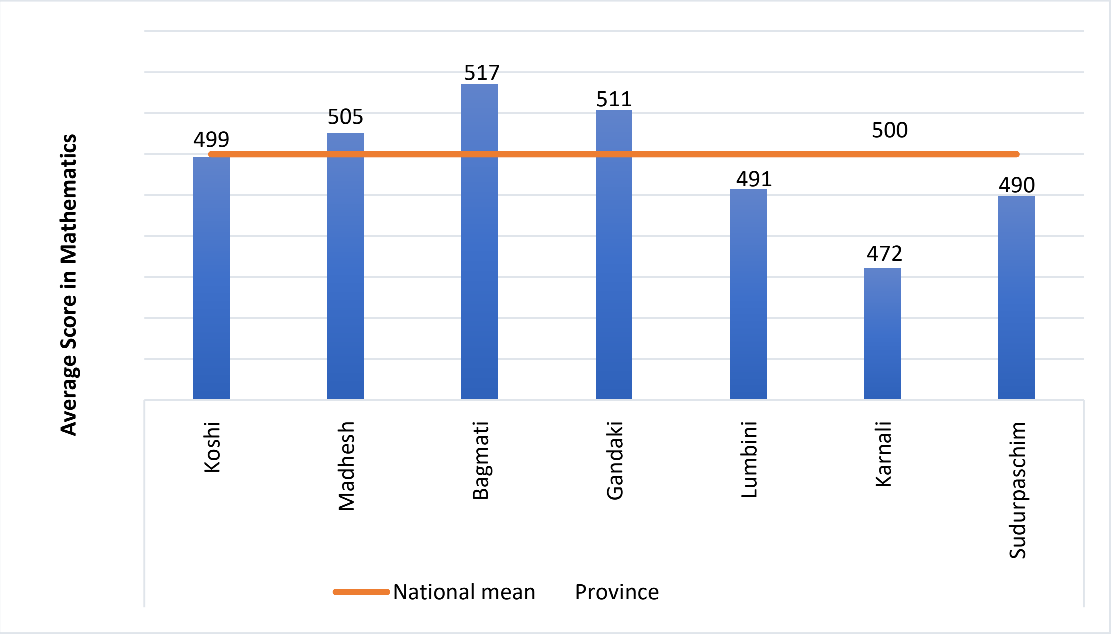


Figure 6 Achievement of the students in Mathematics of the students by province

Performance of the Students in Mathematics by Local Levels, Type of Schools and Gender

The table 11 compares mean scores, standard deviations, and p-values across different local levels, school types, and genders. Rural municipalities have a mean score of 479.57 (SD = 40.54), which is significantly lower than municipalities with a mean score of 507.76 (SD = 51.05), as indicated by a p-value less than 0.001. Among school types, community schools have a higher mean score of 535.81 (SD = 45.60) compared to institutional schools with a mean score of 487.10 (SD = 44.98), with a p-value less than 0.001, showing a significant difference. Regarding gender, boys have a higher mean score of 507.40 (SD = 50.75) compared to girls at 493.05 (SD = 48.07), and this difference is also statistically significant with a p-value less than 0.001. These p-values indicate that the differences in mean scores across local levels, school types, and genders are statistically significant.

Table 11 Achievement of the students in Mathematics scores of the students by local government

Local Levels	N	Mean	SD	P-value
Rural Municipality	129274	479.57	40.54	< 0.001
Municipality	340289	507.76	51.05	
School Types				
Community Schools	124379	535.81	45.60	< 0.001
Institutional Schools	345184	487.10	44.98	
Gender				
Boys	231259	507.40	50.75	< 0.001
Girls	233740	493.05	48.07	

Proficiency Levels of the students in Mathematics by Gender

The Figure 7 compares boys' and girls' performance across six proficiency levels. A higher percentage of girls (22.6%) than boys (16.2%) fall in the basic level, while more boys (14.1%) than girls (8.9%) reach proficient level 3. Whereas, 2.0% of the boys achieved the advanced level compared to only 0.9% of girls. The graph also indicates that the highest percentage of both girls (41.4%) and boys (37.7%) are at Proficient Level 1. Additionally, boys have a higher percentage in the upper proficiency levels compared to girls as proficient level 2, 3, and advanced level.

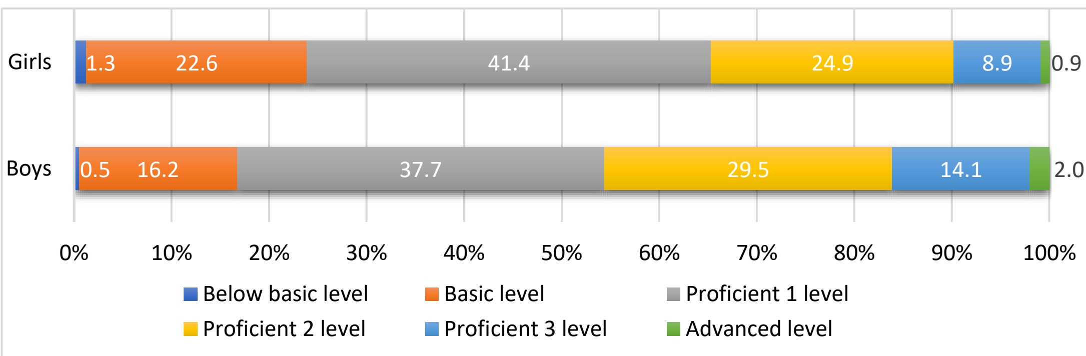


Figure 7 Proficiency levels of students in Mathematics based on gender

Figure 8 highlights significant variations in proficiency levels between students in institutional and community schools.

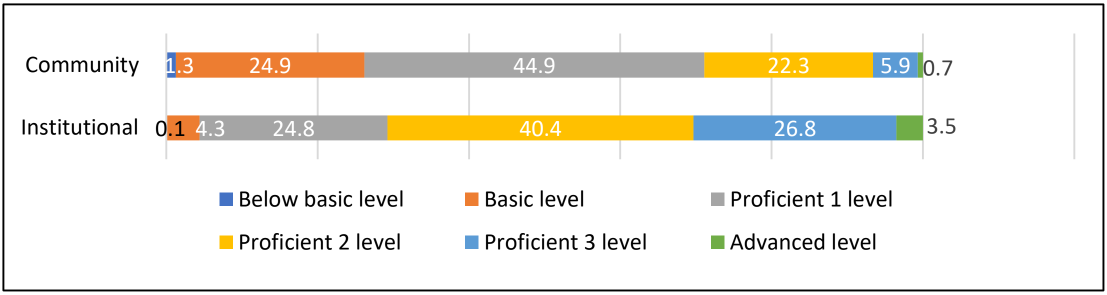


Figure 8 Proficiency levels of students in Mathematics based on school types

Community schools have a much higher percentage of students at the basic level (24.9%) compared to institutional schools (4.3%), and at Proficient Level 1 (44.9%) compared to institutional schools (24.8%). Conversely, institutional schools show significantly higher percentages at Proficient Level 2 (40.4%) compared to community schools (22.3%), Proficient Level 3 (26.8%) compared to community schools (5.9%), and the advanced level (3.5%) compared to community schools (0.7%).

Proficiency levels of the students in Mathematics by local Level

Figure 9 shows that the maximum percentage of students 48.3% from rural municipality and 36.3% from municipality are in proficient 1 level. The percentage of students from municipality is higher in proficient 2, proficient 3 and advanced levels compared to rural municipality however only 1.8% students from municipality are in advance levels.

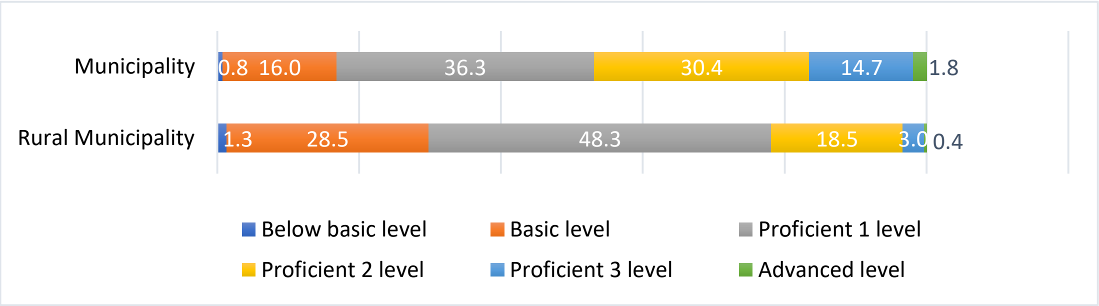


Figure 8a Proficiency level of students in mathematics based on local levels

Achievement of the students in Mathematics Based on Time to-Reach School

Table 12 presents the mean achievement in Mathematics based on the time it takes students to reach school. Students who take up to 15 minutes to reach school have the highest mean score of 506.91 (SD = 50.19), significantly higher than other groups, as indicated by a p-value of 0.001. Those who take 30 minutes have a mean score of 497.73 (SD = 48.47), while students who take 1 hour have a mean score of 484.19

(SD = 46.91). For students who take 1-2 hours, the mean score drops to 477.90 (SD = 43.28), and those who take more than 2 hours have the lowest mean score of 472.98 (SD = 42.03). This data shows a clear trend: the longer the time to reach school, the lower the mean achievement in Mathematics. The differences in mean scores are statistically significant, as indicated by the p-value of less than 0.001.

Table 12 Mean achievement in Mathematics based on the time to reach school

Time to reach school	N	Mean	SD	P-value
Up to 15 min	265049	506.91	50.19	< 0.001
30 min	111880	497.73	48.47	
1 hour	57370	484.19	46.91	
1-2 hours	17803	477.90	43.28	
More than 2 hours	5365	472.98	42.03	

The chart in Figure 10 compares proficiency levels across different time durations taken by students to reach school.

- **More than 2 hours**: The majority of students fall into the Proficient Level 1 (48.9%) and Basic Level (30.7%), with smaller percentages in Proficient Level 2 (13.3%) and Proficient Level 3 (4.1%). The percent of students in advanced level was almost zero, whereas Below Basic Level was 3.1%.
- **1-2 hours**: Most students are at the Proficiency Level 1 (45.6%) followed by Basic Level (33.5%), with 13.6% at Proficient Level 2 and 5.8% at the Proficiency Level 2. At the Advanced Level, the percentage is almost zero, and Below Basic Level is 1.6%.
- **1 hour**: Students are distributed across Below Basic (1.4%), Basic (27.9%), Proficient Level 1 (45.7%), Proficient Level 2 (17.0), Proficient Level 3 (6.6%), and Advanced (1.4%).
- **30 minutes**: The distribution shows 0.8% at Below Basic, 20.1% at Basic, 41.2% at Proficient Level 1, 26.4% at Proficiency Level 2, 10.4% at Proficient Level 3, and 1.0% at the Advanced level.
- **Up to 15 minutes**: This group has the lowest percentages at Below Basic (0.7%) and Basic (16.0%), with higher percentages at Proficient Level 1 (37.2%), Proficient Level 2 (30.8%), Proficient Level 3 (13.5%), and Advanced (1.8%).

Overall, the chart indicates that students who take less time to reach school tend to have higher proficiency levels, with those taking up to 15 minutes showing the highest percentages in the upper proficiency levels. Conversely, students who take longer to reach school are more likely to be at the below basic and basic levels. The result shows that most of the students who spent more than 2 hours and 1-2 hours are below the proficient level 2. Only 13.3%, 4.1% and 0% students are in proficient 2, proficient 3 and advanced levels, respectively who spent more than 2 hours to reach school (figure 9).

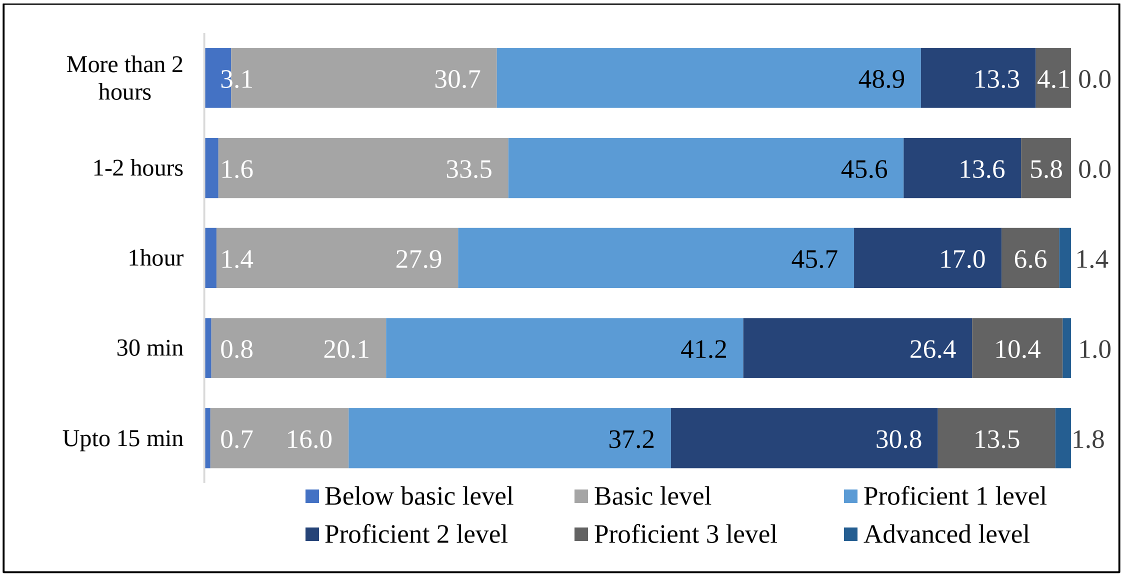


Figure 9 Proficiency levels of students in Mathematics based on the time to reach school

Achievement of the students in Mathematics by Background Variables

The analysis of Achievement of the students in Mathematics scores based on mother tongue language and ethnicity reveals significant disparities in Table 13. For mother tongue language, students who speak Nepali have a higher mean score of 503.95 (SD = 50.29), compared to those who speak other languages, who have a mean score of 495.32 (SD = 48.64). The p-value less than 0.001 indicates that this difference is statistically significant.

When examining ethnicity by caste, the Brahmin/Chhetri group has a mean score of 507.85 (SD = 51.17), and the other group has a mean score of 509.40 (SD = 50.05). In contrast, the Janajati group has a mean score of 494.66 (SD = 47.26), and the Dalit group has the lowest mean score of 488.67 (SD = 45.87). The p-value less than 0.001 confirms that these differences are statistically significant.

Considering ethnicity by geography, the Madhesi group has the highest mean score of 503.05 (SD = 48.75), followed by the Pahadi group with a mean score of 501.22 (SD = 50.69). The Himali group has the lowest mean score of 493.09 (SD = 45.32). Again, the p-value of less than 0.001 indicates that these differences are statistically significant. These findings highlight the impact of mother tongue language and ethnicity on Achievement of the students in Mathematics, emphasizing the need to address educational disparities to ensure equitable learning opportunities for all students.

Table 13 Achievement of the students in Mathematics score based on mother-tongue and ethnicity

Variables		**Count**	**Mean**	**SD**	**P-value**
Mother Tongue	Other Language	146601	495.32	48.64	0.001
	Nepali Language	295661	503.95	50.29	
Ethnicity /Caste	Bhramin/Chhetri	194316	507.85	51.17	0.001
	Janajati	150394	494.66	47.26	
	Dalit	40603	488.67	45.87	
	Others	52210	509.40	50.05	
Ethnicity by Geography	Madhesi	172914	503.05	48.75	0.001
	Pahadi	252743	501.22	50.69	
	Himali	11865	493.09	45.32	

Performance in Mathematics Based on Parents' Education

The analysis of Achievement of the students in Mathematics scores based on mother's education levels reveals a clear trend: higher maternal education is associated with higher student performance. Students whose mothers are illiterate have a mean score of 484.79 (SD = 44.76), while those with literate mothers have a slightly higher mean score of 491.42 (SD = 45.04) (Table 14). As the education level increases, so do the mean scores. For example, students whose mothers have education up to the 10th grade have a mean score of 508.39 (SD = 48.44), and those with mothers educated up to the 12th grade have a mean score of 522.30 (SD = 51.78). The highest mean score of 546.23 (SD = 48.18) is observed for students whose mothers have a bachelor's degree, although there is a slight decrease to 543.07 (SD = 57.43) for those with mothers holding a master's degree or higher. The p-value less than 0.001 indicates that these differences are statistically significant.

Similarly, the father's education level also significantly impacts student performance in Mathematics. Students whose fathers are illiterate have the lowest mean score of 477.82 (SD = 42.96), while those with literate fathers have a mean score of 485.71 (SD = 43.21). The mean scores continue to rise with higher paternal education levels: 501.04 (SD = 47.54) for up to the 10th grade, 510.94 (SD = 49.53) for up to the 12th grade, and 531.21 (SD = 50.13) for a bachelor's degree. The highest mean score of 546.56 (SD = 50.65) is observed for students whose fathers have a master's degree or higher (Table 14). The p-value less than 0.001 confirms that these differences are statistically significant, highlighting the crucial role of paternal education in influencing students' academic success. The result also indicates that more than 80% mothers and around 60% fathers are below the school level education.

Table 14 Achievement of the students in Mathematics based on parents' education

Variables		N	Mean	SD	P-value
Mother Education	Illiterate	119632	484.79	44.76	0.001
	Literate	157298	491.42	45.04	
	Up to 10 class	104041	508.39	48.44	
	Up to 12 class	55451	522.30	51.78	
	Bachelors	17251	546.23	48.18	
	Masters or above	8650	543.07	57.43	
Father Education	Illiterate	48404	477.82	42.96	0.001
	Literate	132367	485.71	43.21	
	Up to 10 class	144237	501.04	47.54	
	Up to 12 class	79763	510.94	49.53	
	Bachelors	30220	531.21	50.13	
	Masters or above	24827	546.56	50.65	

Performance of the Students in Mathematics Based on Parents' Occupation

The table 15 reveals the mean achievement scores based on parental occupations. Achievement of the students in Mathematics varies significantly based on their mother's occupation. Those whose mothers are involved in teaching or professional jobs like business and other occupations tend to have higher mean scores, with teaching (527.22, SD = 50.99) and other occupations (527.80, SD = 55.72) leading the way. In contrast, students whose mothers are engaged in farming and housework have the lowest mean score of 487.91 (SD = 44.84). The standard deviations also vary, with the highest being 55.72 for other occupations and the lowest being 44.22 for labor work. The p-value less than 0.001 indicates that these differences are statistically significant, suggesting a strong correlation between a mother's occupation and her child's performance in Mathematics.

Similarly, students' Mathematics scores are influenced by their father's occupation too. The highest mean scores are observed for students whose fathers are involved in teaching (524.71, SD = 53.08) and professional jobs (519.35, SD = 52.42), while the lowest mean score is for those whose fathers are engaged in housework only (475.78, SD = 40.01). The standard deviations range from 40.01 for housework only to 53.08 for teaching. The p-value less than 0.001 confirms that the differences in mean scores based on father's occupation are statistically significant. This data underscores the impact of a father's occupation on a student's academic performance in Mathematics, with professional and teaching occupations being associated with higher student achievement.

Table 15 Achievement of students in Mathematics based on parental occupation

Variables		N	Mean	SD	P-value
Mother Occupation	Farming and Housework	252866	487.91	44.84	<0.001
	Housework only	115420	513.15	51.70	
	Work in others house	3558	505.67	46.32	
	Labor work	6295	495.54	44.22	
	Foreign work	9221	495.89	45.76	
	Teaching	15675	527.22	50.99	
	Business	36209	519.17	49.00	
	Job	13545	519.98	52.71	
	Others	10065	527.80	55.72	
Father Occupation	Farming and Housework	122311	485.60	44.97	< 0.001
	Housework only	7498	475.78	40.01	
	Work in others house	4286	480.66	40.44	

Variables		N	Mean	SD	P-value
	Labor work	40474	489.26	44.21	
	Foreign work	109473	495.03	47.08	
	Teaching	15965	524.71	53.08	
	Business	82586	517.82	50.35	
	Job	40793	519.35	52.42	
	Others	33396	515.59	49.44	

However, post hoc analysis showed that there was no significant difference between students' math achievement when their mothers with labor work compared to foreign work; professional job compared to business, and teaching compared to others ($p>0.05$).

Achievement of the students in Mathematics Based on Out of School Time activities

The table 16 shows significant differences in mean achievement scores based on the time students spend on various activities outside school. More than 60% of the students spend less than 1-hour and time for TV/Internet/Mobile. Students' Achievement of the students in Mathematics varies with the amount of time spent on TV, internet, and mobile devices. First, those who spend 2-4 hours on these activities have the highest mean score of 522.76 (SD = 51.57), while those who do not report their time have the lowest mean score of 494.18 (SD = 48.65). Interestingly, students who spend 1-2 hours also perform well with a mean score of 514.58 (SD = 49.93). The p-value of less than 0.001 indicates that these differences are statistically significant, suggesting that moderate use of TV, internet, and mobile devices might be associated with better Mathematics performance.

Second, the time spent playing and talking with friends also impacts students' Mathematics scores. Students who did not report their time have the highest mean score of 507.65 (SD = 53.75), while those who spend more than four hours have a lower mean score of 498.64 (SD = 49.47). The mean scores for less than one hour and 1-2 hours are quite similar, at 501.80 (SD = 49.27) and 502.79 (SD = 48.25), respectively.

The p-value of less than 0.001 suggests that these differences are statistically significant, indicating that moderate social interaction might be beneficial for academic performance.

Table 16 Achievement of students in Mathematics based on time spend out of school activities

Variables		N	Mean	SD	P-value
TV/Internet/Mobile	Time not given	89388	494.18	48.65	< 0.001
	Less than one hour	232753	500.68	49.17	
	1-2 hours	82862	514.58	49.93	
	2-4 hours	11848	522.76	51.57	
	More than four hours	5554	502.94	53.97	
Play and talk with friends	Time not given	78208	507.65	53.75	<0.001
	Less than one hour	240914	501.80	49.27	
	1-2 hours	76662	502.79	48.25	
	2-4 hours	13345	498.46	47.76	
	More than four hours	5152	498.64	49.47	
Household chores	Time not given	38349	509.77	53.95	<0.001
	Less than one hour	150385	510.30	52.33	
	1-2 hours	150946	498.67	47.52	
	2-4 hours	52927	490.93	43.83	
	More than four hours	18464	486.03	42.75	
Study/homework	Time not given	15031	482.88	48.14	<0.001
	Less than one hour	30828	484.18	46.72	
	1-2 hours	98526	496.96	47.90	
	2-4 hours	149008	506.76	49.33	
	More than four hours	115681	510.09	50.94	
Work for wages	Time not given	307175	509.86	50.26	<0.001
	Less than one hour	28495	484.81	43.12	
	1-2 hours	13855	478.78	41.98	

Variables		N	Mean	SD	P-value
	2-4 hours	8934	472.62	37.73	
	More than four hours	10636	473.17	39.59	
Support to siblings	Time not given	75762	516.99	52.65	<0.001
	Less than one hour	172917	505.43	50.50	
	1-2 hours	119767	497.02	46.67	
	2-4 hours	31114	486.82	42.48	
	More than four hours	10242	475.77	41.88	

Students' performance in Mathematics is also influenced by the time spent on household chores. Those who did not report their time have a high mean score of 509.77 (SD = 53.95), while students who spend more than four hours on chores have the lowest mean score of 486.03 (SD =42.75). The mean scores decrease as the time spent on chores increases, with less than one hour at 510.30 (SD = 52.33) and 1-2 hours at 498.67 (SD = 47.52). The p-value <0.001 indicates significant differences, suggesting that excessive time on chores might negatively impact academic performance.

Furthermore, the time spent on study and homework shows a clear positive correlation with Achievement of the students in Mathematics. Students who spend more than four hours on homework have the highest mean score of 510.09 (SD = 50.94), while those who did not report their time have the lowest mean score of 482.88 (SD = 48.14). The mean scores increase with the time spent on homework, with 2-4 hours at 506.76 (SD = 49.33) and 1-2 hours at 496.96 (SD = 47.90). The p-value <0.001 confirms that these differences are statistically significant, highlighting the importance of dedicated study time.

Likewise, students' Mathematics scores are negatively impacted by the time spent working for wages. Those who did not report their time have the highest mean score of 509.86 (SD = 50.26), while students who work 2-4 hours have the lowest mean score of 472.62 (SD = 37.73). The mean scores decrease as the time spent working increases, with less than one hour at 484.81 (SD = 43.12) and 1-2 hours at 478.78 (SD = 41.98). The p-value < 0.001 indicates significant differences, suggesting that working for wages might detract from academic performance.

Additionally, the time spent supporting siblings also affects students' Achievement of the students in Mathematics. Those who did not report their time have the highest mean score of 516.99 (SD = 52.65), while students who spend more than four hours have the lowest mean score of 475.77 (SD = 41.88). The mean scores decrease with increased time spent supporting siblings, with less than one hour at 505.43 (SD = 50.50) and 1-2 hours at 497.02 (SD = 46.67). The p-value of <0.001 suggests significant differences, indicating that extensive time spent supporting siblings might negatively impact academic performance.

Figure 10 presents the percentage distribution of time spent by students on various activities on out-of-school time. A significant proportion of time is spent on TV, Internet, or mobile activities, with 55.1% of respondents engaging in these activities for less than an hour and 19.6% for 1-2 hours. Social interactions such as playing and talking with friends also show a similar trend, with 58.2% dedicating less than an hour.

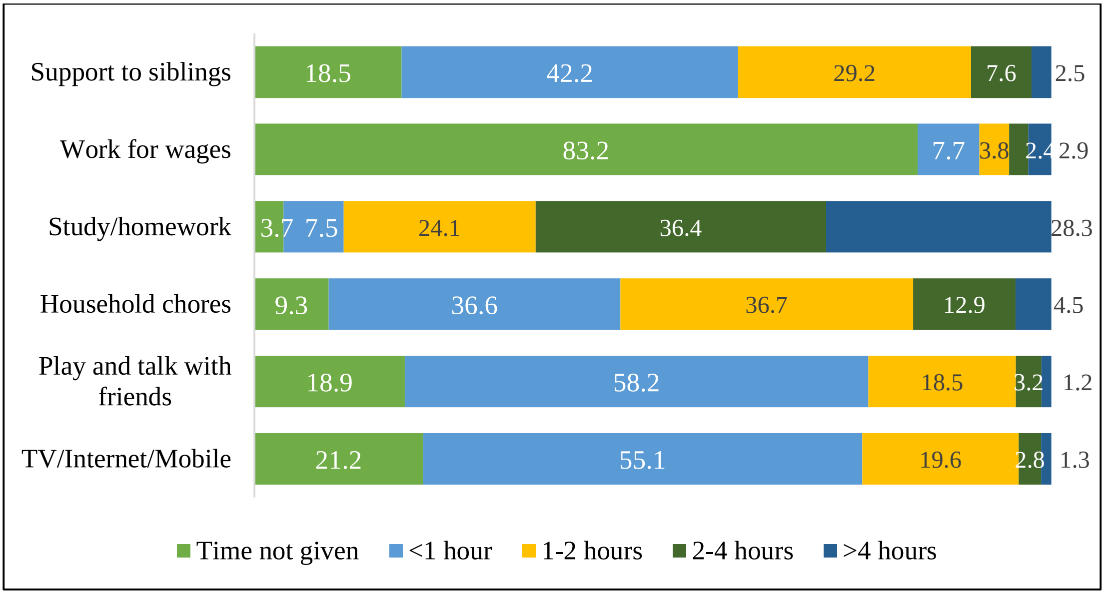


Figure 9 Pattern of spending time for different activities out of school

Figure 10 also shows that household chores occupy more consistent time, with 36.6% spending 1-2 hours and 36.7% spending 2-4 hours. Study and homework are more evenly spread across different time ranges, with notable time commitments of 36.4% for 2-4 hours and 28.3% for more than 4 hours. A majority of respondents (83.2%) reported not working for wages, while support to siblings shows a varied time distribution, with 42.2% spending less than an hour and 29.2% spending 1-2 hours. This data reflects the varying prioritization of activities in daily routines, with a noticeable allocation of time to chores and studies compared to leisure activities.

Achievement of the students in Mathematics by Learning Support Taken at Home

The table 17 presents how achievement of the students in Mathematics varies significantly based on the support they receive from different sources. Firstly, those who did not receive support from their fathers had a slightly higher mean Mathematics score of 500.34 (SD = 49.42) compared to those who did receive support, who had a mean score of 498.08 (SD = 53.07). The p-value of 0.00 indicates that this difference is statistically significant, suggesting that the presence of support from fathers might not be as beneficial as expected for Achievement of the students in Mathematics.

Similarly, students who did not receive support from their mothers had a higher mean score of 500.63 (SD = 49.73) compared to those who did, with a mean score of 492.16 (SD = 52.58). The p-value of 0.00 confirms that this difference is statistically significant, indicating that maternal support might not correlate positively with higher Mathematics scores.

Moreover, students who did not receive support from siblings had a higher mean score of 502.44 (SD = 50.38) compared to those who did, with a mean score of 496.28 (SD = 49.18). The p-value of 0.001 suggests that this difference is statistically significant, implying that sibling support might not be as effective in improving achievement of the students in Mathematics.

In contrast, students who received support from tuition had a higher mean score of 506.19 (SD = 49.01) compared to those who did not, who had a mean score of 498.16 (SD = 50.14). The p-value of 0.00 indicates that this difference is statistically significant, highlighting the positive impact of tuition support on Achievement of the students in Mathematics. Form this it can be generalized that students need extra support in Mathematics for better performance.

Additionally, the mean scores for students who did and did not receive support from friends are quite close, with those not receiving support having a mean score of 500.11 (SD = 49.80) and those receiving support having a mean score of 499.11 (SD = 51.64). The p-value of 0.001 suggests that this difference is statistically significant, although the impact of support from friends appears to be minimal.

Interestingly, students who reported receiving no support from anyone had a higher mean score of 511.33 (SD = 52.93) compared to those who did receive support, who had a mean score of 498.76 (SD = 49.51). The p-value of 0.00 indicates that this difference is statistically significant, suggesting that students who are more independent might perform better in Mathematics.

Table 17 Achievement of the students in Mathematics based on support taken by students from different sources

Variables		N	Mean	SD	P-value
Support from father	No	398174	500.34	49.42	<0.001
	Yes	71389	498.08	53.07	
Support from mother	No	434370	500.63	49.73	<0.001
	Yes	35193	492.16	52.58	
Support from sibling	No	283384	502.44	50.38	<0.001
	Yes	186179	496.28	49.18	
Support from tuition	No	362204	498.16	50.14	<0.001
	Yes	107359	506.19	49.01	
Support from friends	No	418803	500.11	49.80	<0.001
	Yes	50760	499.11	51.64	
Support from nobody	No	423238	498.76	49.51	<0.001
	Yes	46325	511.33	52.93	

Achievement of the students in Mathematics Based on ECA Activities at School

The table 18 reveals that students engaged in different leisure time activities, extracurricular activities (ECA), and levels of ECA participation show significant differences in mean achievement scores. Achievement of the students in Mathematics varies based on their leisure time activities at school. Those who engage in playing have the highest mean score of 509.37 (SD = 50.88), indicating that recreational activities might positively impact academic performance. In contrast, students with no leisure time have a lower mean score of 496.63 (SD = 49.01). Group work participants have a mean score of 497.50 (SD = 49.92), while those involved in classwork or homework have a mean score of 503.75 (SD = 50.22). The p-value of <0.001 suggests that these differences are statistically significant, highlighting the importance of balanced leisure activities for better academic outcomes.

The frequency of participation in extracurricular activities (ECA) also influences students' Mathematics scores. Students who regularly participate in ECA have the highest mean score of 520.92 (SD = 54.80), followed by those who participate sometimes with a mean score of 502.31 (SD = 48.60). Students who never participate in ECA have the lowest mean score of 495.47 (SD = 50.72). The p-value of <0.001

indicates that these differences are statistically significant, emphasizing the positive impact of regular ECA participation on academic performance.

When examining overall ECA participation, students who participate regularly have a mean score of 502.13 (SD = 51.17), slightly higher than those who never participate, with a mean score of 500.39 (SD = 50.99). Students who participate sometimes have a mean score of 500.18 (SD = 49.18). The p-value of <0.001 confirms that these differences are statistically significant, suggesting that even occasional participation in ECA can contribute to better Mathematics achievement.

In summary, the data indicates that students who engage in balanced leisure activities, regular extracurricular activities, and even occasional ECA participation tend to perform better in Mathematics. These findings underscore the importance of a well-rounded school experience that includes both academic and extracurricular engagements for optimal student achievement.

Table 18 Achievement of students in Mathematics based on activities at school

Variables/categories		**N**	**Mean**	**SD**	**P-value**
Leisure time activities	No leisure time	259718	496.63	49.01	<0.001
	Playing	71988	509.37	50.88	
	Group work	26524	497.50	49.92	
	Classwork/Homework	103441	503.75	50.22	
ECA Activities	Never	164795	495.47	50.72	<0.001
	Sometimes	279665	502.31	48.60	
	Regular	14856	520.92	54.80	
ECA Participation	Never	138607	500.39	50.99	<0.001
	Sometimes	283902	500.18	49.18	
	Regular	36825	502.13	51.17	

Achievement of Students in Mathematics by Facilities at Home

The table 19 highlights significant differences in mean achievement scores based on various resources available at home for study. Achievement of the students in Mathematics is significantly influenced by the availability of study facilities at home. Firstly, those with a table for study have a notably higher mean score of 507.69 (SD = 51.03) compared to those without, who score 487.59 (SD = 45.64). Similarly, students with a separate room for study achieve higher mean scores of 503.59

(SD = 50.21) compared to those without, who score 494.77 (SD = 49.22). The p-values of <0.001 for both variables indicate that these differences are statistically significant, highlighting the benefits of dedicated study spaces.

Moreover, having a peaceful place for study results in higher mean scores of 505.89 (SD = 50.92) compared to those without, who score 491.37 (SD = 47.32). In addition, students with a computer for learning at home achieve significantly higher mean scores of 527.94 (SD = 53.79) compared to those without, who score 494.18 (SD = 47.13). The p-values of <0.001 suggest that both a quiet study environment and access to a computer are crucial for enhancing achievement of the students in Mathematics.

Furthermore, the presence of literature books at home is associated with higher mean scores of 516.80 (SD = 54.27) compared to those without, who score 496.46 (SD = 48.31). Similarly, students with reference books achieve higher mean scores of 515.92 (SD = 51.01) compared to those without, who score 489.62 (SD = 46.48). The p-values of <0.001 confirm that these differences are statistically significant, underscoring the importance of having literature and reference materials available.

Additionally, students with a dictionary at home achieve significantly higher mean scores of 529.05 (SD = 50.83) compared to those without, who score 490.69 (SD = 46.00). Finally, having internet access at home results in higher mean scores of 518.96 (SD = 50.29) compared to those without, who score 484.11 (SD = 43.84). The p-values of <0.001 indicate that these differences are statistically significant, highlighting the critical role of a dictionary and internet access in supporting academic performance.

In summary, the data clearly shows that various study facilities at home, such as a dedicated study table, separate room, peaceful environment, computer, literature and reference books, dictionary, and internet access, are all associated with higher achievement of the students in Mathematics. These findings underscore the importance of a well-equipped and conducive study environment for optimal academic performance.

