Provincial Assessment of Students' Learning 2018-19

PUNJAB EXAMINATION COMMISSION

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Amtul Qadus
Chief Executive Officer
Punjab Examination Commission (PEC)

EXECUTIVE SUMMARY

Government of Punjab is consistently striving for improvement of quality of school education through the School Education Department (SED) and its affiliated departments. This curriculum-based Provincial Assessment of Student Learning (PASL) aimed at identifying measures needed at the policy level, changes required in curriculum/textbooks, challenges related to teacher training, proficiency of assessment of student learning and improvements required at school level for ensuring conducive learning environment by investigating: 1) Student and teacher learning achievement levels particularly with reference to higher order learning in the subjects of Mathematics, Science and English, 2) Identifying content areas in need of attention in Mathematics, Science and English and 3) Examining home, school and classroom related factors contributive in student learning.

Data was collected from 18 randomly selected districts of Punjab. Ten schools from each district were selected using stratified random sampling at four levels i.e. district, type of school, gender and locale. Data was collected from 180 schools by using six data collection tools. From each school 25 students, 3 teachers, head teacher, and 25 parents participated in data collection. Therefore, each subject test was solved by 4,500 students and 180 teachers, teacher questionnaire was filled by 540 teachers, and head teacher questionnaire was filled by 180 head teachers. Students-parents questionnaire was filled by 4,500 students and their parents.

Data collection tools comprised of achievement tests for students of grade 4 in Science, Mathematics, and English and questionnaire for head teachers, teachers, and students & parents. Subject tests comprised of 50 MCQs each, while questionnaire for parents & students, teachers, and head teachers comprised of 27, 59 and 61 close-ended items respectively.

The results of the study have some interesting learnings/findings for policy makers, curriculum developers, textbook board, teacher training institutions, assessment regimes, and schools;

POLICY

1. The medium of instruction should be mother tongue or Urdu with the provision of explaining in mother tongue while teaching.
2. Child labor-related issues still prevail in our society which requires immediate attention by SED and labor department.
3. Teachers in schools need to be given an appropriate proportion of work time to give timely feedback to students on homework and classwork regularly. Dedicated staff (Assistant teachers) should be provided in schools for feedback on student homework and ensuring compliance.
4. There are a large number of parents having education below matric; the role of School Council (SC) should be extended to engage them in activities expected from them to support the education of their children.
5. Provision of primary and middle schools in close vicinity to home can bring better student performance and improve access (especially for girls).
6. ECE centers/ECE rooms/Daycare centers to be set up with primary schools where parents can leave infants for care while their older children can study without domestic responsibilities.
7. School management is required to maintain close liaison with parents and community to keep them updated about the improvements brought in schools by SED.

8. Teacher recruitment policy should include teacher professional education as a pre-requisite for recruitment.

9. Schools should ensure minimum academic resources for each child coming to school to minimize the effect of disparity in resources faced by students at home (library, learning games, materials to experience learning activities, etc.)

10. The concept of student performance in schools needs to be revisited and focus on academic score need to be rationalized. Overemphasis on examination results has undermined value of co-curricular activities. Physical sports activities must be made a mandatory part of school life and all related provisions to be ensured in schools.

CURRICULUM/TEXTBOOKS

1. Textbooks need to reconsider the content, presentation of content, contextual relevance, and the examples used in chapters on Fraction, Decimals and Fractions, Factors and Multiples, Measurements, Geometry in Mathematics.

2. Textbooks need to be revisited to ensure that content related to all SLOs is appropriately included.

3. Correspondence of content to the level of learning desired in the SLOs needs attention.

4. The improvement in textbooks about activity-based teaching, teacher's guides on using activities and provision of related facilities need continuity.

5. Learning activities and self-assessment tasks in textbooks need novelty and relevance of student observations/experiences in daily life to prepare them for assessments beyond textbooks.

TEACHER TRAINING

1. In-service teacher training needs to focus on pedagogies of teaching Fraction, Decimals and Fractions, Factors and Multiples, Measurements, Geometry in Mathematics.

2. In Science, both teachers and students need improvement in content learning related to, "Food and Health" and "Movements of Earth".

3. In-service training needs customization for a teacher coming from rural areas or teachers to be posted in rural areas with skills to engage community by utilizing local resources, involving community elders, pooling community resources and sharing resources among schools in the same vicinity can bring improvement in student performance.

4. The teacher training institutes need to work on content specific teaching methods for the teaching of specific content areas instead of general teaching methods.

5. Teacher training should focus in the use of localized resources (AV aids development center need to play an active role in such training).

6. Teacher's ability to develop trust and friendly relations with students and parents should be made mandatory part of the training.

7. Alternate techniques of class management should be focused in teacher training to eliminate corporal punishment. Teacher empowerment to be ensured.

8. In-service teacher training should focus on pedagogies for higher order learning i.e. application, analysis, synthesis, and evaluation.
9. Activity-based pedagogies to be supplemented with the prior determination of what is to be taken out of the activities.
10. Use of black/white board as a tool of two-way interactivity be made part of teacher training.

ASSESSMENT

1. Assessments in schools and external examinations (if any) using sequential tasks help us in knowing the quality of student learning (by Bloom's level of learning).
2. Assessment techniques to measure the development of higher order learning need to be focused in training of item writers at PEC.
3. Assessment beyond textbook should be encouraged and ensured gradually in coming 4-5 years in all assessments/examinations.

SCHOOL

1. Writing should be encouraged through writing competitions, creative writing exercises, valuing student work, making original writing part of classroom assessment, discouraging the reproduction of memorized writings, etc.
2. Provision of the reading material, reading circles, reading and writing competitions, valuing reading beyond textbooks is to be made part of school culture.
3. Arrangement of remedial classes, student guidance, and counseling services, diagnostic study support need to be added in schools.

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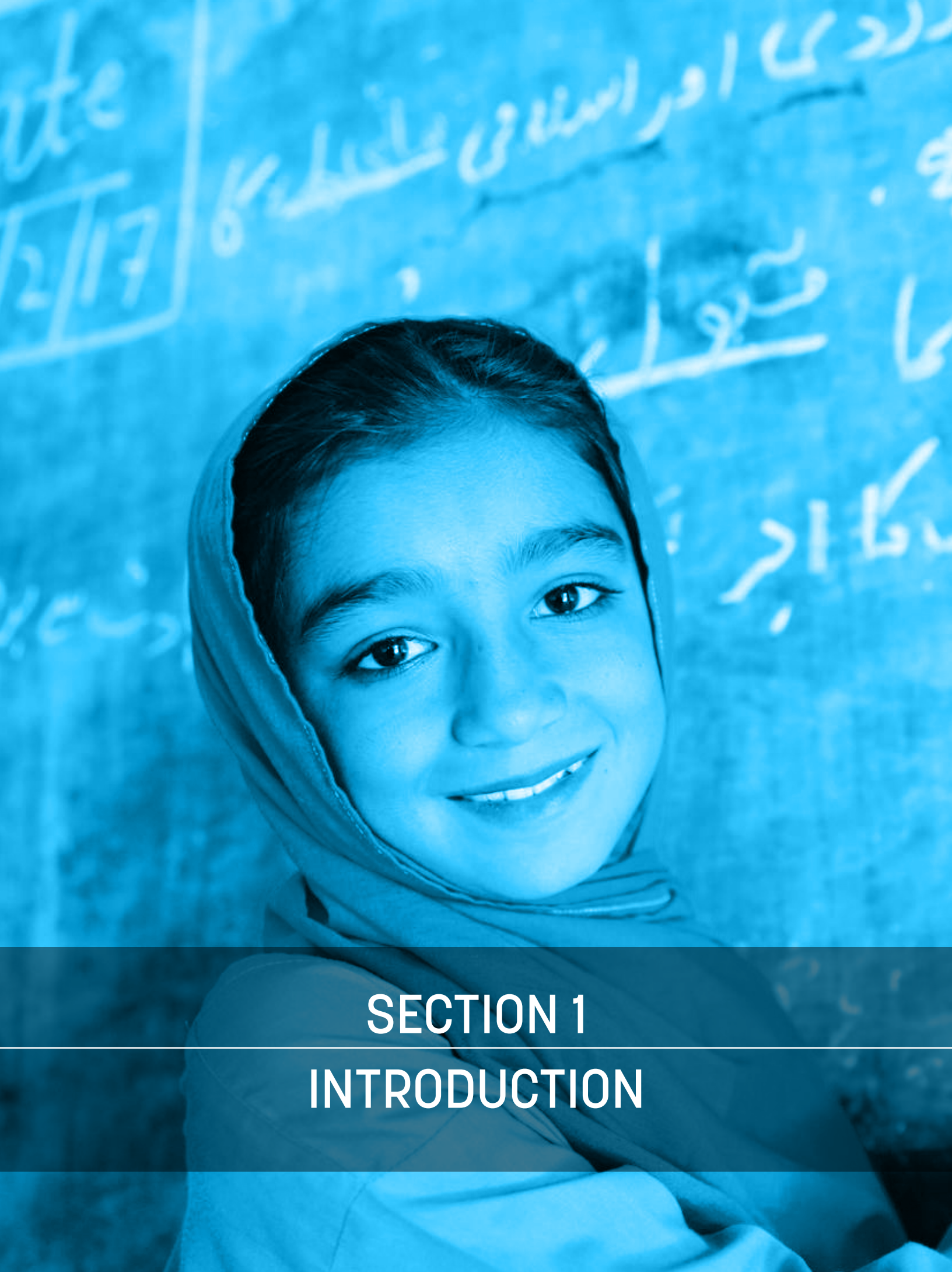
LIST OF ABBREVIATIONS