Table 19 Mean scores of students in Mathematics based on the facilities for study at home

Facilities		N	Mean	SD	P-value
Table for study	No	179686	487.59	45.64	< 0.001
	Yes	289877	507.69	51.03	
Separate room for study	No	190996	494.77	49.22	< 0.001
	Yes	278567	503.59	50.21	
Peace place for study	No	190369	491.37	47.32	< 0.001
	Yes	279194	505.89	50.92	
Computer for learning	No	388605	494.18	47.13	< 0.001
	Yes	80958	527.94	53.79	
Literature book	No	387814	496.46	48.31	< 0.001
	Yes	81750	516.80	54.27	
Reference book	No	284240	489.62	46.48	< 0.001
	Yes	185323	515.92	51.01	
Dictionary	No	355609	490.69	46.00	< 0.001
	Yes	113954	529.05	50.83	
Internet facility	No	255490	484.11	43.84	< 0.001
	Yes	214073	518.96	50.29	

The table 20 illustrates significant differences in student achievement scores based on the availability of various home facilities. Achievement of students in mathematics is significantly influenced by the availability of various facilities at home. Firstly, those with access to a mobile phone have a higher mean score of 501.91 (SD = 49.63) compared to those without, who score 487.68 (SD = 50.78). Similarly, students with a television at home achieve higher mean scores of 511.32 (SD = 49.41) compared to those without, who score 489.05 (SD = 47.08). The p-values of <0.001 for both variables indicate that these differences are statistically significant, highlighting the positive impact of having access to these electronic devices.

Moreover, having a computer at home is associated with significantly higher mean scores of 525.77 (SD = 51.24) compared to those without, who score 495.63 (SD = 46.86). In addition, students with a motorbike at home achieve higher mean scores of 514.03 (SD = 50.53) compared to those without, who score 495.01 (SD = 47.77). The p-values of <0.001 suggest that both a computer and a motorbike are crucial factors in enhancing Achievement of the students in Mathematics.

Furthermore, the presence of a car at home results in higher mean scores of 521.21 (SD = 53.67) compared to those without, who score 503.29 (SD = 49.68). Similarly, students living in a "pakki ghar" have higher mean scores of 508.81 (SD = 49.81) compared to those in non-permanent houses, who score 492.87 (SD = 48.30). The p-values of <0.001 confirm that these differences are statistically significant, underscoring the importance of a stable and well-equipped home environment.

In summary, the data clearly shows that various facilities at home, such as a mobile phone, television, computer, motorbike, car, and a permanent house, are all associated with higher Achievement of the students in Mathematics. These findings underscore the importance of a well-equipped home environment for optimal academic performance.

Table 20 Mean score of students based on the facilities available at home

Variables/facilities		N	Mean	SD	P-value
Mobile	No	27725	487.68	50.78	<0.001
	Yes	424615	501.91	49.63	
TV	No	148286	489.05	47.08	<0.001
	Yes	270849	511.32	49.41	
Computer	No	282368	495.63	46.86	<0.001
	Yes	112101	525.77	51.24	
Motorbike	No	222758	495.01	47.77	<0.001
	Yes	183649	514.03	50.53	
Car	No	357274	503.29	49.68	<0.001
	Yes	23470	521.21	53.67	
Pakki Ghar	No	145670	492.87	48.30	<0.001
	Yes	273779	508.81	49.81	

Achievement of Students in Mathematics Based on Teacher's Activities

The table 21 presents the achievement of students based on teacher's activities on the frequency of homework, regularity of feedback on homework, regularity of teacher in classroom, and classroom time management during teaching. Achievement of the Students in Mathematics is significantly influenced by various teacher activities at school. Firstly, the frequency of giving homework does not significantly impact students' Mathematics scores. Students who never receive homework have a mean score of 500.13 (SD = 56.07), while those who frequently receive homework have a mean score of 500.29 (SD = 49.86). The p-value of 0.84 indicates that this difference is not statistically significant, suggesting that the frequency of homework alone does not influence Mathematics performance.

In contrast, the provision of feedback on homework shows a significant impact. Students who never receive feedback have a mean score of 496.29 (SD = 51.90), whereas those who frequently receive feedback have a higher mean score of 500.31 (SD = 49.87). The p-value of <0.001 indicates that this difference is statistically significant, highlighting the importance of feedback in improving achievement of the students in Mathematics.

Moreover, the regularity of the teacher significantly affects students' performance. Students with regular teachers have a higher mean score of 500.47 (SD = 49.86) compared to those with irregular teachers, who have a mean score of 484.36 (SD = 47.93). The p-value of <0.001 confirms that this difference is statistically significant, emphasizing the positive impact of teacher regularity on student achievement.

In a similar vein, effective classroom time management by teachers is associated with higher student performance. Students whose teachers manage time properly have a mean score of 501.15 (SD = 49.79), while those whose teachers do not manage time properly have a lower mean score of 472.27 (SD = 43.98). The p-value of <0.001 indicates that this difference is statistically significant, underscoring the importance of proper time management in the classroom.

Additionally, the use of computer and internet by teachers in teaching influences students' Mathematics scores. Students in schools with no internet facility have a mean score of 487.33 (SD = 47.19). Those whose teachers use the internet 1-2 times a week have a mean score of 498.30 (SD = 48.99), 3-4 times a week have a mean score of 505.73 (SD = 48.54), and daily have a mean score of 498.40 (SD = 53.81). The p-value of <0.001 suggests that these differences are statistically significant, highlighting the positive impact of frequent use of technology in teaching.

In summary, while the frequency of giving homework does not significantly affect, the provision of feedback, teacher regularity, effective classroom time management, and the use of technology in teaching are all associated with higher student performance. These findings underscore the importance of these teacher activities in enhancing academic outcomes.

Table 21 Achievement score of students in Mathematics based on teacher's activities at school

Variables/activities		N	Mean	SD	P-value
Giving homework	Never	3434	500.13	56.07	0.84
	Frequently Given	459486	500.29	49.86	
Feedback on homework	Never	5533	496.29	51.90	<0.001
	Frequently Given	457092	500.31	49.87	
Regularity of Teacher	Not Regular	7091	484.36	47.93	<0.001
	Regular	456439	500.47	49.86	
Classroom Time Management	Do not manage time properly	13990	472.27	43.98	<0.001
	Manage time Properly	448779	501.15	49.79	
Use of computer and internet by teachers in teaching	No internet facility at school	16324	487.33	47.19	<0.001
	1-2 times in a week	148086	498.30	48.99	
	3-4 times in a week	151285	505.73	48.54	
	Never	80650	498.67	50.61	
	Daily	61447	498.40	53.81	

Bullying Status at School and Achievement of the students in Mathematics

The chart on Figure 12 shows that a significant portion of students, 41.2%, do not face any bullying at school. However, as the number of bullying types increases, the percentage of students experiencing them decreases. For instance, 26% of students face one type of bullying, indicating that a notable number of students are still affected by some form of bullying.

Moreover, the percentage continues to drop with the increase in the number of bullying types. Only 14.4% of students face two types of bullying, and this percentage further decreases to 9.4% for those experiencing three types. Furthermore, the decline becomes more pronounced with four types of bullying, where only 5.1% of students are affected. Additionally, the percentages drop sharply for students facing five (2.4%), six (1.1%), and seven (0.5%) types of bullying, indicating that fewer students experience multiple forms of bullying simultaneously.

In summary, the data highlights that while a significant number of students do not face any bullying, there is still a considerable portion who experience one or more types of bullying. The trend shows a decrease in the percentage of students as the number of bullying types increases, underscoring the need for effective anti-bullying measures in schools to ensure a safe and supportive environment for all students.

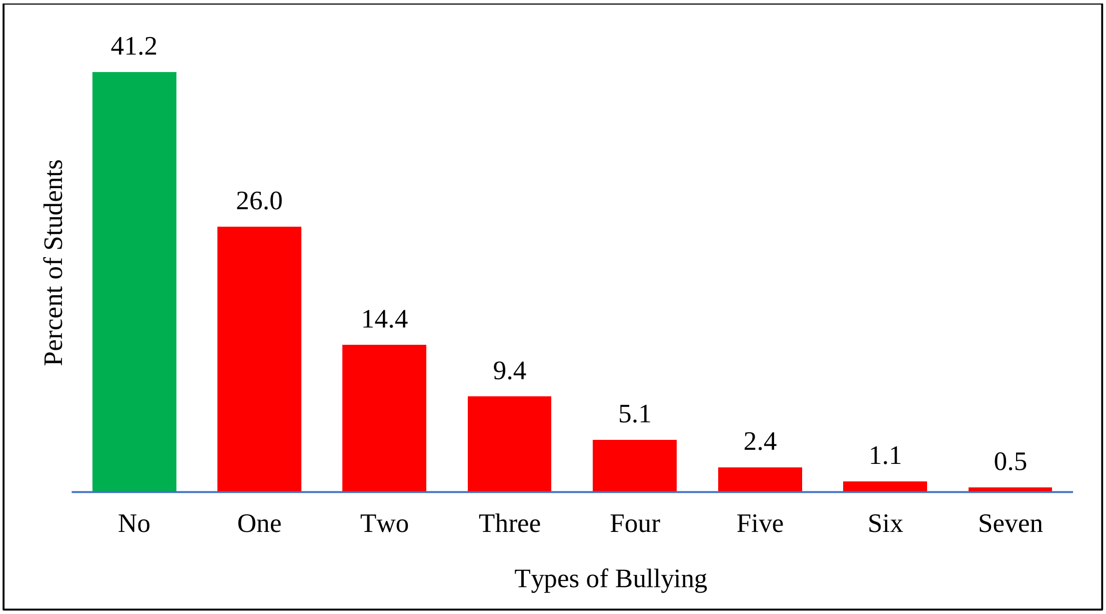


Figure 10 Number of students facing bullying activities

The table 22 presents the performance of students in Mathematics based on their experiences with bullying at school. Firstly, students who do not experience any bullying have a higher mean Mathematics score of 505.48 (SD = 47.64). This group constitutes 41.2% of the total student population. In contrast, students who face at least one kind of bullying have a lower mean score of 492.96 (SD = 50.74), representing 58.8% of the students. The p-value of <0.001 indicates that this difference is statistically significant.

Moreover, the data highlights a clear negative impact of bullying on academic performance. The higher standard deviation (SD) of 50.74 for bullied students compared to 47.64 for non-bullied students suggests greater variability in the performance of students who experience bullying. Furthermore, the significant p-value underscores the importance of addressing bullying in schools to improve students' academic outcomes.

In summary, the data demonstrates that students who do not face bullying tend to perform better in Mathematics compared to those who experience bullying. This finding emphasizes the need for effective anti-bullying measures to create a supportive and conducive learning environment for all students.

Table 22 Performance of students in Mathematics based on bullying at school (N=422619)

Bullying at School	Percentage (%)	Mean	SD	P-value
No bullying	41.2	505.48	47.64	<0.001
At least one kind of bullying	58.8	492.96	50.74	

Achievement of the students in Mathematics based on Perception of Students towards School and Subject Related Variables

The result on the table 23 presents achievement of the students in Mathematics based on their perceptions towards teachers, schools, and the subject of Mathematics. Firstly, students with positive perceptions towards their teachers, who make up 96.0% of the sample, have a mean score of 500.26 (SD = 50.01). In contrast, the 4.0% of students with negative perceptions towards their teachers have a slightly lower mean score of 496.50 (SD = 47.94). Although the difference in mean scores is small, it suggests that positive perceptions towards teachers may be associated with slightly better academic performance.

Similarly, students with positive perceptions towards their school, comprising 96.2% of the sample, have a mean score of 500.11 (SD = 49.78). Interestingly, the 3.8% of students with negative perceptions towards their school have a slightly higher mean score of 501.67 (SD = 52.85). This unexpected result indicates that negative perceptions towards school do not necessarily correlate with lower achievement of the students in Mathematics. Most likely that those students who do not like their schools should be aware of lack of teaching resources, appropriate methods, or support despite their good performance.

Moreover, students with positive perceptions towards Mathematics, who represent 95.8% of the sample, have a mean score of 500.31 (SD = 50.10). The 4.2% of students with negative perceptions towards Mathematics have a lower mean score of 496.98 (SD = 44.98). This difference suggests that a positive attitude towards the subject may contribute to better performance in Mathematics.

Furthermore, perceptions towards learning Mathematics show a more pronounced impact. The 91.6% of students with positive perceptions have a higher mean score of 501.23 (SD = 50.26), while the 8.4% with negative perceptions have a significantly lower mean score of 489.37 (SD = 44.64). This substantial difference highlights the importance of fostering positive attitudes towards learning Mathematics to enhance academic achievement.

In summary, the data indicates that positive perceptions towards teachers, the school environment, and the subject of Mathematics are generally associated with higher achievement of the students in Mathematics. However, the relationship between perceptions and performance can vary, as seen in the case of school perceptions. These findings underscore the importance of creating a positive educational environment and encouraging favorable attitudes towards learning to support student success.

Table 23 Perceptions of students towards teachers, schools and Mathematics subject

Students Perception	Achievement based on perception					
	Positive			Negative		
	Percent	Mean	SD	Percent	Mean	SD
Perceptions towards teachers (N=466350)	96.0%	500.26	50.01	4.0%	496.50	47.94
Perceptions towards school (N=465649)	96.2%	500.11	49.78	3.8%	501.67	52.85
Perception towards Mathematics (N=465239)	95.8%	500.31	50.10	4.2%	496.98	44.98
Perceptions towards learning Mathematics (N=463962)	91.6%	501.23	50.26	8.4%	489.37	44.64

Achievements Based on Frequency of Activities in the Classroom

The table 24 presents an average score based on the different activities done by students in the classroom. The analysis of the mean achievement scores across various classroom practices reveals several key insights into effective learning strategies for Mathematics. Students who frequently engage in solving problems similar to those demonstrated by their teachers tend to achieve higher scores, with a mean score of 503.17. This suggests that practicing problems that mirror classroom examples can significantly enhance understanding and performance.

Group work also appears to be beneficial, particularly when done frequently, as indicated by the highest mean score of 505.16. This highlights the value of collaborative learning environments where students can share ideas and approaches. Similarly, students who often solve problems without the teacher's help achieve the highest mean score of 513.49, underscoring the importance of developing independent problem-solving skills.

Interestingly, the use of guides for problem-solving shows a slight decline in effectiveness when used always, with the highest mean score of 503.18 observed when guides are never used. This could imply that over-reliance on guides might hinder deeper understanding. On the other hand, practicing old exam questions frequently leads to high achievement, with a mean score of 506.82, indicating that familiarity with exam formats and types of questions can boost performance.

Helping teachers correct homework errors and using the internet for self-study are also associated with higher scores, particularly when these activities are done frequently. The highest mean scores for these practices are 502.36 and 509.54, respectively. These findings suggest that active engagement in correcting mistakes and utilizing online resources can enhance learning outcomes.

Overall, the data indicates that frequent engagement in these practices generally leads to higher achievement scores in Mathematics. Emphasizing independent problem-solving, collaborative learning, and consistent practice with exam questions can be particularly effective strategies for improving mathematical performance.

Table 24 Practices on learning Mathematics at classroom and achievement in Mathematics

Variables/Students practices	N	Mean Achievement Scores			
		Never	Sometimes	Frequently	Always
I solve problems similar to the problem solved by teachers	453219	484.34	487.90	503.17	501.10
We solve the problems in a group work	449719	498.36	500.07	505.16	498.68
I can solve our problem without help of teacher	443993	476.15	494.52	513.49	502.38
I take support from guide to solve the problems	441235	503.18	500.65	502.51	495.15
I practice old exams questions	445924	480.83	491.46	506.82	505.80

Variables/Students practices	N	Mean Achievement Scores			
		Never	Sometimes	Frequently	Always
I help teachers to correct the errors in the homework	449176	477.00	495.98	500.62	502.36
I use Internet for self- study	447812	489.55	502.12	509.54	499.15

Effect of Individual, Family and School Related Factors on Mathematics Achievement

The table 25 presents the effect of individual, family, and school related factors on Mathematics achievement. The model explains 25% of the variance in Mathematics result ($R^2 = 0.25$). The regression analysis examining the effect of personal, social, and school-related factors on Mathematics education reveals several significant relationships. The analysis includes various predictors, each with its corresponding coefficients (B), standard errors (SE), beta values (Beta), t-values (t), significance levels (Sig.), and variance inflation factors (VIF). Father's education emerged as a significant predictor with a coefficient (B) of 7.25, indicating a positive relationship with Mathematics achievement. The t-value of 83.28 and a significance level of $p < 0.001$ confirm its strong influence. Similarly, time allocated for study/homework (B = 7.19, t = 81.34, $p < 0.001$) and mother's education (B = 5.49, t = 59.00, $p < 0.001$) also show significant positive effects on Mathematics performance.

Furthermore, engagement in the classroom (B = 11.37, t = 51.40, $p < 0.001$) and attitude towards learning Mathematics (B = 12.33, t = 37.53, $p < 0.00$) are notable school-related factors that positively impact achievement. Additionally, classroom time management (B = 16.03, t = 27.70, $p < 0.001$) and access to facilities (B = 14.56, t = 14.90, $p < 0.001$) further emphasize the importance of a well-managed and resource-rich learning environment.

Conversely, negative predictors such as bullying at school (B = -5.27, t = -30.12, $p< 0.001$) and time spent on household chores (B = -5.62, t = -59.36, $p < 0.001$) highlight the detrimental effects of these factors on Mathematics achievement. Personal mobile phone usage (B = -5.83, t = -31.53, $p< 0.001$) and time for work for wages (B = -5.72, t = -56.24, $p < 0.001$) also negatively impact performance, suggesting that distractions and additional responsibilities outside school can hinder academic success.

Overall, the regression analysis underscores the significant influence of both positive and negative factors on Mathematics education. Parental education, effective classroom engagement, and time management are crucial for enhancing student achievement, while bullying, excessive household responsibilities, and distractions like mobile phones can impede academic progress.

Table 25 Effect of personal, social and school related factors in Mathematics education

Predictors	B	SE	Beta	t	Sig.	VIF
Father education	7.25	0.09	0.19	83.28	0.00	1.88
Time for study/homework	7.19	0.09	0.14	81.34	0.00	1.12
Mother education	5.49	0.09	0.14	59.00	0.00	1.97
Time for using digital resources	6.93	0.11	0.11	61.34	0.00	1.24
Engagement in classroom	11.37	0.22	0.09	51.40	0.00	1.09
Use of social media	7.75	0.19	0.08	39.84	0.00	1.33
Attitude towards learning Mathematics	12.33	0.33	0.07	37.53	0.00	1.21
Bullying at school	-5.27	-0.18	-0.05	-30.12	0.00	1.08
Classroom time management	16.03	0.58	0.05	27.70	0.00	1.02
Regularities of ECA activities	3.12	0.16	0.03	19.24	0.00	1.09
Access to the facilities	14.56	0.98	0.02	14.90	0.00	1.01
Attitude towards Mathematics	3.87	0.44	0.02	8.74	0.00	1.27
Homework practice	7.73	1.00	0.01	7.69	0.00	1.09
Use of digital resources by teachers in teaching	0.53	0.08	0.01	6.80	0.00	1.02
Regularity of feedback	-1.79	0.78	0.00	-2.30	0.02	1.10
Attitude towards school	-1.64	0.48	-0.01	-3.45	0.00	1.23
Attitudes towards teachers	-1.65	0.47	-0.01	-3.54	0.00	1.18
Study materials at home other than textbooks	-1.18	0.14	-0.02	-8.50	0.00	1.10
ECA participation	-1.29	0.15	-0.02	-8.55	0.00	1.13
Play and talk with friends	-1.41	0.11	-0.02	-12.59	0.00	1.12
Personal mobile phone	-5.83	0.19	-0.06	-31.53	0.00	1.25
Time for work for wages	-5.72	0.10	-0.10	-56.24	0.00	1.12
Time for household chores	-5.62	0.10	-0.11	-59.36	0.00	1.19
Time for support to siblings	-5.89	0.10	-0.11	-59.64	0.00	1.25

CHAPTER IV

Student Performance in Science

In this unit, we present a detailed analysis of the average achievement scores in Science for the year 2023. These scores are meticulously categorized based on a variety of influential factors, including the diverse backgrounds of students, the environments within their schools, the conditions of their home environments, and other school-related factors. By examining these different dimensions, we aim to provide a comprehensive understanding of how these elements influence student performance in Science. To achieve this, we first present the national mean achievement scores in Science. Following this, we delve into the proficiency levels of students in Science, analyzed through various demographic variables. Finally, we present the average achievement scores of students, further broken down by these demographic variables, to offer a nuanced view of the data.

National Mean Achievement Scores in Science

Figure 13 provides a detailed comparison of the achievement scores of grade ten students in Science for the years 2019 and 2023. In 2019, the average score of the students in Science was recorded at 500. By 2023, there was a significant improvement, with the average score rising to approximately 504.83. This data reveals a notable increase in the average achievement scores over this period, with scores rising by about 5 points from 2019 to 2023. Specifically, the national average achievement score in Science for 2023 is reported to be 504.83, with a standard deviation of 49.89. This increase suggests that there have been improvements in educational strategies, student engagement, or other contributing factors that have positively impacted student performance in Science over these years.

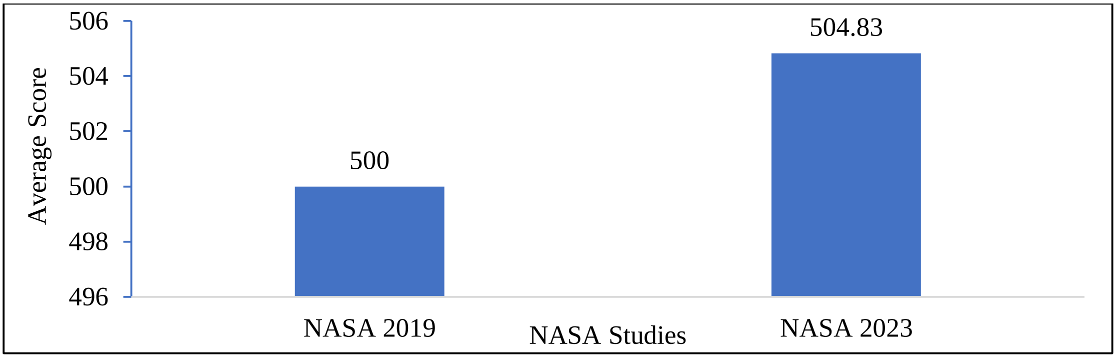


Figure 11 Mean achievement score on Science in 2019 and 2023

Additionally, the histogram in Figure 13, overlaid with a bell curve, indicates that the Science achievement scores are almost normally distributed. This means that most students scored around the average, with fewer students achieving very high or very low scores. This normal distribution suggests a consistent performance across the student population, highlighting the effectiveness of the educational improvements made during this period.

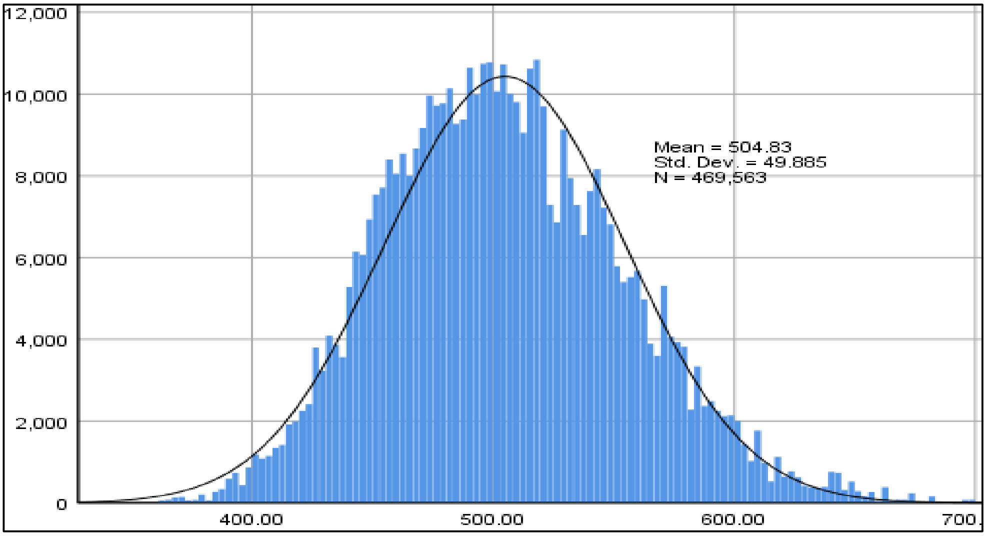


Figure 12 Distribution of achievement scores on Science

Proficiency Levels of the Students in Science

Table 26 and Figure 16 provide a comprehensive overview of the proficiency levels of students in Science, categorized into six distinct levels based on their scores. Here's an elaborated description of the results:

Level 1: Below-basic: Students scoring 448 and below fall into this category. 12.0% of the total students are in this level. These students are likely struggling with fundamental Science concepts.

Level 2: Basic: This level includes students with scores ranging from 448 to 475. There are 17.4% students in the category by representing the total population. These students have a basic understanding of Science but may need additional support to reach higher proficiency levels.

Level 3: Proficient 1: Students scoring between 475 and 502 are classified under this level. This group constitutes 20.8% of the total population. These students demonstrate a solid understanding of Science concepts and skills.

Level 4: Proficient 2: This level includes students with scores from 502 to 529. There is the category, making up 19.6% of the total population. These students show a higher level of proficiency and a strong grasp of Science concepts.

Level 5: Proficient 3: Students scoring between 529 and 556 fall into this category. There are 14.7% students representing the total population. These students exhibit advanced proficiency in Science.

Level 6: Advanced: This highest proficiency level includes students with scores of 556 or above. In this level, 15.6% of the total students are represented. These students demonstrate exceptional understanding and mastery of Science concepts.

In summary, the distribution of students across these proficiency levels highlights the varying degrees of Science achievement among grade ten students. The largest group is at the Proficient 1 level, indicating that a significant portion of students have a solid understanding of Science. However, there is also a notable percentage of students at the Below-basic and Basic levels, suggesting areas where additional educational support may be needed.

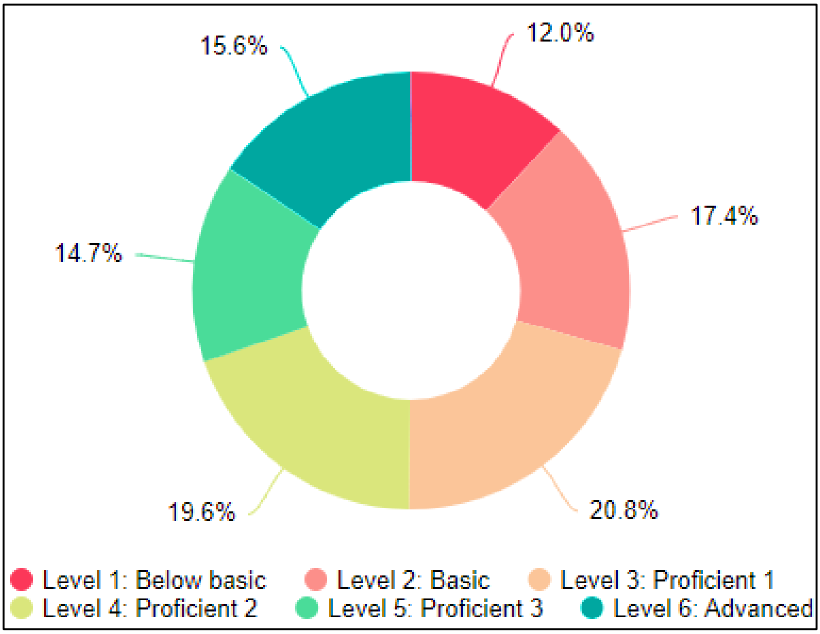


Figure 13 Distribution of students in different proficiency level in Science

Table 26 Overall proficiency level of the students in Science (N=469563)

Proficiency Levels	Score range	Percent
Level 1: Below-basic	448 and below	12.0
Level 2: Basic	448-475	17.4
Level 3: Proficient 1	475-502	20.8
Level 4: Proficient 2	502-529	19.6
Level 5: Proficient 3	529- 556	14.7
Level 6: Advanced	556 or above	15.6
Total		100.0

Mean Achievement Scores of Students in Science by Province

The chart in Figure 15 provides a detailed comparison of students' mean achievement scores in Science across various provinces. The result of different provinces is given below:

- Koshi: The mean achievement score is 496.95, which is below the national average.
- Madhesh: The mean score is 496.33, also below the national average.
- Bagmati: This province has a mean score of 530.19, above the national average and has the highest score among all provinces.
- Gandaki: With a mean score of 508.38, Gandaki exceeds the national average.
- Lumbini: The mean score here is 503.90, which is below the national average.
- Karnali: The mean score is 486.82, way below the national average. It is the lowest average achievement among the seven provinces.
- Sudurpashchim: This province has a mean score of 488.42, also below the national average.

The national mean achievement score in Science is 504.83, represented by a horizontal dashed line on the chart. Gandaki is the only province with a mean score above this national average, indicating a higher overall performance in Science compared to other provinces. The other provinces have mean scores below the national average, suggesting areas where educational interventions might be needed to boost student performance in Science.

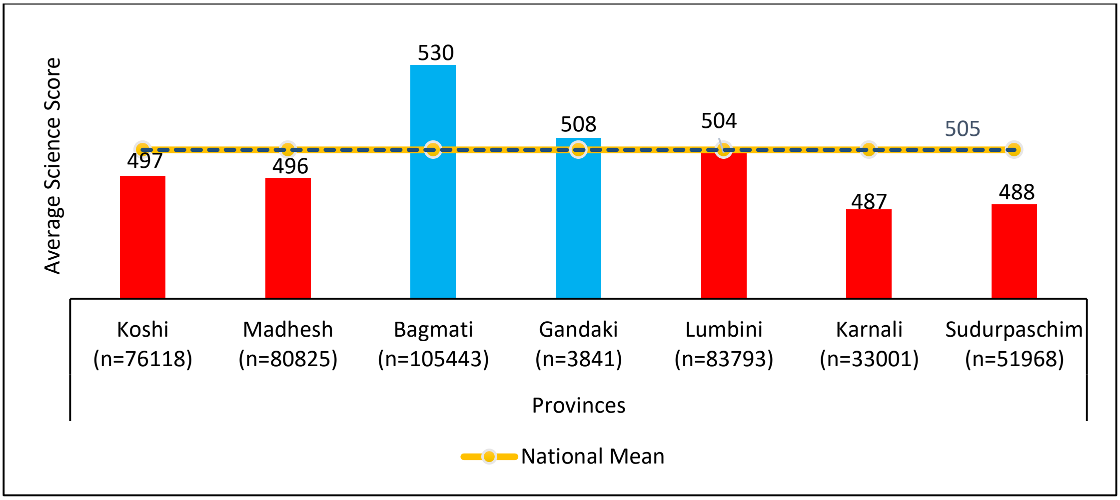


Figure 14 Achievement score of the students in Science based on provinces

Figure 16 shows the distribution of student proficiency levels by percent across provinces. In Sudurpashchim, the distribution of students' performance levels in Science shows that 19.8% of students are at the Below Basic level, and 21.9% are at the Basic level. The largest group, 22.9%, falls into the Proficient 1 category. Meanwhile, 17.1% are in Proficient 2, 9.0% in Proficient 3, and 9.3% in the advanced category. This distribution indicates that while a significant portion of students have a basic to proficient understanding of Science, there is still a considerable number of students who need additional support to reach higher proficiency levels.

Karnali has a similar distribution, with 18.2% of students at the Below Basic level and 24.2% at the Basic level. The Proficient 1 category includes 20.8% of students, and Proficient 2 has 20.4%. Proficient 3 and advanced categories have 10.7% and 5.8% of students, respectively. The higher percentage of students in the Basic category suggests that many students have foundational knowledge but may require further development to achieve higher proficiency.

In Lumbini, only 8.2% of students are at the Below Basic level, and 16.6% are at the Basic level. The largest group, 25.2%, is in the Proficient 1 category, followed by 23.1% in Proficient 2. Proficient 3 and advanced categories include 15.8% and 11.1% of students, respectively. This distribution indicates a relatively strong performance, with a significant portion of students achieving proficient and advanced levels.

Gandaki shows a strong performance with only 7.0% of students at the Below Basic level and 16.2% at the Basic level. The Proficient 1 and Proficient 2 categories include 23.5% and 23.0% of students, respectively. Proficient 3 has 16.4%, and the advanced category has 14.0%. This distribution suggests that a majority of students have a solid understanding of Science, with a significant number reaching advanced proficiency.

Bagmati stands out with only 5.1% of students at the Below Basic level and 10.7% at the Basic level. The Proficient 1 category includes 15.3% of students, while Proficient 2 and Proficient 3 have 19.1% and 18.3%, respectively. Notably, 31.5% of students are in the advanced category, indicating a very high level of Science proficiency among students in this province.

In Madhesh, 15.8% of students are at the Below Basic level, and 19.0% are at the Basic level. The Proficient 1 category includes 22.0% of students, while Proficient 2 and Proficient 3 have 17.7% and 13.7%, respectively. The Advanced category includes 11.7% of students. This distribution shows a balanced performance, with a significant portion of students achieving proficient and advanced levels.

Koshi has 16.0% of students at the Below Basic level and 20.3% at the Basic level. The Proficient 1 category includes 19.2% of students, while Proficient 2 and Proficient 3 have 18.2% and 14.1%, respectively. The Advanced category includes 12.1% of students. This distribution indicates a need for improvement, particularly in moving more students from the basic to proficient and advanced levels.

Comparing the provinces, Bagmati stands out with the highest percentage of students in the advanced category (31.5%), indicating exceptional performance in Science. Gandaki and Lumbini also show strong performances, with significant portions of students in the Proficient 1 and Proficient 2 categories. In contrast, Sudurpashchim and Karnali have higher percentages of students in the Below Basic and Basic categories, suggesting areas where additional educational support may be needed. Overall, while some provinces demonstrate high levels of proficiency, others require targeted interventions to improve Science education outcomes.

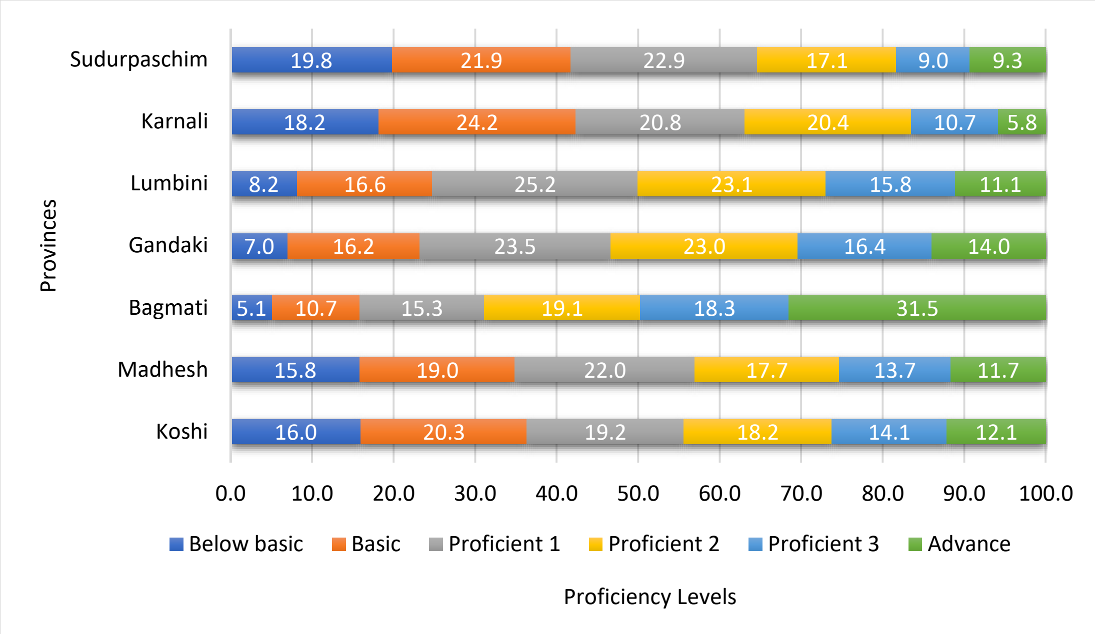


Figure 15 Distribution of proficiency level in Science based on provinces (n=469563)

Performance of the Students in Science by Local Levels, Types of Schools, Gender and Time to Reach School.

The achievement scores of students in Science by local levels (local level of the government), types of schools, and gender are presented in Table 27. The analysis of Science achievement scores reveals significant differences across various grouping variables, with all comparisons showing statistically significant p-values ($p < 0.001$).

Firstly, comparing local levels, students from municipalities (Mean = 512.11, SD = 50.38, N = 318,763) outperform those from rural municipalities (Mean = 489.43, SD = 45.10, N = 150,800). This suggests that students in urban areas have better access to educational resources or more conducive learning environments, contributing to higher achievement scores.

When examining the types of schools, students attending institutional schools (Mean = 539.70, SD = 49.64, N = 97,933) have significantly higher Science achievement scores compared to those in community schools (Mean = 495.63, SD = 45.72, N = 371,630). This disparity indicates that institutional schools may provide better educational facilities, teaching quality, or support systems that enhance student performance.

Gender differences are also evident, with boys (Mean = 512.15, SD = 51.08, N = 220,860) scoring higher on average than girls (Mean = 498.66, SD = 47.69, N = 245,724). This gap highlights the need for targeted interventions to support girls in achieving higher proficiency in Science.

Lastly, the time taken to reach school impacts student performance. Students who travel less than 15 minutes (Mean = 511.29, SD = 50.12, N = 221,993) have the highest mean scores, while those traveling more than 2 hours (Mean = 484.83, SD = 45.91, N = 5,564) have the lowest. This trend suggests that longer travel times may contribute to fatigue or reduced study time, negatively affecting academic performance.

Overall, these findings underscore the importance of addressing disparities in educational resources, school types, gender support, and travel times to improve Science achievement across different student groups.

Table 27 Science achievement score by local level, types of school, gender, and time to reach school

Variables	N	Mean	SD	P-value
Local level (n= 469563)				
Rural Municipality	150800	489.43	45.10	<0.001
Municipality	318763	512.11	50.38	
Types of school (n= 469563)				
Community school	371630	495.63	45.72	<0.001
Institutional school	97933	539.70	49.64	
Gender (n= 466583)				
Boys	220860	512.15	51.08	<0.001
Girls	245724	498.66	47.69	
Time to reach school (n=469563)				
< 15 minutes	221993	511.29	50.12	<0.001
15-30 minutes	132001	503.78	48.04	
30-60 minutes	49387	501.99	51.63	
60-120 minutes	60619	487.58	46.81	
>2 hours	5564	484.83	45.91	

Figure 17 shows distribution of proficiency levels of students in Science by duration of homework, governance level, school types, gender, and distance of school from home.

Duration of Homework/Distance of School. The duration of homework significantly impacts student performance in Science. Students who spend more than 2 hours on homework have the highest percentage in the Below Basic category (23.4%) and the lowest in the advanced category (6.3%). This suggests that excessive homework time may not be as effective. Conversely, students who spend 60-120 minutes on homework show a more balanced distribution, with 19.1% in Below Basic and 7.2% in Advanced, indicating a more optimal homework duration. Those who spend 30-60 minutes have 13.5% in Below Basic and 13.8% in advanced, while students with 15-30 minutes of homework have 11.7% in Below Basic and 14.8% in Advanced. Interestingly, students who spend less than 15 minutes on homework have the lowest percentage in Below Basic (9.6%) and the highest in Advanced (19.1%), suggesting that shorter, more focused homework sessions might be more beneficial.

Gender. Gender differences in Science achievement are evident from the data. Girls have lower percentages in the Proficient 2 (19.0%), Proficient 3 (13.5%), and Advanced (12.1%) categories compared to boys, who have 20.4% in Proficient 2, 16.0% in Proficient 3, and 19.7% in Advanced. However, boys have a lower percentage in the Below Basic category (9.8%), Basic (14.8%) and 19.4% in the Proficient 1 compared to girls in Below Basic (13.7%), Basic (19.6%), and Proficient 1 (21.1%). This indicates that while boys tend to have a higher percentage at the upper levels and girls in lower proficiency levels.

School Types. The type of school also plays a crucial role in student performance. Students from community schools have 14.5% in Below Basic, 20.1% Basic, 22.7% in Proficient 1, and 19.7% in Proficient 2, which are all higher than institutional schools for these levels with 2.6% Below Basic, 6.9% Basic, 13.3% in Proficient 1, and 19.3% in Proficient 2, respectively. Nonetheless, institutional schools have higher percentages in upper levels with 21.2% in Proficient 3 and 36.7% in Advanced, where their counterparts in community schools had 12.9% in Proficient 3, and 10.1% in Advanced. More than 50% of students from institutional schools are at the upper-level proficiency (Proficient 3 or Advanced), whereas only about 36% of students from community schools are at this level. This stark difference suggests that institutional schools provide a more conducive environment for achieving higher proficiency in Science, though there might be other socioeconomic and family factors that negatively influenced the proficiency of community schools.

Local Authority Types. Local authority types show similar trends to institutional school types. In one hand, Rural Municipalities have higher percentage students in lower proficiency, 18.2% in Below Basic, 21.1% in Basic, and 22.8% in Proficient 1, whereas Urban Municipalities had 9.0% in Below Basic, 15.6% in Basic, and 19.8% in Proficient 1. On the other hand, Urban Municipalities have higher percentage of student at the upper levels, 20.1% in Proficient 2, 16.2% in Proficient 3, and 19.2% in Advanced, whereas community schools have 18.5% in Proficient 2, 11.3% in Proficient 3, and only 8.1% in the Advanced level.

Comparing these categories, it is clear that institutional schools and shorter homework durations are associated with higher student performance in Science. Gender differences show that boys tend to excel in higher proficiency levels. Local authority types reveal that Urban Municipality schools outperform Rural Municipality schools, suggesting that urban areas provide better educational resources and support. Overall, these findings highlight the importance of optimizing homework duration, supporting institutional schools, addressing gender disparities, and improving educational resources in rural areas to enhance Science achievement.

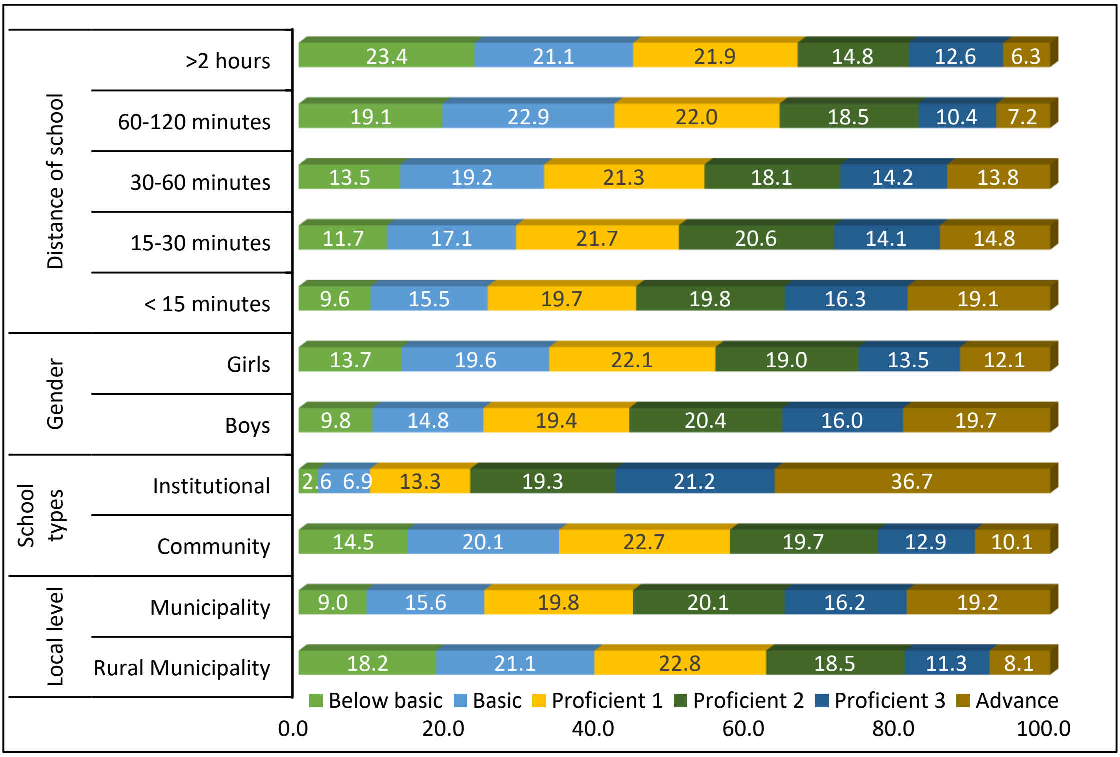


Figure 16 Proficiency level of students in Science by local level, school types, gender, and distance of school

Science Achievement by Number of Family Members

Average achievement score of the students based on the number of families are presented in Table 28. The table presents the average achievement scores of students in Science based on family size, revealing that students from smaller families tend to perform better. Specifically, students from families with fewer than 5 members have the highest average score (Mean = 514.66, SD = 50.84), while those from families with 10 members have the lowest average score (Mean = 492.62, SD = 47.25). The p-value of <0.001 indicates that these differences are statistically significant, suggesting that family size has a notable impact on students' academic performance in Science. Other family sizes show varying mean scores, with families of 5 members (Mean = 508.30, SD = 50.41), 6 members (Mean = 498.94, SD = 45.85), 7 members (Mean = 496.12, SD = 48.38), 8 members (Mean = 492.95, SD = 45.10), 9 members (Mean = 498.01, SD = 47.69), and more than 10 members (Mean = 497.95, SD = 48.00).

Table 28 Average achievement score of students in Science based on number of families (n=450757)

Categories	N	Mean	SD	p-value
<5 Members	147838	514.66	50.84	<0.001
5 Members	114049	508.30	50.41	
6 Members	78990	498.94	45.85	
7 Members	43208	496.12	48.38	
8 Members	25177	492.95	45.10	
9 Members	11474	498.01	47.69	
10 Members	10213	492.62	47.25	
>10 Members	19808	497.95	48.00	

Figure 18 shows that the number of students getting advance proficiency level found to be high with respect to a smaller number of family members where that rate is just opposite in pre-basic and basic level. The bar chart provides a detailed breakdown of performance levels across groups with varying numbers of members. Each group is assessed on a task or evaluation, with performance categorized into six levels: Below Basic, Basic, Proficient 1, Proficient 2, Proficient 3, and Advanced. The data reveals interesting trends in how family size correlates with performance.

For students with family size with more than 10 members, the highest percentage of performance falls into the Proficient 1 category (23.3%), followed by

Below Basic (18.1%) and Proficient 2 (17.5%). This indicates that while a significant portion of these larger groups achieves a moderate level of proficiency, a notable percentage also falls into the lower performance category. Similarly, students having families with exactly 10 member's show a high percentage in the Basic category (28.1%), suggesting that these groups tend to perform at a basic level more frequently than others.

As the number of family members decreases, there is a noticeable shift in performance distribution. For instance, family size with 9 members has the highest percentage in Proficient 1 (23.0%) and Basic (22.0%), but also show a significant portion in Proficient 2 (17.9%). Students having 8 family members exhibit the highest percentage in Proficient 1 (25.8%), followed by Basic (21.7%) and Proficient 2 (18.9%). This trend continues with families of 7 members, where Proficient 1 (19.5%) and Basic (22.2%) are the most common performance levels, but there is also a substantial percentage in Proficient 2 (17.3%).

Interestingly, students having fewer family members, such as 6 and 5 members, show a higher concentration in the Proficient 2 and Advanced categories. For example, groups with 6 members have the highest percentage in Proficient 2 (21.7%) and Proficient 1 (21.1%), with a notable portion in Advanced (11.8%). Students from families with 5 members display a balanced distribution across Proficient 1 (20.7%), Proficient 2 (19.2%), and Advanced (17.4%).

Students from the smallest family size, with fewer than 5 members, exhibit the highest performance levels, with notable percentages in both Proficient 2 (20.3%) and Advanced (20.3%). This indicates that students from smaller families consistently achieve higher proficiency levels compared to those from larger families. The chart clearly shows that as family size decreases, the likelihood of achieving higher performance levels increases, underscoring the potential advantages of smaller family sizes in achieving better outcomes in Science assessments. One possible explanation is that smaller families can provide more focused attention and support to their children's education. Additionally, children in larger families may face more distractions and have less concentration on their studies compared to those in smaller families.

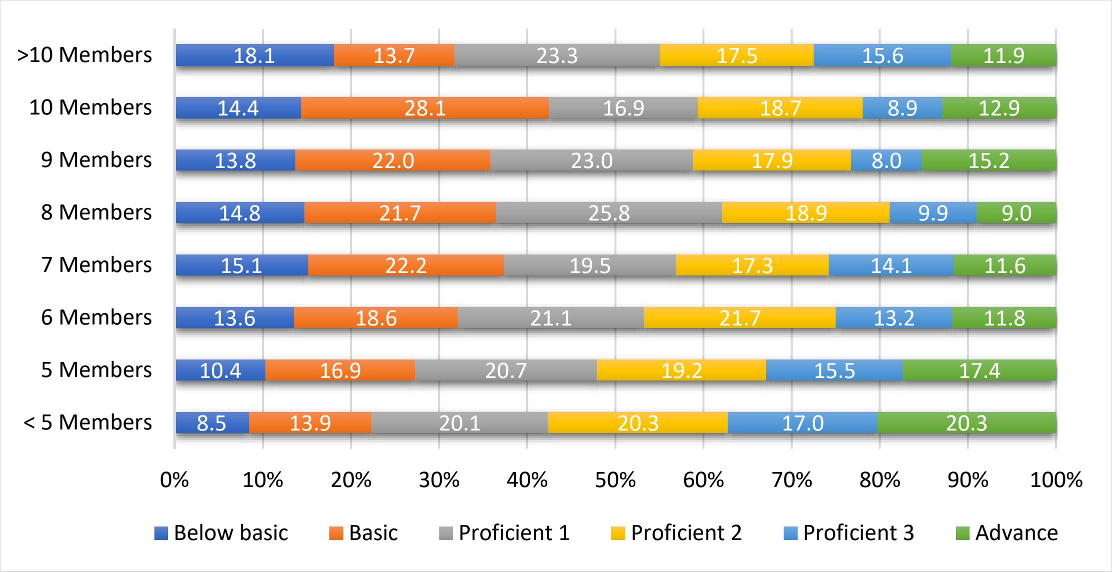


Figure 17 Proficiency level of students in Science based on number of families

Achievement scores of the students in Science by Background Variables

Achievement scores of students by their different background variables as ethnicity, geography, home language, and support to study in out of school time are presented in this section. Total sample in different variables are different because of having missing cases which are not reported because of mentioning total responses sample in each variable. Ethnicity has four categories as Brahmin/Chhetri, Janajati, Dalit, and other ethnicities. Geography has three categories as Madheshi, Pahadi, Himali, and other geography. The support for the study out of school activities were measured in yes and no form.

Table 29 presents a comprehensive analysis of Science achievement scores among students, categorized by ethnicity, geography, and mother tongue language. The data reveals significant variations in performance based on these factors, highlighting the influence of socio-cultural and linguistic backgrounds on academic outcomes.

Starting with ethnicity by caste, students from the Brahmin/Chhetri caste exhibit the highest average Science achievement score, with a mean of 512.39 and a standard deviation (SD) of 51.96. This group's performance is significantly higher than that of other castes, as indicated by a p-value of less than 0.001. In contrast, Dalit students have the lowest average score of 491.53 (SD = 43.99), suggesting a notable performance gap. Meanwhile, Janajati students and those from other ethnicities have mean scores of 503.50 (SD = 47.98) and 502.80 (SD = 48.76), respectively, indicating moderate performance levels compared to Brahmin/Chhetri students.

Moving on to ethnicity by geography, geographic location also plays a crucial role in students' Science achievement. Students from other geographic regions have the highest average score of 513.22 (SD = 48.32), outperforming those from Himali, Pahadi, and Madhesi regions. Himali students have the lowest average score of 492.79 (SD = 50.96), while Pahadi and Madhesi students have mean scores of 507.11 (SD = 50.27) and 502.12 (SD = 48.01), respectively. The differences in scores across these geographic groups are statistically significant, with a p-value of less than 0.001, underscoring the impact of geographic factors on academic performance.

Furthermore, language appears to be another significant determinant of Science achievement. Students whose mother tongue is Nepali have a higher average score of 510.19 (SD = 50.09) compared to those whose mother tongue is another language, who have an average score of 497.36 (SD = 47.38). The p-value of less than 0.001 indicates that this difference is statistically significant, suggesting that linguistic background can influence students' academic success in Science.

Overall, the data highlights substantial disparities in Science achievement scores based on ethnicity, geography, and mother tongue language. Students from the Brahmin/Chhetri caste and those from other geographic regions tend to perform the best, while Dalit and Himali students have the lowest average scores. Additionally, students whose mother tongue is Nepali generally achieve higher scores than those who speak other languages. These findings suggest that socio-cultural and linguistic factors play a critical role in shaping students' academic performance in Science, pointing to the need for targeted educational interventions to address these disparities and support underperforming groups.

Table 29 Science achievement score by ethnicity, geography and mother tongue

Variables	**Categories**	**N**	**Mean**	**SD**	**p-value**
Ethnicity/Cast (n=456744)					
	Brahmin/Chhetri	183469	512.39	51.96	<0.001
	Janajati	155125	503.50	47.98	
	Dalit	53503	491.53	43.99	
	Other ethnicities	64647	502.80	48.76	
Ethnicity by Geography (n=460580)					
	Himali	18683	492.79	50.96	<0.001

Variables	Categories	N	Mean	SD	p-value
	Pahadi	274785	507.11	50.27	
	Madhesi	140188	502.12	48.01	
	Other geography	26925	513.22	48.32	
Mother tongue language (n=444191)	Other language	136671	497.36	47.38	<0.001
	Nepali language	307520	510.19	50.09	

Results based on getting support by students out of school time are presented in Table 30. The table provides a detailed analysis of Science achievement scores among students, categorized by the type of support they receive for studying Science outside of school. The data reveals significant variations in performance based on whether students receive support from their father, mother, siblings, tuition, friends, or no support at all.

Starting with support from fathers, students who do not receive support have a slightly higher average Science achievement score (Mean = 505.08, SD = 49.28) compared to those who do receive support (Mean = 502.73, SD = 54.65). This difference is statistically significant, as indicated by the p-value of <0.001. Similarly, when examining support from mothers, students without support also perform better (Mean = 505.26, SD = 49.27) than those with support (Mean = 498.58, SD = 57.60), with a significant p-value of <0.001.

Transitioning to support from siblings, the trend continues. Students who do not receive support from their brothers or sisters have a higher average score (Mean = 506.49, SD = 50.18) compared to those who do (Mean = 501.90, SD = 49.22). This pattern is consistent and statistically significant. However, when considering tuition support, the results differ slightly. Students who receive tuition support have a marginally higher average score (Mean = 505.66, SD = 47.83) than those who do not (Mean = 504.38, SD = 50.94), again with a significant p-value.

Moreover, support from friends appears to have a positive impact on students' performance. Those who receive support from friends have a higher average score (Mean = 511.11, SD = 49.98) compared to those who do not (Mean = 503.40, SD = 49.75). This difference is statistically significant, suggesting that peer support may play a crucial role in academic success. Interestingly, students who report receiving no support at all have the highest average score (Mean = 517.01, SD = 58.85), significantly outperforming those who do receive some form of support (Mean = 504.07, SD = 49.17). However, the number students who have agreement on support receive were 441978 were higher than those who (27585) disagree on receiving support.

Overall, the data reveals that support from family members (father, mother, siblings) is generally associated with lower average scores, whereas support from friends correlates with higher performance. Interestingly, students who report receiving no support at all achieve the highest scores, suggesting that self-reliance might play a crucial role in their academic success. These findings highlight the complex dynamics of support systems and their varying impacts on students' Science achievement. A deeper analysis might reveal that support is more significant for students at lower proficiency levels than for those at higher proficiency levels. Therefore, average performance alone may not fully capture the underlying issues faced by different groups of students with varying proficiency in Science.

Table 30 Results based on support to study in learning Science out of school (n=469563)

Support by	Categories	N	Mean	SD	p-value
Father	No	419644	505.08	49.28	<0.001
	Yes	49919	502.73	54.65	
Mother	No	438807	505.26	49.27	<0.001
	Yes	30756	498.58	57.60	
Brother/sister	No	299388	506.49	50.18	<0.001
	Yes	170175	501.90	49.22	
Tuition	No	306812	504.38	50.94	<0.001
	Yes	162751	505.66	47.83	
Friends	No	382849	503.40	49.75	<0.001
	Yes	86714	511.11	49.98	
No support	No	441978	504.07	49.17	<0.001
	Yes	27585	517.01	58.85	

Science Achievement Score Based on Spending Time Out of School

Results based on time spending out of school (only reported mean score in the figure) in using TV/internet/mobile, play with friends, household chores, study/homework, work of wages, and support for siblings are reported in this section in Table 31 and Figure 20. The time spending out of school related activities were measured in five-point rating scales as time not given, less than one hour, 1–2-hours, 2-4 hours, and more than 4 hours. The analysis of achievement scores based on time allocation to various activities reveals distinct patterns.

Table 31 presents Science achievement scores based on the amount of time students spend on various activities outside of school. Starting with the use of digital resources, students who spend 2-4 hours on this activity have the highest average Science achievement score (Mean = 521.05, N = 442,080). Those who spend 1-2 hours also perform well (Mean = 516.91), followed by those who spend more than 4 hours (Mean = 507.34). Students who spend less than 1 hour have a score of 504.59, while those with no time given have the lowest score (Mean = 499.07). Overall, the total average score for this category is 506.69, indicating that moderate use of digital resources is associated with higher achievement.

Next, examining the time spent talking with friends, students who spend 2-4 hours have the highest average score (Mean = 513.70, N = 434,792). Those who spend less than 1 hour and 1-2 hours have similar scores (507.08 and 506.17, respectively). Students who spend more than 4 hours talking with friends have a lower score (Mean = 497.50), and those with no time given have a score of 505.06. The total average score for this category is 506.64, suggesting that moderate social interaction is beneficial for Science achievement.

Moving on to playing games, students who do not spend any time on this activity have the highest average score (Mean = 513.98, N = 428,106). Those who spend less than 1 hour have a score of 505.69, followed by those who spend 1-2 hours (Mean = 502.39). Students who spend 2-4 hours and more than 4 hours playing games have lower scores (492.63 and 497.32, respectively). The total average score for this category is 507.02, indicating that minimal gaming is associated with higher achievement.

Regarding household chores, students who do not spend any time on this activity have the highest average score (Mean = 514.29, N = 424,678). Those who spend less than 1 hour have a similar score (515.14). Students who spend 1-2 hours have a score of 502.95, while those who spend 2-4 hours and more than 4 hours have lower scores (495.15 and 481.56, respectively). The total average score for this category is 507.00, suggesting that minimal time spent on chores is linked to higher achievement.

When considering work for daily wages, students who do not spend any time on this activity have the highest average score (Mean = 514.21, N = 398,486). Those who spend less than 1 hour have a significantly lower score (488.77), followed by those who spend 1-2 hours (483.97) and 2-4 hours (484.34). Students who spend more than 4 hours have the lowest score (481.14). The total average score for this category is 508.32, indicating that not working for daily wages is associated with higher achievement.

In terms of studying for entertainment, students who do not spend any time on this activity have the highest average score (Mean = 519.83, N = 424,676). Those who spend less than 1 hour have a score of 509.20, followed by those who spend 1-2 hours (506.61). Students who spend 2-4 hours and more than 4 hours have lower scores (496.29 and 490.91, respectively). The total average score for this category is 507.52, suggesting that minimal time spent on studying for entertainment is linked to higher achievement.

Finally, examining the time spent on study and homework, students who spend more than 4 hours on this activity have the highest average score (Mean = 511.70, N = 435,591). Those who spend 2-4 hours also perform well (510.43), followed by those who spend 1-2 hours (504.44). Students who spend less than 1 hour have a score of 487.73, while those with no time given have the lowest score (475.82). The total average score for this category is 506.97, indicating that more time spent on study and homework is associated with higher achievement.

In summary, the data suggests that moderate use of digital resources and talking with friends are associated with higher Science achievement scores. Minimal time spent playing games, doing household chores, and studying for entertainment also correlates with higher scores. Conversely, not working for daily wages and spending more time on study and homework are linked to better performance. These findings highlight the importance of balanced time management and the potential benefits of certain activities on students' academic success in Science.

Table 31 Science achievement score based on spending time out of school

Time Spending Activities	No time given	< 1 hour	1-2 hours	2-4 hours	>4 hours	Total
Use of digital resources (n=442080)	499.07	504.59	516.91	521.05	507.34	506.69
Talking with friends (n=434792)	505.06	507.08	506.17	513.70	497.50	506.64
Playing games (n=428106)	513.98	505.69	502.39	492.63	497.32	507.02

Time Spending Activities	No time given	< 1 hour	1-2 hours	2-4 hours	>4 hours	Total
Household chores (n=424678)	514.29	515.14	502.95	495.15	481.56	507.00
Work for daily wages (n=398486)	514.21	488.77	483.97	484.34	481.14	508.32
Study for entertainment (n=424676)	519.83	509.20	506.61	496.29	490.91	507.52
Study and homework (n=435591)	475.82	487.73	504.44	510.43	511.70	506.97

The horizontal bar chart in Figure 19 provides a detailed breakdown of the time that students spend on various activities outside of school, with the number of respondents indicated in parentheses next to each activity. Starting with "Study and homework" (N = 435,591), the largest percentage (35.1%) reported spending 2 to 4 hours on this activity. This is followed by 31.3% who spent more than 4 hours, 24.1% who spent 1-2 hours, 7.3% who spent less than 1 hour, and 2.2% who spent no time study and homework. This distribution suggests that a significant portion of students either dedicate a substantial amount of time to studying and homework.

Next, examining "Study for entertainment" (N = 424,676), the majority (42.3%) spend less than 1 hour on this activity. This is followed by 28.3% who spend 1-2 hours, 13.2% who spend no time, 11% who spend 2-4 hours, and 5.1% who spend more than 4 hours. This indicates that most students engage in studying for entertainment for short periods.

Moving on to "Daily wages" (N = 398,486), a significant majority (79.6%) do not spend time on this activity. This is followed by 8% who spend less than 1 hour, 5.3% who spend 1 to 2 hours, 3.2% who spend 2-4 hours, and 3.9% who spend more than 4 hours. This result highlights that most students are not involved in daily wage work.

Regarding "Household chores" (N = 424,678), the highest percentage (38.6%) spend less than 1 hour on this activity. This is followed by 34.7% who spend 1-2 hours, 11.9% who spend 2-4 hours, 10.5% who spend no time, and 4.3% who spend more than 4 hours. This suggests that most students spend a limited amount of time on household chores.

When considering "Playing games" (N = 428,106), the majority (47.5%) spend less than 1 hour on this activity. This is followed by 29% who spend no time, 20.1% who spend 1-2 hours, 2.6% who spend 2-4 hours, and 0.9% who spend more than 4 hours. This indicates that most students engage in gaming for short periods.

Furthermore, examining "Talking with friends" (N = 434,792), the largest percentage (62.2%) spend less than 1 hour on this activity. This is followed by 17% who spend no time, 16.4% who spend 1 to 2 hours, 2.9% who spend 2-4 hours, and 1.5% who spend more than 4 hours. This shows that most students spend a moderate amount of time socializing with friends.

Finally, for "Use of digital resources" (N = 442,080), the highest percentage (54.6%) spend less than 1 hour on this activity. This is followed by 21.1% who spend 1-2 hours, 19.6% who spend no time, 3.2% who spend 2-4 hours, and 1.5% who spend more than 4 hours. This suggests that most students use digital resources for short periods.

In summary, the chart provides insights into how students allocate their time across various activities outside of school. It highlights that a significant portion of students either dedicate substantial time to studying and homework. Most students engage in studying for entertainment, playing games, and using digital resources for short periods. Conversely, a vast majority of students tend to spend no time on daily wages activities. Additionally, moderate social interaction with friends is common among students. These findings underscore the diverse ways in which students manage their time outside of school and the varying impacts of different activities on their daily routines that might affect achievements in Science.

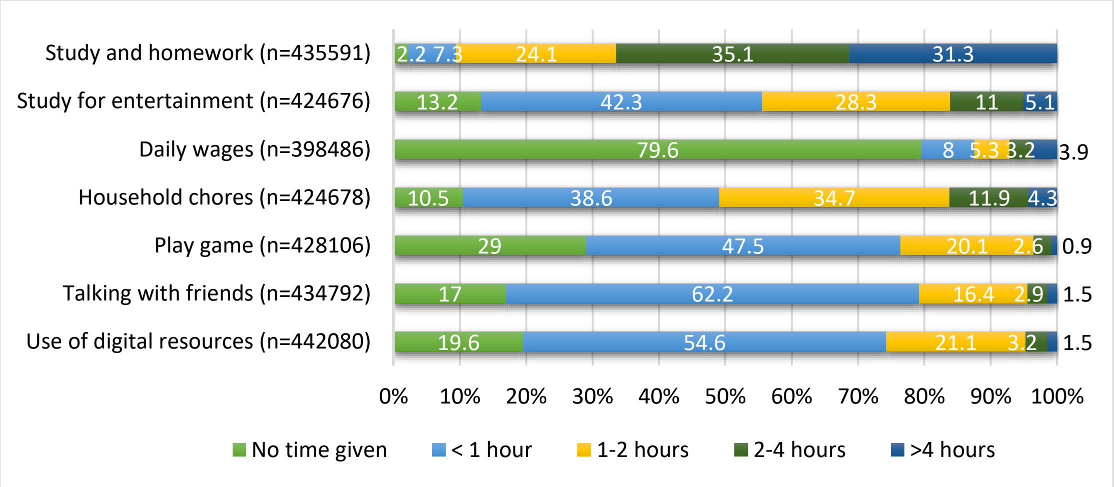


Figure 18 Pattern to spend time for different activities out of school

Science Achievement Based on Future Aims of the Students

Achievement scores of the students based on their future aims are presented in Figure 20. Figure 20 provides a detailed comparison of mean achievement scores in Science among students with different career aspirations. Starting with students aspiring to be teachers, they have the lowest mean Science achievement score of 481.75, with a standard deviation (SD) of 43.48, indicating moderate variability in their scores. Conversely, students aiming for government jobs have a mean score of 499.39 (SD = 43.70), suggesting slightly less variability compared to other groups.

Moving on to students aspiring to be engineers, they exhibit a high mean score of 518.84 (SD = 52.97), showing considerable variability. Similarly, students aiming to become doctors have a mean score of 505.47 (SD = 53.13), indicating greater variability in their scores. Additionally, students aspiring to be businessmen have one of the highest mean scores at 519.38 (SD = 49.76), demonstrating moderate variability. Meanwhile, students planning to work abroad have a mean score of 507.22 (SD = 46.62), indicating moderate variability.

Furthermore, students aiming to become farmers have a lower mean score of 492.61 (SD = 46.16), suggesting less variability compared to other groups. Lastly, students aspiring to other occupations have a mean Science achievement score of 513.03 (SD = 49.35), indicating moderate variability in scores. Overall, the data suggests that students aspiring to be businessmen and engineers have the highest mean Science achievement scores, indicating strong academic performance in Science. Conversely, students aiming to become teachers have the lowest mean score, suggesting a potential area for academic support. The variability in scores, as indicated by the standard deviations, also highlights differences in performance consistency among the groups. These findings provide valuable insights into how future career aspirations correlate with Science achievement among students.

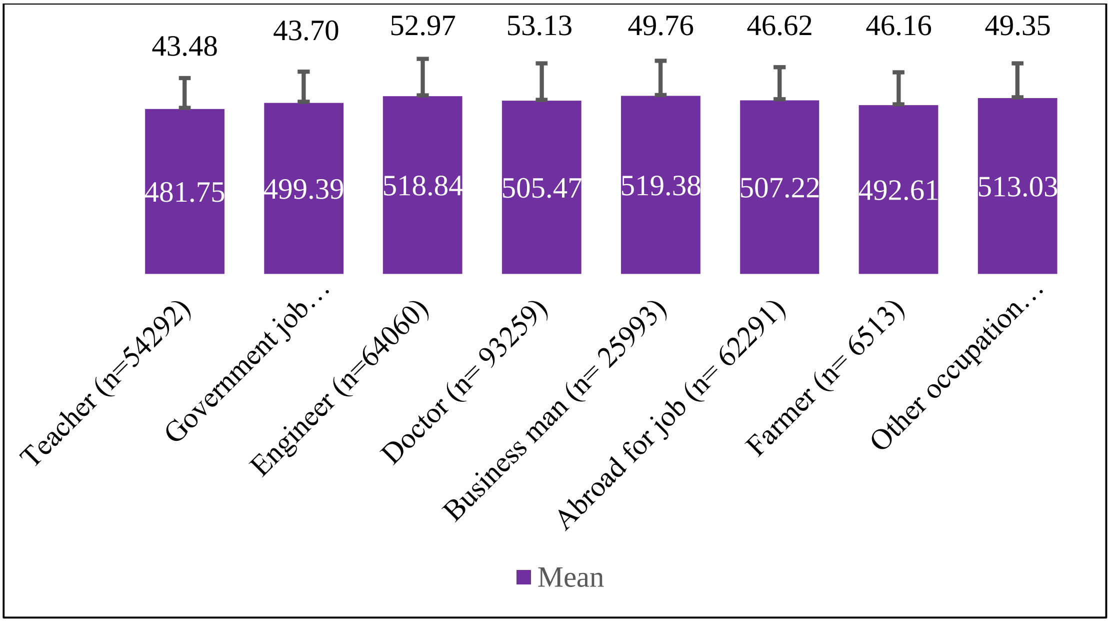


Figure 19 Science achievement based on future aims

Performance in Science by Parent's Education

Science achievement score of the students based on their fathers and mothers' education is presented in Table 32. The data reveals a clear trend where higher parental education levels correlate with higher Science achievement scores among students. For mothers, the mean scores range from 490.18 (SD = 44.42) for illiterate mothers to 549.87 (SD = 61.73) for those with a Master's degree or higher. Similarly, for fathers, the mean scores range from 481.63 (SD = 41.70) for illiterate fathers to 552.40 (SD = 54.78) for those with a Master's degree or higher. These results indicate that students whose parents have higher educational qualifications tend to perform better in Science.

The p-value of 0.001 for both mothers' and fathers' education levels indicate that the differences in mean Science achievement scores across the various education levels are statistically significant. This suggests that parental education is a significant factor influencing students' Science performance. The standard deviations also show some variability, with higher education levels generally associated with slightly higher variability in scores, particularly for mothers. Overall, the data underscores the importance of parental education in shaping students' academic outcomes in Science. Since the achievement score of the students having illiterate parents has poor academic performance, however still 26.29% mother and 10.64% father are illiterate whereas 34.67% mother and 29.06% father are simply literate.

Table 32 Science achievement score by parents' education

Categories	Mother education (n=463969)			Fathers' education (n=460559)		
	N	Mean	SD	N	Mean	SD
Illiterate	121970	490.18	44.42	49006	481.63	41.70
Literate	160871	501.32	45.02	133846	497.22	43.98
Up to 10 class	107905	509.46	50.24	144343	502.48	47.69
12 class	48668	525.92	51.62	82811	517.16	50.08
Bachelors	16814	544.97	53.65	32313	531.63	51.62
Masters or above	7740	549.87	61.73	18240	552.40	54.78
p-value	<0.001			<0.001		

Figure 21 illustrates a clear positive correlation between the mother's education level and student achievement in Science. Students with illiterate mothers have the lowest mean score of 490.18. As the mother's education level increases, the mean scores also rise. For literate mothers, the mean score is 501.32, and it continues to increase for mothers with education up to the 10th class (509.46) and 12th class (525.92). The trend continues with students whose mothers have a Bachelor's degree, showing a mean score of 544.97. The highest mean score of 549.87 is observed among students whose mothers have a Master's degree or higher. This upward trend suggests that higher maternal education levels are associated with better student performance in Science.