CEO	Chief Executive Officer
CPD	Continuous Professional Development
ECE	Early Childhood Education
LSA	Large Scale Assessment
MCQs	Multiple Choice Questions
NEAS	National Educational Assessment System
NEEC	National Educational Equipment Centre
OMR	Optical Mark Recognition
PASL	Provincial Assessment of Students' Learning
PEAS	Provincial Educational Assessment System
PEC	Punjab Examination Commission
PMIU	Programme Monitoring and Implementation Unit
QAED	Quaid-i-Azam Academy for Educational Development
SC	School Council
SED	School Education Department
SES	Socioeconomic Status
SLOs	Student Learning Outcomes
SOPs	Standard Operating Procedures
SPSS	Statistical Package for Social Sciences
UNESCO	United Nations Educational Scientific and Cultural Organization
UNICEF	United Nations International Children's Education Fund



SECTION 1
INTRODUCTION

CHAPTER 1
INTRODUCTION

Punjab Examination Commission (PEC) is mandated by the Government of Punjab to carry out curriculum based Large Scale Assessments (LSA) at provincial level to inform policymakers, curriculum department, textbook board, pre-service and in-service teacher training institutions, assessment regimes and School Education Department (SED) about effectiveness and relevance of initiatives underway for the improvement of educational outcomes. The tradition of such studies is nascent in Punjab and this study is a milestone in strengthening the culture of using assessment to review the health of the system without associating LSA results to individual level decisions.

OVERVIEW OF PROVINCIAL ASSESSMENT OF LEARNING

Our school education has had limited success in educating children to enhance their capabilities as per requirement despite making time and again efforts in this regard. Policy documents are generally appreciated for demonstrating the understanding of the real issues of education but fall short of suggesting follow-up measures to realize the goals set in the policy documents[1]. The ideas good at face value, lost their essence when it came to implementation. Educational practices in school classroom remained supportive to rote learning and in fact, never valued higher order learning.

Instead of bringing change in textbooks, teacher's capacity to use pedagogies for higher order learning, providing school environment conducive for higher order learning and encouraging assessment of higher-order learning, we limited our examinations to the measurement of lower order learning alone. The examination was reduced to a large proportion of lower order questions and a small number of questions included to measure higher order learning were rarely of the level claimed to be measured. This restricted our capacity to validly interpret results as a measure of higher order learning among students at all levels of education.

Moreover, administration of examination has always been doubted for technical soundness of tests, the relevance of the measured content, credibility of conduct, fairness in scoring, transparency of result compilation and political influences on examination bodies. Therefore, a trust deficit prevails on assessment data available to us for policy making and related decisions.

Besides the above stated technical and logistic limitation of our examination, another administrative issue is the high stakes connected to examination results in our system for students, teachers, head teachers, and administrative staff. The system of rewarding or punishing teachers, head teachers, and other school officials on the basis of student performance in examination leads to manipulation of results data in order to safeguard their (legitimate/ illegitimate) interests. Our system's overwhelming reliance on examination scores alone for promotion to next grade/class burdens students and parents to obtain high grades without caring about the meaningful learning and use of differentiation in ethical or non-ethical means.

[1] Shahid Siddique (2016).Education Policies in Pakistan: Politics, Projections, and Practices, Oxford University Press, Lahore.

Even if we ignore the above-mentioned challenges of examination scores, the performance of our grade 5 students ranged between 42-57 % in Science, Mathematics, and English during the last three examinations conducted by PEC[2].

We failed to distinguish that end year examination of all students are only meant to make decisions about promotion/retention of the student in a particular grade level. Any other use of such data leads to the malpractices at all levels of examinations. Low stake examinations like sample based large surveys are the popular mean of knowing the efficiency of education systems across the world.

BACKGROUND

The learning of students in schools is contingent upon coordinated efforts of various offices working under SED supporting schools to become a source of laying the foundation for children's lifelong learning. The intended purpose of schools in such a school system is to enable all children to develop their full potential by acquiring knowledge, skills, and attitude. An interplay among policy, curriculum, syllabus, schools, teachers, and assessment through the departments/institutions predisposed with the responsibility of relieving these functions. Besides being internally efficient these departments/ institutions need to work harmoniously with sister departments/institutions to guarantee an education system enabling preparation of lifelong learners.

Continuous feedback to each of these components of the system is one viable way to testify the existing practices and proposes emerging improvements in the existing system. The dynamicity in policy, curriculum, textbooks, teaching practices, teacher training, school environment and assessment practices is the key for creating and sustaining school system considered effective where students are able to apply the knowledge and skills they have learned in their daily activities and are thus prepared to develop more complex social and economic competencies and abilities in their future lives[3].

Large Scale Assessment (LSA) is used as a credible, representative, economical and efficient mean of gathering student performance data to be used to appraise system level changes needed in curriculum, textbooks, teaching, teacher training, school environment and assessment to accomplish aspirations enshrined in the government policies backed by effective accountability and management oversight at all levels.

[2] Exam Analysis Report 2015, 2016 and 2017. Reports available at http://www.pec.edu.pk/publications

[3] Quality of education: attaining standards for improved learning outcomes and school effectiveness, Ministry of Federal Education and Professional Training, 2016. http://moent.gov.pk/mopttm/ userfiles1/file/Minimum%20Standards%20for%20Quality%20Education%20in%20Pakistan.pdf.

WHY PEC LARGE SCALE ASSESSMENT

Punjab Examination Commission (PEC) has several functions as an assessment/examination body as given in the Punjab Examination Commission Act of 2010. PEC has been conducting an examination of grade 5 and grade 8 in the province on a yearly basis. Besides that, some other functions of PEC include providing input to allied departments in school education for improvement in their work. The Act bestows the responsibility to collect data from research in order to improve curricula and teaching methodology, recommend strategies for capacity building of the teachers and educationists that in turn would improve the assessment system of students, identify the areas where improvement in training of the teachers or educationists is required and advise the government on all policy matters related to student performance by conducting large scale assessment surveys periodically.

The tradition of LSAs in various countries of the world originated in the late 1950s, which later on consolidated itself in the form of cross-national large-scale assessments with the aim of using countries as natural laboratories to explore student's learning[4]. Pakistan has very recently decided to participate in such studies and in-country LSAs in this context hold vital importance. The data generated by Large-scale assessments of students' learning can be used for knowing the quality (to diagnose system strengths and weaknesses over time), equity (by examining education outcomes for specific groups and sub-groups historically ignored, marginalized or disadvantaged such as girls, locale, minorities etc.), and accountability (to appreciate/ check work of different offices/ individuals involved in the education system)[5].

The assessment data is typically used for monitoring and evaluation of education policies vis-a-vis regional countries and provinces within country, policy implementation in terms of curricular and programmatic reforms, agenda setting to evaluate the quality of the education and propose evidence-based changes leading to improvement in quality of education.