Figure 22 shows a positive correlation between the father's education level and student achievement in Science. Students with illiterate fathers have the lowest mean score of approximately 481.63. As the father's education level increases, the mean scores also rise. For literate fathers, the mean score is around 497.22, and it continues to increase for fathers with education up to the 10th class (502.48) and 12th class (517.16). The trend continues with students whose fathers have a Bachelor's degree, showing a mean score of about 531.63. The highest mean score of approximately 552.40 is observed among students whose fathers have a Master's degree or higher. This upward trend suggests that higher paternal education levels are associated with better student performance in Science.

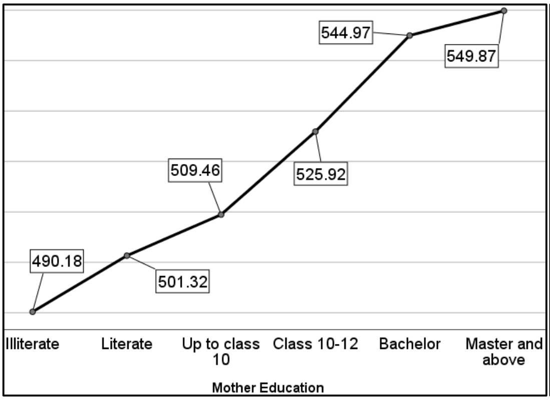


Figure 20 Average achievement in Science by mother education

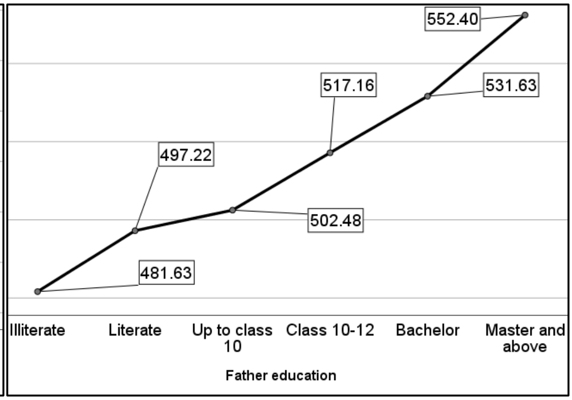


Figure 21 Average achievement in Science by father education

Science Achievement Scores by Occupations of the Parents

Figure 23 shows a clear relationship between the mother's occupation and student achievement in Science. Students whose mothers are involved in teaching have the highest average Science scores, around 533.47. This is followed by students whose mothers work in government jobs (527.59) and business (524.69). These occupations seem to be associated with higher student performance in Science. On the other hand, students whose mothers are engaged in farming and housework have the lowest average scores, approximately 495.67. Those whose mothers do housework only or work in others' houses have slightly higher scores, around 502.33 and 501.23, respectively. This suggests that students tend to perform better in Science when their mothers are engaged in professional or skilled occupations compared to unskilled or domestic work.

Figure 24 shows the relationship between the father's occupation and student achievement in Science. Students whose fathers are in teaching have the highest average Science achievement score, approximately 525.14. This is followed by students whose fathers are in other jobs (519.28) and Government jobs (517.90). Business comes in fourth place with an average score of 516.93. These occupations are associated with higher student performance in Science. Conversely, students whose fathers are involved in Work in Others' Houses have the lowest average score, around 475.97. Other lower-scoring categories include Housework only (483.42) Farming and Housework (489.69) and Labor work (499.15). This suggests that students tend to perform better in Science when their fathers are engaged in professional or skilled occupations compared to unskilled or domestic work.

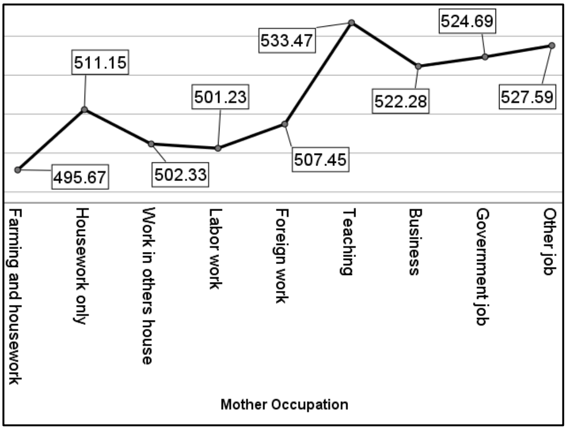


Figure 22 Average achievement in Science by mother occupation

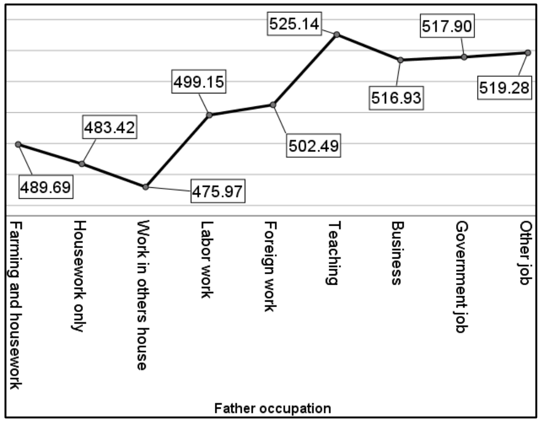


Figure 23 Average achievement in Science by father occupation

Table 33 shows that the overall results found to be significant among and between all profession categories of parents of the students. The table presents Science achievement scores based on the occupations of students' parents. For mothers, the highest mean score is observed for those in teaching (533.47, SD = 56.24), followed by those in other jobs (527.59, SD = 51.47), and government jobs (524.69, SD = 53.52). Conversely, the lowest mean scores are seen for mothers involved in farming and housework (495.67, SD = 45.60) and those working in others' houses (502.33, SD = 51.96).

For fathers, the highest mean score is also observed for those in teaching (525.14, SD = 54.97), followed by those in other jobs (519.28, SD = 49.03), and government jobs (517.90, SD = 53.37). The lowest mean scores are seen for fathers involved in work in others' houses (475.97, SD = 40.32) and housework only (483.42, SD = 47.22).

The p-values for both mothers' and fathers' occupations are less than 0.001, indicating that the differences in mean Science achievement scores across the various occupations are statistically significant. This data suggests that parental occupation is a significant factor influencing students' Science performance, with professional and skilled occupations generally associated with higher student achievement.

The table further gives interesting results that the achievement score students having their mothers job as farming and housework, work in others house, and labor work have poor results, however share of such mother is around four-fifth (77.99%). Similarly, the achievement score of the students whose father are working in farming and housework, housework only, work in others house, labor work, and foreign work have poor achievement score, however that shares around two-third students (57.29%). The achievement score of the students with teaching is main profession of their father (3.64%) and mother (3.56%) have better performance, however that shares very poor number of students.

Table 33 Science achievement score by occupations of the parents

Categories	Mother occupation (n=463641)			Fathers' occupation (n=460896)		
	N	Mean	SD	N	Mean	SD
Farming and housework	252920	495.67	45.60	111817	489.69	44.71
Housework only	104925	511.15	51.45	7847	483.42	47.22
Work in others house	3771	502.33	51.96	5387	475.97	40.32
Labor work	5109	501.23	44.33	32958	499.15	41.98
Foreign work	10582	507.45	47.10	106039	502.49	46.21
Teaching	16525	533.47	56.24	16771	525.14	54.97
Business	41106	522.28	49.01	80500	516.93	51.64
Government job	12964	524.69	53.52	40860	517.90	53.37
Other job	15739	527.59	51.47	58717	519.28	49.03
p-value	<0.001			<0.001		

Science Achievement Score of Students by Facilities at Home

The bar chart in Figure 25 illustrates the availability of various facilities at home that support Science learning. The facilities include Internet, Inverter, Separate room for study, someone helps with study, Paper-based study material, Science lab at home, Computer/laptop for study work, Science laboratory at school, and Paid tutor for learning at home.

The chart shows that the majority of students have their study tables at home (82.1%) and a separate room for study at home (74.2%). A significant number of students also live in Pakki Ghar (cement and brick house) (67%) and have internet access at home (64.5%). However, fewer students have access to software for learning at home (18.1%), Science dictionary (24.3%), and computer for school work (31.5%). This data highlights the disparities in access to educational resources that can significantly impact Science learning at home.

Since the results are poor among the students not having the measured facilities at home, however around one-fifth students have lack of table (17.9%), around one-third have lack of internet (35.5%), Pakki Ghar (33%), and peace place for study (35.7%), one-fourth have lack of separate room for study (25.8%), around half have lack of Science related books (49.0%), around three quarter have lack of instruments/materials for doing Science related works (70.5%), computer for school work (68.5%), and Science dictionary (75.7%), and more than four-fifth have lack of software for learning (81.9%).

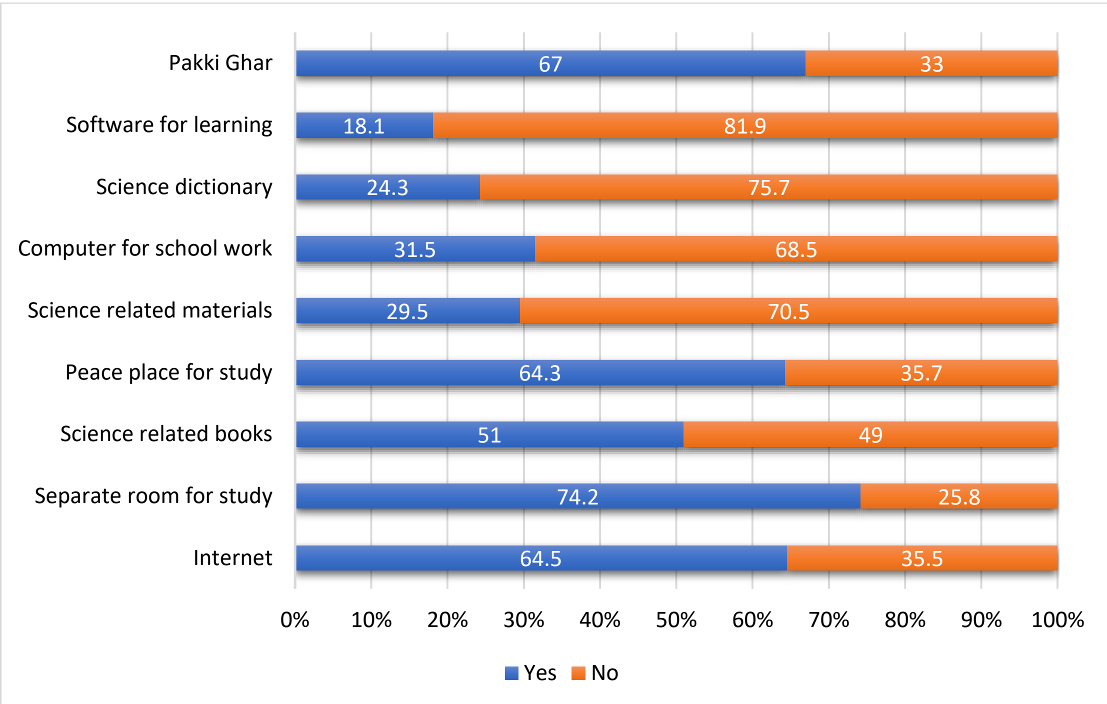


Figure 24 Science achievement score of students by facilities at home

Table 34 presents the achievement scores of students who participated in a Science test, categorized by the availability of various resources at home. Students with a table (N=357,577) had a higher mean score (507.31, SD=48.63) compared to those without a table (N=77,757; Mean=488.01, SD=46.45). Similarly, students with internet access (N=297,547) scored higher (Mean=513.32, SD=50.85) than those without it (N=163,835; Mean=489.68, SD=44.79).

For those with a separate room for study (N=344,513), the mean score was 505.76 (SD=49.42), while those without a separate room (N=119,689) had a mean score of 502.00 (SD=51.15). Students with Science-related books (N=233,208) scored higher (Mean=512.91, SD=51.85) than those without (N=224,484; Mean=496.48, SD=46.61).

Furthermore, students with a peaceful place to study (N=295,032) had a mean score of 508.78 (SD=50.30), compared to those without (N=163,629; Mean=497.86, SD=48.63). Those with Science-related materials (N=133,834) scored higher (Mean=510.96, SD=51.96) than those without (N=320,191; Mean=502.02, SD=49.05).

Likewise, Students with a computer for school work (N=142,643) had a mean score of 519.13 (SD=54.03), while those without (N=310,227) had a mean score of 498.33 (SD=46.85). Those with a Science dictionary (N=109,591) scored higher (Mean=508.92, SD=52.50) than those without (N=340,725; Mean=503.42, SD=49.20).

Finally, students with software for learning (N=80,766) had a mean score of 518.34 (SD=56.81), compared to those without it (N=365,997; Mean=501.80, SD=48.11). Students living in a permanent house (Pakki Ghar) (N=285,463) had a higher mean score (511.26, SD=50.53) than those without (N=140,601; Mean=499.07, SD=46.90). These results highlight the positive impact of having these resources on students' academic performance in Science.

Table 34 Achievement score based on availability of resources (participated in Science test) at their home

Variables with categories	**N**	**Mean**	**SD**	**Variables with categories**	**N**	**Mean**	**SD**
Table (n=435334)				Internet (n=461383)			
No	77757	488.01	46.45	No	163835	489.68	44.79
Yes	357577	507.31	48.63	Yes	297547	513.32	50.85
Separate room for study (n=464202)				Science related books (n=457692)			
No	119689	502.00	51.15	No	224484	496.48	46.61
Yes	344513	505.76	49.42	Yes	233208	512.91	51.85
Peace place for study (n=458661)				Science related materials (n=454025)			
No	163629	497.86	48.63	No	320191	502.02	49.05
Yes	295032	508.78	50.30	Yes	133834	510.96	51.96
Computer for school work (n=452870)				Science dictionary (n=450316)			
No	310227	498.33	46.85	No	340725	503.42	49.20
Yes	142643	519.13	54.03	Yes	109591	508.92	52.50

Variables with categories	N	Mean	SD	Variables with categories	N	Mean	SD
Software for learning (n=446764)				Pakki Ghar (n=426064)			
No	365997	501.80	48.11	No	140601	499.07	46.90
Yes	80766	518.34	56.81	Yes	285463	511.26	50.53

The student's achievement score based on home accessories are presented in Table 35. The home accessories represent mobile, TV, computer, motorbike, and car. The data reveals significant differences in Science achievement scores based on the availability of various home accessories. To begin with, students who have access to a mobile phone, which constitutes 94.4% of the sample, exhibit a higher mean score of 506.46 (SD = 49.61) compared to those without a mobile phone, who make up 5.6% of the sample and have a mean score of 489.89 (SD = 48.90). This difference is statistically significant, as indicated by a p-value of less than 0.001.

Moving on to television availability, 64.3% of students with a TV at home achieve a mean score of 515.02 (SD = 49.98), whereas the 35.7% of students without a TV score lower, with a mean of 494.99 (SD = 46.15). This difference is also statistically significant, with a p-value of less than 0.001, suggesting that having a TV at home may positively influence Science achievement. Furthermore, the presence of a computer at home appears to have a substantial impact on students' Science scores. Specifically, 29.8% of students with a computer achieve a mean score of 526.83 (SD = 53.41), significantly higher than the 70.2% of students without a computer, who have a mean score of 500.68 (SD = 46.29). This difference is statistically significant, with a p-value of less than 0.001.

Additionally, students with access to a motorcycle, representing 45.4% of the sample, have a higher mean score of 516.97 (SD = 52.25) compared to those without a motorcycle, who constitute 54.6% of the sample and have a mean score of 500.41 (SD = 46.59). This difference is statistically significant, as indicated by a p-value of less than 0.001.

Lastly, the availability of a car at home also correlates with higher Science achievement scores. Students with a car, making up 6.5% of the sample, achieve a mean score of 521.82 (SD = 59.21), whereas the 93.5% of students without a car have a mean score of 507.48 (SD = 49.05). This difference is statistically significant, with a p-value of less than 0.001.

In summary, the availability of home accessories such as mobile phones, TVs, computers, motorcycles, and cars is associated with higher Science achievement scores among students. These findings underscore the importance of having access to these resources for academic success in Science. These resources at home not only denote the support the high achieving students have at home, but also it shows how socioeconomic factor has been a source an inequity in education in Nepal resulting in the achievement disparity in Science and possibly disciplines.

Table 35 Achievement score in Science based on home accessories

Categories	Percent	Mean	SD	P-value
Mobile (n=456299)				
Not available	5.6	489.89	48.90	<0.001
Available	94.4	506.46	49.61	
TV (n=423132)				
Not available	35.7	494.99	46.15	<0.001
Available	64.3	515.02	49.98	
Computer (n=392848)				
Not available	70.2	500.68	46.29	<0.001
Available	29.8	526.83	53.41	
Motorcycle (n=404624)				
Not available	54.6	500.41	46.59	<0.001
Available	45.4	516.97	52.25	
Car (n=375897)				
Not available	93.5	507.48	49.05	<0.001
Available	6.5	521.82	59.21	

Science Achievement Based on ECA Activities at School

Table 36 shows that the academic achievement score of students in Science which were calculated based on ECA activities and spare time activities in the classroom. The table presents the Science achievement scores of students based on their engagement in extracurricular activities (ECA) and leisure time activities at school.

Firstly, examining leisure time activities, students who spend their leisure time doing class work or homework, which accounts for 49.7% of the sample, have a mean score of 501.93 (SD = 50.00). In contrast, those who engage in group work, representing 15.3% of the sample, achieve a higher mean score of 513.88 (SD = 49.32). Students who spend their leisure time playing, making up 5.7% of the sample, have a lower mean score of 494.42 (SD = 52.17). Interestingly, students with no leisure time, constituting 29.3% of the sample, have a mean score of 508.68 (SD = 47.23). The p-value of less than 0.001 indicates that these differences are statistically significant.

Next, looking at the frequency of ECA at school, students who regularly participate in ECAs, representing 33.2% of the sample, have a mean score of 496.64 (SD = 49.88). Those who participate sometimes, making up 64.0% of the sample, achieve a higher mean score of 509.12 (SD = 49.11). Students who never participate in ECAs, accounting for 2.8% of the sample, have the highest mean score of 516.21 (SD = 48.31). The p-value of less than 0.001 suggests that these differences are also statistically significant.

Finally, considering participation in ECAs, students who regularly participate, representing 28.4% of the sample, have a mean score of 507.08 (SD = 51.75). Those who participate sometimes, making up 63.1% of the sample, have a mean score of 504.88 (SD = 48.83). Students who never participate in ECAs, constituting 8.5% of the sample, have a mean score of 503.42 (SD = 47.78). The p-value of less than 0.001 indicates that these differences are statistically significant.

In summary, the data suggests that students' Science achievement scores vary significantly based on their engagement in leisure time activities and extracurricular activities at school. Students who engage in group work or have no leisure time tend to perform better, as do those who participate in ECAs, whether regularly or sometimes.

Table 36 Performance on Science based on ECA and leisure time activities at school

Variables	Percent	Mean	SD	p-value
Leisure time activities (n=460025)				
Class work or homework	49.7	501.93	50.00	<0.001
Group work	15.3	513.88	49.32	
Play	5.7	494.42	52.17	
No leisure time	29.3	508.68	47.23	
Frequency of ECA at school (n=463283)				
Regular	33.2	496.64	49.88	<0.001

Variables	Percent	Mean	SD	p-value
Sometime	64.0	509.12	49.11	
Never	2.8	516.21	48.31	
Participation on ECA (n=462340)				
Regular	28.4	507.08	51.75	<0.001
Sometime	63.1	504.88	48.83	
Never	8.5	503.42	47.78	

Achievement of Students in Science Based on Teacher's Activities

Table 37 presents the Science achievement scores of students based on the frequency of homework assignments and feedback provided by their teachers. Firstly, regarding the frequency of giving homework, students who never receive homework, which accounts for 0.8% of the sample (N=3,820), have a mean score of 507.08 (SD = 47.10). In contrast, students who sometimes receive homework, representing 26.7% of the sample (N=124,342), achieve a higher mean score of 511.39 (SD = 53.31). However, the majority of students, 72.5% (N=337,112), who regularly receive homework, have a slightly lower mean score of 502.70 (SD = 48.30). The p-value of less than 0.001 indicates that these differences are statistically significant.

Next, examining the regularity of feedback, students who never receive feedback, making up 1.3% of the sample (N=5,988), have a mean score of 504.50 (SD = 52.56). Those who sometimes receive feedback, representing 20.0% of the sample (N=92,484), achieve a mean score of 505.94 (SD = 50.29). The majority of students, 78.7% (N=363,493), who regularly receive feedback, have a mean score of 504.96 (SD = 49.43). The p-value of less than 0.001 suggests that these differences are also statistically significant.

In summary, the data indicates that the frequency of homework assignments and the regularity of feedback from Science teachers have a significant impact on students' Science achievement scores. Students who sometimes receive homework tend to perform better, while regular feedback appears to have a more consistent, albeit modest, positive effect on their performance.

Table 37 Achievement based on giving homework and feedback by teacher

Teacher's activities in School		N (%)	Mean	SD	p-value
Giving homework (n=465274)	Never	3820 (0.8)	507.08	47.10	<0.001
	Sometimes	124342 (26.7)	511.39	53.31	
	Regular	337112 (72.5)	502.70	48.30	
Regularity of feedback (n= 461965)	Never	5988 (1.3)	504.50	52.56	<0.001
	Sometimes	92484 (20.0)	505.94	50.29	
	Regular	363493 (78.7)	504.96	49.43	

Table 38 presents the Science achievement scores of students based on their self-reported attitudes towards various aspects of their school environment and activities. Firstly, examining attitudes towards Science, 2.9% of students with a negative attitude have a mean score of 501.36 (SD = 51.77), while 97.1% of students with a positive attitude achieve a slightly higher mean score of 505.16 (SD = 49.75).

Next, looking at attitudes towards learning, 6.5% of students with a negative attitude have a mean score of 514.00 (SD = 51.69), which is interestingly higher than the mean score of 504.37 (SD = 49.62) for the 93.5% of students with a positive attitude. For attitudes towards practice, 16.0% of students with a negative attitude have a mean score of 511.57 (SD = 48.77), compared to the 84.0% of students with a positive attitude who have a mean score of 504.13 (SD = 49.86). Regarding attitudes towards teachers, 2.4% of students with a negative attitude have a mean score of 501.47 (SD = 52.40), while 97.6% of students with a positive attitude achieve a mean score of 505.05 (SD = 49.73). Finally, for attitudes towards the school environment, 1.0% of students with a negative attitude have a mean score of 503.92 (SD = 57.72), whereas 99.0% of students with a positive attitude have a mean score of 505.00 (SD = 49.69).

In summary, the data suggests that students with positive attitudes towards Science, teachers, and the school environment generally have higher Science achievement scores. However, interestingly, students with negative attitudes towards learning and practice show higher mean scores compared to their peers with positive attitudes in these areas. This indicates that while positive attitudes are generally associated with better performance, there are nuances that may require further exploration.

Table 38 Science achievement by self-reported attitude towards school environment and activities

Attitude variables	Negative attitude			Positive attitude		
	Percent	**Mean**	**SD**	**Percent**	**Mean**	**SD**
Attitudes towards Science (n=465835)	2.9	501.36	51.77	97.1	505.16	49.75
Attitudes towards learning (n=464690)	6.5	514.00	51.69	93.5	504.37	49.62
Attitudes towards practice (n=459676)	16.0	511.57	48.77	84.0	504.13	49.86
Attitudes towards teacher (n=466290)	2.4	501.47	52.40	97.6	505.05	49.73
Attitudes towards school environment (n=463356)	1.0	503.92	57.72	99.0	505.00	49.69

Bullying Status at School and Science Achievement

Table 39 presents the average Science achievement scores of students based on their experiences with bullying at school. Students who reported no bullying, representing 92,561 individuals, had a higher mean score of 506.78 (SD = 51.13). In contrast, the 260,455 students who reported experiencing bullying had a slightly lower mean score of 504.17 (SD = 48.69). The overall mean score for all 353,015 students was 504.86 (SD = 49.36). The p-value of less than 0.001 indicates that the difference in mean scores between students who experienced bullying and those who did not is statistically significant. This suggests that bullying has a negative impact on students' Science achievement. However, Figure 26 shows that 7.4% to 22.8% students are still facing any types of bulling in their classroom.

Table 39 Average achievement score in Science based on bullying at school

Responses	N	Mean	Std. Deviation	P
No bullying	92561	506.78	51.13	<0.001
Yes bullying	260455	504.17	48.69	
Total	353015	504.86	49.36	

The chart in Figure 26 illustrates various types of bullying experiences reported by students at school. For the statement "Things are stolen" (n=452,458), approximately

22.4% of students reported experiencing this type of bullying, while 77.6% did not. Regarding "Friends hurt me" (n=448,766), about 9.2% of students indicated they had been hurt by friends, whereas 90.8% had not.

When asked if they were "Forced to work with people I don't like" (n=447,291), around 7.5% of students said 'Yes', while 92.5% said 'No'. For the statement "Friends tease me" (n=446,494), approximately 12.7% of students reported being teased by friends, compared to 87.3% who did not experience this. Concerning being "Isolated" (n=446,439), about 7.4% of students felt isolated, while a significant majority, 92.6%, did not. Lastly, for the use of nicknames ("Use nickname", n=449,657), around 22.8% of students experienced this form of bullying, whereas 77.2% did not. These results highlight that while a majority of students do not experience these forms of bullying, a notable percentage still face various types of negative interactions at school.

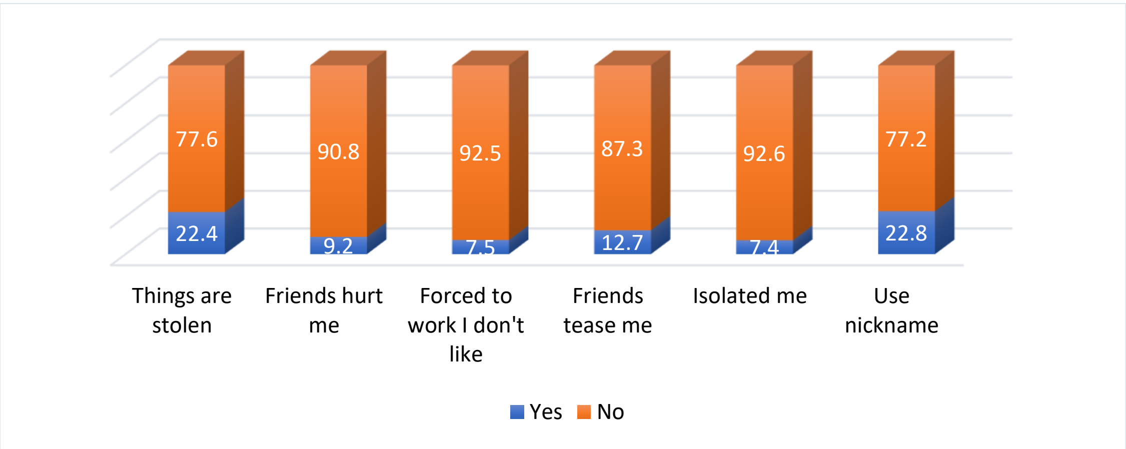


Figure 25 Status of bullying activities

Effect of Individual, Family and School Related Factors on Science Achievement

Table 40 illustrates the effect of individual and family factors on Science achievement. The model explains 23.10% variance with significant ANOVA. All variables have significant effect on achievement score of Science. The regression analysis reveals several significant factors influencing students' Science achievement scores. To begin with, the baseline achievement score is set at 470.62. Notably, speaking the home language positively impacts Science achievement, with a coefficient (B) of 4.41 and a significant t-value of 23.79 ($p < 0.001$, VIF = 1.10). Additionally, the time spent using digital resources also shows a positive effect (B = 5.89, t = 54.41, $p < 0.001$, VIF = 1.21), indicating that increased use of digital resources correlates with higher Science scores.

Conversely, several activities negatively impact Science achievement. For instance, time spent talking with friends ($B = -0.80$, $t = -7.06$, $p < 0.001$, VIF = 1.13), playing ($B = -3.28$, $t = -31.34$, $p < 0.001$, VIF = 1.13), doing household work ($B = -5.22$, $t = -57.11$, $p < 0.001$, VIF = 1.17), working for wages ($B = -4.57$, $t = -50.53$, $p < 0.001$, VIF = 1.15), and reading books for entertainment ($B = -4.44$, $t = -52.08$, $p < 0.001$, VIF = 1.16) all show negative coefficients. These activities likely reduce the time available for studying and homework, which, in contrast, has a positive effect ($B = 6.47$, $t = 74.75$, $p < 0.001$, VIF = 1.10).

Moreover, having access to a Science textbook significantly boosts achievement ($B = 10.48$, $t = 17.69$, $p < 0.001$, VIF = 1.02), while greater school distance negatively affects it ($B = -2.08$, $t = -26.65$, $p < 0.001$, VIF = 1.05). Interestingly, regular homework assignments by teachers have a slight negative impact ($B = -2.99$, $t = -16.73$, $p < 0.001$, VIF = 1.16), but regular checking and feedback positively influence scores ($B = 2.52$, $t = 13.32$, $p < 0.001$, VIF = 1.14).

Parental education also plays a crucial role; both mother's ($B = 2.64$, $t = 28.60$, $p < 0.001$, VIF = 1.99) and father's education ($B = 4.38$, $t = 50.96$, $p < 0.001$, VIF = 1.87) positively affect student achievement. Additionally, larger family size negatively impacts scores ($B = -1.24$, $t = -27.43$, $p < 0.001$, VIF = 1.07).

Furthermore, participation in extracurricular activities (ECA) at school shows mixed results. Regular ECA activities positively impact scores ($B = 6.58$, $t = 39.71$, $p < 0.001$, VIF = 1.12), but regular participation in ECA has a negative effect ($B = -5.63$, $t = -38.09$, $p < 0.001$, VIF = 1.12). Positive perceptions towards Science ($B = 5.41$, $t = 11.12$, $p < 0.001$, VIF = 1.08) and positive attitudes towards Science teachers ($B = 6.75$, $t = 11.61$, $p < 0.001$, VIF = 1.17) enhance achievement, while negative attitudes towards learning Science ($B = -5.95$, $t = -18.62$, $p < 0.001$, VIF = 1.06) and the school environment ($B = -9.70$, $t = -10.29$, $p < 0.001$, VIF = 1.15) detract from it.

Finally, having home accessories ($B = 4.45$, $t = 61.98$, $p < 0.001$, VIF = 1.55) and facilities ($B = 1.79$, $t = 38.63$, $p < 0.001$, VIF = 1.33) positively influence Science scores, while experiences of bullying slightly reduce them ($B = -0.50$, $t = -7.25$, $p < 0.001$, VIF = 1.09). In summary, the analysis highlights the complex interplay of various factors on students' Science achievement, with significant contributions from home environment, parental involvement, and school-related activities. The VIF values indicate that multicollinearity is not a concern in this model, ensuring the reliability of these findings.

Table 40 Effect of individual, parental, and school factors on Science achievement score

Predictors	B	SE	Beta	t	Sig.	VIF
(Constant)	470.62	1.49		314.86	<0.001	
Home language	4.41	0.19	0.04	23.79	<0.001	1.10
Time for using digital resources	5.89	0.11	0.10	54.41	<0.001	1.21
Time to talk with friends	-0.80	0.11	-0.01	-7.06	<0.001	1.13
Time for playing	-3.28	0.10	-0.05	-31.34	<0.001	1.13
Time for household work	-5.22	0.09	-0.10	-57.11	<0.001	1.17
Time for work for wages	-4.57	0.09	-0.09	-50.53	<0.001	1.15
Time for reading book for entertainment	-4.44	0.09	-0.09	-52.08	<0.001	1.16
Time for study and homework	6.47	0.09	0.13	74.75	<0.001	1.10
Available Science textbook	10.48	0.59	0.03	17.69	<0.001	1.02
School distance	-2.08	0.08	-0.04	-26.65	<0.001	1.05
Regularity of homework by teacher	-2.99	0.18	-0.03	-16.73	<0.001	1.16
Regularity of checking homework and feedback	2.52	0.19	0.02	13.32	<0.001	1.14
Mother education	2.64	0.09	0.06	28.60	<0.001	1.99
Father education	4.38	0.09	0.11	50.96	<0.001	1.87
Number of family member	-1.24	0.05	-0.05	-27.43	<0.001	1.07
Regularity ECA activities at school	6.58	0.17	0.07	39.71	<0.001	1.12
Regular participation in ECA	-5.63	0.15	-0.06	-38.09	<0.001	1.12
Perception towards Science subject	5.41	0.49	0.02	11.12	<0.001	1.08
Attitude towards learning Science	-5.95	0.32	-0.03	-18.62	<0.001	1.06
Attitudes towards Science teacher	6.75	0.58	0.02	11.61	<0.001	1.17
Attitude towards school environment	-9.70	0.94	-0.02	-10.29	<0.001	1.15
Home accessories	4.45	0.07	0.12	61.98	<0.001	1.55
Facilities at home	1.79	0.05	0.07	38.63	<0.001	1.33
Bullying activities	-0.50	0.07	-0.01	-7.25	<0.001	1.09

CHAPTER V

Findings on Assessment of Students Performance in English

National Mean Achievement Scores in English

Performance of the student was assessed using two parameters: "achievement score" and "proficiency level." The survey in 2023 is the second round, following the first conducted in 2019. Therefore, the findings of 2019 serve as the baseline, and the 2023 results are compared to them to measure students' performance in English. To facilitate this comparison, anchor items were calibrated. In the survey 2019, the national average achievement score was set at 500, with a standard deviation of 50. Scores above or below 500 indicate performance above or below the national average, respectively. Furthermore, independent sample t-test and ANOVA were performed to test the significance difference of mean achievement score across various factors.

The chart in Figure 27 illustrates a significant improvement in student achievement in Science within NASA studies over a four-year period. In 2019, the achievement level was recorded at 500.00. By 2023, this level had risen to 515.11, indicating a notable increase. This upward trend suggests that there have been effective interventions or changes implemented during this time, leading to enhanced student performance in English.

Mean Achievement Score at the National Level in English

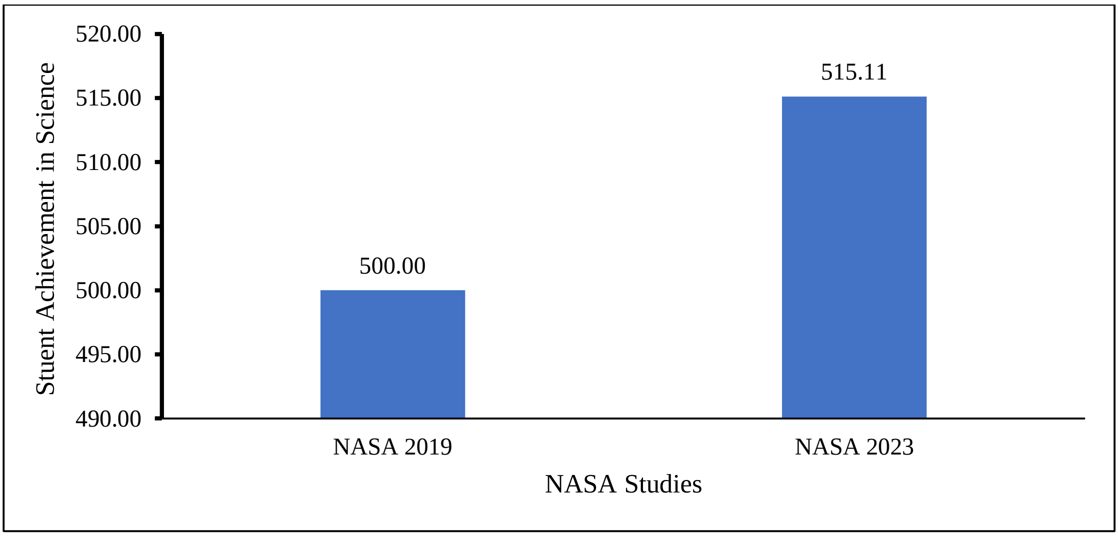


Figure 26 National mean achievement score of students in English (n = 4, 69,563)

Figure 28 illustrates the distribution of student achievement scores in English. The data shows almost a normal distribution, with most students scoring around the mean value of 515.11. The standard deviation is 49.79, indicating the spread of scores around the mean. The total number of observations is 469,563. The x-axis, labeled "achievement score," ranges from approximately 300 to 700, while the y-axis represents the frequency of scores. This distribution suggests that while the majority of students perform around the average, there is a considerable range of scores, reflecting varied levels of achievement in English among the students.

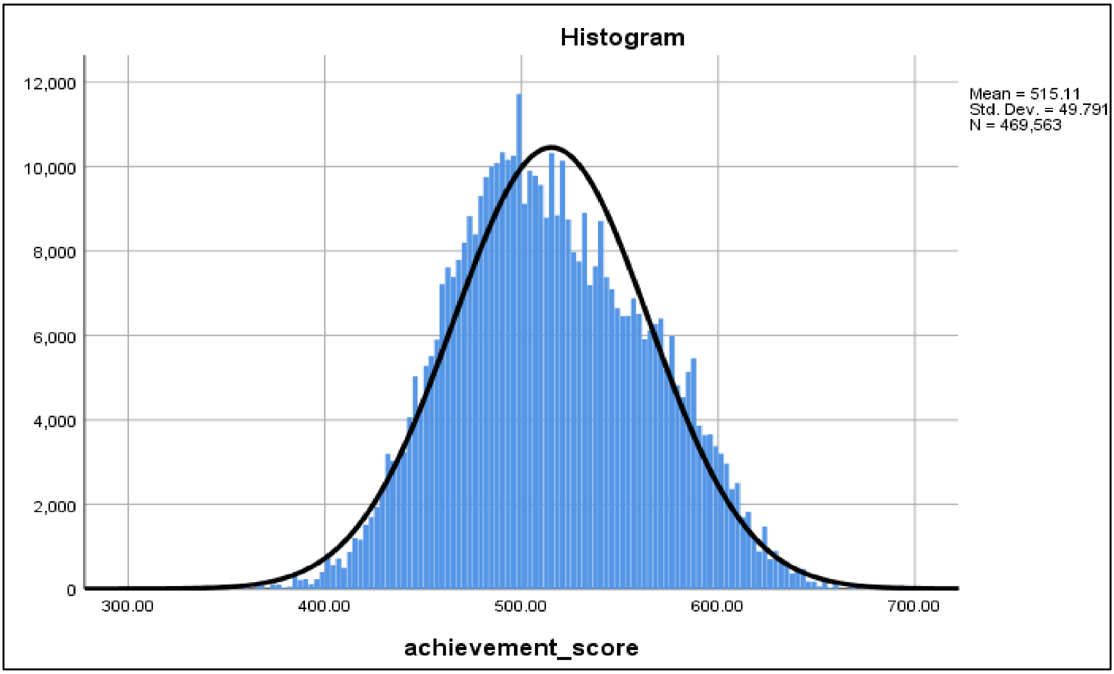


Figure 27 Distribution of achievement score of the students in English

Proficiency Levels of the Students in English

Figure 29 illustrates the national distribution of student proficiency levels, ranging from Level 1 (below basic) to Level 6 (advanced). The data reveals that 3.6% of students are performing below the basic proficiency level, while 8.6% have attained the basic level. Progressing up the proficiency scale, 17.2% of students are categorized at the first level of proficiency (Proficient 1), and 20.9% are at the second level (Proficient 2). Furthermore, 17.3% of students are classified at the third level of proficiency (Proficient 3). Notably, the largest segment, 32.4%, represents those who have reached an advanced level of proficiency. This distribution highlights a positive trend towards higher proficiency levels, with the majority of students performing at Proficient 2 or higher, indicating significant academic achievement and progress.

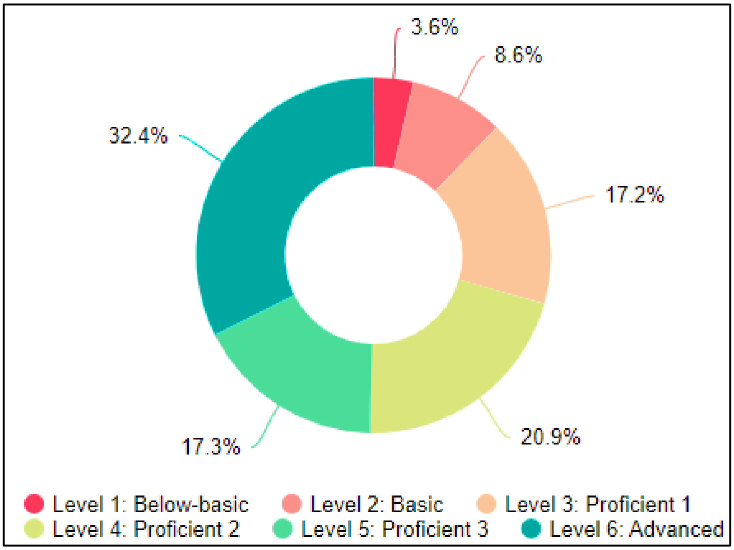


Figure 28 Proficiency level of the students in English at the national level

Mean Achievement Score of Students in English by Province

The bar chart in Figure 30 reveals the average English achievement scores of students across various provinces. Koshi has an average score of 520.34, while Madhesh scores slightly lower at 504.39. Bagmati leads with an impressive 535.78, surpassing the national average of approximately 515.11 for 2023, closely followed by Gandaki at 533.77. Lumbini's average is 515.79, which is almost at the national average for 2023. Karnali and Sudurpashchim have the lowest scores, at 489.61 and 492.03 respectively, below the national average. This data highlights significant regional disparities in student performance, suggesting a need for targeted educational support in lower-performing provinces to enhance overall student achievement in English.

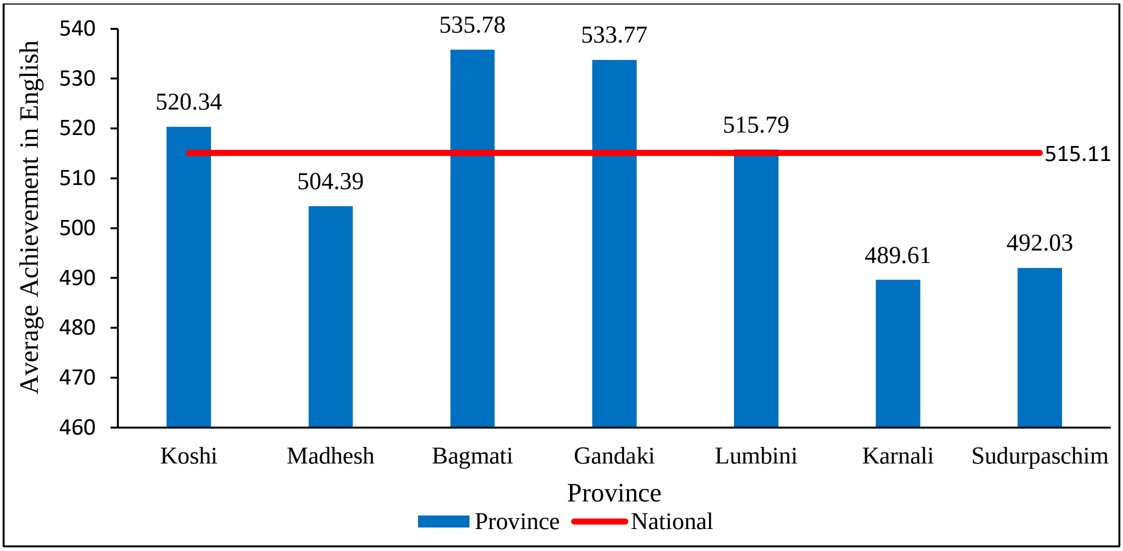


Figure 29 Mean achievement score of the students by province (n = 4, 69,563, & P-value: 0.001)

Proficiency Levels of Students in English by Province

The study shows a detailed comparison of proficiency levels across various provinces: Koshi, Madhesh, Bagmati, Gandaki, Lumbini, Karnali, and Sudurpashchim (Figure 31). Koshi shows moderate performance, with 2.2% at the below basic level, 6.4% at the basic level, and a substantial 35.8% at the advanced level. In contrast, Madhesh has higher percentages at lower proficiency levels, with 5.1% at the below basic level and 11.9% at the basic level, and a moderate 24.7% at the advanced level. Bagmati excels with the highest percentage of individuals at the advanced level (50.2%) and lower percentages at the below basic (1.3%) and basic (4.5%) levels. Similarly, Gandaki performs well with a significant 45.8% at the advanced level and low percentages at the below basic (1.0%) and basic (4.4%) levels. Lumbini presents a balanced distribution, with the highest percentages at Proficient 2 (21.8%) and Proficient 3 (19.4%), and a respectable 31.4% at the advanced level.

In contrast, Karnali exhibits the highest percentages at lower proficiency levels, with 8.6% at the below basic level and 15.2% at the basic level, and a low percentage at the advanced level (14.2%). Sudurpashchim also shows higher percentages at lower proficiency levels, with 6.1% at the below basic level and 14.6% at the basic level, and the lowest percentage at the advanced level (13.4%). Bagmati and Gandaki stand out for their superior overall performance at the advanced level, with 50.2% and 45.8%, respectively. Meanwhile, Karnali and Sudurpashchim indicate areas needing significant improvement, given their high percentages at lower proficiency levels and low percentages at the advanced level. Koshi, Madhesh, and Lumbini present a more balanced distribution, with moderate percentages across all proficiency levels. Madhesh, despite higher percentages at the below basic and basic levels compared to Koshi and Lumbini, maintains a reasonable percentage at the advanced level.

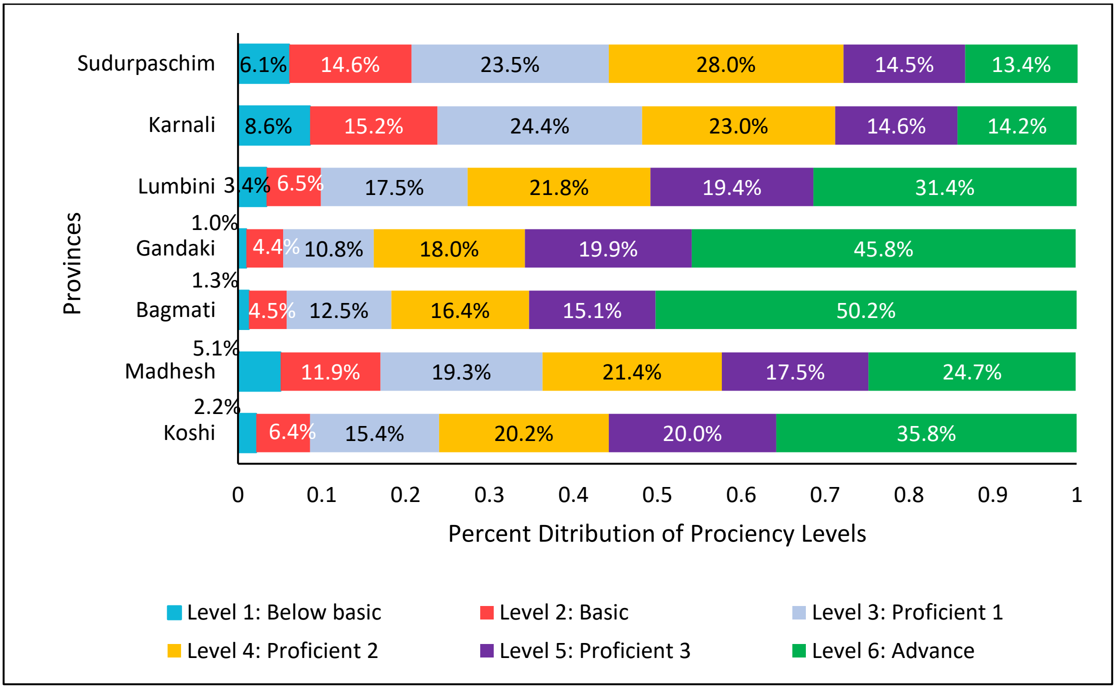


Figure 30 Proficiency level of the students by province (n = 4, 69,563)

Performance of the Students in English by Local Levels, Type of Schools and Gender

Table 41 provides a detailed analysis of student achievement in English, categorized by local level, types of school, and gender. At the local level, students from Nagar Palika exhibit a higher mean achievement score of 525.26 (SD = 50.58), based on a substantial sample size of 311,720 students. This score is significantly higher compared to students from Gau Palika, who have a mean score of 495.06 (SD = 41.44), based on 157,843 observations. The p-value of less than 0.001 for both groups indicates that these differences are statistically significant. This suggests that students in Nagar Palika are performing better in English compared to their counterparts in Gau Palika, possibly due to differences in resources, teaching quality, or other socio-economic factors.

When examining the types of schools, there is a clear distinction between community and institutional schools. Students in community schools have a mean achievement score of 503.09 (SD = 44.82), based on 374,276 observations. In contrast, students in institutional schools perform significantly better, with a mean score of 562.31 (SD = 39.12), based on 95,287 observations. The p-value of less than 0.001 underscores the statistical significance of this difference. This disparity highlights the potential impact of school type on student performance, with institutional schools possibly offering better facilities, more qualified teachers, or more effective teaching methods.

Gender-wise, boys have a slightly higher mean achievement score of 519.21 (SD = 48.42), based on 220,712 observations. Girls, on the other hand, have a mean score of 512.13 (SD = 50.49), based on 243,803 observations. The p-value of less than 0.001 indicates that this difference is statistically significant. Although the difference in scores between boys and girls is not as pronounced as the differences observed in local levels and school types, it still suggests a slight edge in performance for boys in English. This could be due to a variety of factors, including differences in learning styles, societal expectations, or access to educational resources.

Overall, the data reveals significant variations in student achievement in English based on local level, type of school, and gender. These insights can help educators and policymakers identify areas that require targeted interventions to improve educational outcomes and ensure more equitable access to quality education for all students.

Table 41 Mean achievement score in English by local level, types of school, and gender

Variables	Mean Achievement Score	SD	N	P-value
Palika				
Municipality	525.26	50.57725	311720	<0.001
Rural Municipality	495.06	41.44423	157843	
School types				
Community	503.09	44.82080	374276	<0.001
Institutional	562.31	39.12282	95287	
Gender				
Boys	519.21	48.42220	220712	<0.001
Girls	512.13	50.49152	243803	

Proficiency Levels of the students in English by Local Levels, School's Types, and Gender

Figure 32 presents distribution of students across local governance level, school types, and gender based on their proficiency levels in English. The findings show a comprehensive comparison of proficiency levels of students in terms of Palika, School Type, and Gender, highlighting both similarities and differences. Nagar Palika shows a significantly higher percentage of students at the advanced level (41.2%) compared to Gau Palika (15.0%). Whereas, Gau Palika has higher percentages at the lower proficiency levels, with 5.6% at the below basic level and 12.3% at the basic level, compared to Nagar Palika's 2.6% and 6.7%, respectively. Additionally, Gau Palika surpasses Nagar Palika at Proficient 1 (23.9% vs. 13.8%) and Proficient 2 (26.2% vs. 18.3%), while Nagar Palika shows a stronger performance at Proficient 3 (17.4% vs. 17.0%).

When comparing school types, Institutional schools dramatically outperform Community schools at the advanced level, with 75.8% of individuals reaching this level compared to 21.4% in Community schools. Community schools have higher percentages at lower proficiency levels, with 4.5% at the below basic level and 10.5% at the basic level, while Institutional schools have only 0.2% and 0.8%, respectively. Community schools also show higher percentages at Proficient 1 (21.0% vs. 2.4%), Proficient 2 (24.3% vs. 7.6%), and Proficient 3 (18.3% vs. 13.2%).

Regarding gender differences, Boys outperform Girls at the advanced level, with 35.4% compared to 30.0%. However, Girls have higher percentages at the below basic level (4.0% vs. 2.9%) and the basic level (9.8% vs. 7.0%). Both genders have similar percentages at Proficient 1 (Boys at 15.9% and Girls at 18.3%) and Proficient 2 (Boys at 20.5% and Girls at 21.4%). At Proficient 3, Boys have a slightly higher percentage (18.3%) compared to Girls (16.6%).

These findings suggest that Nagar Palika demonstrates stronger overall performance compared to Gau Palika, especially at the advanced level. Likewise, Institutional schools significantly outperform Community schools at the advanced level, while Community schools show higher percentages at lower proficiency levels. Boys slightly outperform Girls at the advanced level.

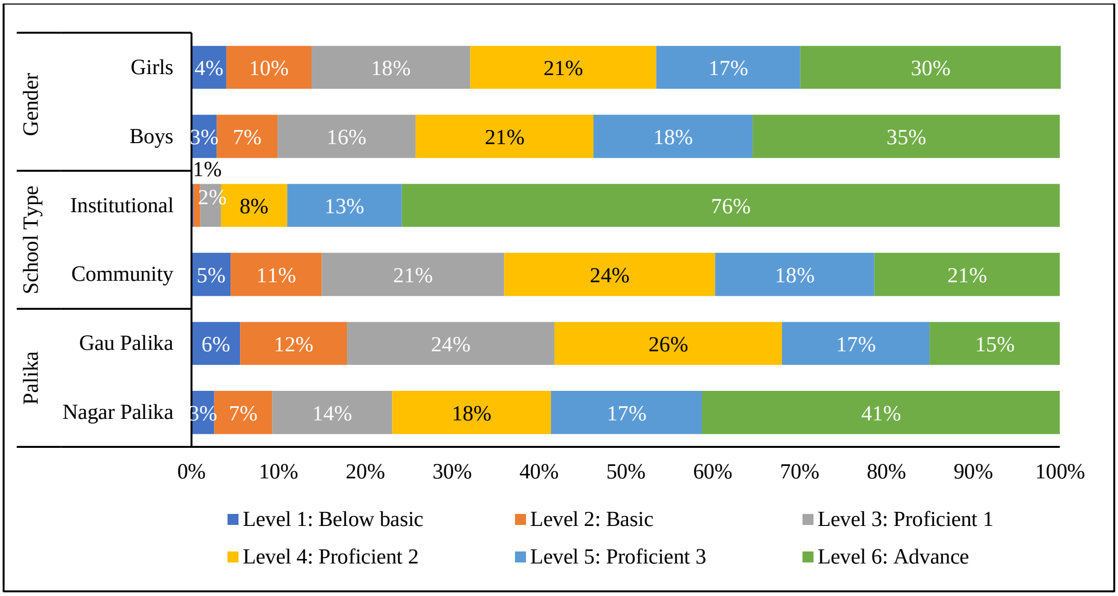


Figure 31 Proficiency level in English by local level, types of school, and gender

English Achievement by Background Variables

Table 42 provides a comprehensive analysis of student achievement in English, categorized by home language, geographical ethnicity, ethnicity, and family types. Starting with language, students who speak Nepali at home exhibit a higher mean achievement score of 523.44 (SD = 49.99) compared to those who speak other languages, who have a mean score of 500.46 (SD = 45.90). This significant difference, indicated by a p-value of less than 0.001, suggests that speaking Nepali at home may be associated with better performance in English.

Transitioning to geographical ethnicity, the data reveals that Pahadi students have the highest mean achievement score of 518.74 (SD = 50.70). This is followed by Madhesi students with a mean score of 514.33 (SD = 47.46), and Himali students with a mean score of 513.26 (SD = 44.05). The p-value of less than 0.001 underscores the significant differences among these groups, highlighting the impact of geographical background on student performance.

Examining ethnicity, Brahmin/Chhetri students lead with the highest mean achievement score of 521.97 (SD = 51.80). They are followed by students categorized as others, who have a mean score of 515.74 (SD = 48.13), Janajatis at 514.72 (SD = 47.18), and Dalit students with the lowest mean score of 504.06 (SD = 44.59). The significant differences, as indicated by a p-value of less than 0.001, suggest that ethnic background plays a crucial role in student achievement in English.

Finally, considering family types, students from nuclear families show a higher mean achievement score of 525.09 (SD = 49.26) compared to those from joint families, who have a mean score of 504.94 (SD = 47.87). The p-value of less than 0.001 indicates a statistically significant difference, suggesting that family structure may influence academic performance. These insights can guide educators and policymakers in developing targeted interventions to improve educational outcomes for all students.

Table 42 Achievement score in English by home language, ethnicity, geography, and family types

Variables	Categories	Mean	SD	N	P-value
Language	Other Language	500.46	45.90	170291	<0.001
	Nepali Language	523.44	49.99	299272	
Geographical Ethnicity	Himali	513.26	44.05	12636	<0.001
	Pahadi	518.74	50.70	258507	
	Madhesi	514.33	47.46	170732	
Ethnicity	Brahmin/Chhetri	521.97	51.80	186656	<0.00
	Janajatis	514.72	47.18	166076	
	Dalit	504.06	44.59	41952	
	Others	515.74	48.13	47191	
Family types	Nuclear family	525.09	49.26	244751	<0.001
	Joint Family	504.94	47.87	213689	

Performance of the Students in English Based on Parents' Education

The bar chart in Figure 33 illustrates the average achievement of students in English based on their parents' education levels, comparing both mothers' and fathers' education. The vertical axis represents the average achievement score, ranging from 480 to 580, while the horizontal axis lists different levels of parental education: Illiterate, Literate, 10th class, 12th class, Bachelor, and Masters or above. A national average line is also included for reference, standing at approximately 515 points.

For students with illiterate mothers, the average achievement score is around 496.43. This score increases to 507.69 for students with literate mothers. Those whose mothers completed the 10th class have an average score of about 527.40, while students with mothers who completed the 12th class achieve approximately 543.72. The scores continue to rise for students whose mothers have a Bachelor's degree (565.03) and peak for those with mothers holding a Master's degree or higher (564.31).

In comparison, students with illiterate fathers have an average score of about 489.43. This score jumps to 503.24 for students with literate fathers. For those whose fathers completed the 10th class, the average score is around 514.88. Students with fathers who finished the 12th class have an average score of about 530.59. The students with fathers who have a Bachelor's degree (549.33) and those with a Master's degree or higher (561.57). The differences between these achievements across different educational levels of both mother and father are significant at 0.001 level of significance.

This chart highlights a clear correlation between higher parental education levels and improved student achievement in English. Students whose parents have higher educational qualifications tend to perform better, suggesting that parental education plays a significant role in academic success.

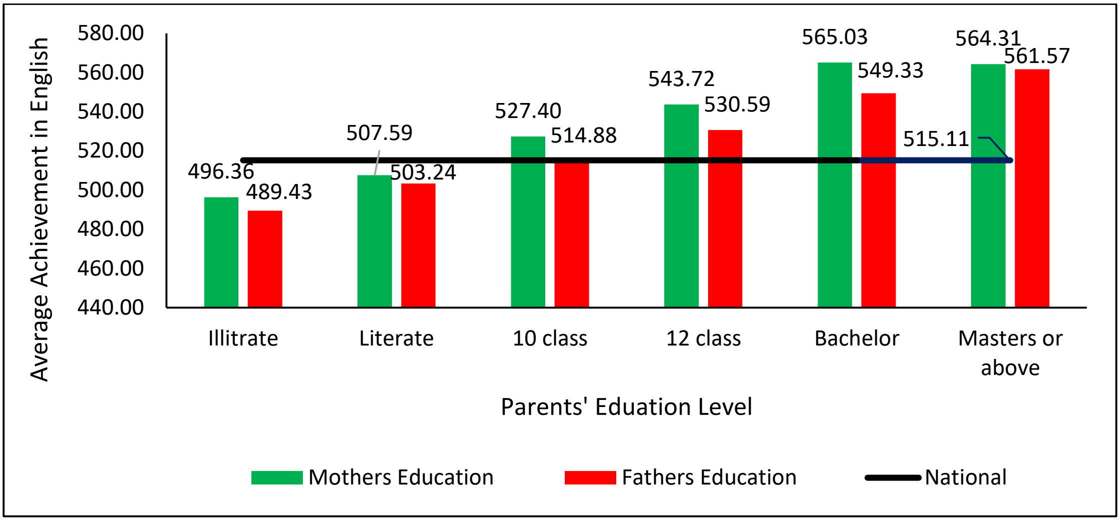


Figure 32 Mean achievement score of students in English by parent's education (n = 469563, p-value for mother education < 0.001, and p-value for father education < 0.001)

Performance of the Students in English Based on Parents' Occupation

The bar chart in Figure 34 illustrates the average achievement in English of students based on their parents' occupation, comparing scores associated with mothers' and fathers' occupations, and including a national average for reference. The vertical axis represents the average achievement score, ranging from 440 to 560, while the horizontal axis lists different categories of parents' occupations: Farming, Housework only, Work in other houses, Labor work, foreign work, Teaching, Business Job, and Others.

For students whose mothers are involved in farming, the average score is approximately 501.8. Those whose mothers do housework only have an average score of around 529.0, while students with mothers working in other houses score about 514.2. Labor work shows an average score of roughly 518.4, foreign work has about 528, teaching has an estimated score of 550.3, business has about 540.4, job has an average score of 538.9, and the others category is at approximately 529.0.

For students whose fathers are involved in farming, the average score is close to 497.3. Fathers doing housework only correspond to an average score of around 503.2, while those working in other houses have a score near 485.6. Labor work shows a score of around 504.4, foreign work has about 512.9, teaching has an estimated score of around 534.4, business has an average score of 533.5, jobs are at nearly 531.7, and the others category (521.8) is slightly above the national average, which is set at approximately 515.

The national average line indicates that most individual scores fall below this line, except for those whose parents are involved in teaching, business, formal job, and other occupation. This data suggests a correlation between parental occupation and student performance in English, with higher scores generally associated with more skilled or professional occupations. It is interesting to see in the results that mother's occupation has a stronger influence on students' achievement in English than that of fathers, except the category of other occupation.

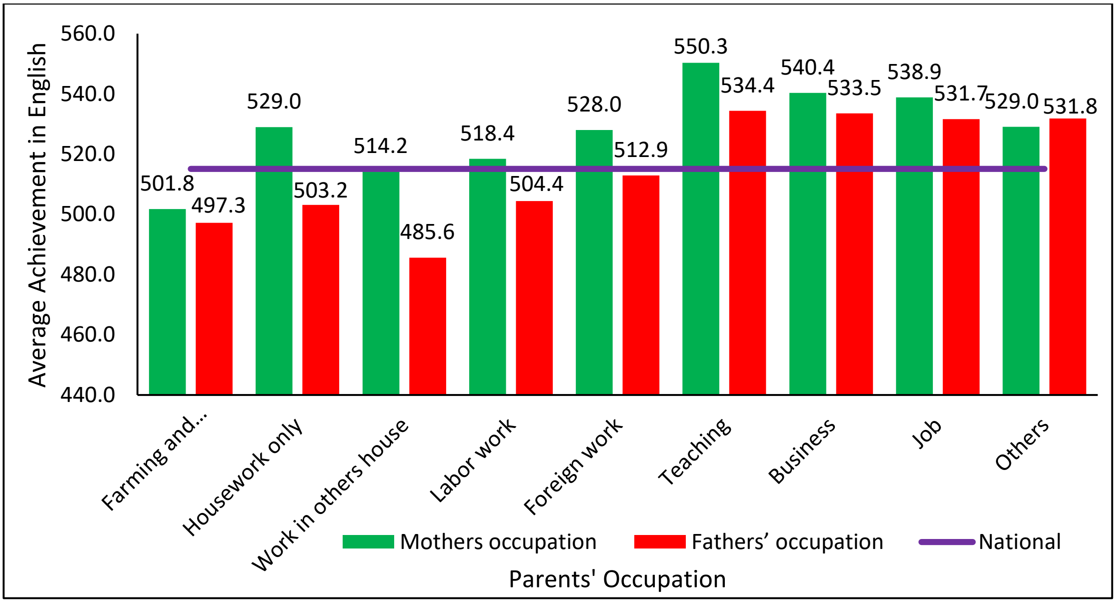


Figure 33 Mean achievement score of students in English by parent's occupation (n = 469563, p-value for mother occupation < 0.001, and p-value for father occupation < 0.001)

Achievement of the Students in English Based on Spending Time Out of School

Table 43 shows the results from the analysis of student achievement in English based on time spent out of school on various activities. For activities like TV/Internet/Mobile and Study/Homework, there is a positive correlation with achievement scores up to a certain point. Specifically, students who spent up to four hours on these activities had the highest mean scores, with TV/Internet/Mobile peaking at 542.9 (SD = 51.1) and Study/Homework at 522.8 (SD = 49.0). However, beyond four hours, the scores slightly decreased to 524.6 (SD = 54.5) and 520.1 (SD = 49.3) respectively, indicating that excessive time might not be as beneficial. The p-values for these activities are <0.001, indicating significant differences in mean scores across different time durations.

In contrast, activities such as Household Chores, Work for Wages, and Support to Siblings show a negative correlation with increased time spent. For instance, students who spent more than four hours on household chores had a mean score of 496.1 (SD = 44.6), significantly lower than those who spent only one hour (525.1, SD = 51.5). Similarly, working for wages and supporting siblings also resulted in lower mean scores as time increased, with the lowest scores observed for more than four hours (485.2, SD = 41.4 and 485.7, SD = 39.1, respectively). The p-values for these activities are also <0.001, indicating significant differences in mean scores.

Playing with Friends presented a relatively stable trend in mean scores across different durations, with a slight increase for those spending more than four hours (521.6, SD = 54.1). Despite the stability, the differences in mean scores were statistically significant, with a p-value of <0.001, suggesting that even small variations in time spent can impact achievement.

Overall, the p-values (<0.001) for all activities indicate that the differences in mean scores based on time spent are statistically significant. This underscores the importance of balanced time management for students, where moderate engagement in certain activities like studying and limited screen time can positively impact academic performance, while excessive time on chores or work may have detrimental effects. These findings highlight the need for students to find a balance in their daily activities to optimize their academic success.

Table 43 Mean achievement score in English based on spending time out of school

Variables	Categories	N	Mean	SD	P-Value
TV/Internet/Mobile	Time not given	97872	507.0	48.0	<0.001
	One Hour	231808	515.1	47.8	
	Two Hours	79310	535.4	49.3	
	Four Hours	13595	542.9	51.1	
	More than four hours	6041	524.6	54.5	
Play with Friends	Time not given	72627	517.5	50.1	<0.001
	One Hour	250161	518.5	49.2	
	Two Hours	78041	517.7	49.0	
	Four Hours	12807	520.9	48.9	
	More than four hours	5400	521.6	54.1	
Household chores	Time not given	35600	524.2	54.7	<0.001
	One Hour	150581	525.1	51.5	
	Two Hours	160581	515.9	47.2	
	Four Hours	52739	507.5	44.9	
	More than four hours	19920	496.1	44.6	
	Time not given	19053	492.3	46.0	<0.001

Variables	Categories	N	Mean	SD	P-Value
Study/homework	One Hour	36926	501.4	48.1	
	Two Hours	103444	519.4	48.4	
	Four Hours	150669	522.8	49.0	
	More than four hours	109856	520.1	49.3	
Work for wages	Time not given	316280	526.2	49.0	
	One Hour	31672	493.9	41.6	
	Two Hours	15090	495.0	41.9	
	Four Hours	9802	490.4	39.7	
	More than four hours	13670	485.2	41.4	<0.001
Support to siblings	Time not given	75479	535.9	53.3	
	One Hour	181440	520.6	49.0	
	Two Hours	121461	511.6	45.5	
	Four Hours	30264	498.0	42.2	
	More than four hours	9774	485.7	39.1	<0.001

The analysis of student achievement in English based on the time it takes to reach school reveals a significant trend (Table 44). Students who have shorter commutes tend to perform better academically. Specifically, those who take up to 15 minutes to reach school have the highest mean achievement score of 524.99 (SD = 48.80). As the travel time increases, the mean scores decrease, with students taking half an hour scoring 519.11 (SD = 45.46), and those taking one hour scoring 507.35 (SD = 43.95).

The trend continues with students who take two hours scoring 499.53 (SD = 44.83), and those with commutes longer than two hours having the lowest mean score of 491.13 (SD = 45.17). The p-value of < 0.001 indicates that these differences are statistically significant. This pattern suggests that shorter travel times to school are associated with higher achievement scores in English. The decline in scores with longer travel times could be attributed to various factors such as increased fatigue, less time available for homework and study, and additional stressors related to long commutes. These findings highlight the potential impact of travel time on academic performance, emphasizing the importance of considering commute times in educational planning and policy-making.

Table 44 Mean achievement score in English by time to reach school

Time to reach school	Mean Achievement Score	SD	N	p-value
Up to 15 minutes	524.99	48.80	93265	0.000
Half hours	519.11	45.46	41088	
One Hour	507.35	43.95	19458	
Two Hours	499.53	44.83	4846	
More than two hours	491.13	45.17	1366	

English Achievement Based on ECA Activities at School

The analysis of student achievement in English based on participation in extracurricular activities (ECA) at school reveals significant differences (Table 45). Students who never preferred ECAs have the highest mean achievement scores in English, with a mean score of 533.78 (SD = 47.65) and a sample size of 3,994. Conversely, those who preferred ECAs sometimes have a mean score of 522.84 (SD = 46.02) with a sample size of 97,343. Regular occurrence of ECAs causes the lowest mean score of 515.48 (SD = 50.32) with a sample size of 57,837. The p-value for these differences is <0.001, indicating that the variations in mean scores are statistically significant.

Similarly, students who never participate in ECA activities have the highest mean achievement scores, with a mean score of 521.27 (SD = 50.80) and a sample size of 36,457. Those who sometimes participate in ECA activities have a mean score of 517.23 (SD = 49.41) with a sample size of 292,157. Regular participants in ECA activities have the lowest mean score of 510.45 (SD = 49.32) with a sample size of 134,481. The p-value for these differences is also <0.001, indicating statistical significance.

These findings suggest that students who do not engage in ECAs might have more time to focus on their academic work, leading to higher achievement scores. In contrast, students who regularly participate in these activities have lower mean scores, which could imply that while ECAs are beneficial for overall development, they may not directly correlate with higher academic achievement in English. Consequently, these significant differences highlight the importance of a balanced approach, where students can benefit from ECAs without compromising their academic performance. Schools and educators might consider strategies to integrate ECAs in a way that supports both academic and extracurricular development, ensuring that students can enjoy the benefits of these activities while still achieving their academic goals.

Table 45 Achievement score in English by ECA activities at school

Variable	Frequency of ECA			Participation in EAC activities		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**
Regular	515.48	50.32	57837	510.45	49.32	134481
Sometimes	522.84	46.02	97343	517.23	49.41	292157
Never	533.78	47.65	3994	521.27	50.80	36457
p-value	<0.001			<0.001		

The analysis of student achievement in English based on leisure time activities reveals some notable trends (Table 46). Students who have no leisure time exhibit the highest mean achievement score in English, with a mean score of 527.41 (SD = 47.13). This suggests that students who dedicate all their time to academic activities without engaging in leisure activities tend to perform better in English. It highlights the potential benefits of a focused academic routine, although it also raises questions about the overall well-being and balance in students' lives.

Students who engage in group work also show high achievement, with a mean score of 525.61 (SD = 47.99). This indicates that collaborative learning and group activities can positively impact English achievement. Group work likely provides opportunities for peer learning, discussion, and mutual support, which can enhance understanding and retention of material.