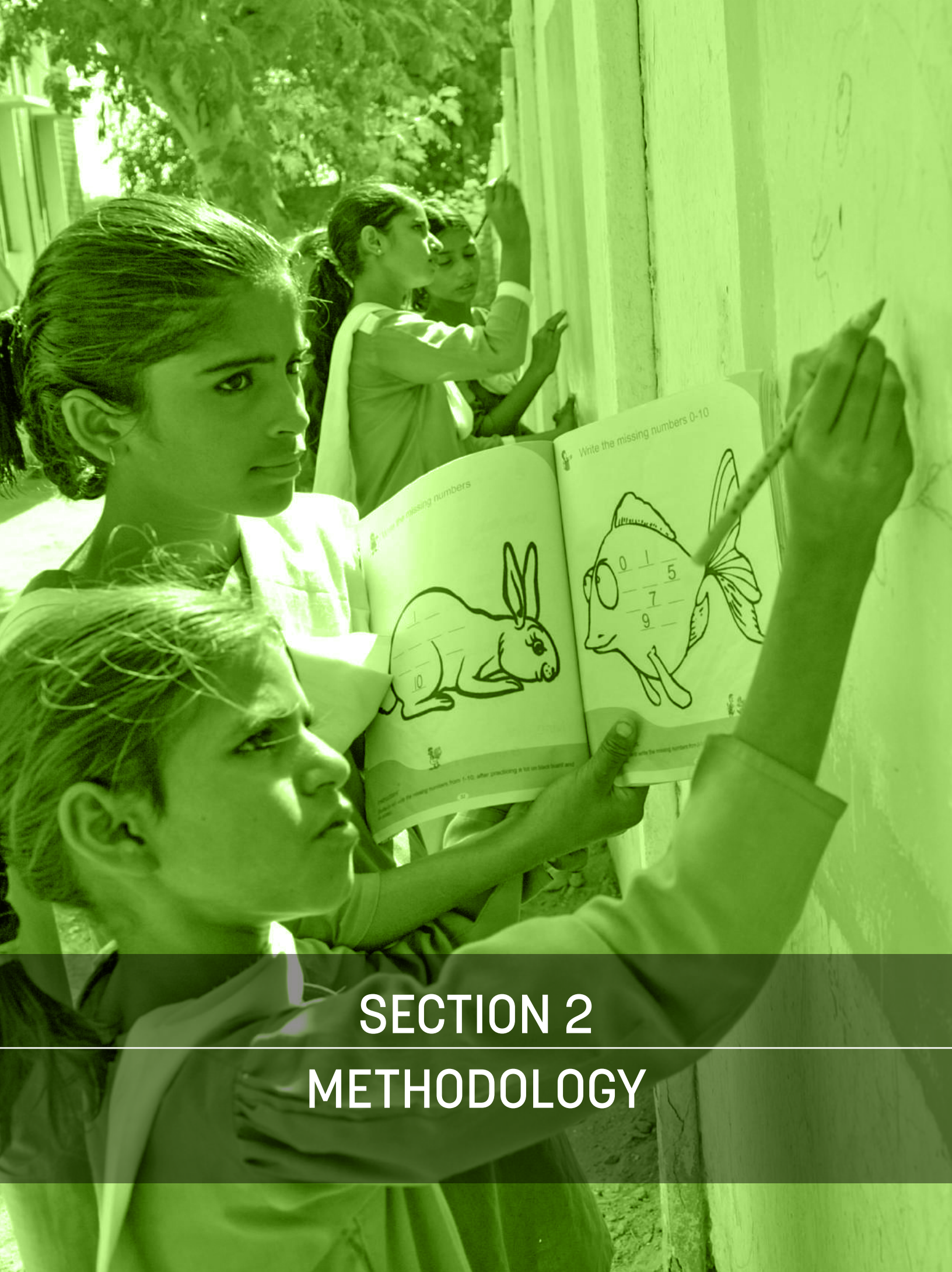
OBJECTIVES

The purpose of this LSA of grade 4 is to assess the learning achievement of grade 4 students in the subject of Mathematics, Science, and English from a representative sample of students in public schools of Punjab. Grade 4 is preferred for Provincial Assessment of Students' Learning (PASL) because grade 4 examinations are not considered high stake examination for any decision regarding student academic career. The assessment is low stake and results have no direct implications for students, teachers or headteachers; but will be used for the improvement of the educational system and functioning of related departments.
This study helped in identifying measures needed at the policy level, changes required in curriculum/textbook, challenges related to teacher training, proficiency of assessment of student learning and improvements required at school level for ensuring conducive learning environment by investigating:

1. Student and teacher learning achievement levels particularly with reference to higher order learning in the subjects of Mathematics, Science, and English.
2. Identifying content areas in need of attention in Mathematics, Science, and English.
3. Examining home, school and classroom related factors contributive in student learning.

[4] Foshay, A.W. (1962). Educational achievements of thirteen-year olds in twelve countries: Results of an international research project, 1959–61 (Vol. 4). Hamburg, Germany: UNESCO Institute for Education.

[5] Tobin, M., Lietz, D., Nugroho, D., Vivekanandan, R. and Nyamkhuu, T. (2015). Using large-scale assessments of student's learning to inform education policy: Insights from the Asia-Pacific region, UNESCO Bangkok office.



SECTION 2
METHODOLOGY

CHAPTER 2
ASSESSMENT FRAMEWORK

The assessment of three subjects; Mathematics, Science, and English of grade 4 was planned. There were many background variables that helped to assess in learning of students. It was pertinent to identify relevant stakeholders and perspectives presumably contributing in students' achievement. The empirical data of such factors gives considerable opportunity to draw sensible inferences from these assessments. This chapter explains the assessment frameworks envisaged for measuring student learning and background factor causing variation in student performance.

ASSESSMENT FRAMEWORK FOR MATHEMATICS

The subject of Mathematics is pivotal to learning of all other subjects and understanding logic and reasoning which formulates the basis for necessary life skills in performing different activities like computing, managing deals with money transferring and developing different things. Moreover, Mathematics provides a base to excel in fundamental faculties of mind necessary for understanding other subjects such as engineering, accounting, business, banking, ecology, and aerospace. Mathematics helps us to understand the underlying mechanism working behind the latest advancements and information based current world.

This framework is developed to guide in developing assessments to measure mathematical skills among students of grade 4. It includes particular topics to reflect curricula by using enlisted SLOs in a table of the specification to understand the overall structure of the framework. The framework ensures coverage of content across various levels of learning (cognitive domain) described in Blooms Taxonomy of Educational Objectives[6]. Content domain specifies the subject matter to be assessed and the cognitive domain covers the measurement of higher order learning skills aspired to be developed through operationalizing the curriculum. The framework reflects the proportionate representation of the content with respect to the emphasis on different content areas depicted in the curriculum/textbook. Using this principle, maximum weight is given to "basic arithmetic functions" as it represents 78% (7/9 units) of the units in the textbook. "Geometry" and "data handling" having one unit each is given weight accordingly.

The use of arithmetic functions and the underlying cognitive process involved to solve the problem presented to students first time required them to apply, analyze, reason or evaluate the learned mathematical principles in new situations.

MATHEMATICS CONTENT DOMAINS

Table 1 shows the percentage of questions allocated to each content domain proportionate to the units allocated to the respective content domain in the textbook. Each content domain consists of topic areas, and each topic area, in turn, includes several topics.

[6] Bloom, B.S. (Ed.). Engelhart, M.D., Furst, E.J., Hill, W.H., Krathwohl, D.R. (1956). Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain. New York: David McKay Co Inc.

Table 1: Target percentage of Mathematics assessment devoted to content domains

SR.	CONTENT DOMAIN	PERCENTAGES
1	Number	70% (comprised of 7 units)
2	Measurement and Geometry	20% (comprised of 2 units)
3	Information Handling	10% (comprised of 1 unit)

NUMBER

It provides the foundation of Mathematics in primary grades. The number of content domain consists of three areas. The seventy percent of the assessment devoted to number is apportioned as follows:

1. Whole numbers (addition, subtraction, multiplication, division, factors, and multiples) (45%)
2. Fractions (arithmetic functions) (15%)
3. Decimal and Fractions (10%)

Whole numbers are the predominant component of the number domain and student should be able to compute with whole numbers of reasonable size as well as use computation with unknown contexts. The assessment will include an understanding of basic arithmetic functions of whole numbers. However, because objects and quantities often do not come in whole numbers, it is vital for children to understand fractions and decimals. Students should be able to compare, add, and subtract similar fractions and decimals to solve problems.

Topic wise list of SLOs sampled for inclusion in the Mathematics test is as follows;

Whole Numbers (Numbers and arithmetic operations)

1. Identify place values of digits up to one hundred million
2. Add numbers up to 6 digits
3. Multiply numbers up to 5 digits by numbers of 3 digits
4. Solve real-life problems involving subtraction of six digits (context)
5. Solve real-life problem involving subtraction (context)
6. Solve real-life problem involving multiplication (context)
7. Solve real-life problem involving mix algebraic operations (context)
8. Solve real-life problems involving Pakistani currency Mix (context)

Factors and Multiples

1. Identify divisibility rules for 2,3,5 and 10
2. List factors of a number up to 50
3. Differentiate between prime and composite numbers
4. Factorize a number by using prime factors
5. Differentiate between factors and numbers
6. Find HCF of two of more 2-digit numbers using prime factorization
7. Find LCM by common multiples
8. Solve real-life problems involving HCF (context)
9. Find LCM by prime factorization (context)
10. Solve real-life problems involving LCM (context)

Fractions

1. Recognize like and unlike fractions
2. Arrange fractions in ascending and descending order
3. Convert improper fraction to mixed fraction and vice versa
4. Subtract fractions with unlike denominators
5. Multiply two or more fractions (proper, improper & whole)
6. Verify the associative property of multiplication of fractions
7. Divide a whole number by a fraction
8. Divide a fraction by another fraction (all types- context)
9. Solve real-life problems involving fraction using all four operations

Decimals and Fraction

1. Know a decimal number as an alternative way of writing a fraction
2. Identify the place value of a digit in decimals
3. Convert a given fraction to a decimal
4. Convert decimal up to three decimal places to fractions
5. Multiply a decimal by 1000
6. Divide a decimal by a 1-digit number
7. Solve real-life problems involving decimal up to two decimal
8. Solve real-life problems involving decimals (context)

MEASUREMENT AND GEOMETRY

We are surrounded by objects with different shapes and sizes. Measurement is the process of identifying attributes of objects like lengths, time and mass while geometry

helps us to visualize the shape and sizes. The assessment framework ensures the proportionate coverage to these two content areas:

i. Measurement (10%)

ii. Geometry (10%)

Measurement

1. Convert kilogram to gram
2. Use the appropriate unit to measure the length of different objects
3. Solve real-life problems involving conversion (addition and subtraction)
4. Convert years to months, months to days and weeks to days
5. Solve simple real-life problems involving conversion (unit & time)

Geometry

1. Recognize parallel and non-parallel lines
2. Recognize angles with the help of a protractor
3. Identify the center, radius, diameter, and circumference of a circle
4. Construct a rectangle with given sides with the help of set squares

INFORMATION HANDLING

The explosion of data in today's information society has resulted in extensive visual displays of quantitative information. Most of the time, information through the internet, newspapers, magazines, textbooks, and articles have been presented through charts, graphs, and tables. Students should understand the information given in the charts and graphs and can organize and categorize information to make a meaningful comparison.

Reading, interpreting and representing data (5%)

1. Read and know the information given in the bar graph
2. Solving real-life problems by information given through bar graph
3. Sketching bar graph with the help of data

Using data to solve problems (5%)

1. Solving real-life problems through line graphs Inferring information and solving real-life problems

The other dimension of the Mathematics assessment framework pertains to cognitive levels of learning. This dimension ensures the provision of test questions to assess the higher order learning among the students.

COGNITIVE DOMAIN

Along with an assessment of content knowledge, it is vital to assess student learning at various levels of learning described in the cognitive domain to ascertain the measurement of higher order learning among students. The levels of learning included in this assessment are knowledge and comprehension, application, and reasoning.

Knowledge and comprehensions cover the facts, concepts and procedures students need to know.