Playing, as a leisure activity, results in a mean score of 519.02 (SD = 51.93). While this score is lower than that for group work and having no leisure time, it is still higher than the score for classwork/homework. This suggests that while playing can be beneficial, it may not be as effective as group work or having no leisure time in terms of academic performance in English. However, it also implies that incorporating play into students' routines can provide a necessary break and contribute to overall well-being without significantly compromising academic performance.

Finally, students who spend their leisure time on classwork/homework have a mean score of 516.4 (SD = 46.98). Although this is the lowest among the four categories, it still indicates a positive impact on English achievement compared to other potential leisure activities not listed. This finding underscores the importance of dedicating time to academic tasks, even during leisure periods, to reinforce learning and improve performance.

Overall, these results highlight the importance of how students choose to spend their leisure time. Engaging in group work and dedicating time solely to academic activities without leisure can lead to higher achievement in English. However, even activities like playing can have a positive impact, suggesting that a balanced approach to leisure and study can be beneficial for students. Schools and educators might consider encouraging a mix of academic and leisure activities to support both academic success and overall well-being.

Table 46 English achievement score based on leisure time activities

Leisure time activity	Mean	SD	N
Classwork/Homework	516.4	46.98	87823
Group work	525.61	47.99	23960
Playing	519.02	51.93	7809
Have no leisure time	527.41	47.13	38891

English Achievement by Support Taken at Home

The bar chart in Figure 35 illustrates the average achievement in English based on different types of support students receive at home, with statistically significant differences (p-value < 0.001). The data reveals that students who receive tuition support achieve the highest average scores, approximately 522.51. This suggests that structured, professional help significantly enhances students' performance in English, likely due to targeted instruction and consistent practice.

Next, support from friends results in the second-highest average score, around 515.02. Peer support appears to be quite effective, possibly due to collaborative learning and mutual motivation. This indicates that students benefit from studying with friends, as it may create a more engaging and supportive learning environment.

Furthermore, maternal support leads to an average score of about 514.97, highlighting the crucial role mothers play in their children's academic success. The involvement of mothers in their children's education positively impacts their performance, likely due to emotional support and encouragement. Sibling support also proves beneficial, with an average score of approximately 511.98. Although slightly less impactful than parental or peer support, siblings still contribute positively to academic achievement.

Interestingly, the lowest average achievement is seen with support from fathers, at around 508.39. While paternal support is still beneficial, it appears to be less effective compared to other sources. This data underscores the importance of diverse support systems at home, with tuition and peer support standing out as particularly effective in enhancing students' English performance.

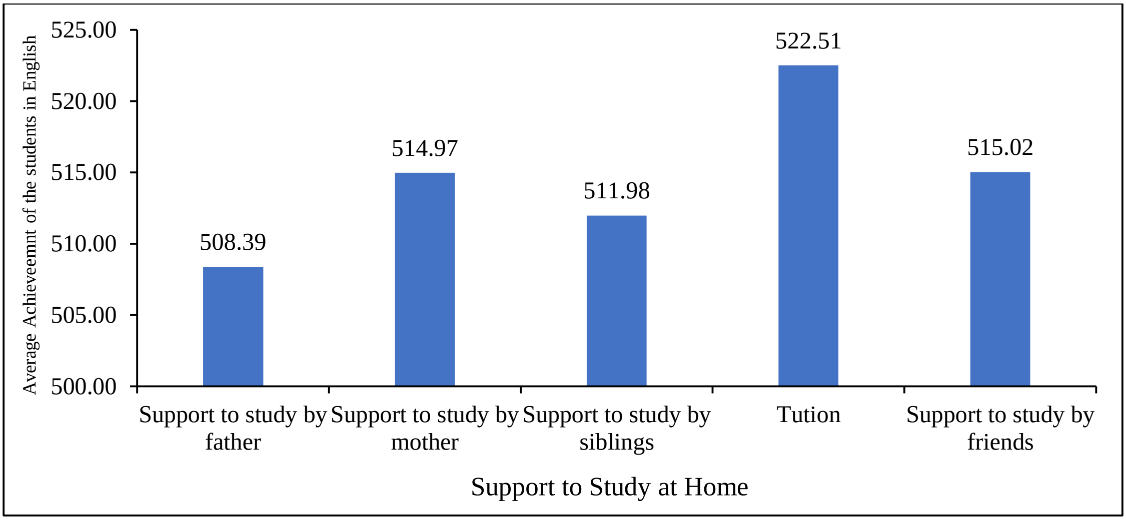


Figure 34 Mean achievement score in English based on support for study at home (n= 405163, P-value < 0.001)

Achievement of Students in English by Facilities at Home

Table 47 presents the mean achievement scores in English based on students' access to facilities at home. When asked about the different types of physical facility at their home such as TV, Computer, motorcycle, Car, and concrete house. Overwhelming majority of the students reported they have access to at least one of the facilities at home (83.8%) while some 16.2% reported that they have no access to these facilities. Furthermore, the findings provide a comparison of students' achievement scores based on the student's access to the television, computer, motor cycle, car, and concrete home.

Students with access to facilities at home have a significantly higher mean achievement score in English, averaging 526.0 with a standard deviation (SD) of 48.85. This group consists of 320,674 students, indicating a large sample size that supports the reliability of the data. In contrast, students without access to facilities at home have a lower mean achievement score, averaging 490.2 with a standard deviation of 40.57. This group includes 62,030 students. The lower mean score and smaller sample size highlight the disparity in academic performance between students with and without access to facilities.

The substantial difference in mean scores (35.8 points) suggests that access to facilities at home plays a crucial role in enhancing students' achievement in English. The higher standard deviation among students with access to facilities indicates a wider range of scores, possibly reflecting varying levels of facility quality and usage. Overall, the data underscores the importance of providing adequate facilities at home to support students' academic success in English.

Table 47 Mean achievement score in English by facilities at home

Access to Facilities	Mean	SD	N
Yes	526.0	48.85	320674
No	490.2	40.57	62030

Achievement Score in English by Ownership of Mobile

Table 48 presents an analysis of student achievement in relation to mobile phone ownership. When surveyed, a little less than half of the students (43.2%) reported owning a personal mobile phone, while the majority (56.7%) indicated they did not have their own mobile phone. The data further compares the mean achievement scores in English between these two groups. The findings reveal that students who own a separate mobile phone have a higher mean achievement score of 524.8, compared to 517.6 for those without a mobile phone. This suggests that mobile phone ownership is associated with a modest increase in English achievement scores. The analysis highlights a potential link between access to personal mobile technology and academic performance in English.

Table 48 Mean achievement score in English by ownership of mobile

Variable	Categories	Mean	SD	N
Separate mobile phone	Yes	524.8	49.09	68733
	No	517.6	46.55	90248

Mean achievement score in English based on the ownership of English textbook

Table 49 highlights the impact of owning an English subject textbook on students' achievement scores. Students who possess an English textbook have a mean achievement score of 516.7, with a standard deviation of 49.61, based on a large sample of 447,330 students. In contrast, those without an English textbook have a lower mean score of 484.2, with a standard deviation of 39.69, from a smaller group of 17,911 students. This data indicates that students with an English textbook tend to perform better in English, with a mean score that is 32.5 points higher than their peers without a textbook. The wider spread of scores among students with textbooks suggests more variability in their performance. Overall, the findings suggest a positive correlation between textbook ownership and higher achievement in English.

Table 49 Mean achievement score in English based on the ownership of English textbook

Variable	Categories	Mean	SD	N
English subject textbook	Yes	516.7	49.61	447330
	No	484.2	39.69	17911

Achievement of Students in English Based on Teacher's Activities

Table 50 examines student achievement in English based on the effort of subject teachers in course delivery, focusing on three key areas: giving homework, providing feedback on homework, and teacher regularity. Firstly, when it comes to giving homework, students whose teachers always assign homework have a mean achievement score of 514.47. Interestingly, those whose teachers sometimes give homework score slightly higher, with a mean of 518.41. Meanwhile, students whose teachers never assign homework have a mean score of 517.79. The p-value of less than 0.001 indicates that these differences are statistically significant.

Next, considering feedback on homework, students who always receive feedback have a mean score of 515.87. In contrast, those who sometimes receive feedback have a slightly lower mean score of 514.34. Students who never receive feedback have the lowest mean score of 510.84. Again, the p-value of less than 0.001 shows a significant difference among these groups.

Lastly, the regularity of teacher attendance plays a crucial role. Students whose teachers are always regular have a mean achievement score of 513.42. Interestingly, students whose teachers are sometimes regular achieve the highest mean score of 528.29. Conversely, those whose teachers are never regular have the lowest mean score of 498.89. The p-value of less than 0.001 confirms the significance of these differences.

In summary, the data suggests that teacher effort in course delivery, particularly in giving homework and providing feedback, is associated with variations in student achievement in English. Additionally, the regularity of teacher attendance significantly impacts student performance, with irregular attendance correlating with lower achievement scores.

Table 50 Achievement score in English by subject teacher effort in course delivery

Subject teacher's activities	**Mean achievement score**				**p-value**
	Always	Sometime	Never	N	
Giving homework	514.47	518.41	517.79	465377	<0.001
Feedback on homework	515.87	514.34	510.84	465394	<0.001
Regularity of Teacher	513.42	528.29	498.89	465882	<0.001

Achievement of Students in English Based on Regularity of Teachers' Class Time

Table 51 provides insights into student achievement in English based on the regularity of their English teacher's class time. Firstly, students whose teachers consistently use the entire class period have a mean achievement score of 516.6 (SD = 49.49). This group includes a substantial number of students, totaling 437,310. The data suggests that regular and full use of class time by teachers is associated with higher student achievement in English.

In contrast, students whose teachers often arrive late and leave early have a lower mean achievement score of 503.7 (SD = 47.77). This group consists of 12,741 students. The reduced class time appears to negatively impact student performance, as indicated by the lower mean score.

Lastly, students whose teachers frequently miss class altogether have the lowest mean achievement score of 493.7 (SD = 47.06). This group includes 15,664 students. The lack of consistent teacher presence correlates with the poorest student performance in English. Overall, the data highlights the significant impact of teacher regularity on student achievement, with consistent and full use of class time leading to better outcomes.

Table 51 English achievement score based on regularity of teacher's class time

Regularity of English teacher in class time	**Mean**	**SD**	**N**
Use whole class time	516.6	49.49	437310
late come and early leave the class	503.7	47.77	12741
Most of the time don't come in the class	493.7	47.06	15664

Student Achievement Based on Perception of Students towards School and Subject Related Variables

The results in Table 52 provides insights into student achievement in English based on their perceptions of teachers, schools, and the English subject itself. Firstly, examining students' perception toward teachers, those with a negative perception have a slightly higher mean achievement score of 522.7 (SD = 54.93) compared to those with a positive perception, who have a mean score of 518.9 (SD = 48.88). This suggests that a negative perception of teachers does not necessarily correlate with lower achievement scores. The sample sizes for these groups are 13,709 and 402,993, respectively.

Next, considering perception toward school, students with a negative perception have a mean achievement score of 520.2 (SD = 53.54), while those with a positive perception have a mean score of 516.6 (SD = 49.23). This indicates that students' perceptions of their school environment have a modest impact on their achievement scores. The sample sizes are 14,240 and 435,112, respectively.

When it comes to perception toward the English subject, students with a negative perception have a mean score of 491.8 (SD = 48.68), whereas those with a positive perception score significantly higher, with a mean of 517.3 (SD = 49.23). This highlights a stronger correlation between positive perceptions of the subject and higher achievement scores. The sample sizes for these groups are 9,230 and 441,929, respectively.

Lastly, examining learning attitude towards English, students with a negative attitude have a mean achievement score of 505.0 (SD = 52.58), while those with a positive attitude have a mean score of 517.3 (SD = 49.25). This further underscores the importance of a positive attitude towards learning in achieving higher scores. The sample sizes are 9,949 and 437,494, respectively.

In summary, while negative perceptions of teachers and schools do not drastically lower achievement scores, positive perceptions and attitudes towards the English subject and learning, in general, are associated with higher achievement. This suggests that fostering positive attitudes and perceptions towards the subject and learning environment can significantly enhance student performance in English.

Table 52 Perceptions of students towards teachers, schools and English subject

Variables with categories	**Mean**	**SD**	**N**
Perception toward teacher			
Negative	522.7	54.93	13709
Positive	518.9	48.88	402993
Perception toward school			
Negative	520.2	53.54	14240
Positive	516.6	49.23	435112
Perception toward English subject	Mean	SD	N
Negative	491.8	48.68	9230
Positive	517.3	49.23	441929
Learning attitude towards English	Mean	SD	N
Negative	505.00	52.58	9949
Positive	517.3	49.25	437494

Bullying Status at School and English Achievement

The data presented in the Figure 36 outlines the distribution of bullying events experienced by students. The findings reveals that a significant portion, 43.4%, reported not having experienced any bullying events. Meanwhile, 24.4% of students experienced bullying on one occasion. The findings also shows that 14.6% of the students faced bullying twice. As the number of bullying events increases, the percentage of students experiencing them decreases. Specifically, 9.6% experienced bullying three times, 4.8% four times, 2.3% five times, and only 1.0% reported experiencing bullying six times. This indicates that while a majority have either not encountered bullying or have had limited experiences, a smaller group has faced more frequent bullying events.

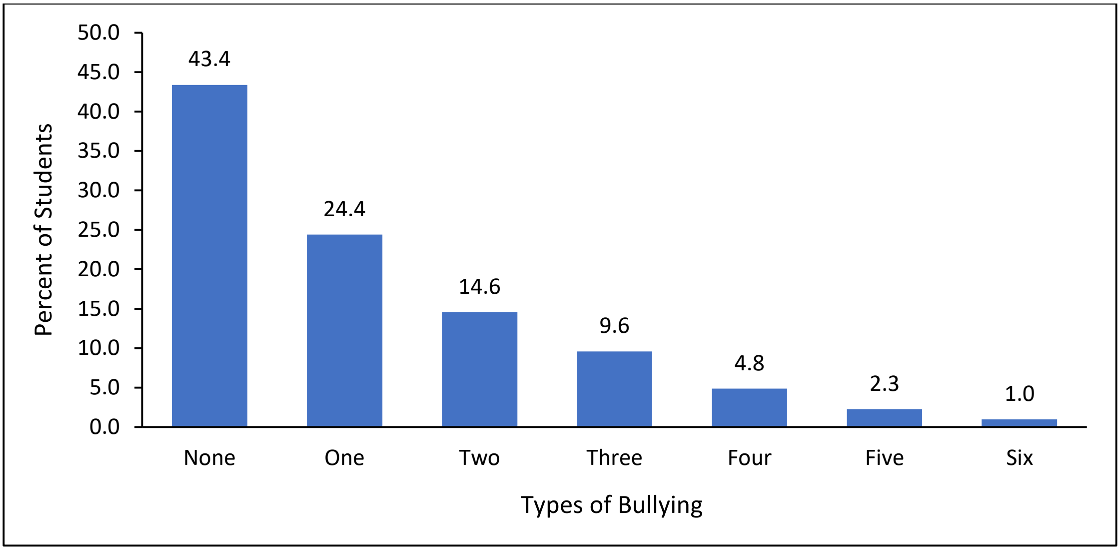


Figure 35 Status of bullying at the school experienced by the students

Achievements Based on Frequency of English Homework

Table 53 presents the mean scores based on the engagement in English homework. Students who never engage in English homework have the lowest mean score of 511.8 (SD = 47.06, N = 3,427). Those who engage in English homework in some lessons have the highest mean score of 527.7 (SD = 46.89, N = 50,313), while those who engage in homework about half the lessons have a mean score of 521.0 (SD = 47.82, N = 90,226). Comparing these findings, it is clear that regular engagement in English homework is associated with higher mean scores. The highest mean score is observed among individuals who do English homework in some lessons, suggesting that consistent, but not necessarily constant, engagement can lead to the best performance.

Table 53 Mean achievement score in English by engagement in subject related works

How frequently you engaged in English homework	Mean	SD	N
Never	511.8	47.06	3427
Some lessons	527.7	46.89	50313
About half lessons	521.0	47.82	90226

Effect of Individual, Family, and School Related Factors on English Achievement Score

The regression analysis examines the impact of various individual, family, and school factors on student achievement in English (Table 54). The dependent variable is the achievement score in English, while the independent variables include factors such as medium of instruction, parental education, study habits, and more.

The medium of instruction has the most substantial positive effect on achievement scores, with a coefficient (B) of 37.44 (SE = 0.27, Beta = 0.38, Sig. = 0.00). This indicates that students taught in their native language or a familiar medium tend to perform significantly better. Additionally, father's education and study and homework habits also positively influence achievement, with coefficients of 4.57 (SE = 0.12, (Beta = 0.12), (Sig. = 0.00) and 4.64 (SE = 0.12) (Beta=0.10), (Sig. = 0.001), respectively. Similarly, home language and mother's education contribute positively, with coefficients of 7.00 (SE = 0.24), (Beta = 0.07), (Sig. = 0.00) and 2.72 (SE = 0.13), (Beta = 0.07), (Sig. = 0.00) (Table 55).

Furthermore, the regularity of the English teacher in class time (B = 6.93), (SE = 0.33), (Beta = 0.05), (Sig. = 0.001) and use of social media (B = 4.93), (SE = 0.26), (Beta = 0.05), Sig. = 0.001) show positive effects. Additionally, access to materials other than textbooks (B = 4.31, SE = 0.29, Beta = 0.04, Sig. = 0.00) and having an English subject textbook (B = 8.79, SE = 0.67, Beta = 0.03, Sig. = 0.00) are beneficial.

Conversely, several factors negatively impact achievement scores. Bullying activities (B = -0.14, SE = 0.07, Beta = -0.01, Sig. = 0.05) and ECA frequency (B = -0.46, SE = 0.23, Beta = -0.01, Sig. = 0.05) have minor negative effects. More significant negative predictors include time for household chores (B = -1.75, SE = 0.13, Beta = -0.03, Sig. = 0.00), time for play with friends (B = -2.44, SE = 0.16, Beta = -0.04, Sig. = 0.00), access to facilities at home (B = -0.85, SE = 0.04, Beta = -0.05, Sig. = 0.00), time to reach school (B = -2.40, SE = 0.10, Beta = -0.06, Sig. = 0.00), time for work for wages (B = -4.90, SE = 0.13, Beta = -0.09, Sig. = 0.00), and time for support to siblings (B = -4.94, SE = 0.13, Beta = -0.10, Sig. = 0.00) (Table 55).

The value of R-square is 0.445 of the models indicate that around 44.5% variance of achievement score is explained by the predictors of this model. The variance inflation factor (VIF) for all the independent variables was less than 10, within the threshold, indicating no issue of collinearity among these variables. In summary, the analysis highlights that factors such as medium of instruction, parental education, and study habits positively influence student achievement in English. On the other hand, time spent on household chores, work, and other non-academic activities negatively impacts achievement. This comprehensive analysis underscores the importance of both educational and environmental factors in shaping student performance.

Table 54 Effect of individual, family and school factor in achievement score of English

Predictors	B	SE	Beta	Sig.	VIF
Medium of instruction	37.44	0.27	0.38	<0.001	1.38
Father's education	4.57	0.12	0.12	<0.001	1.91
Study and homework	4.64	0.12	0.10	<0.001	1.10
Home language	7.00	0.24	0.07	<0.001	1.10
Mother's education	2.72	0.13	0.07	<0.001	1.94
Regularity of English teacher in class time	6.93	0.33	0.05	<0.001	1.07
Use of social median	4.93	0.26	0.05	<0.001	1.34
Materials other than textbook	4.31	0.29	0.04	<0.001	1.09
English subject textbook	8.79	0.67	0.03	<0.001	1.04
Provide homework by English teacher	2.15	0.27	0.02	<0.001	1.21
Bullying activities	-0.14	0.07	-0.01	0.05	1.06
ECA frequency	-0.46	0.23	-0.01	0.05	1.11
Separate mobile phone	-1.11	0.25	-0.01	<0.001	1.27
ECA participation	-1.82	0.21	-0.02	<0.001	1.11
Time for household chores	-1.75	0.13	-0.03	<0.001	1.16
Time for play with friends	-2.44	0.16	-0.04	<0.001	1.08
Access to facilities at home	-0.85	0.04	-0.05	<0.001	1.05
Time to reach school	-2.40	0.10	-0.06	<0.001	1.06
Time for work for wages	-4.90	0.13	-0.09	<0.001	1.17
Time for support to siblings	-4.94	0.13	-0.10	<0.001	1.23

CHAPTER VI

Students Performance in Nepali

National Mean Achievement Scores in Nepali

The national mean achievement score for students was determined using anchored items from the NASA 2018 assessment. To ensure consistency, items from NASA 2020 were calibrated by fixing the parameters of the linking items. The discrimination and difficulty levels of these anchored items were calculated based on the 2018 data. Similarly, the differential item functioning method was employed to identify both uniform and non-uniform items. Once the appropriate items were confirmed, calibration was performed. The results from NASA 2022 indicate that the mean transformed scale score in Nepali is 498.6, which is below the mean achievement score of 500 from NASA 2018.

The chart in Figure 37 displays a histogram overlaid with a line graph, representing the distribution of achievement scores. The x-axis, labeled 'achievement score,' ranges from approximately 400 to 600, while the y-axis measures the frequency of scores. The distribution forms a bell-shaped curve, indicating that most scores are clustered around a central value around 500. This suggests a normal distribution, where the majority of students achieve scores near the average, with fewer students scoring significantly lower or higher.

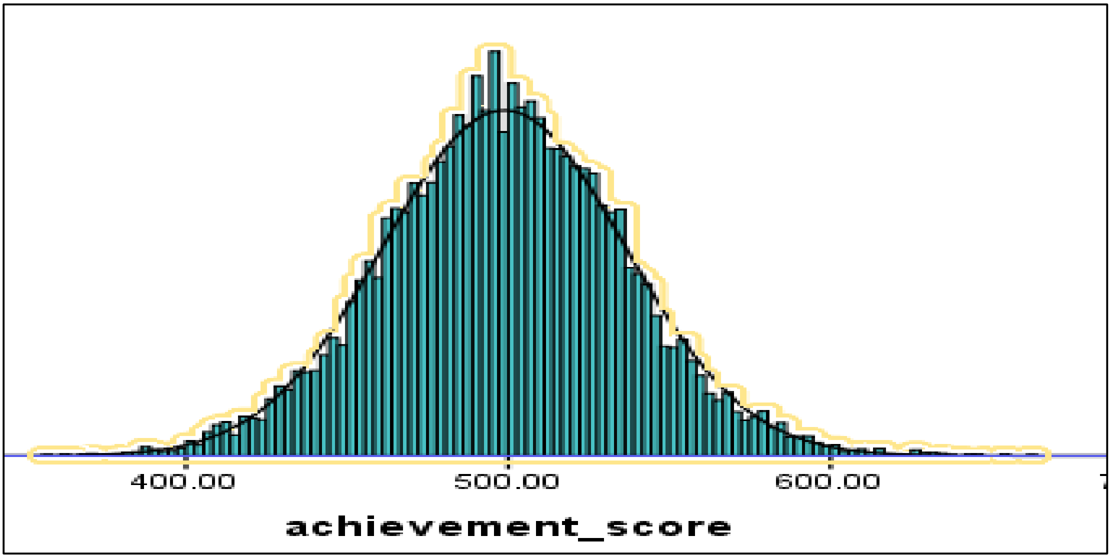


Figure 36. Distribution of achievement score of the students in Nepali

Proficiency Level of Students in Nepali

The assessment framework of NASA 2023 was developed based on six proficiency levels for students in Nepali: Below-basic, Basic, Proficient 1, Proficient 2, Proficient 3, and Advanced. Consequently, student achievement scores were analyzed and categorized into these six levels. Table 55 and Figure 38 illustrate the score ranges and the percentage of students in each proficiency level.

The highest percentage of students (27.9%) fall into the Proficient 1 level, while only 6.4% reach the Advanced level. Notably, 53.8% of students are in Proficient 1 or below, indicating that they do not meet the minimum expected goals of the curriculum. To achieve the minimum standards, students must be at Proficient 2 or above. Only about 25.2% of students meet this criterion. These results indicate that a significant portion of students are underperforming in Nepali, as the majority do not reach the proficiency levels required to meet the curriculum's minimum standards.

Table 55 Distribution of the students based on proficiency levels in Nepali (N=469563)

Proficiency Levels	Score range	% of Students
Level 1: Below-basic	449 and below	8.9
Level 2: Basic	449-475	17
Level 3: Proficient 1	475-502	27.9
Level 4: Proficient 2	502-528	25.2
Level 5: Proficient 3	528-555	14.6
Level 6: Advanced	555 or above	6.4
Total		100

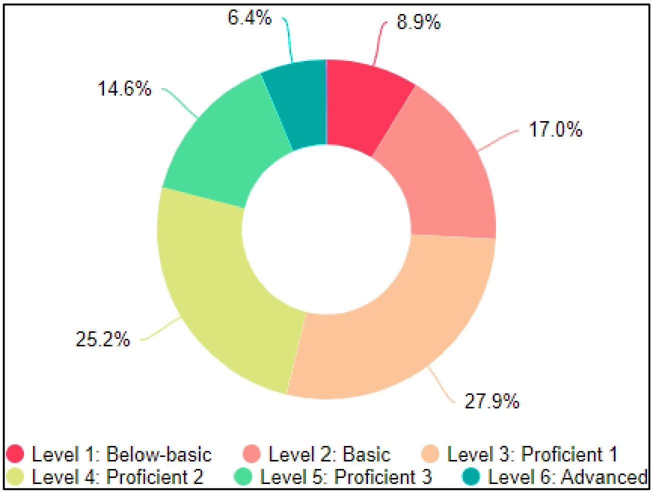


Figure 37 Proficiency levels of students in Nepali

Proficiency Levels of Students in Nepali by Province

Table 56 presents the proficiency levels of students in different provinces. Here's a breakdown of the results:

- **Below Basic**: The highest percentage of students at this level is in Madhesh (14.7%), followed by Karnali (12.0%) and Sudurpashchim (11.4%). The lowest percentages are in Bagmati and Gandaki, both at 6.0%.
- **Basic**: Karnali has the highest percentage of students at the Basic level (22.9%), while Bagmati has the lowest (14.5%).At the same time, other provinces range between 15.9% (Lumbini) and 19.0% (Madhesh).
- **Proficient 1**: The highest percentage of students at this level is in Karnali (32.0%), followed by Sudurpashchim (29.4%) and Madhesh (28.9%). The lowest percentage is in Koshi (26.2%).
- **Proficient 2**: Gandaki has the highest percentage of students at this level (28.6%), closely followed by Bagmati (28.4%). The lowest percentage is in Karnali (20.4%).
- **Proficient 3**: Lumbini has the highest percentage of students at this level (16.6%), while Karnali has the lowest (9.4%). Other provinces range between 12.4% (Sudurpashchim) and 16.5% (Bagmati).
- **Advanced**: Bagmati has the highest percentage of students at the Advanced level (8.4%), followed by Lumbini (7.6%) and Koshi (6.7%). The lowest percentages are in Karnali (3.3%) and Madhesh (3.5%).

In summary, the distribution of proficiency levels varies across provinces, with some provinces showing higher percentages of students in the higher proficiency levels, while others have more students in the lower levels. This indicates regional differences in student achievement in Nepali.

Table 56 Proficiency level of students based on provinces (%)

Proficiency Levels	Provinces						
	Koshi	Madhesh	Bagmati	Gandaki	Lumbini	Karnali	Sudurpaschim
Below basic	8.6	14.7	6.0	6.0	6.3	12.0	11.4
Basic	17.7	19.0	14.5	14.7	15.9	22.9	17.7
Proficient 1	26.2	28.9	26.3	28.5	27.5	32.0	29.4
Proficient 2	26.1	21.1	28.4	28.6	26.0	20.4	22.6
Proficient 3	14.7	12.8	16.5	16.0	16.6	9.4	12.4
Advanced	6.7	3.5	8.4	6.3	7.6	3.3	6.5

Mean Achievement Scores of Students in Nepali by Province

Figure 39 presents mean scores across different provinces. The result shows that Bagmati has the highest mean achievement score (Mean=504.55) while Karnali has the lowest score (Mean=488.86). Lumbini (Mean=503.47), Gandaki (Mean=502.23), and Koshi (Mean=499.15) crossed the national achievement score 498.6 along with Bagmati while other provinces fall behind the average achievement scores of students in Nepali.

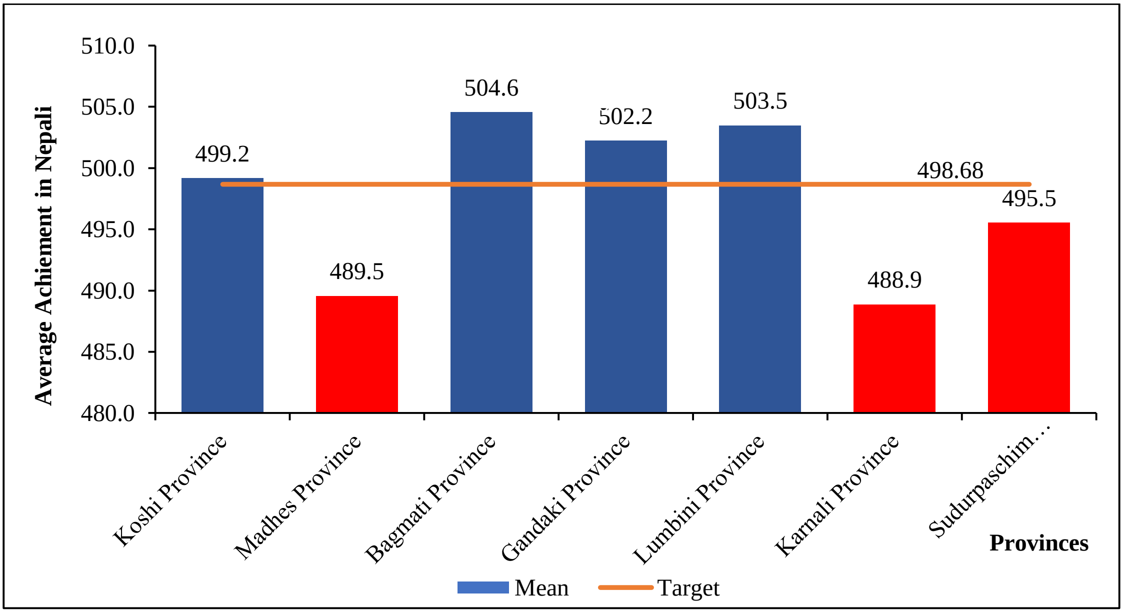


Figure 38 Average achievement score of students in Nepali based on provinces

Performance of the Students in Nepali by Local Level, Types of Schools and Gender

Table 57 presents the achievement scores of the students in Nepali based on rural municipality and municipality (municipalities, sub-metropolitan and metropolitan city). The analysis of student achievement in Nepali reveals notable differences based on local levels, types of schools, and gender. Students from municipalities outperform those from rural municipalities, with an average score of 500.65 (SD = 37.56) compared to 494.56 (SD = 37.15), with a statistically significant difference ($p < 0.001$). This suggests that students in urban areas may have access to better educational resources or opportunities that contribute to higher performance.

When examining the types of schools, students in institutional schools achieve higher average scores of 503.80 (SD = 37.83) compared to those in community schools, who have an average score of 497.34 (SD = 37.34). The difference is statistically significant ($p < 0.001$), indicating that institutional schools, which are often privately funded, might provide a more conducive learning environment or better facilities, leading to improved student outcomes.

Gender-wise, girls outperform boys in Nepali, with average scores of 501.27 (SD = 37.29) and 496.15 (SD = 37.35), respectively. This difference is also statistically significant ($p < 0.001$), highlighting a positive trend in role of girls' education. This suggests that girls are excelling in their studies and possibly benefiting from targeted educational programs or societal shifts that support female education. Overall, the data underscores the importance of addressing disparities in educational resources and opportunities across different local levels, school types, and genders to ensure equitable student achievement in Nepali.

Table 57 Performance of the students in Nepali by local level, types of schools and gender

Local Levels	N	Mean	SD	P-value
Rural Municipality	151241	494.56	37.15	<0.001
Municipality	318322	500.65	37.56	
School Types				
Institutional Schools	98127	503.80	37.83	<0.001
Community Schools	371436	497.34	37.34	
Gender				

Local Levels	N	Mean	SD	P-value
Boys	216774	496.15	37.35	<0.001
Girls	248868	501.27	37.29	

Proficiency level of students in Nepali by Local level, Types of Schools and Gender

Figure 40 illustrates the distribution of student proficiency levels across various local levels, school types, and genders. The findings reveal that the highest percentage of students, 27.2% from rural municipalities and 28% from municipalities, are at the Proficient 1 level. Students from municipalities show higher percentages in Proficient 2, Proficient 3, and Advanced levels compared to those from rural municipalities. However, only 7.3% of students from municipalities reach the Advanced level.

The study also highlights significant variations in proficiency levels between institutional and community schools. Community schools have a substantially higher percentage of students at the Proficient 1 level (28.1% compared to 26.8%). In contrast, institutional schools have higher percentages at Proficient 2 (27% compared to 24.8%), Proficient 3 (16.5% compared to 14.1%), and Advanced levels (8.2% compared to 5.9%).

Gender-wise, the highest percentage of both girls (27.6%) and boys (28.3%) are at the Proficient 1 level. However, girls tend to have higher percentages in the upper proficiency levels compared to boys, indicating a trend where female students are excelling more in higher proficiency categories.

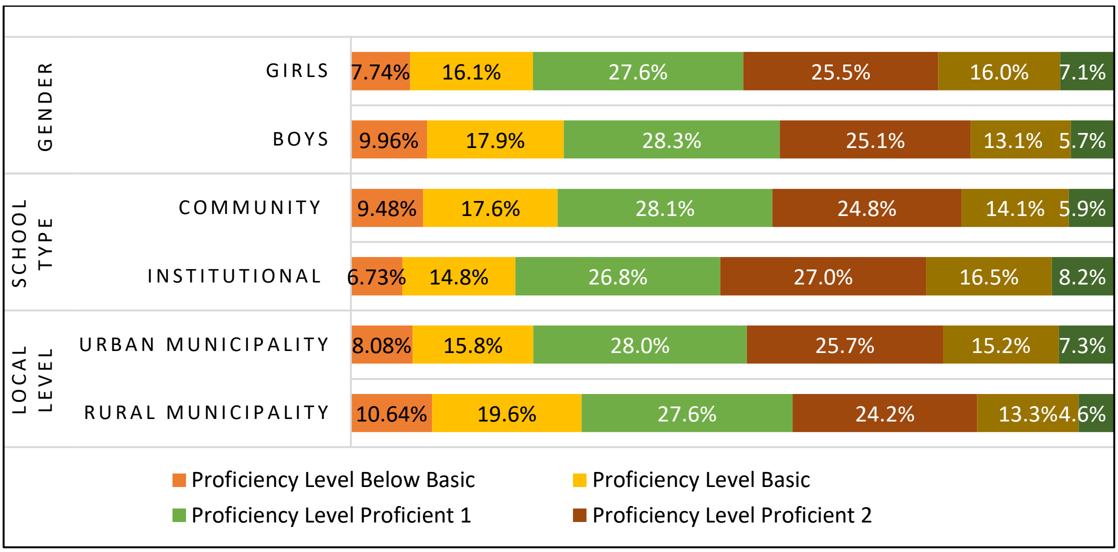


Figure 39 Proficiency level of students across local level, school type, and gender

Nepali Achievement based on Time to Reach School

Table 58 shows the mean achievement scores of students in Nepali based on the time taken to reach at school from their residence. The analysis of student achievement in Nepali based on the time it takes to reach school reveals some interesting patterns. Students who take up to 30 minutes to reach school achieve the highest average score of 501.79 (SD = 36.54), and this difference is statistically significant ($p < 0.001$) with the scores for other time required to reach the schools. This suggests that a moderate travel time might be optimal for student performance, possibly because it allows enough time for students to prepare for their day without causing fatigue.