Applying is the ability of students to apply knowledge and conceptual understanding to solve daily life problems by selecting the relevant knowledge and applying it to a given situation and answer viably regarding the problem at hand.

The **reasoning** goes beyond the solution of daily life problems and requires rationalizing, arguing, justifying solution adopted to address unfamiliar situations, complex contexts, and multistep problems in concrete and abstract situations.

Table 2 shows the allocated percentages of test items by different levels of learning for the assessment of grade 4.

Table 2: Target percentage of Mathematics assessment devoted to cognitive domains

SR.	CONTENT DOMAIN	PERCENTAGES
1	Knowing and comprehending	25%
2	Applying	50%
3	Reasoning	25%

The main focus of assessment is intended to assess higher order thinking skills of students to know performance regarding the processing of those skills. Detail of the cognitive domain is given below:

KNOWLEDGE AND COMPREHENSION

Ability to apply mathematical skills in different situations depends on expertise in basic mathematical concepts and skills. The facility to recall the knowledge learned determines the chances of higher-order learning. Without access to a knowledge base, that enables easy recall of the basic facts and numbers, students would find purposeful thinking impossible.

Procedures form a bridge between basic knowledge and the use of Mathematics for solving problems, especially those encountered by many of us in daily lives. In essence, fluent use of procedures entails recall of sets of actions and how to carry them out.

Table 3: Distribution of test items in Mathematics by different sub-skills of knowledge

KNOWING	CLARIFICATION OF CONCEPTS	EXAMPLES	PERCENTAGE
Recall	Recall definitions, terminology, number properties, units of measurement, geometric properties and notation	axb=ab a+a+a=3a	5%
Recognize	Recognize numbers, expressions, quantities, and shapes Recognize entities that are mathematically equivalent	Equivalent familiar fractions, decimals and percent	5%
Classify/ Order	Classify numbers, expressions, quantities and shapes by common properties	Ascending and descending orders, less and greater than	5%
Compute	Carryout straight forward algebraic procedures	Algebraic functions, +,-, x, ÷ with whole numbers, fractions, and decimals	5%
Measure	Use measuring instruments and choose appropriate units of measurement	Length, weight, mass, time	5%

APPLYING

This domain involves the application of mathematical facts, concepts, and procedures in a range of contexts. Such application is the core of mathematical thinking and communication enabling students to create equivalent representations which are fundamental to success in the subject.

Problem-solving is central to the applying domain, with an emphasis on more familiar and routine tasks. Problems may be set in real-life situations involving, for example, numeric or algebraic expression, fractions, decimals, geometric figures, and graphical data.

Table 4: Distribution of test items in Mathematics by different sub-skills of application

APPLYING	CLARIFICATION OF CONCEPTS	PERCENTAGE
Determine	Determine appropriate operations, strategies, and tools for solving problems for which there are commonly used methods of solutions	20%
Represent	Display data in tables or graphs, create equations, inequalities, geometric figures that model problem situations	10%
Implement	Implement strategies and operations to solve problems involving familiar mathematical concepts and procedures	20%

REASONING

Reasoning in Mathematics involves logical and systematic thinking. It includes institutive and inductive reasoning based on patterns and regularities that can be used to arrive at solutions to problems set in a novel or unfamiliar situation. Such problems may be purely mathematical or may have real-life setting. Both types of items involve transferring knowledge and skills to new situation and interaction among reasoning skills usually are a feature of such items.

Even though many of the cognitive skills listed in the reasoning domain may be drawn on when thinking about and solving novel or complex problems, each by itself represents a valuable outcome of Mathematics education, with the potential to influence learners thinking more generally. For example, reasoning involves the ability to observe and make conjectures. It also involves making logical deductions based on specific assumptions and rules.

Table 5: Distribution of test items in Mathematics by different sub-skills of reasoning

REASONING	CLARIFICATION OF CONCEPTS	PERCENTAGE
Analyze	Determine the relationship between numbers, expressions, quantities, and shapes	5 %
Integrate	Link different elements of knowledge, related representations, and procedures to solve problems	5%
Evaluate	Evaluate alternative problem solving strategies and solutions	5%
Draw conclusions	Make valid inferences on the basis of information and evidence	5%
Generalize	Make statements that represent a relationship in more general and more widely applicable terms	5%

TABLE OF SPECIFICATION

The distribution of items across content, the cognitive process involved in solving the problems from content and related SLOs are mentioned in the table of specification. It entails content detail for item development, distribution of items across content and demarcation across the SLOs. The assessment comprises of 50 MCQ items with four options in each. Nearly, two minutes were provided to attempt each item in overall 100 minutes. One mark assigned on each correct response. Table 6 specifies distribution of each item and sub factors.

Table 6: Test specifications by content and level of learning in Mathematics

SR	CONTENT	SLOS	LEVEL OF COGNITIVE DOMAIN TO ASSESS THE THINKING PROCESS			
			K (25%)	APP (50%)	R (25%)	T
1	Numbers and arithmetic operations (U, 1-3)	Identify place values of digits up to one hundred million	1			8
		Add numbers up to 6 digits	1			
		Multiply numbers up to 5 digits by numbers by 3 digits	1			
		Solve real-life problems involving subtraction of six digits (context)		1		
		Solve real-life problem involving subtraction (context)		1		
		Solve real-life problem involving multiplication (context)		1		
		Solve real-life problem involving mix algebraic operations (context)			1	
		Solve real-life problems involving Pakistani currency Mix (context)			1	
2	Factors and Multiples (U, 4)	Identify divisibility rules for 2,3,5 and 10	1			10
		List factors of a number up to 50	1			
		Differentiate between prime and composite numbers		1		
		Factorize a number by using prime factors		1		
		Differentiate between factors and numbers		1		
		Find HCF of two of more 2-digit numbers using prime factorization		1		
		Find LCM by common multiples		1		
		Solve real-life problems involving HCF (context)			1	
		Find LCM by prime factorization (context)			1	
		Solve real-life problems involving LCM (context)			1	
3	Fractions (U, 5)	Recognize like and unlike fractions	1			9
		Arrange fractions in ascending and descending order	1			
		Convert improper fraction to mixed fraction and vice versa		1		
		Subtract fractions with unlike denominators		1		
		Multiply two or more fractions (proper, improper & whole)		1		
		Verify the associative property of multiplication of fractions		1		
		Divide a whole number by a fraction		1		
		Divide a fraction by another fraction (all types- context)			1	
		Solve real-life problems involving fraction using all four operation			1	
4	Decimals and fractions (U, 6)	Know a decimal number as an alternative way of writing a fraction	1			8
		Identify the place value of a digit in decimals	1			
		Convert a given fraction to a decimal		1		
		Convert decimal up to three decimal places to fractions		1		
		Multiply a decimal by 1000		1		
		Divide a decimal by a 1-digit number		1		
		Solve real-life problems involving decimal up to two decimal			1	
		Solve real-life problems involving decimals (context)			1	
5	Measurements (U, 7)	Convert Kilogram to gram	1			6
		Use the appropriate unit to measure the length of different objects		1		
		Solve real-life problems involving conversion (addition and subtraction)		1		
		Convert years to months, months to days and weeks to days		1		
		Solve real-life problems involving conversion, (addition & subtraction)			1	
		Solve simple real-life problems involving conversion (unit & time)			1	
6	Geometry (U, 8)	Recognize parallel and non-parallel lines	1			4
		Recognize angles with the help of a protractor		1		
		Identify the center, radius, diameter, and circumference of a circle		1		
		Construct a rectangle with given sides with the help of set squares			1	
7	Information Handling (U, 9)	Read and know the information given in the bar graph	1			5
		Solving real-life problems by information given through bar graph		1		
		Sketching bar graph with the help of data				
		Solving real-life problems through line graphs		1		
		Inferring information and solving real-life problems		1		
					1	
Total			12	25	13	50

Note: K=Knowledge; App=Application; R= Reasoning; T= Total items

Moreover, the application and reasoning items are based on daily life real problems. The nature of questions was on both; concrete and abstract in nature to determine the level of students learning appropriately.

This framework is completely in accordance with national curricula, SLOs, and content of grade 4 Mathematics. The distribution of test against content and cognitive processes was made in accordance with the purpose of this Large Scale Assessment (LSA).

ASSESSMENT FRAMEWORK FOR SCIENCE

Human beings are curious by nature and have a great tendency to learn especially at a younger age. Children during primary education start systematic inquiry around their world in which they live, through Science education. As they progress and develop their understanding of the Science they become increasingly able to make informed decisions for their lives. As adults, they can become informed citizens capable of distinguishing scientific fact from fiction and understanding the scientific basis of important social, economic, and environmental issues. There is more demand across the world for those who are qualified to pursue the carrier in Science, Engineering, and technology that drive the innovation necessary for economic growth and for improving quality of life. To meet this demand and address the challenges of existing times, it is essential to prepare students to enter the advanced study in the areas of Science.

This framework is designed to guide in developing assessments to measure Science skills among students of grade 4. It includes particular topics to reflect Curricula, SLOs, and table of specifications to understand the overall structure of the framework. There is an urge to intend towards cognitive processes instead of mere content. There is a need to focus on skills development instead of revolving around the content memorization. Therefore, the assessments were based on two domains; content domain and cognitive domain. Content domain specifies the subject matter to be assessed and the cognitive domain would specify the thinking processes involved in attempting content being assessed.

The content domain reflects basic skills and functions based on Life Sciences. There is equal emphasis on Life Sciences and Physical Sciences as both have 4 & 5 units respectively in the textbook. While there is less focus on Earth Science as it entails only one unit in the Science textbook for grade 4. These practices include skills from daily life and school studies that students use in a systematic way to conduct scientific inquiry and investigation that is fundamental to all Science disciplines.