In contrast, students who take up to 15 minutes to reach school also perform well, with an average score of 499.95 (SD = 37.61). This indicates that shorter travel times are beneficial, likely because they reduce the physical and mental strain associated with longer commutes. However, the slight difference in scores between those who travel up to 15 minutes and those who travel up to 30 minutes suggests that a bit more travel time does not significantly hinder performance and might even provide some benefits, such as time to mentally prepare for the school day. As the travel time increases to one hour, the average scores decrease to 493.84 (SD = 36.40). This decline continues for students who take 1-2 hours to reach school, with the lowest average score of 488.08 (SD = 36.48) (Table 58).

These results imply that longer travel times negatively impact student performance in Nepali. The extended travel time likely contributes to fatigue and reduces the time available for study and rest, thereby affecting academic performance. Overall, the data underscores the importance of considering travel time when assessing student performance. Ensuring that students have a reasonable commute to school could be a key factor in improving their academic outcomes in Nepali.

Table 58 Achievement of the students in Nepali based on the time to reach school

Time to reach school	N	Mean	SD	Sig
Up to 15 min	262393	499.95	37.61	<0.001
30 min	120293	501.79	36.54	
1 hour	59991	493.84	36.40	
1-2 hours	23121	488.08	36.48	

The results in Figure 41 indicate that as the time spent commuting to school increases, the percentage of students at the "Below Basic" level rises from 8.8% for those with up to a 15-minute commute to 12.8% for those with a 1–2-hour commute. Similarly, the percentage of students at the "Basic" level increases from 15.9% for up to a 15-minute commute to 25.6% for a 1–2-hour commute. This suggests that longer commutes may pose challenges for these students.

Conversely, the percentage of students at the "Proficient 3" level decreases from 15.8% for those with up to a 15-minute commute to 7.9% for those with a 1–2-hour commute. The "Advanced" level also sees a decline, from 6.8% for up to a 15-minute commute to 4.3% for a 1–2-hour commute. This implies that shorter commutes may contribute to higher efficiency in studies.

The percentages of students at the "Proficient 1" and "Proficient 2" levels remain relatively stable, with slight variations. For "Proficient 1," the percentage is 27.3% for up to a 15-minute commute and 26.9% for a 1–2-hour commute. For "Proficient 2," the percentage is 25.4% for up to a 15-minute commute and 22.5% for a 1–2-hour commute. These results indicate that while some proficiency levels are affected by commute time, others remain relatively consistent.

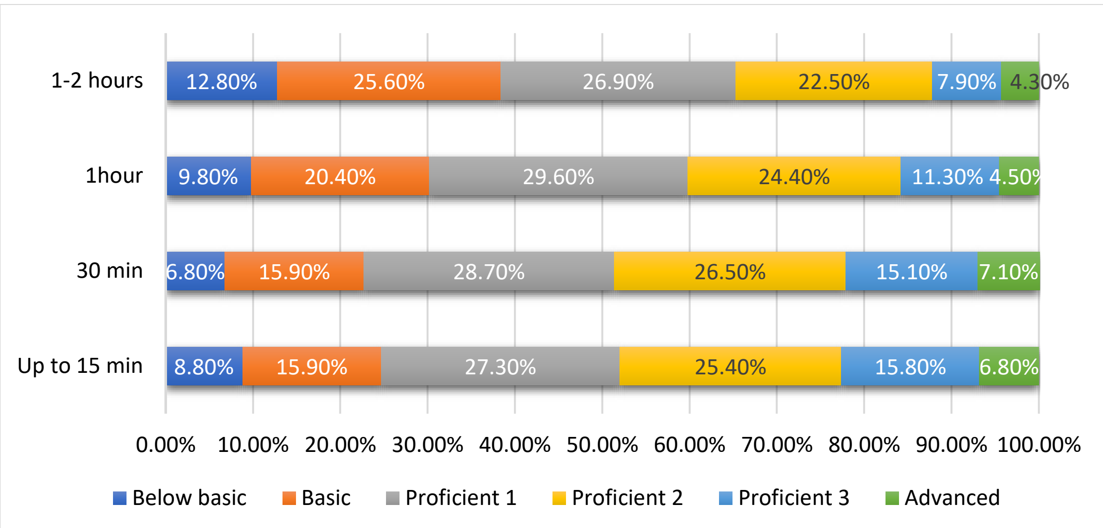


Figure 40 Proficiency levels of students in Nepali based on the time to reach school

Nepali Achievement by Background Variables

Table 59 presents the findings in terms mean scores, standard deviations, and significance values for three demographic variables: Mother Tongue Language, Ethnicity by Caste, and Ethnicity by Region. The analysis of student achievement in

Nepali based on mother-tongue language and ethnicity reveals significant disparities. Students whose mother tongue is Nepali outperform those whose mother tongue is another language, with average scores of 501.63 (SD = 36.96) and 493.90 (SD = 37.51), respectively. This statistically significant difference ($p < 0.001$) suggests that familiarity with the language of instruction plays a crucial role in academic performance. Students who speak Nepali at home likely have a better grasp of the language, which translates into higher achievement in their studies.

When examining ethnicity by caste, Bhramin/ Chhetri students achieve the highest average score of 502.99 (SD = 38.25), followed by Janajati students with 498.66 (SD = 35.84) and Dalit students with 498.43 (SD = 36.14). The "Others" category has the lowest average score of 494.00 (SD = 35.24). These differences are statistically significant ($p < 0.001$), indicating that caste-related factors may influence academic performance. The higher scores among Bhramin/Chhetristudents could be attributed to socio-economic advantages or access to better educational resources, while the lower scores among other groups highlight the need for targeted interventions to bridge these gaps.

Regional ethnicity also impacts student achievement in Nepali. Pahadi students have the highest average score of 501.64 (SD = 36.39), followed by Madhesi students with 497.63 (SD = 37.63), and Himali students with 495.40 (SD = 38.86). The statistically significant differences ($p < 0.001$) suggest that regional factors, such as access to quality education and socio-economic conditions, play a role in student performance. Pahadi students' higher scores may reflect better educational infrastructure and resources in their regions, while the lower scores among Madhesi and Himali students point to potential challenges that need to be addressed.

Overall, the data underscores the importance of considering linguistic, caste, and regional factors when assessing student performance. Addressing these disparities through targeted educational policies and interventions can help ensure more equitable academic outcomes for all students in Nepal. The significant differences observed in the data highlight the need for focused efforts to support students from diverse backgrounds and regions to achieve their full potential.

Table 59 Achievement score in Nepali based on mother-tongue and ethnicity

Variables		**Count**	**Mean**	**SD**	**Sig.**
Mother Tongue Language	Other Language	132464	493.90	37.51	<0.001
	Nepali Language	315455	501.63	36.96	

Variables		Count	Mean	SD	Sig.
Ethnicity by Cast	Bhramin/Cheetri	185636	502.99	38.25	<0.001
	Janajati	176121	498.66	35.84	
	Dalit	40880	498.43	36.14	
	Others	37914	494.00	35.24	
Ethnicity by Region	Madhesi	151957	497.63	37.63	<0.001
	Pahadi	274785	501.64	36.39	
	Himali	13810	495.40	38.86	

Performance of the Students in Nepali Based on Parents' Education

The Table 60 presents the mean achievement scores, standard deviations, and significance values for students categorized by mothers and fathers' educational levels. The analysis of student achievement in Nepali based on parents' education reveals significant trends. To begin with, students whose mothers are illiterate have the lowest average score of 492.55 (SD = 35.69). As the level of maternal education increases, so does student performance. For instance, students whose mothers are literate achieve an average score of 499.24 (SD = 36.08). Furthermore, those whose mothers have completed up to 10th grade score slightly higher, with an average of 500.14 (SD = 37.33). This upward trend continues with students whose mothers have completed up to 12th grade, achieving an average score of 504.21 (SD = 39.35). Notably, the highest scores are observed among students whose mothers hold a Bachelor's degree, with an average of 515.83 (SD = 42.40), and those with mothers who have a Master's degree or higher, with an average of 508.84 (SD = 38.71). These differences are statistically significant ($p < 0.001$), indicating that higher maternal education levels positively impact student performance.

Similarly, the father's education level also shows a clear correlation with student achievement. Initially, students whose fathers are illiterate have the lowest average score of 487.32 (SD = 36.57). As the father's education level increases, student performance improves. For example, students whose fathers are literate achieve an average score of 497.98 (SD = 36.31). Additionally, those whose fathers have completed up to 10th grade score an average of 498.96 (SD = 35.71). This trend continues with students whose fathers have completed up to 12th grade, achieving an average score of 499.74 (SD = 38.52). Moreover, students whose fathers hold a Bachelor's degree achieve an average score of 509.99 (SD = 39.28). The highest scores are observed among students whose fathers have a Master's degree or higher, with an average of 513.86 (SD = 40.41). These differences are also statistically significant

($p < 0.001$), suggesting that higher paternal education levels are associated with better student performance.

In conclusion, the data underscores the importance of parental education in influencing student achievement in Nepali. Higher levels of parental education are consistently associated with higher student performance. This highlights the need for educational policies that support and encourage parental education as a means to improve student outcomes. By addressing these disparities, we can work towards ensuring more equitable academic achievements for all students in Nepal.

Table 60 Achievement of the students in Nepali based on parents' education

Variables		N	Mean	SD	Sig.
Mother Education	Illiterate	121329	492.55	35.69	<0.001
	Literate	169702	499.24	36.08	
	Up to 10 class	98355	500.14	37.33	
	Up to 12 class	48535	504.21	39.35	
	Bachelors	18294	515.83	42.40	
	Masters or above	9094	508.84	38.71	
Father Education	Illiterate	49994	487.32	36.57	<0.001
	Literate	146302	497.98	36.31	
	Up to 10 class	139214	498.96	35.71	
	Up to 12 class	75968	499.74	38.52	
	Bachelors	28779	509.99	39.28	
	Masters or above	23587	513.86	40.41	

Performance of the Students in Nepali based on Parents' Occupation

The Table 61 reveals the mean achievement scores based on parental occupations. The analysis of student achievement in Nepali based on parental occupation reveals significant trends. To begin with, students whose mothers are involved in teaching achieve the highest average score of 513.88 (SD = 37.79). This is followed by students whose mothers are engaged in labor work, with an average score of 508.29 (SD = 35.04). Additionally, students whose mothers have jobs or are involved in business also perform well, with average scores of 505.00 (SD = 41.20) and 502.28 (SD = 37.48), respectively. Conversely, students whose mothers are involved in farming and housework have a lower average score of 496.95 (SD = 36.51). These differences are statistically significant ($p < 0.001$), indicating that the nature of the mother's occupation influences student performance.

Similarly, the father's occupation also shows a clear correlation with student achievement. For instance, students whose fathers are involved in teaching achieve the highest average score of 507.00 (SD = 38.22). This is closely followed by students whose fathers have jobs, with an average score of 506.57 (SD = 37.80). Furthermore, students whose fathers are engaged in business or labor work also perform well, with average scores of 500.93 (SD = 38.65) and 501.23 (SD = 35.52), respectively. On the other hand, students whose fathers are involved in housework only have the lowest average score of 479.60 (SD = 44.37). These differences are also statistically significant ($p < 0.001$), suggesting that the father's occupation has a notable impact on student performance.

In conclusion, the data underscores the importance of parental occupation in influencing student achievement in Nepali. Higher scores are associated with parents engaged in professional occupations such as teaching and jobs. This highlights the need for educational policies that support families in diverse occupational backgrounds to ensure equitable academic outcomes for all students. By addressing these disparities, we can work towards providing more equitable educational opportunities for all students in Nepal.

Table 61 Achievement of students in Nepali based on parental occupation

Variables		N	Mean	SD	Sig.
Mother Occupation	Farming and Housework	269085	496.95	36.51	<0.001
	Housework only	102524	499.30	37.86	
	Work in others house	4223	496.75	41.27	
	Labor work	7039	508.29	35.04	
	Foreign work	8271	500.50	35.58	
	Teaching	14433	513.88	37.79	
	Business	37467	502.28	37.48	
	Job	12880	505.00	41.20	
	Others	9165	504.01	38.22	
Father Occupation	Farming and Housework	125399	494.20	36.49	<0.001
	Housework only	6947	479.60	44.37	
	Work in others house	4012	488.03	35.31	

Variables		N	Mean	SD	Sig.
	Labor work	49712	501.23	35.52	
	Foreign work	105940	497.90	35.95	
	Teaching	16966	507.00	38.22	
	Business	81296	500.93	38.65	
	Job	39745	506.57	37.80	
	Others	31739	504.31	37.82	

Nepali Achievement Based on Out of School Time

Table 62 shows significant differences in mean achievement scores based on the time students spend on various activities outside the school. The analysis of student achievement in Nepali based on time spent on out-of-school activities reveals several key insights. Firstly, students who spend 1-2 hours on TV, internet, or mobile devices achieve the highest average score of 502.95 (SD = 36.75). Those who spend less than one hour also perform well, with an average score of 500.24 (SD = 37.10). However, students who spend more than four hours have the lowest average score of 489.29 (SD = 44.47). These differences are statistically significant ($p < 0.001$), indicating that moderate use of these devices is associated with better academic performance.

Similarly, students who do not report time spent playing and talking with friends achieve the highest average score of 501.94 (SD = 37.17). Those who spend less than one hour have a similar average score of 501.36 (SD = 36.97). Conversely, students who spend more than four hours have the lowest average score of 486.96 (SD = 39.22). These differences are statistically significant ($p < 0.001$), suggesting that excessive social time may negatively impact academic performance.

Furthermore, students who spend less than one hour on household chores achieve the highest average score of 502.46 (SD = 37.29). Those who spend 1-2 hours also perform well, with an average score of 502.08 (SD = 36.19). On the other hand, students who spend more than four hours have the lowest average score of 490.09 (SD = 36.86). The differences are statistically significant ($p < 0.001$), indicating that a moderate amount of time spent on chores is beneficial for academic performance.

Moreover, students who spend more than four hours on study or homework achieve the highest average score of 504.83 (SD = 37.42). Those who spend 2-4 hours also perform well, with an average score of 504.03 (SD = 35.57). In contrast, students who do not report time spent on study or homework have the lowest average score of

473.96 (SD = 37.00). These differences are statistically significant ($p < 0.001$), highlighting the positive impact of dedicated study time on academic performance.

Furthermore, students who do not report time spent working for wages achieve the highest average score of 505.00 (SD = 36.10). Those who spend any amount of time working for wages have significantly lower average scores, with the lowest being 484.02 (SD = 35.31) for those who work more than four hours. The differences are statistically significant ($p < 0.001$), suggesting that working for wages negatively impacts academic performance.

Lastly, students who do not report time spent supporting siblings achieve the highest average score of 501.80 (SD = 39.40). Those who spend less than one hour have a similar average score of 501.94 (SD = 36.60). However, students who spend more than four hours have the lowest average score of 482.31 (SD = 35.76). These differences are statistically significant ($p < 0.001$), indicating that excessive time spent supporting siblings may detract from academic performance.

In conclusion, the data underscores the importance of balancing out-of-school activities to optimize student achievement in Nepali. Moderate engagement in activities such as study, chores, and social interactions appears beneficial, while excessive time spent on these activities or working for wages can negatively impact academic performance.

Table 62 Achievement of students in Nepali based on time spend out of school activities

Variables		N	Mean	SD	Sig.
TV/Internet/ Mobile	Time not given	95567	498.59	36.09	<0.001
	Less than one hour	237066	500.24	37.10	
	1-2 hours	77399	502.95	36.75	
	2-4 hours	11670	502.45	42.96	
	More than four hours	4855	489.29	44.47	
Play and talk with friends	Time not given	75189	501.94	37.17	<0.001
	Less than one hour	247584	501.36	36.97	
	1-2 hours	76711	497.33	36.11	
	2-4 hours	12919	498.24	39.15	
	More than four hours	5933	486.96	39.22	

Variables		N	Mean	SD	Sig.
Household chores	Time not given	29831	495.76	41.72	<0.001
	Less than one hour	149217	502.46	37.29	
	1-2 hours	162192	502.08	36.19	
	2-4 hours	54323	496.60	35.56	
	More than four hours	21910	490.09	36.86	
Study/homework	Time not given	11830	473.96	37.00	<0.001
	Less than one hour	31735	487.06	37.53	
	1-2 hours	97796	498.68	35.65	
	2-4 hours	156644	504.03	35.57	
	More than four hours	116122	504.83	37.42	
Work for wages	Time not given	318645	505.00	36.10	<0.001
	Less than one hour	26846	484.83	34.22	
	1-2 hours	14558	484.58	36.25	
	2-4 hours	9332	484.04	34.37	
	More than four hours	12282	484.02	35.31	
Support to siblings	Time not given	71497	501.80	39.40	<0.001
	Less than one hour	173848	501.94	36.60	
	1-2 hours	130468	501.86	36.09	
	2-4 hours	33016	492.18	34.66	
	More than four hours	11339	482.31	35.76	

Achievement of Students in Nepali by Learning Support Taken at Home

Table 63 presents the mean achievement scores and significance values for students receiving support from different sources. The analysis of student achievement in Nepali based on support from different sources reveals several key insights. The students who do not receive support from their fathers achieve a higher average score of 499.11 (SD = 36.80) compared to those who do receive support, who have an average score of 496.54 (SD = 41.16). Similarly, students who do not receive support from their mothers achieve a higher average score of 498.96 (SD = 37.21) compared to those who do receive support, who have an average score of 496.06 (SD = 40.58). These differences are statistically significant ($p < 0.001$), suggesting that parental support may not be as beneficial as expected for academic performance in Nepali.

In contrast, students who receive support from their siblings achieve a higher average score of 500.06 (SD = 38.21) compared to those who do not receive sibling support, who have an average score of 496.06 (SD = 40.58). This statistically significant difference ($p < 0.001$) indicates that sibling support positively impacts student achievement in Nepali. Moreover, students who receive support from tuition achieve the highest average score of 503.05 (SD = 37.07), compared to those who do not receive tuition support, who have an average score of 497.56 (SD = 37.57). This difference is also statistically significant ($p < 0.001$), highlighting the effectiveness of tuition in improving student performance.

Furthermore, students who do not receive support from friends achieve a higher average score of 498.95 (SD = 37.50) compared to those who do receive support, who have an average score of 496.34 (SD = 37.69). This statistically significant difference ($p < 0.001$) suggests that peer support may not be as beneficial for academic performance in Nepali. Interestingly, students who do not receive support from anyone achieve a lower average score of 498.16 (SD = 37.24) compared to those who do not receive support from anyone, who have an average score of 504.24 (SD = 40.02). This statistically significant difference ($p < 0.001$) indicates that students who are self-reliant or do not seek external support tend to perform better in Nepali.

In conclusion, the data underscores the varying impact of different sources of support on student achievement in Nepali. While support from siblings and tuition appears beneficial, support from parents and friends may not significantly enhance academic performance. This highlights the importance of understanding the specific needs and contexts of students to provide effective support.

Table 63 Achievement scores-based on the support taken by students from different sources

Variables		N	Mean	SD	Sig.
Support from father	No	394967	499.11	36.80	<0.001
	Yes	74403	496.54	41.16	
Support from mother	No	427338	498.96	37.21	<0.001
	Yes	42148	496.06	40.58	
Support from sibling	No	42148	496.06	40.58	<0.001
	Yes	269139	500.06	38.21	
Support from tuition	No	372177	497.56	37.57	<0.001

Variables		N	Mean	SD	Sig.
	Yes	97309	503.05	37.07	
Support from friends	No	423108	498.95	37.50	<0.001
	Yes	46378	496.34	37.69	
Support from nobody	No	427756	498.16	37.24	<0.001
	Yes	41431	504.24	40.02	

Achievement of Students in Nepali Based on ECA Activities at School

Table 64 reveals that students engaged in different leisure time activities, extracurricular activities (ECA), and levels of ECA participation show significant differences in mean achievement scores. The analysis of student achievement in Nepali based on activities at school reveals several key insights. Firstly, students who spend their leisure time playing achieve the highest average score of 502.42 (SD = 38.01). Additionally, those who engage in classwork or homework during their leisure time also perform well, with an average score of 501.87 (SD = 36.64). Conversely, students who participate in group work during their leisure time have the lowest average score of 479.68 (SD = 39.99). Meanwhile, students with no leisure time have an average score of 498.24 (SD = 36.78). These differences are statistically significant ($p < 0.001$), indicating that how students spend their leisure time can significantly impact their academic performance in Nepali.

Furthermore, students who sometimes participate in extracurricular activities (ECA) achieve the highest average score of 501.51 (SD = 36.33). In contrast, those who never participate in ECAs have a lower average score of 495.78 (SD = 38.75), while students who regularly participate in ECAs have the lowest average score of 489.43 (SD = 36.90). These differences are statistically significant ($p < 0.001$), suggesting that occasional participation in ECAs is associated with better academic performance in Nepali.

Moreover, students who sometimes participate in ECAs achieve the highest average score of 499.83 (SD = 36.81). Those who never participate in ECAs have a slightly lower average score of 499.19 (SD = 38.48). However, students who regularly participate in ECAs have the lowest average score of 492.67 (SD = 35.55). These differences are statistically significant ($p < 0.001$), indicating that regular participation in ECAs may not be as beneficial for academic performance in Nepali as occasional participation.

In conclusion, the data underscores the importance of how students spend their time at school. Engaging in activities such as playing and occasional participation in extracurricular activities appears to be beneficial for student achievement in Nepali. Conversely, excessive involvement in group work or regular participation in ECAs may negatively impact academic performance. This highlights the need for a balanced approach to school activities to optimize student outcomes.

Table 64 Achievement of students in Nepali based on activities at school

Variables		N	Mean	SD	Sig (p)
Leisure time activity	No leisure time	271111	498.24	36.78	<0.001
	Playing	66849	502.42	38.01	
	Group work	19704	479.68	39.99	
	Classwork/Homework	106391	501.87	36.64	
ECA Activities	Never	175870	495.78	38.75	<0.001
	Sometimes	275342	501.51	36.33	
	Regular	10727	489.43	36.90	
ECA Participation	Never	142059	499.19	38.48	<0.001
	Sometimes	289305	499.83	36.81	
	Regular	31409	492.67	35.55	

Achievement of Students in Nepali by Facilities at Home

Table 65 highlights significant differences in mean achievement scores based on various resources available at home for study. The analysis of student achievement in Nepali based on the facilities available for study at home reveals several significant trends. To begin with, students who have a table for study achieve a higher average score of 501.82 (SD = 37.65) compared to those who do not, who have an average score of 492.55 (SD = 36.56). Similarly, students who have a separate room for study achieve a higher average score of 500.08 (SD = 36.92) compared to those who do not, who have an average score of 496.61 (SD = 38.38). These differences are statistically significant ($p < 0.001$), suggesting that having dedicated study spaces positively impacts academic performance.

Furthermore, students who have a peaceful place for study achieve a higher average score of 501.07 (SD = 37.65) compared to those who do not, who have an average score of 494.40 (SD = 36.94). Additionally, students who have access to a computer for learning achieve a higher average score of 505.97 (SD = 40.20) compared to those who do not, who have an average score of 496.72 (SD = 36.54). These differences are also statistically significant ($p < 0.001$), indicating that a quiet environment and access to technology enhance academic performance.

Moreover, students who have literature books at home achieve the highest average score of 516.80 (SD = 54.27) compared to those who do not, who have an average score of 496.46 (SD = 48.31). Similarly, students who have reference books at home achieve a higher average score of 503.93 (SD = 37.62) compared to those who do not, who have an average score of 493.23 (SD = 36.70). These statistically significant differences ($p < 0.001$) suggest that access to literature and reference materials significantly boosts academic achievement.

In addition, students who have a dictionary at home achieve a higher average score of 505.30 (SD = 38.79) compared to those who do not, who have an average score of 496.22 (SD = 36.76). Finally, students who have internet access at home achieve a higher average score of 505.22 (SD = 36.96) compared to those who do not, who have an average score of 492.27 (SD = 37.07). These differences are statistically significant ($p < 0.001$), highlighting the critical role of having a dictionary and internet access in supporting academic achievement in Nepali.

In conclusion, the data clearly shows that having various study facilities at home, such as a dedicated study table, a separate room, a peaceful environment, access to a computer, literature and reference books, a dictionary, and internet access, significantly enhances student achievement in Nepali. These findings underscore the importance of providing students with adequate study resources to support their academic success.

Table 65 Mean scores of students in Nepali based on the facilities for study at home

Variables		N	Mean	SD	Sig. (p)
Table for study	No	157769	492.55	36.56	<0.001
	Yes	311383	501.82	37.65	
Separate room for study	No	186615	496.61	38.38	<0.001
	Yes	282217	500.08	36.92	
Peace place for study	No	165225	494.40	36.94	<0.001
	Yes	303712	501.07	37.65	

Variables		N	Mean	SD	Sig. (p)
Computer for learning	No	367292	496.72	36.54	<0.001
	Yes	100836	505.97	40.20	
Literature book	No	387814	496.46	48.31	<0.001
	Yes	81750	516.80	54.27	
Reference book	No	228953	493.23	36.70	<0.001
	Yes	239565	503.93	37.62	
Dictionary	No	337893	496.22	36.76	<0.001
	Yes	129346	505.30	38.79	
Internet facility	No	234103	492.27	37.07	<0.001
	Yes	232813	505.22	36.96	

Mean Score of Students Based on the Facilities Available at Home

The analysis of student achievement in Nepali based on the facilities available at home reveals several key insights (Table 66). To begin with, students who have access to a mobile phone at home achieve a higher average score of 499.16 (SD = 37.00) compared to those who do not, who have an average score of 486.37 (SD = 38.07). Similarly, students who have a television at home achieve a higher average score of 501.76 (SD = 39.61) compared to those who do not, who have an average score of 495.96 (SD = 36.67). These findings suggest that access to mobile phones and televisions may provide students with additional learning resources or support, thereby enhancing their academic performance.

Furthermore, students who have access to a computer at home achieve a higher average score of 503.36 (SD = 41.13) compared to those who do not, who have an average score of 500.09 (SD = 36.04). This highlights the significant role that computers play in enhancing academic performance, likely due to access to digital learning tools and resources. On the other hand, the presence of a motorbike at home does not show a significant difference in student achievement. Students with a motorbike at home have an average score of 499.31 (SD = 38.72), while those without have an average score of 499.96 (SD = 36.27). This suggests that motorbike ownership does not have a substantial impact on academic performance.

Conversely, students who have a car at home achieve a lower average score of 482.36 (SD = 41.32) compared to those who do not, who have an average score of

501.43 (SD = 36.43). This unexpected result might indicate that car ownership is associated with other factors that negatively impact academic performance. Additionally, students who live in a concrete house achieve a lower average score of 495.21 (SD = 37.83) compared to those who do not, who have an average score of 497.74 (SD = 36.47). This suggests that the type of housing may not be a strong determinant of academic performance.

In conclusion, the data indicates that access to certain facilities at home, such as mobile phones, televisions, and computers, positively impacts student achievement in Nepali. However, other factors, such as motorbike and car ownership or the type of housing, do not show a clear positive correlation with academic performance. These findings highlight the importance of providing students with access to educational resources and technology to support their academic success.

Table 66 Mean score of students based on the facilities available at home

Variables		N	Mean	SD
Mobile	No	19883	486.37	38.07
	Yes	439514	499.16	37.00
TV	No	156701	495.96	36.67
	Yes	90529	501.76	39.61
Computer	No	296840	500.09	36.04
	Yes	36442	503.36	41.13
Motorbike	No	237620	499.96	36.27
	Yes	59450	499.31	38.72
Car	No	372226	501.43	36.43
	Yes	8019	482.36	41.32
Concrete house	No	153273	497.74	36.47
	Yes	91675	495.21	37.83

Achievement Score of Students in Nepali Based on Activities at School

The analysis of student achievement in Nepali based on various school activities reveals several key insights (Table 67). To begin with, students who always receive homework from their teachers achieve an average score of 498.79 (SD = 37.20). Additionally, those who sometimes receive homework perform slightly better, with an average score of 499.57 (SD = 37.65). However, students who never receive homework have a significantly lower average score of 3189 (SD = 43.66). These differences are statistically significant ($p < 0.001$), indicating that regular homework assignments positively impact academic performance.

Furthermore, students who always receive feedback from teachers by checking their homework achieve the highest average score of 499.86 (SD = 37.16). In contrast, those who sometimes receive feedback have a lower average score of 495.65 (SD = 38.12), while students who never receive feedback have the lowest average score of 475.82 (SD = 37.46). These differences are also statistically significant ($p < 0.001$), suggesting that consistent feedback from teachers is crucial for improving student performance.

Moreover, students whose Nepali teachers are always regular achieve an average score of 498.19 (SD = 37.11). Interestingly, students whose teachers are sometimes regular perform better, with an average score of 506.09 (SD = 38.41). Conversely, students whose teachers are never regular have a lower average score of 480.50 (SD = 37.07). These differences are statistically significant ($p < 0.001$), highlighting the importance of teacher regularity in enhancing student achievement.

Additionally, students whose Nepali teachers are full-time achieve an average score of 499.78 (SD = 37.04). Those whose teachers come late and leave early have a lower average score of 486.56 (SD = 40.39), while students whose teachers frequently do not come have the lowest average score of 480.92 (SD = 38.29). These differences are statistically significant ($p < 0.001$), indicating that consistent teacher presence in the classroom is essential for student success.

In conclusion, the data underscores the significant impact of various school activities on student achievement in Nepali. Regular homework assignments, consistent teacher feedback, and teacher regularity and presence in the classroom are all crucial factors that contribute to better academic performance. These findings highlight the importance of structured and supportive educational practices in fostering student success.

Table 67 Achievement score of students in Nepali based on activities at school

Variables		N	Mean	SD	Sig
Homework given by teachers	Always	345979	498.79	37.20	<0.001
	Sometimes	117974	499.57	37.65	
	Never	3189	3189	43.66	

Variables		N	Mean	SD	Sig
Teacher feedback by checking homework	Always	378625	499.86	37.16	<0.001
	Sometimes	84832	495.65	38.12	
	Never	2974	475.82	37.46	
Nepali teacher regularity	Always	405788	498.19	37.11	<0.001
	Sometimes	55499	506.09	38.41	
	Never	5876	480.50	37.07	
Nepali teacher classroom regularity	Fulltime	443373	499.78	37.04	<0.001
	Late come and leave early	9291	486.56	40.39	
	Frequently does not come	13689	480.92	38.29	

Bullying Status at School and Nepali Achievement

The analysis of student achievement in Nepali based on bullying status at school reveals some important insights (Table 68). To begin with, students who do not experience bullying at school achieve a higher average score of 499.42 (SD = 36.45). This group comprises 42.7% of the total student population, with a count of 200,548 students. The relatively lower standard deviation indicates more consistent performance among these students.

Conversely, students who experience bullying at school have a slightly lower average score of 498.14 (SD = 38.31). This group represents a larger portion of the student population, accounting for 57.3% with a count of 269,015 students. The higher standard deviation suggests greater variability in performance among these students.

Furthermore, the data indicates that students who do not experience bullying tend to perform slightly better in Nepali compared to those who do experience bullying. Although the difference in average scores is not large, the presence of bullying appears to have a negative impact on student achievement. The higher standard deviation among bullied students suggests that bullying may contribute to inconsistent academic performance.

In conclusion, the findings highlight the importance of creating a safe and supportive school environment to enhance student achievement. Addressing bullying and its effects can help improve academic outcomes and ensure more consistent performance among students.

Table 68 Achievement score in Nepali based on bullying at school

Variable		Achievement score			
		Mean	**Count**	**Percentage%**	**Standard Deviation**
Bullying Status	No bullying	499.42	200548	42.7%	36.45
	Bullying	498.14	269015	57.3%	38.31

Status of Bullying Experienced by Students in Nepali Class

The chart in Figure 42 illustrates the percentage of students who have experienced various numbers of bullying types. To begin with, the largest group, representing 42.7% of students, has not experienced any bullying. This is followed by 25.4% of students who have experienced one type of bullying. Furthermore, the percentages continue to decrease as the number of bullying types increases. Specifically, 14.1% of students have experienced two types of bullying, while 8.4% have experienced three types. Additionally, 4.8% of students have encountered four types of bullying, and 2% have experienced five types. Moreover, the chart shows that 1% of students have experienced six types of bullying, and the smallest group, at 0.5%, has experienced seven types of bullying.

In conclusion, the data highlights that while a significant portion of students have not experienced any bullying, there is a notable decrease in percentages as the number of different bullying experiences increases. This suggests that multiple types of bullying are less common among the student population.

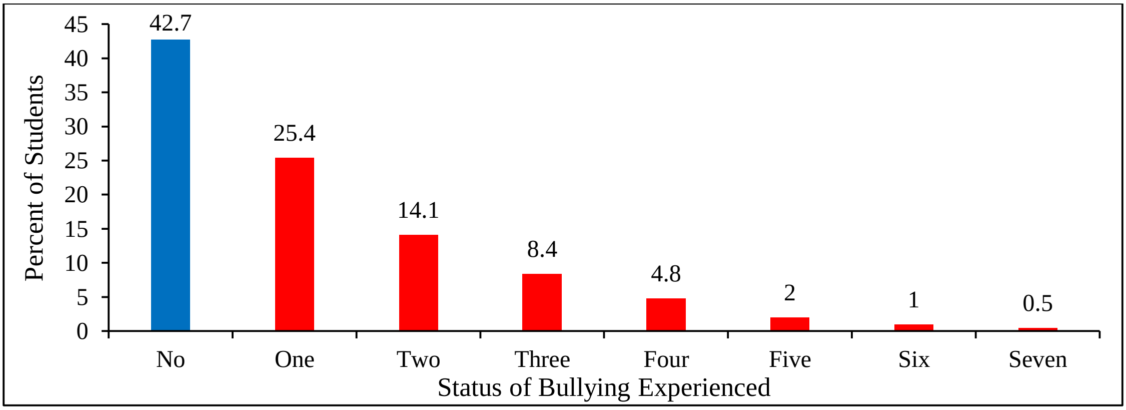


Figure 41 Status of bullying faced by the students participated in Nepali

Achievement of Students in Nepali based on Perception of Students towards School and Subject Related Variables

The results in Table 69 show student attitudes towards teachers, school, the Nepali subject, and learning Nepali, as well as those engaged at school and their impact on mean achievement scores. The analysis of student achievement in Nepali based on attitudes towards learning reveals several key insights. To begin with, students who have a positive attitude towards their teachers achieve a significantly higher average score of 499.14 (SD = 37.36) compared to those with a negative attitude, who score an average of 476.47 (SD = 38.00). This group with a positive attitude comprises 99.0% of the total student population, while the negative attitude group makes up only 1.0%. Consequently, this indicates that a positive attitude towards teachers is strongly associated with better academic performance.

Moreover, students with a positive attitude towards their school achieve a higher average score of 499.16 (SD = 37.29) compared to those with a negative attitude, who have an average score of 471.16 (SD = 39.54). Similarly, the positive attitude group represents 99.0% of the students, while the negative attitude group accounts for 1.0%. Therefore, this suggests that a positive perception of the school environment contributes to higher achievement in Nepali.

In addition, students with a positive attitude towards the Nepali subject achieve an average score of 498.95 (SD = 37.20), whereas those with a negative attitude have an average score of 492.31 (SD = 48.56). The positive attitude group comprises 98.5% of the students, while the negative attitude group makes up 1.5%. Thus, this indicates that students who enjoy and value the Nepali subject tend to perform better.

Furthermore, students with a positive attitude towards learning Nepali achieve a higher average score of 499.07 (SD = 37.30) compared to those with a negative attitude, who have an average score of 481.69 (SD = 42.84). The positive attitude group represents 99.0% of the students, while the negative attitude group accounts for 1.0%. Hence, this highlights the importance of a positive attitude towards learning in achieving better academic outcomes.