The practice of Science is, by its very nature, strongly connected to the area of Science under study and, therefore, cannot be assessed in isolation. Some items in the Science assessment at grade 4 would assess one or more of these important Science practices together with content specified in the content domains and thinking processes specified in the cognitive domains. The use of Science practices and underlying cognitive processes involved to solve daily life problems by applying reasoning skills. The assessment must advocate emphasis on cognitive processes which is vital to know whether thinking processes are content dependent or persist independently.

CONTENT DOMAINS

The table 7 shows the grade 4 content domains and the target percentages of assessment score points devoted to each. Each content domain consists of topic areas, and each topic area, in turn includes several sub-topics. Across the grade 4 Science assessment, each topic was of equal weight (approximately) with respect to their weight-age in the SLOs.

Table 7: Target percentage of Science assessment devoted to content domains

SR.	CONTENT DOMAIN	PERCENTAGES
1	Life Science	40% (four chapters)
2	Physical Science	50% (five chapters)
3	Earth and Space Science	10% (one chapter)

LIFE SCIENCE

The study of Life Science at grade 4 level provides an opportunity to students to capitalize on their innate curiosity and begin to understand the living world around them. Life Science is represented by four areas. The forty percent of the assessment is devoted to Life Science which is apportioned as follows:

1. Understanding ourselves (10%)
2. Characteristics and Needs of Living Things (10%)
3. Food and Health (10%)
4. Living Things and their Environment (10%)

Students are expected to to build their knowledge on general characteristics of organisms, how they function, how they interact with each other and with their environment. Students should also be familiar with fundamental concepts related to life cycles, heredity, and human health that in later grades will lead to a more sophisticated understanding of how the human body functions.

Understanding Ourselves

1. Identify major parts of the human body
2. State functions of major parts of the body
3. How bones and muscles work together?
4. Identify common disorders and their causes

Characteristics and Needs of Living Things

1. Identify factors necessary for animals to survive
2. Explain that many characters are inherited from parents
3. Explain the similarities and differences within a single species
4. Compare differences between two different animals
5. Label key stages in the life cycle of an animal
6. Show growth in plants through experiment

Food and Health

1. Identify the sources of common food
2. Classify different food into their basic groups

3. Interpret a food pyramid to show the relative importance of various food groups
4. Suggest a balanced meal along with the reason
5. Explain the effects of unbalance diet on health

Living Things and Their Environment

1. Explain the environment with examples
2. Identify producers, consumers, and decomposers
3. Differentiate between different types of environment
4. Classify animals on the basis of food they eat
5. Show simple food chain between producers, consumers, and decomposers

PHYSICAL SCIENCE

At grade 4, students learn many physical phenomena that they observe in their everyday lives that can be explained through an understanding of Physical Science concepts. The topic areas for the Physical Science content domain are:

1. Matter and its states (10%)
2. Temperature and its measurement (10%)
3. Force and machines (10%)
4. Introduction to sounds (10%)
5. Investigating electricity and magnetism (10%)

Matter and its States

1. Explain matter with an example
2. Compare solid, liquid and gases with shape and volume
3. Explain conversion of solid, liquid and gas in another form
4. Predict how various material mix with water
5. Demonstrate separation of insoluble solids from water by decantation and filtration

Temperature and its Measurement

1. Explain heat and temperature
2. Label given device for measuring temperature
3. Measure and record a body temperature using laboratory thermometer
4. Use a clinical thermometer and record the temperature of different animals
5. Suggest safety measures required in using thermometers

Force and Machines

1. Define force by examples
2. Investigate ways in which motion of an object can be changed
3. Differentiate between speed and distance

4. Demonstrate how force can change the position and the shape of an object
5. How simple machines make work easier?

Introduction to Sound

1. Investigate the source of sound producing
2. Differentiate between low and high sounds
3. Demonstrate that sound can travel through matters
4. The explosion of sound in the core of the heart is not heard why?
5. Devise ways to reduce noise pollution
6. Differentiate between noise and other sounds

Investigating Magnetic Electricity

1. Distinguish between insulator and conductor
2. Make the simplest electric circuit
3. Recognize that a magnet has poles
4. Differentiate between open and closed circuits
5. Investigate that a freely suspended magnet always points in the N-S direction
6. Demonstrate how magnets can be formed and stored

EARTH AND SPACE SCIENCE

Earth Science is the study of earth and its place in the solar system at 4th grade curriculum focuses on the study of related phenomena and process that students can observe in their everyday lives.

Movements of the Earth

Three topic areas included in this domain are generally considered to be important for students in the 4th grade to understand as they learn about the planet on which they live and its place in the solar system:

1. Explain the term revolution
2. Identify that the distance between the earth and the sun effects the time earth takes to revolve around the sun
3. Explain earth tilt on its axis and causes of seasons

COGNITIVE DOMAIN

Along with an assessment of content knowledge, it is vital to know about the range of cognitive process being used during the assessment. The cognitive domains as already mentioned are knowledge, application, and reasoning.

Knowledge and comprehensions cover the facts, concepts and procedures students need to know.
Applying is the ability of students to use the knowledge and conceptual understanding to solve daily life problems by selecting the relevant knowledge and applying it to a given situation and answer viably regarding the problem at hand.

Reasoning goes beyond the solution of daily life problems and requires rationalizing, arguing, justifying solution adopted to address unfamiliar situations, complex contexts, and multistep problems in concrete and abstract situations.

Table 8 below shows the target percentages devoted to each cognitive domain for the fourth-grade assessments.

Table 8: Target percentage of Science assessment devoted to cognitive domains

SR.	CONTENT DOMAIN	PERCENTAGES
1	Knowing and comprehending	25%
2	Applying	50%
3	Reasoning	25%

The main focus of assessment in the cognitive domain is intended to assess higher order thinking skills of students to know their performance regarding the processing of those skills. It is pertinent to determine exercised varying level of these skills when students display their mathematical competency, which goes beyond the content knowledge. The detail of the cognitive domain is given below:

KNOWLEDGE AND COMPREHENSION

Ability in applying Mathematical skills in different situations depends on expertise with Science concepts and skills. The level of knowledge, students able to recall and the range of concepts he/she understands results the greater chance for engaging in a wide range of problem-solving situations. It is nearly impossible for students to synthesis or evaluate on a topic without its basic knowledge. Basic knowledge of Science concepts forms the foundation of scientific thoughts.

Procedures form a bridge between basic knowledge and the use of Science for solving problems, especially those encountered by many people in their daily lives. In essence, fluent use of procedures entails recall of sets of actions and how to carry them out. Students need to be efficient and accurate in using a variety of scientific procedures and tools. They need to see that particular procedures can be used to solve entire classes of problems, not just individual problems.

Table 9: Distribution of test items in Science by different sub-skills of knowledge

KNOWING	CLARIFICATION OF CONCEPTS	PERCENTAGE
Recall/Recognize	Identify or state facts, relationships, and concepts; identify the characteristics or properties of specific organisms, materials, and processes; identify the appropriate uses for scientific equipment and procedures; and recognize and use scientific vocabulary, symbols, abbreviations, units and scales	10%
Describe	Identify descriptions of properties, structures, and functions of organisms and materials, and relationship among organisms, materials, and processes and phenomena	10%
Provide Examples	Provide or identify examples of organisms, materials, and processes that possess certain specified characteristics; and clarify statements of facts or concepts with appropriate examples	5%

APPLYING

This domain involves the application of scientific facts, concepts, and procedures in a range of contexts. Such application is the core of critical thinking and communication enabling students to create equivalent representations which are fundamental to success in the subject.

Items in this domain require students to engage in applying knowledge of facts, relationships, processes, concepts, equipment and methods in a context likely to be familiar in the teaching and learning of Science.

Table 10: Distribution of test items in Science by different sub-skills of application

KNOWING	CLARIFICATION OF CONCEPTS	PERCENTAGE
Compare/ Contrast/ Classify	Identify or describe similarities and difference between groups of organisms, material, or processes; and distinguish, classify, or sort individual objects, materials processes based on characteristics and properties	10%
Relate	Relate knowledge of an underlying Science concept to an observed or inferred property, behavior, or use of objects, organisms, and materials	10%
Use Models	Use the model to demonstrate knowledge of Science concepts to illustrate a process, cycle, relationship, or system, or to find solutions to Science problems	10%
Interpret Information	Use knowledge of Scientific concepts to interpret relevant textual, tabular, pictorial, and graphical information	10%
Explain	Provide or identify an explanation for an observation or a natural phenomenon using a Science concept or principle	10%

REASONING

Items in this domain require students to engage in reasoning to analyze data and other information, draw conclusions, and extend their understanding to new situations. In contrast to the more direct applications of scientific facts and concepts exemplified in the applying domain, items in the reasoning domain involve unfamiliar or more complicated contexts. Answering such items can involve more than one approach or strategy. Scientific reasoning also encompasses developing a hypothesis and designing scientific investigations.

Table 11: Distribution of test items in Science by different sub-skills of reasoning

REASONING	CLARIFICATION OF CONCEPTS	PERCENTAGE
Analyze	Identify the elements of scientific problems and use relevant information, concepts, relationships, and data patterns to answer questions and solve problems	5%
Synthesize	Answer questions that require consideration of a number of different factors or related concepts	5%
Formulate questions	Formulate questions that can be answered by investigation and predict results of an investigation, by given information about the design, formulate testable assumptions based on conceptual understanding and knowledge acquired by experience	5%
Design investigation	Plan investigation or procedures appropriate for answering scientific questions or testing hypothesis and describe or recognize the characteristics of well-designed investigations in terms of variables to be measured	5%
Evaluate	Evaluate alternative explanations; evaluate results of investigations with respect to the sufficiency of data to support conclusions	5%
Generalize	Make general conclusions that go beyond the experimental or given conditions; apply conclusions to new situations	

TABLE OF SPECIFICATION

The distribution of items across content and the cognitive process involved solving the problems from content and related SLOs are mentioned in the table of specification. It entails content detail for item development, distribution of items across content and demarcation across the SLOs. The assessment entails 50 items on MCQs format, 2 minutes are given to attempt each item and overall 100 minutes are allocated. One mark is assigned on each response. The items are mentioned in the table with continuous sequence following above weight-age to each cognitive domain and content list. Table of specification is given to see the detail of items across content and cognitive domains in table 12. It is pertinent to mention here that item development is based on the sub-factors of each cognitive domain as given above in the table. Moreover, the application and reasoning items are content free and based on daily life real situations. The nature of questions were be both; concrete and abstract in order to determine the level of students learning appropriately and get the benefit of this assessment in real sense.

Table 12: Test specifications by content and level of learning in Science

SR.	CONTENT	SLOS	LEVEL OF COGNITIVE DOMAIN TO ASSESS THE THINKING PROCESS			
			K (25%)	APP (50%)	R (25%)	T
1	Understanding ourselves	Identify major parts of the human body State functions of major parts of the body How bones and muscles work together? Identify common disorders and their causes	1 1	 1 1		4
2	Characteristics and needs of living things	Identify factors necessary for animals to survive Explain that many characters are inherited from parents Explain the similarities and differences within a single species Compare differences between two different animals Label key stages in the life cycle of an animal Show growth in plants through experiment	1	 1 1 	 1 1	6
3	Food and health	Identify the sources of common food Classify different food into their basic groups Interpret a food pyramid to show the relative importance of various food groups Suggest a balanced meal along with the reason Explain the effects of unbalanced diet on health	1	1 1 1	 1	5
4	Living things and their environment	Explain the environment with examples Identify producers, consumers, and decomposers Differentiate between different types of environments Classify animals on the basis of food they eat Show simple food chain between producers, consumers, and decomposers	1 1	 1 1 	 1	5
5	Matter and its states	Explain matter with an example Compare solid, liquid and gases with shape and volume Explain conversion of solid, liquid and gas in another form Predict how various material mix with water Demonstrate separation of insoluble solids from water by decantation and filtration	1	1 1 	 1 1	5
6	Temperature and its measurements	Explain heat and temperature Label given device for measuring temperature Measure and record a body temperature using laboratory thermometer Use a clinical thermometer and record the temperature of different animals Suggest safety measures required in using thermometers	1	1 1 	 1 1	5
7	Force and Machines	Define force by examples Investigate ways in which motion of an object can be changed Differentiate between speed and distance Demonstrate how force can change the position and the shape of an object How simple machines make work easier?	1	1 1 1 	 1	5
8	Introduction to sounds	Investigate the source of sound producing Differentiate between low and high sounds Demonstrate that sound can travel through matters The explosion of sound in the core of the heart is not heard why? Devise ways to reduce noise pollution Differentiate between noise and other sounds	1	1 1 1 	 1 1	6
9	Investigating Magnetics Electricity	Distinguish between insulator and conductor Make the simplest electric circuit Recognize that a magnet has poles Differentiate between open and closed circuits Investigate that a freely suspended magnet always points in the N-S direction Demonstrate how magnets can be formed and stored	1	 1 1 1 	 1 1	6
10	Movements of the Earth	Explain the term revolution Identify that the distance between the earth and the sun effects the time earth takes to revolve around the sun Explain earth tilt on its axis and causes seasons	1	1 1		3
Total			12	25	13	50

Note: K=Knowledge; App=Application; R= Reasoning; T=Total items

This framework is devised as per National Curriculum, SLOs, and content of grade 4 Science course. The distribution of test against content and cognitive processes was made with specific consideration of this assessment to see the range of abilities that the students entail against both domains. The items should represent SLOs mentioned against each item appropriately.

ASSESSMENT FRAMEWORK FOR ENGLISH

This framework is developed to guide assessment for measuring English writing skills among students of grade 4. It includes particular areas identified in the curriculum to reflect competencies, SLOs with the help of a table of specifications to understand the overall structure of the framework. The structure of the curriculum is different from the other subjects as in the subject of English learning areas and competencies have been identified instead of the unit-wise break up of contents. Therefore, the assessment was developed on the basis of SLOs reflecting the following four skills and competencies.

C1: Reading and thinking skills

C2: Writing skills

C3: Oral communication skills

C4: Formal and lexical aspects of language

The cognitive processes involved in the development of assessments focus on knowledge, comprehension, and application. Table 13 shows the target percentage of testing items devoted to each competency and cognitive domain for grade 4 assessment.

Table 13: Target percentages of English assessment by competencies (C1, C2, C3 and C4)

SR.	COMPETENCIES	K	C	APP	T
1	C1: Reading and thinking skills	-	3	-	3
2	C2: Writing skills	1	9	1	11
3	C3: Oral communication skills	3	1	-	4
4	C4: Formal and lexical aspects of language	3	25	4	32
Total items		**7**	**38**	**5**	**50**

Note. K= Knowledge; C= Comprehension; App= Application; T=Total items

The four main competencies are further divided into standards which have their specific benchmarks and finally SLOs at the bottom level of measurement. The SLOs indicate the specific level to measure the competencies and identify the appropriate level of learning like knowledge, comprehension or application for a particular SLO.

The four main competencies and their subsequent standards have been explained below:

C1 - READING AND THINKING SKILLS

Standard 1: All students will search for, discover and understand a variety of text types through tasks which require multiple reading and thinking strategies for comprehension, fluency, and enjoyment (C1, S1)

Standard 2: All students will read and analyze literary text to seek information, ideas, enjoyment; and to relate their own experiences to those of common humanity as depicted in literature. (C1, S2).

1. Identify digraphs, silent letters, and inflections in words; comprehend words, sentences, and paragraphs as meaningful units of an expression.
2. Use pre-reading strategies to
   - guess the meaning of unfamiliar words through context.
3. Apply critical thinking to interact with the text using intensive reading strategies (while-reading) to
   - locate specific information to answer short questions.
4. Use critical thinking to respond to the text (post-reading):
   - Relate what is read to their own feelings and experiences.
5. Apply strategies to comprehend questions for appropriate response by marking key words, verbs, and tenses in a variety of the following question types:
   - Factual
   - Personal response
   - Interpretive
   - Inferential
   - Explain position and direction on a picture, photograph or a map.
   - Locate specific information in a calendar and a class timetable.
6. Recognize how information is presented in a pie chart and bar graph. Read to compare the information given in a pie chart and a bar graph.
7. Describe briefly story elements:
   - describe the characters in a story

C2 - WRITING SKILLS

Standard 1: All students will produce with developing fluency and accuracy, academic, transactional and creative writing, which is focused, purposeful and shows an insight into the writing process (C2, S1)

1. Write multi-syllable words with correct spellings.
2. Make sentences by replacing words and phrases in the given sentences.
3. Recognize that
   - the main idea of a paragraph is given in the topic sentence.

4. Write short informal invitations to friends, family members and teachers to demonstrate the use of following conventions:
   - purpose
   - date and time
   - venue
   - name of addressee and sender
5. Revise written work for correct
   - spelling and punctuation
   - pronoun-antecedent agreement
   - subject-verb agreement
6. Revise written work for layout, legibility, vocabulary, and grammar

C3 - ORAL COMMUNICATION SKILLS

Standard 1: All students will use appropriate social and academic conventions of spoken discourse for effective oral communication with individuals and in groups, in both informal and formal settings. (C3, S1)

1. Use appropriate expressions in conversation to
   - express regret
   - express likes and dislikes
   - express needs and feelings
   - express opinions
   - seek permission to do something
   - show ability/ inability to do something
   - respond to instruction and directions
2. Demonstrate conventions and dynamics of group oral interaction to
   - agree/ disagree politely
   - lead and follow
   - express needs and feelings
   - express joy

C4 - FORMAL AND LEXICAL ASPECTS OF LANGUAGE

Standard 1: Pronunciation: All students will understand and articulate widely acceptable pronunciation, stress and intonation patterns of the English language for improved communication. (C4, S1)

Standard 2: Vocabulary: All students would enhance vocabulary for effective communication. (C4, S2)

1. Pronounce and spell long and short vowels and diphthongs as they occur as practice items and sentences in reading lessons and in speech.
2. Identify and classify words that begin with vowel sounds.
3. Recognize and use more cognates from the immediate and extended environment.

4. Classify into different categories, and use more naming, actions and describing words from pictures, signboards, labels, etc.
5. Recognize, find out, create and use more rhyming words.
6. Locate, provide, connect and use words similar and opposite in meaning.
7. Locate, identify, differentiate between, and use few simple pairs of words including homophones.
8. Copy and take dictation of words studied in class.
9. Apply spelling change in the plural form of regular and irregular nouns and regular verb forms.

NOUNS

1. Recall, and demonstrate the use of more common, countable and uncountable nouns from the immediate and extended environment. Identify and use collective nouns.
2. Classify and change the gender of more nouns from the immediate and extended environment (masculine/feminine/ neuter).
3. Classify nouns as common and proper nouns (names of people, pets, places, mountains, lakes, rivers, etc.).