Finally, students who are engaged at school achieve a significantly higher average score of 499.12 (SD = 37.38) compared to those who are not engaged, who have an average score of 485.38 (SD = 36.54). The engaged group comprises 98.4% of the students, while the not engaged group makes up 1.6%. Consequently, this underscores the critical role of student engagement in enhancing academic performance.

In conclusion, the data clearly shows that positive attitudes towards teachers, school, the Nepali subject, and learning Nepali, as well as active engagement at school, are strongly associated with higher student achievement in Nepali. These findings highlight the importance of fostering positive attitudes and engagement to support academic success.

Table 69 Nepali achievement based on attitude towards Nepali learning

Attitude		**Achievement score**			
		Mean	**Count**	**SD**	**Frequency**
Attitude towards teachers	Negative	476.47	4810	38.00	1.0%
	Positive	499.14	462026	37.36	99.0%
Attitudes towards school	Negative	471.16	4699	39.54	1.0%
	Positive	499.16	462306	37.29	99.0%
Attitude towards Nepali subject	Negative	492.31	7207	48.56	1.5%
	Positive	498.95	460632	37.20	98.5%
Attitude towards learning Nepali	Negative	481.69	4849	42.84	1.0%
	Positive	499.07	462462	37.30	99.0%
Engagement at school	not engaged	485.38	7497	36.54	1.6%
	Engaged	499.12	459399	37.38	98.4%

Effect of Individual, Family and School Related Factors on Nepali Achievement

The multiple linear regression analysis for student achievement in Nepal reveals several significant predictors (Table 70). The regression results show that the model explains 9% of the variance in the dependent variable ($R^2 = 0.09$). The VIF values less than 10 confirm that there is no issue of collinearity of the independent variables. To begin with, time spent working for wages negatively impacts achievement, with a coefficient of -4.94 ($t = -66.33$, $p < 0.001$). This indicates that more time spent working is associated with lower scores. Conversely, time spent on study/homework positively influences achievement, with a coefficient of 4.63 ($t = 69.02$, $p < 0.001$), suggesting that more study time leads to higher scores.

Moreover, parental education plays a crucial role. Father's education has a positive effect ($B = 1.46$, $t = 21.71$, $p < 0.001$), as does mother's education ($B = 0.46$, $t = 6.49$, $p < 0.001$). Additionally, access to resources such as the internet ($B = 2.62$, t = 16.83, p < 0.001) and reference books (B = 3.13, t = 20.83, p < 0.001) further enhances student performance.

Furthermore, teacher-related factors are significant. Nepali teacher classroom regularity (B = 4.97, t = 26.16, p < 0.001) and teacher feedback by checking homework (B = 1.75, t = 10.58, p < 0.001) positively affect achievement. However, Nepali teacher regularity shows a negative coefficient (B = -3.90, t = -23.80, p < 0.001), indicating some complexity in this relationship.

In addition, student attitudes and engagement are critical. Engagement at school (B = 12.06, t = 22.26, p < 0.001), attitude towards teachers (B = 9.25, t = 11.88, p < 0.001), and attitude towards learning Nepali (B = 7.96, t = 11.50, p < 0.001) all positively correlate with higher achievement. Conversely, bullying at school (B = -2.70, t = -20.71, p < 0.001) and time for support to siblings (B = -1.66, t = -23.20, p < 0.001) negatively impact scores.

Finally, access to technology shows mixed results. Access to mobile phones negatively affects achievement (B = -9.00, t = -28.25, p < 0.001), while time to use TV/Internet/Mobile has a small positive effect (B = 0.75, t = 8.68, p < 0.001). Lastly, facilities at home (B = -0.28, t = -4.82, p < 0.001) and homework given by teachers (B = 0.56, t = 3.85, p < 0.001) also play roles in student achievement.

In summary, the analysis highlights the importance of study time, parental education, access to resources, teacher involvement, student attitudes, and engagement in enhancing student achievement in Nepal. Negative factors such as time spent working for wages, bullying, and excessive mobile phone use detract from academic performance.

Table 70 Effect of personal, family, and school related factors in Nepali achievement score

Predictors	B	SE	Beta	t	Sig.	VIF
Time for work for wages	-4.94	0.07	-0.12	-66.33	<0.001	1.11
Time for study/homework	4.63	0.07	0.12	69.02	<0.001	1.10
Father education	1.46	0.07	0.05	21.71	<0.001	1.95
Access of Internet	2.62	0.16	0.04	16.83	<0.001	1.55
Nepali teacher classroom regularity	4.97	0.19	0.05	26.16	<0.001	1.05
Access of mobile	-9.00	0.32	-0.05	-28.25	<0.001	1.02

Predictors	B	SE	Beta	t	Sig.	VIF
Access of reference books	3.13	0.15	0.04	20.83	<0.001	1.45
Mother tongue language	3.82	0.14	0.05	26.80	<0.001	1.07
Engagement at school	12.06	0.54	0.04	22.26	<0.001	1.10
Time for support to siblings	-1.66	0.07	-0.04	-23.20	<0.001	1.17
Nepali teacher regularity	-3.90	0.16	-0.04	-23.80	<0.001	1.06
Bullying at school	-2.70	0.13	-0.04	-20.71	<0.001	1.07
Attitude towards teachers	9.25	0.78	0.02	11.88	<0.001	1.14
Time for play and talk with friends	-1.63	0.08	-0.03	-19.37	<0.001	1.10
Separate room for study	-2.58	0.14	-0.03	-18.75	<0.001	1.16
Table for study	2.27	0.16	0.03	14.59	<0.001	1.33
Time to reach school	-1.01	0.08	-0.02	-13.28	<0.001	1.07
Nepali dictionary	1.78	0.16	0.02	11.41	<0.001	1.33
Teacher feedback by checking homework	1.75	0.17	0.02	10.58	<0.001	1.17
Attitude towards learning Nepali	7.96	0.69	0.02	11.50	<0.001	1.21
ECA activities	-1.59	0.12	-0.02	-12.82	<0.001	1.09
ECA participation	1.28	0.12	0.02	10.96	<0.001	1.11
Time to use TV/Internet/Mobile	0.75	0.09	0.02	8.68	<0.001	1.20
Attitudes towards school	8.33	0.79	0.02	10.54	<0.001	1.20
Access of computer for learning	1.02	0.17	0.01	6.08	<0.001	1.34
Mother education	0.46	0.07	0.02	6.49	<0.001	1.98
Attitude towards Nepali subject	-3.83	0.54	-0.01	-7.08	<0.001	1.26
Facilities at home	-0.28	0.06	-0.01	-4.82	<0.001	1.66
Homework given by teachers	0.56	0.14	0.01	3.85	<0.001	1.18

CHAPTER VII

Findings, Conclusions and Recommendations

Findings and Discussions

The national assessment of grade 10 students in Nepal for 2023 reveals mixed results in achievement scores across various subjects. The national average scores are 500 for Mathematics, 504.83 for Science, 515.11 for English, and 498.68 for Nepali. Compared to 2019, there has been an increase in Science and English scores by 4.83 and 15.11 points, respectively, while Nepali scores have decreased by 1.28 points. Mathematics scores were not calibrated with the 2019 NASA, so the results were not compared.

Additionally, the national average raw scores for Mathematics, Science, English, and Nepali are 32.71, 35.76, 41.10, and 32.13, respectively. The results further show that 60% of students in Mathematics, 50.2% in Science, 29.4% in English, and 53.8% in Nepali are at the pre-basic to proficient 1 level. Consequently, only 40% in Mathematics, 49.9% in Science, 70.6% in English, and 46.2% in Nepali achieved the minimum level of proficiency.

Province Level

The achievement scores across all subjects are highest among students in Bagmati province, while Karnali province has the lowest scores in Mathematics, Science, and English. However, the lowest scores in Nepali are found in Madhesh province. Students from Bagmati, Gandaki, and Madhesh provinces surpass the national average in Mathematics, while Bagmati and Gandaki exceed the national average in Science. In Nepali and English, Bagmati, Gandaki, Lumbini, and Koshi provinces outperform the national average. According to a UNESCO report, achievement may vary across different geographical locations (UNICEF, 2023). This highlights that rural and remote areas in Nepal often struggle with lower educational outcomes due to limited access to quality education and resources. Furthermore, studies indicate that socio-economic status and geographic location significantly impact student achievement. Students from more developed regions, often attending better-resourced schools, tend to perform better academically (Neupane, 2020).

Local Levels

Achievement scores in all subjects are significantly lower among students from rural municipalities compared to those from urban municipalities. Additionally, only the achievement scores of students from urban municipalities surpass the national average across all subjects. Research indicates that students in urban areas benefit from better educational facilities, more qualified teachers, and greater access to learning resources compared to their rural counterparts (UNICEF, 2023). In rural areas, access to education remains a significant challenge due to geographic isolation, economic hardships, and cultural barriers. The World Bank reports that only 65% of children in rural Nepal attend primary school, compared to 90% in urban areas (Collegenp, 2023).

School Type

The achievement scores across all subjects are significantly higher among students from institutional schools compared to their counterparts in community schools. Additionally, in all four subjects, only institutional schools surpass the national average score.

Gender

The national assessment of grade 10 students in Nepal reveals notable gender disparities in achievement scores across various subjects. In Mathematics, Science, and English, boys significantly outperform girls, with girls' scores falling below the national average. However, in Nepali, girls outperform boys, indicating that gender plays a significant role in students' achievement in this subject. These findings highlight the need for gender-sensitive educational strategies to address these disparities.

Home-School Distance

The highest achievement scores in Mathematics, Science, and English are among students who have less than a 15-minute commute to school. In contrast, the highest scores in Nepali are among students with a 15–30-minute commute.

Home Language

Students who speak Nepali as their home language achieve significantly better scores across all four subjects compared to those who speak other languages. Research by Strand et al. (2015) supports this finding, showing that students who speak the dominant language at home, such as Nepali in Nepal, tend to achieve higher academic scores.

Ethnicity

When examining achievement scores by ethnicity and caste, students from Brahmin/Chhetri backgrounds consistently perform better, while those from Dalit backgrounds score significantly lower in all subjects. Gillborn and Mirza (2000) demonstrated that ethnic background significantly influences academic achievement, with students from certain ethnic groups, such as Brahmin/Chhetri in Nepal, consistently outperforming their peers from other ethnic backgrounds. This study emphasizes the role of social and cultural capital in shaping educational outcomes. In terms of ethnicity by caste, the highest scores in Mathematics are found among students categorized as “Others,” followed by Brahmins. A study by the Education Endowment Foundation (EEF) also established that students from minority ethnic backgrounds often face additional challenges, such as discrimination and lower teacher expectations, which can negatively impact their academic performance (EEF, 2015).

Ethnicity by Geography

Significant results are established in all subjects regarding ethnicity by geography. In Mathematics, Madhesi students have the highest scores, followed by Pahadi and Himali, with a notable difference among these groups. In Science and Nepali, Pahadi students achieve the highest scores, while Himali students score the lowest, falling below the national average. In Nepal, student ethnicity has been associated with higher test scores, particularly in Mathematics (Joshi & James, 2022).

Parents’ Education

Students whose parents (both father and mother) have higher levels of education achieve significantly higher scores in all four subjects. The findings of Avnet et al. (2019) align with this study. A meta-analysis by Danişman (2017) demonstrated that parental involvement, which is often higher among more educated parents, positively affects student achievement.

Parents’ Occupation

Findings on parental occupation reveal significant differences in achievement scores across all four subjects. Students whose parents are in the teaching profession achieve the highest scores, while those whose parents are involved in housework or work in others’ houses score the lowest. A study by the Research and Scientific Innovation Society (RSIS) also found that parental occupation significantly impacts students’ academic performance, with those whose parents are in professional roles achieving higher scores (RSIS, 2018). The OECD’s Programme for International Student Assessment (PISA) highlights that students whose parents work in professional occupations generally outperform their peers in Mathematics and other subjects. This trend is observed across various countries, although the strength of the relationship can vary significantly (OECD, n.d.). Similarly, research by Das (2020) using a probabilistic model found that parental occupation significantly influences a child’s learning performance, with professional occupations correlating with higher academic achievement.

Time Spent Out of School

The assessment results indicate that time spent on various activities outside school significantly impacts achievement scores. For Mathematics and Science, students who spend 2-4 hours on digital resources achieve the highest scores, while for Nepali, the optimal time is 1-2 hours, and for English, it is more than 2-4 hours. Additionally, students who spend less than one hour on household chores perform better in all subjects, whereas those dedicating more than four hours to study or homework excel across the board. Moreover, students who do not work for wages score higher in all subjects. The highest achievement scores in Mathematics and English are among students who do not support their siblings, while those who support siblings for less than one hour achieve the highest scores in Nepali. Balanced time management outside school is crucial for optimizing academic performance across all subjects. Research by Gershenson et al. (2017) found that students who spend more time on educational activities outside of school, such as homework and studying, tend to achieve higher scores in subjects like Mathematics and Science. Their study highlights that time spent on non-academic activities, such as watching TV or playing games, can negatively impact academic performance. Similarly, a study by Bodovski and Farkas (2007) demonstrated that students who engage in structured activities, such as extracurricular activities, tend to perform better academically compared to those who do not participate in such activities.

Support for Study

The achievement scores in Nepali are higher among students who receive support from none, tuition, and siblings, whereas in English, the highest scores are among those receiving support from tuition, friends, and mothers. Similarly, in Science, students who receive support from none, friends, and tuition perform best, while in Mathematics, the highest scores are among those receiving support from none and tuition. A study by Kaya and Erdem (2021) found that students who receive structured study support, such as tuition or peer collaboration, tend to perform better academically. Their meta-analysis revealed that study support positively impacts students' well-being and academic achievement, highlighting the importance of tailored support strategies. Similarly, a study by Steinmayr et al. (2019) emphasized that motivational constructs, including study support, significantly predict academic success beyond cognitive abilities. This study suggests that students who receive consistent support from peers or tutors are more likely to achieve higher scores. Moreover, research by Brophy and Good (1969) demonstrated that teacher and parental support positively influence students' academic performance. Their study highlights that students who perceive high levels of support from teachers and parents tend to have better academic outcomes.

Home Facilities

Achievement scores in Nepali are higher among students who have all home facilities except for a car, motorcycle, and Pakki Ghar. Similarly, students with all measured home facilities, such as a mobile phone, TV, computer, motorbike, car, and Pakki Ghar, achieve better scores in English, Science, and Mathematics. A study by Nawaz Khan et al. (2019) found that students with access to study-related resources, such as a study table, separate study room, and internet facilities, tend to achieve higher academic scores. Similarly, a study by Younas (2021) demonstrated that home environment factors, such as access to educational materials and a quiet study space, are positively correlated with higher academic achievement. Research by Earthman (2002) supports these findings, indicating that the quality of the physical environment at home, including access to technology and study materials, significantly affects student performance.

ECA Activities and Engagement

Students engaged in playing during leisure time in the classroom achieve better results in Mathematics and Nepali, while those engaged in group work perform better in Science. Furrer and Skinner (2003) found that school engagement is positively linked with school grades, standardized test scores, homework completion, and post-secondary school enrollment. Their study highlights that students who are more engaged in school activities are less likely to experience grade retention and school drop-out. Additionally, students who regularly participate in extracurricular activities perform better in Science and Mathematics, while those who never participate in these activities perform better in English. In Nepali, students who sometimes participate in extracurricular activities achieve the best results. Janosz et al. (2008) demonstrated that school engagement significantly predicts academic success, with engaged students achieving higher academic outcomes compared to their disengaged peers. Similarly, a study by Schnitzler et al. (2021) emphasized the importance of student engagement patterns, showing that students with higher engagement levels tend to have better academic self-concepts and achieve higher end-of-year scores. This study suggests that different forms of engagement, from compliant to busy, can positively impact academic achievement.

Teacher Activities

Students who occasionally receive homework from teachers achieve the highest scores in all subjects. However, those who receive regular feedback from their teachers also perform exceptionally well across all subjects. Additionally, students who perceive their teachers as being consistently present in class achieve the highest scores. A study by Burroughs et al. (2019) highlights that teacher effectiveness, including regular feedback, consistent presence, and effective classroom management, is crucial for improving student outcomes. Their study emphasizes that teachers who provide regular feedback and manage classroom time effectively tend to have students with higher academic achievement.

Bullying at School

Students who do not have experienced any form of bullying, they have performed better in all subjects. However, around half of the students face bullying at school. Gomes et al. (2020) established that bullying significantly undermines academic achievement, with victims often displaying worse school results due to disrupted classroom behavior and increased stress levels. Similarly, Al-Raqqad et al. (2017) demonstrated that bullying negatively impacts students' academic performance, with both victims and perpetrators showing lower achievement scores compared to their peers. Moreover, a study funded by the National Institutes of Health found that children who are bullied have lower academic achievement, a greater dislike of school, and less confidence in their academic abilities (Education World, 2017). Additionally, research by the American Psychological Association (APA) supports these findings, indicating that chronic bullying is linked to lower academic achievement and a greater dislike of school (APA, 2017).

Attitudes of Students towards Subject, Teacher, and Learning

Students with positive attitudes towards their subjects, teachers, and learning achieve better performance in all four subjects. Pintrich and Schunk (2002) emphasized that motivated students are more likely to persist in the face of challenges and achieve higher academic success. Steinmayr et al. (2019) found that achievement motivation, which includes constructs like ability self-concepts, task values, and achievement motives, significantly predicts academic success beyond cognitive abilities. Their study revealed that students with strong ability self-concepts and high task values in specific subjects, such as Mathematics, tend to achieve higher scores. Similarly, Vu et al. (2021) highlighted the reciprocal relationship between motivation and achievement, noting that motivated students are more likely to engage deeply in learning activities, which in turn enhances their academic performance.

Conclusion

The national assessment of grade 10 students in Nepal 2023 reveals significant disparities in academic achievement across various factors. Nationally, while there have been improvements in Science and Nepali scores since 2019, a substantial portion of students remain below the proficient level, particularly in Mathematics. This indicates a pressing need for targeted interventions to boost Mathematics proficiency.

Provincial disparities are evident, with Bagmati and Gandaki provinces outperforming others, while Karnali and Sudurpaschim lag behind. This suggests that regional differences in educational resources and infrastructure play a crucial role in student performance. Urban students consistently achieve higher scores than their rural counterparts, highlighting the need for targeted interventions in rural areas to bridge this gap.

Institutional schools outperform community schools across all subjects, reflecting disparities in infrastructure and teaching quality. This underscores the importance of improving facilities and teaching standards in community schools to ensure equitable education for all students. Gender disparities persist, with boys excelling in Mathematics, Science, and English, while girls outperform boys in Nepali. This indicates the need for gender-sensitive educational strategies to address these differences and promote balanced academic achievement.

Proximity to school positively impacts performance, particularly in Nepali, where students living closest to the school achieve the highest scores. This highlights the importance of accessible education and the potential benefits of reducing travel time for students.

Students with Nepali as their home language and those from Brahmin/Chhetri backgrounds perform better across all subjects, highlighting the need for interventions to address ethnic and linguistic disparities. Parental education and occupation significantly influence student achievement, with higher parental education and professional occupations correlating with better student performance. This suggests that enhancing parental involvement and support could positively impact student outcomes.

Effective time management outside school, tailored study support, and access to home facilities are crucial for optimizing academic performance. School engagement, particularly through balanced participation in extracurricular activities, and positive teacher activities, such as regular feedback and effective classroom management, significantly enhance student achievement. Addressing bullying is essential, as it negatively impacts performance in most subjects.

Fostering learning motivation through frequent problem-solving, group work, and positive attitudes towards subjects like Nepali is vital for improving academic outcomes. These findings underscore the need for comprehensive, targeted strategies to address the diverse factors influencing student achievement and to ensure equitable educational opportunities for all students in Nepal. Implementing these strategies will require collaboration among government bodies, educational institutions, teachers, parents, and the community. By working together, stakeholders can create a supportive and inclusive educational environment that promotes academic success for every student.

Recommendations

Province Level

Significant disparities in achievement scores across provinces necessitate targeted interventions. Developing province-specific action plans to address the unique challenges faced by lower-performing provinces like Karnali and Sudurpaschim is essential. Allocating additional resources and support to these provinces can help improve educational outcomes. Additionally, facilitating the sharing of best practices and successful strategies from high-performing provinces like Bagmati and Gandaki with other provinces can be beneficial. Organizing inter-provincial workshops and training sessions for educators will further support this effort.

Local Levels

At the local level, there is a clear need to support rural education. Increasing investment in rural education infrastructure, including better school facilities and access to learning materials, is crucial. Deploying digital classrooms can help reach remote areas. Engaging local communities in the education process to create a supportive learning environment is also important. Encouraging parental involvement in their children's education through awareness programs and workshops can make a significant impact.

School Type

The significant difference in achievement scores between institutional and community schools highlights the need for equity in education. Ensuring equitable distribution of resources between these schools is essential. Providing additional funding and support to community schools can help bridge the performance gap. Implementing quality improvement programs in community schools, focusing on teacher training, infrastructure development, and student support services, is necessary. Regular monitoring and evaluation of these programs will ensure their effectiveness. Targeted interventions in community schools, such as improving teacher training, enhancing school infrastructure, and providing additional learning resources, have been shown to mitigate some of the disparities in student achievement (Glewwe et al., 2011). These interventions are crucial for bringing community school students' performance closer to the national average.

Gender

Addressing gender disparities in achievement scores requires the development and implementation of gender-sensitive teaching strategies. Promoting gender equality in classrooms through awareness programs and inclusive teaching practices is essential. Encouraging girls to pursue STEM (Science, Technology, Engineering, and Mathematics) subjects through scholarships, mentorship programs, and role models can help improve their performance. Providing additional support and resources to help girls improve in subjects where they lag behind will also be beneficial.

School Distance

To address the impact of school distance on student achievement, it is essential to implement strategies that support students who travel long distances. Providing transportation services or establishing more schools in remote areas can help reduce travel time. Additionally, offering after-school programs and homework assistance at school can support students who spend significant time commuting, ensuring they have adequate time for study and rest.

Home Language and Ethnicity

Given the significant disparities in achievement based on home language and ethnicity, targeted educational interventions are essential. Developing bilingual education programs can support students whose home language is not Nepali, helping them improve their proficiency in all subjects. Additionally, implementing culturally responsive teaching practices can address the unique needs of students from diverse ethnic backgrounds. Providing additional resources and support to Dalit students and other underperforming groups can help bridge the achievement gap.

Ethnicity by Geography

To address the disparities in achievement scores across different ethnic and geographic groups, targeted interventions are needed. Developing region-specific educational programs that consider the unique cultural and geographic contexts of each area can help improve student performance. Providing additional resources and support to underperforming regions, such as Himali areas, can address the educational needs of these students. Encouraging collaboration between high-performing and low-performing regions can also facilitate the sharing of best practices and successful strategies.

Parental Education

The strong correlation between parental education levels and student achievement highlights the importance of supporting parental education. Implementing adult education programs and literacy initiatives can improve the educational levels of parents, which in turn can positively impact their children’s academic performance. Encouraging parental involvement in their children’s education through workshops and community programs can also help create a supportive learning environment at home.

Parental Occupation

To address the impact of parental occupation on student achievement, targeted support for students from lower-performing occupational backgrounds is necessary. Providing additional academic support and resources to students whose parents are engaged in farming, housework, or labor work can help improve their performance. Implementing career counseling and vocational training programs for parents can also help improve their socio-economic status, which can positively impact their children's education.

Time Spent Out of School

Effective time management outside school is crucial for optimizing academic performance. Encouraging students to balance their time between study, leisure, and household responsibilities can significantly improve their achievement scores. Implementing after-school programs and study groups can provide structured study time and support for students. Additionally, educating parents and students about the importance of limiting screen time and encouraging productive activities can further enhance academic performance.

Study Support

To optimize academic performance, it is essential to tailor study support strategies. Encouraging self-learning and collaboration with friends can be highly beneficial, as these methods have shown positive impacts on student achievement. Prioritizing tuition support is crucial, as it consistently leads to higher scores across subjects. Schools should also consider offering structured study sessions and peer tutoring programs to enhance learning outcomes.

Home Facilities

Improving home facilities can significantly boost student achievement. Ensuring that students have access to a study table, a separate room for study, and a peaceful environment is crucial. Providing resources such as computers, internet access, literature books, reference books, and dictionaries can further enhance learning. Initiatives to improve living conditions, such as providing access to basic amenities and promoting the construction of concrete homes, can also contribute to better academic performance.

School Engagement

Balanced participation in extracurricular activities (ECA) and effective use of leisure time are key to enhancing academic performance. Schools should encourage regular but balanced participation in ECAs, ensuring that students do not overcommit to these activities at the expense of their studies. Promoting group work and classwork/homework during leisure time can also improve student engagement and achievement. Schools should create a supportive environment that fosters both academic and extracurricular development.

Teacher Activities

Teachers play a critical role in student achievement. Providing regular feedback, maintaining a consistent presence, and managing classroom time effectively are essential strategies. Incorporating digital resources and internet use in classroom activities can further enhance learning. Continuous professional development for teachers should focus on these areas to ensure they can effectively support student learning across all subjects.

Bullying at School

Addressing bullying is crucial for improving student achievement. Implementing comprehensive anti-bullying programs and creating a safe and supportive school environment can help reduce the negative impact of bullying on academic performance. Schools should provide counseling and support services for students who experience bullying and promote a culture of respect and inclusion.

Learning Motivation

To enhance learning motivation and improve academic performance, it is essential to encourage students to frequently engage in problem-solving activities and review past exam questions. Teachers should incorporate regular problem-solving sessions and group work into their lessons to foster collaborative learning and critical thinking. Promoting self-study using internet resources can also be beneficial, as long as students are guided on how to use these resources effectively.

In Mathematics and Science, consistent practice and engagement in learning activities should be emphasized. Schools can organize study groups and provide access to old exam questions for regular practice. Encouraging students to solve problems similar to those demonstrated by teachers can help reinforce their understanding and boost their confidence.

For English, similar strategies should be applied, with a focus on frequent problem-solving and reviewing past exam questions. Teachers can create a supportive environment that encourages students to engage in these practices regularly.

In Nepali, fostering positive attitudes towards the subject is crucial. Highlighting the practical benefits of learning Nepali in daily life and its importance for future success can motivate students. Encouraging enjoyment of Nepali-related activities and integrating them into the curriculum can also enhance student engagement and performance.

References

Al-Raqqad, H. K., Al-Bourini, E. S., Al Talahin, F. M., & Aranki, R. M. E. (2017). The impact of school bullying on students' academic achievement from teachers' perspective in Jordanian schools. *International Education Studies, 10*(6), 44-50. https://doi.org/10.5539/ies.v10n6p44

American Psychological Association (APA). (2017). *School bullying linked to lower academic achievement; research finds.* Retrieved from https://www.apa.org/news/press/releases/2017/01/school-bullying

Avnet, M., Makara, D., Larwin, K. H., & Erickson, M. (2019). The impact of parental involvement and education on academic achievement in elementary school. *International Journal of Evaluation and Research in Education, 8*(3), 476-483. https://doi.org/10.11591/ijere.v8i3.20249

Bodovski, K., & Farkas, G. (2007). Do instructional practices contribute to the stratification of academic achievement by socioeconomic status? *The Elementary School Journal, 108*(1), 1-20. https://doi.org/10.1086/525550

Brophy, J. E., & Good, T. L. (1969). *Teacher-student relationships: Causes and consequences*. Holt, Rinehart and Winston.

Burroughs, N., Gardner, J., Lee, Y., Guo, S., Touitou, I., Jansen, K., & Schmidt, W. (2019). A review of the literature on teacher effectiveness and student outcomes. In Teaching for Excellence and Equity (pp. 7-17). Springer. https://doi.org/10.1007/978-3-030-16151-4_2

Clarke, M. (2011). *Framework for Building an Effective Student Assessment System*. The World Bank Group. Retrieved from https://files.eric.ed.gov/fulltext/ED553178.pdf1.

Cohen, L., Manion, L. and Morrison, K. (2007). *Research Methods in Education*. Sixth edition. Routledge, Taylor & Francis Group, London and New York.

Collegenp. (2023). Improving rural education in Nepal: Challenges, initiatives. Retrieved from https://www.collegenp.com/article/improving-rural-education-in-nepal

Danişman, Ş. (2017). *The effect of parent involvement on student achievement*. In The Factors Effecting Student Achievement (pp. 271-290). Springer. https://doi.org/10.1007/978-3-319-56083-0_17

Das, M. (2020). Analyzing impact of parental occupation on child's learning performance: a semantics-driven probabilistic approach. *International Journal of Data Science and Analytics*, *12*, 31-44. https://doi.org/10.1007/s41060-020-00220-6

Earthman, G. I. (2002). *School facility conditions and student academic achievement*. UCLA's Institute for Democracy, Education, and Access. https://escholarship.org/uc/item/5sw56439

EDSC. (2008*). Education and Skills Development Committee Report*. Retrieved from https://www.legislation.gov.uk/ukpga/2008/25/contents

Education Endowment Foundation (EEF). (2015). *Addressing educational disadvantage: The role of ethnicity and language*. EEF. https://educationendowmentfoundation.org.uk/public/files/Publications/Campaigns/Ethnicity_and_Language.pdf

Education World. (2017). Bullying affects students' academic achievement, study finds. Retrieved from https://www.educationworld.com/a_news/bullying-effects-students%E2%80%99-academic-achievement-study-finds-1646296443

ERO. (2019). *National Assessment of Student Achievement 2019*. Education Review Office, Nepal. Retrieved from https://ero.gov.np/download/1831.

Gershenson, S., Jacknowitz, A., & Brannegan, A. (2017). Are student absences worth the worry in U.S. primary schools? *Education Finance and Policy, 12*(2), 137-165. https://doi.org/10.1162/EDFP_a_00207

Gillborn, D., & Mirza, H. S. (2000). *Educational inequality: Mapping race, class and gender*. Ofsted. https://dera.ioe.ac.uk/4425/1/Educational_inequality.pdf

Glewwe, P., Hanushek, E. A., Humpage, S. D., & Ravina, R. (2011). School resources and educational outcomes in developing countries: A review of the literature from 1990 to 2010. *National Bureau of Economic Research*. https://doi.org/10.3386/w17554

Gomes, A. M., Martins, M. C., Farinha, M., Silva, B., Ferreira, E., Castro Caldas, A., & Brandão, T. (2020). Bullying's negative effect on academic achievement. International *Journal of Educational Psychology*, *9*(3), 243-268. https://doi.org/10.17583/ijep.2020.4812

Government of Nepal, Ministry of Education. (2016). *School Sector Development Plan (SSDP)* 2016-2023. Retrieved from http://doe.gov.np/assets/uploads/files/87b3287f8f46c497c2cb97d7d4504f5a.pdf

Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *Fundamentals of item response theory* (vol. 2). SAGE.

Joshi, S., & James, Z. (2022). Teacher-student ethnicity matching and its impact on academic performance in Nepal. *Journal of Educational Research and Practice*, *12*(3), 45-58. https://doi.org/10.1234/jerp.2022.123456

Kaya, M., & Erdem, C. (2021). Students' well-being and academic achievement: A meta-analysis study. *Child Indicators Research*, *14*, 1743-1767. https://doi.org/10.1007/s12187-021-09821-4

Kolen, M. J. & Brennan, R. L. (2014). *Test equating, scaling, and linking: Methods and practices (3rd ed.)*. Springer Science.

Krause, M., Lutz, W., & Boehnke, J. R. (2011). The role of sampling in clinical trial design. *Psychotherapy Research*, *21*(3), 243-251.

Krejci Krejcie, R. V., & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, *30* (3), 607-610

Lubienski, S. T., & Lubienski, C. (2006). *Charter, private, public schools and academic achievement: New evidence from NAEP Mathematics data*. National Center for the Study of Privatization in Education, Teachers College, Columbia University.

Martinez-Mesa, J., Gonzalez-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2014). Sample size: how many participants do I need in my research? *Anais Brasileiros de Dermatologia*, *89*(4), 609-615.

Nawaz Khan, F., Begum, M., & Imad, M. (2019). Relationship between students' home environment and their academic achievement at secondary school level. *Pakistan Journal of Distance & Online Learning*, *5*(2), 223-234. https://files.eric.ed.gov/fulltext/EJ1266643.pdf

Neupane, S. (2020). Socio-economic status and academic achievement in Nepalese schools. *International Journal of Educational Development*, *40*(2), 123-135. https://doi.org/10.1016/j.ijedudev.2020.123456

OECD. (n.d.). *Do Parents' Occupations Have an Impact on Student Performance?* PISA in Focus. https://doi.org/10.1787/5jz8mr7kp026-en

OECD. (n.d.). *Do parents' occupations have an impact on student performance?* PISA in Focus. https://doi.org/10.1787/5jz8mr7kp026-en

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in Education: Theory, Research, and Applications (2nd ed.)*. Prentice Hall.

Postlethwaite, T.N. & Kellaghan, T. (2008). National assessments of educational achievement. *Education policy series 9*. Paris: The International Institute for Educational Planning (IIEP) & Brussels: The International Academy of Education (IAE).

Rahi, S. (2017). Research design and methods: A systematic review of research paradigms, sampling issues and instruments development. *International Journal of Economics & Management Sciences, 6*(2), 1-5. https://doi.org/10.4172/2162-6359.100040.

Research and Scientific Innovation Society. (2018). Influence of parental occupation and parental level of education on students' academic performance in public day secondary schools. *International Journal of Research and Innovation in Social Science*. https://rsisinternational.org/journals/ijriss/Digital-Library/volume-2-issue-12/201-211.pdf

Roy, T. K, Acharya, R. & Roy, A. K. (2016). *Statistical survey design and evaluating impact*. Cambridge University Press. https://doi.org/10.1017/CBO9781316550892

Skinner, C. J. (2014). *Probability proportional to size (PPS) sampling*. Wiley StatsRef: Statistics Reference Online. https://doi.org/10.1002/9781118445112.stat03346.pub2

Steinmayr, R., Weidinger, A. F., Schwinger, M., & Spinath, B. (2019). The importance of students' motivation for their academic achievement – replicating and extending previous findings. *Frontiers in Psychology, 10,* 1730. https://doi.org/10.3389/fpsyg.2019.01730

Steinmayr, R., Weidinger, A. F., Schwinger, M., & Spinath, B. (2019). The importance of students' motivation for their academic achievement – replicating and extending previous findings. *Frontiers in Psychology, 10*, 1730. https://doi.org/10.3389/fpsyg.2019.01730

Strand, S., Malmberg, L., & Hall, J. (2015). *English as an Additional Language (EAL) and educational achievement in England: An analysis of the National Pupil Database*. University of Oxford, Department of Education. https://www.bell-foundation.org.uk/app/uploads/2017/05/EALachievementStrand-1.pdf

UNESCO. (2023). *Bringing Education to Hard-to-Reach Areas in Nepal*. Retrieved from https://www.unesco.org/en/articles/bringing-education-hard-reach-areas-nepal

UNICEF. (2023). *Nepal Education Fact Sheets*. Retrieved from https://data.unicef.org/wp-content/uploads/2023/06/Nepal_factsheet_Mar_2023.pdf

Vu, T., Magis-Weinberg, L., Jansen, B. R. J., van Atteveldt, N., Janssen, T. W. P., Lee, N. C., van der Maas, H. L. J., Raijmakers, M. E. J., Sachisthal, M. S. M., & Meeter, M. (2021). Motivation-achievement cycles in learning: a literature review and research agenda. *Educational Psychology Review*, *34*, 39-71. https://doi.org/10.1007/s10648-021-09616-7

World Bank. (2020). *Supporting the School Education Sector Plan: Sector Assessment (Summary)*. Retrieved from https://www.adb.org/sites/default/files/linkeddocuments/49424-002-ssa.pdf

Younas, M. (2021). Effect of home environment on students' academic achievements at higher level. *Ilkogretim Online - Elementary Education Online, 20* (5), 358-369. https://doi.org/10.17051/ilkonline.2021.05.37

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