PRONOUNS

1. Illustrate the use of pronouns learned earlier. Show possession by using the pronouns my, your, his, her, our, their and its, before nouns.
2. Use the personal pronouns mine, ours, yours, his, hers, it's, and theirs.
3. Demonstrate correct use of my – mine, your – yours, etc.
4. Illustrate the use of question words learned earlier. Identify and use question words when, how many, and how much, etc.

ARTICLES

Recall the rules for the use of 'a' and 'an'. Choose between 'a' or 'an' before words that start with mute consonant letters.

VERBS

1. Recognize helping verb as aiding the main verbs. Identify the use of verbs be, do and have as helping verbs. Distinguish between being, do and have as main and helping verbs.
2. Identify and make simple sentences with the verbs be, do and have as main and helping verbs.

TENSES

1. Use Past Continuous Tense for actions that were in progress at some time in the past and to give a descriptive background to a narrative/recount.
2. Use Future Simple Tense for expressing actions in the future.

ADJECTIVES

1. Classify adjectives of quantity, quality, size, shape, color, and origin.

ADVERBS

1. Recognize that an adverb qualifies verbs, adjectives, and other adverbs. Identify and use simple adverbs of manner and time.

PREPOSITION (WORDS SHOWING POSITION, TIME AND MOVEMENT)

1. Use some words showing position, time and movement.

CONJUNCTIONS (JOINING WORDS)

1. Demonstrate the use of and, or & but.
2. Recognize the function of more joining words.
3. Use words such as, first, second, next and then to show a sequence.

CAPITALIZATION

1. Use capitalization according to rules learned earlier.
2. Recognize and apply capitalization to the initial letter of proper nouns: names of holidays, special events and groups.

SENTENCE STRUCTURE

1. Make simple sentences by using SV (subject + verb) and SVO (subject + verb + object) pattern.
2. Demonstrate use of subject-verb agreement according to person and number.

TYPES OF SENTENCES

1. Identify and make simple sentences to show instructions, commands and strong feelings.
2. Recognize the function of more wh forms used in questions.
3. Respond to, and ask more why questions.

COGNITIVE DOMAIN

Along with an assessment of content knowledge, it is vital to know about the range of cognitive process being used during the assessment. The cognitive domains are knowledge, application, and reasoning.

KNOWLEDGE

The first domain knowledge covers the content areas and competencies related to the identification of digraphs, silent letters, and inflections in words; comprehend words, sentences, and paragraphs as meaningful units of an expression. It demands the learner being able to write multi-syllable words with correct spellings. Complete a simple paragraph using the given words, phrases and sentences. Pronounce and spell long and short vowels and diphthongs as they occur as practice items and sentences in reading lessons and in speech. Identify and classify words that begin with vowel sounds.

COMPREHENSION

It is the second domain of cognitive level that covers the content areas and competencies related to the use of techniques for writing unified sentences and paragraphs. Write a variety of interpersonal and transactional texts e.g. short notes, informal invitations and letters, and dialogues (speech bubbles, cartoon strips) using vocabulary, tone, style of expression appropriate to the communicative purpose and context.

APPLYING

It is the third domain of the cognitive domain, focuses on the ability of students to apply knowledge and conceptual understanding to solve problems or answer questions. The domain required the students' ability to use past continuous tense for actions that were in progress at some time in the past and to give a descriptive background to a narrative.

Table 14: Target percentages of English assessment by levels of cognitive domain

SR.	CONTENT DOMAIN	PERCENTAGES
1	Knowledge	14%
2	Comprehension	76%
3	Application	10%

Table 15: Test specifications by competency and level of learning in English

	SLO'S	K	C	APP
C_1Reading and thinking skills	Identify and recognize the function of pronouns and transitional devices.		1	
	Use pre-reading strategies to guess the meaning of unfamiliar words through context.		1	
	Apply strategies to comprehend questions for appropriate response by marking key words, verbs, and tenses		1	
C_2 Writing skills	Write multi-syllable words with correct spellings.	1	2	
	Make sentences by replacing words and phrases in the given sentences.		3	
	Write short informal invitations to friends, family members and teachers to demonstrate the use of following conventions: Purpose Date and time Venue Name of addressee and sender		2	
	Revise written work for correct Spelling and punctuation. Pronoun-antecedent agreement. Subject-verb agreement.		1	1
	Revise written work for layout, legibility, vocabulary, and grammar.		1	
C_3 Oral communication skills	Use appropriate expressions in conversation to -Express regret.		1	
	-Express needs and feelings.	1		
	-Seek permission to do something.	1		
C_4 Formal and lexical aspects of language	Pronounce and spell long and short vowels and diphthongs as they occur as practice items and sentences in reading lessons and in speech.		1	
	Locate, provide, connect and use words similar and opposite in meaning.		1	
	Locate, identify, differentiate between, and use few simple pairs of words including homophones.			1
	Apply spelling change in the plural form of regular and irregular nouns and regular verb forms.		2	
	Nouns Recall, and demonstrate the use of more common, countable and uncountable nouns from the immediate and extended environment. Identify and use collective nouns.		3	
	Classify and change the gender of more nouns from the immediate and extended environment (masculine/ feminine/ neuter).	1	5	
	Pronouns Illustrate the use of pronouns learned earlier. Show possession by using the pronouns my, your, his, her, our, their and its, before nouns. Demonstrate correct use of my – mine, your – yours, etc.		2	
	Articles Recall the rules for the use of 'a' and 'an'. Choose between a or an. Choose between a or a before words that start with mute consonant letters.		1	1
	Verbs Recognize helping verb as aiding the main verbs. Identify the use of verbs be, do and have as helping verbs. Distinguish between being, do and have as main and helping verbs.		1	
	Identify and make simple sentences with the verbs be, do and have as main and helping verbs.	1	1	

	Tenses Use Past Continuous Tense for actions that were in progress at some time in the past and to give a descriptive background to a narrative/recount.		2	
	Adjectives Classify adjectives of quantity, quality, size, shape, color, and origin.	1	3	1
	Adverbs Recognize that an adverb qualifies verbs, adjectives, and other adverbs. Identify and use simple adverbs of manner and time.		1	
	Words Showing Position, Time and Movement (Preposition) Use some words showing position, time and movement.		1	
	Joining Words (Conjunctions) Recognize the function of more joining words.			1
	Sentence Structure Make simple sentences by using SV (subject + verb) and SVO (subject + verb + object) pattern.	1	1	
Total		7	38	5

Note: K= Knowledge; C= Comprehension; App= Application

ASSESSMENT FRAMEWORK FOR BACKGROUND VARIABLES

Background variables are widely studied as an associate of student learning. These factors generally include; facilities at home, school, and classroom and are treated as a source of variation in the achievement. Data on background variables is useful in identifying factors causing variation in student learning and subsequently providing the right kind of support to the system for improving student learning.

The background questionnaire framework addresses selected factors, sub-factors, indicators, and statements helpful in devising clear guidelines to develop tools to capture evidence of variation through relevant stakeholders. The framework was mainly based on three main areas;

1. Home related factors
2. School related factors
3. Classroom related factors

The detail of each factor is given below:

HOME RELATED FACTORS

Parents/ guardians are mainly responsible for upbringing and success in their child's education in schools. The effect of parental contribution can be better understood through home related background information on students' achievement in Science, Mathematics, and English. Home-related factors were further divided into:

- Resources available at home for learning
- The language spoken at home

HOME RESOURCES

There is ample evidence that the availability of related resources at home positively related to student performance. Socioeconomic status is often indicated through proxy variables such as parents' level of education, income, parent occupation and reading material like books available at home. A scale is developed mainly covering resources related to socioeconomic status with the potential of contributing towards students learning e.g. availability of a computer, internet connection, books, dictionaries etc.

THE LANGUAGE SPOKEN AT HOME

Information related to the language spoken at home is to be collected from children and their parents. It is important to know whether the language at school during classroom teaching and at home is different or the same. Some parents focus on dual languages. There may be variation in languages spoken in different homes. Generally, it is considered that there might be little chance of variation in language at home among children living in the same context. But it can vary in some cases due to the background of the families. The variance in the language spoken at homes can vary in achievement scores of the students.

Detail of these factors is given in table 16.

Table 16: Detail of factors, sub-factors, and indicators related to home

FACTOR	SUB-FACTORS	INDICATORS
Home related factors	Resources available at home for learning	SES status of the family
		Parent education
		Parent occupation
		Reading material available at home (books, dictionaries)
		Computer, tablet, internet connection, TV/ radio, mobile phone/ PTCL phone etc.
		Nutrition (breakfast, hunger)
		Health care (eyesight), Growth
		Community-related information (cleanliness, playground, safety)
		Parents' spending on each child
		Tutoring
		Parent support in study
	The language spoken at home	The language spoken by father
		The language spoken by mother
		The language spoken in the street with playmates
		The language spoken by siblings

SCHOOL RELATED FACTORS

School-related factors are very important determinant and effective in achieving curricular targets. A school was not only a discrete collection of attributes but rather a well-managed; integrated system where each action directly affects all other parts of the school's functions. A questionnaire was developed regarding quality school indicators to measure sources of variation in students' achievement scores. Some sub-factors related to school were given below:

- School characteristics
- Teaching material
- School emphasis
- Parents' perception of their child's school

- Safe environment
- General facilities
- Sense of ownership

SCHOOL CHARACTERISTICS

To collect key contextual information about schools, a school-related questionnaire was given to head teachers on a number of school characteristics including school size, school location, and school level. Moreover, head teachers were asked about the proportion of students who have a variety of numeracy and literacy skills at the time of their enrollment in primary schools. It is important to relate advantaged and disadvantaged students with their achievement scores. This data was obtained from head teachers.

TEACHING MATERIAL AND RESOURCES

For a favorable learning environment, sufficient instructional resources and facilities are important to be provided in the schools. The adequacy and quality of school resources are critical for quality teaching. Research highlights that schools with better resources have higher achievement as compared to schools with low resources which affect the capacity to implement the curriculum.

The resources include teaching materials, school buildings, grounds, ventilated classrooms and safe drinking water, classroom space and equipment like computer and internet, etc.

SCHOOL EMPHASIS ON SUCCESS

Information regarding school focus on success was collected from head teachers and teachers. The level of focus of school leaders on school success was directly related to the achievement level of the schools. A positive school atmosphere with high expectations for academic excellence can contribute to the success of a school. There is a positive association between academic achievement and a school's emphasis on academic success. The measures of school emphasis on academic success include school administrators' and teachers' expectations for successful curriculum implementation and students' achievement, parental support for student achievement, and the students' desire to achieve.

PARENTS' PERCEPTION OF THEIR CHILD'S SCHOOL

The information regarding parents' attitude towards their children's schools is pertinent to know their level of satisfaction towards schools. Parents views were taken into account to evaluate the school academically as well as school safety and the extent that school communicates with and involves parents in their child education.

SAFE ENVIRONMENT

There is a need to obtain information regarding discipline and safety in the schools from teachers and head teachers. It is important to see the relationship between school safety, order and discipline as reported by school staff and students achievement. Research showed the safety and discipline of schools as a predictor of student achievement. Respect for individual students, teachers, safe and disciplined environment, constructive interactions among school, community, teachers, parents, and students contribute towards building a positive school climate

associated which is pre-requisite for higher student achievement. Lack of safety disturbs discipline and ultimately leads to lower academic achievement. Schools with clear rules and demonstrated fairness tend to have atmospheres of greater discipline and safety.

SENSE OF BELONGING

Research showed a positive relationship between school belonging and academic achievement. Students' sense of belonging to their school referred to as school connectedness contributes to their general well-being. Students with a strong sense of belonging feel safe at school, enjoy school, and have good relationships with teachers and classmates.

Detail of indicators of this factor is given in table 17.

Table 17: Detail of factors, sub-factors, and indicators related to school

FACTOR	SUB-FACTORS	INDICATORS
School related factors	School characteristics	Location, name, gender, level, medium, type, district, etc. Number of classes, number of teachers, sanctioned posts, number of rooms, number of students, students teacher ratio, subject teachers school buildings and playgrounds Classroom space and equipment like computer, library, tablet and internet etc.
	Teaching Material and resources	Science kit Mathematics kit Language kit
	School Emphasis	School leader vision Teachers commitment Curriculum implementation Student motivation Respect to individuals (teachers, students, parents) Fairness Rules and Discipline Community participation
	Parents' perceptions of their child's school	Trust of parents Parents' support Parents' satisfaction towards school Parents' attitude Parents' involvement
	Safe environment	Parents' satisfaction towards the safety of their children Punishment Dropout Safety measures
	General facilities	Electricity Drinking water, Toilets Air, light, and fan School council role IT facilities Furniture Library/reading facilities Co-curricular activities (games, quizzes, debates, Hamd and Naat competitions) Civil works in a school School condition
	Sense of ownership	Student – teacher relationship Student-student relationship Students attitude towards school Students' satisfaction in school Students' motivation level Community ownership Political involvement in school

CLASSROOM RELATED FACTORS

Teaching and learning process mainly takes place in the classroom; however better learning is likely to be influenced by the classroom environment and learning activities. Questionnaires were developed for teachers and students focusing on classroom-related factors and practices which are influential in teaching and learning.

- Teacher preparation and experience
- Teaching time
- Teaching strategies and practices
- Supportive/conducive classroom environment
- Challenges faced by students and teachers

TEACHER PREPARATION AND EXPERIENCE

Pedagogical knowledge is essential for teaching different subjects by using relevant strategies and suitable practices in the classroom. It is important for teachers to know how students learn and to understand the use of relevant pedagogies during the teaching of Science, Mathematics and English. Professional development of teachers is essential through seminars, workshops, and conferences to expose them for better and creative experiences to make their teaching more creative.

Experience of teachers is also contributive towards the professional development of teachers and important to know how newly appointed teachers and teachers with varied level of experience address their classes in the classroom during instruction.

TEACHING TIME

The curriculum implementation is the instructional time used by teachers to teach the subjects of Science, Mathematics, and English. It is important to know that all schools allocated equal time for instruction of these subjects. Moreover, the allocated time is the same as the prescribed time given in the curriculum document. Literature found that instructional time is related to the student achievement but with the condition that how effectively and efficiently that instructional time was used.

Homework is a way that teachers use to extend their instructions and evaluate students' learning. The amount of homework varies across schools, subjects, and teachers. In this study, data was collected on homework related factors including time, guidelines and instructions to complete homework, checking of homework and feedback provided to students on their homework by teachers.

TEACHING STRATEGIES AND PRACTICES

The frequency with which teachers implement a variety of teaching strategies and practices during the teaching of a topic can be collected to determine the strategies used by teachers with respect to content taught. The strategies leading to higher order learning are important to identify and inculcate. Specific classroom practices may include knowing that opportunities for students to work on the problems independently, chances to express their views freely, choose their own methods to solve problems, justify their choices and present outcomes. Subject-specific use of the strategies with reference to Mathematics, Science, and English can vary slightly across subjects.

CLARITY IN TEACHING

A key quality of effective teaching is clear instruction. Teachers' main task is to explain the content clearly and gauge students' understanding on the topic. For challenging topics, it is essential for teachers to employ a

variety of pedagogical techniques and explanations to ensure students comprehension. Moreover, teachers can link new concepts with the known and daily concepts or daily context related tasks already known and understood by the students. There is a possible indication that students' positive image towards clarity of instruction would help and may increase their achievement score. Teachers can create a supportive environment by providing positive feedback, listening and responding to the questions asked and being considerate about students' needs.

SUPPORTIVE CLASSROOM ENVIRONMENT

The classroom environment is a key element in supporting the teaching and learning process. Classroom climate includes teaching aids, ventilated classroom with sufficient light and necessary equipments. The well-equipped classroom can be supportive and a source of motivation to enhance students' achievements.

CHALLENGES FACED BY STUDENTS AND TEACHERS

Teachers face a lot of problems on a day to day basis. They are overburdened in the school responsibilities along with outdoor activities assigned by the authorities to perform. Ultimately they have little time to plan their daily lessons and their teaching suffers. Over crowded classes, parents' attitude, administrative issues, extra duties like census, election duties, and exam duties. Students with weak background followed by frequent absences from schools create problems for teachers to teach content without having pre-requisite skills. Children with hunger and fatigue cannot concentrate in the classroom thus have compromised learning experience. Detail of indicators of classroom related factors are given in table 18.

Table 18: Factors, sub-factors, and indicators related to classroom

FACTOR	SUB-FACTORS	INDICATORS
Classroom related factors	Teacher preparation and experience	Teacher qualification (academic and professional)
		Teaching experience
		Number of trainings
		Nature of trainings
		Subject taught
		Nature of appointment
		Tuition to students
		Number of hours for preparation
	Instructional time	Instructional time for teaching Math
		Instructional time for teaching Science
		Instructional time for teaching English
		Homework
		Feedback
		Efficient use of time
		Other activities
	Instructional strategies and practices	Use of investigating techniques in Math's teaching
		Nature of practices in the Science classroom
		Nature of strategies in the English classroom
		The option of asking questions
		Focus on problem-solving skills
		Teaching Science without IT
		Use of charts and Models
	Instructional clarity	Efficient and effective teaching
		Concept clarity
		Linkage of concepts with daily life examples
		Facilitation to students queries
		Students satisfaction
		Productive feedback
	Supportive classroom environment	Welcoming and Encouraging attitude
		Address students' needs
		Friendly behavior
		Furnished, equipped classroom
	Challenges faced by students and teachers	Duties other than teaching
		Overburden/ overcrowded classes
		Parents' attitude
		Lack of students interest
		Administrative Issues
		Frequent absenteeism
		Fatigue, Hunger, Health issues
		Other tasks beyond studies
		Parents' issues

CHAPTER 3
TOOL DEVELOPMENT

Two types of tools were developed to collect data; one for measuring students' achievement in the subjects (English, Science, Mathematics) and others were to measure the influence of sources of variation which can contribute in students' achievement like, head teachers, teachers, and students/parents. Overall following six tools were developed:

1. English test (50 items- MCQs)
2. Mathematics test (50 items- MCQs)
3. Science test (50 items- MCQs)
4. Questionnaire for parents and students (27 close-ended items)
5. Questionnaire for teachers (51+8 close-ended items)
6. Questionnaire for head teachers (61 close-ended items)

A workshop was conducted by PEC to provide guidance to subject specialists about test construction. The workshop continued for three days in the PEC office to develop achievement tests.

There were three subject specialists for each subject to develop achievement test and one official from PEC for coordination. Three versions of the test were developed for each subject. Each version comprised of 50 MCQs. The questionnaires for head teachers, teachers, students, and parents were also developed as per frameworks given in the previous sections.

PILOTING

The piloting of the achievement tests in the subject of English, Science, and Mathematics was conducted by team of 10 officials from Research (& Analysis) and Assessment (& Framework) wings of PEC.

Training of PEC Test Administrators was held at PEC office one day before pre-testing by consultant. A manual for field staff was also developed to describe the protocols for data collection. PEC Test Administrators were responsible for ensuring confidentiality of tests and timely conduct of tests and other tools in all sampled schools in their respective districts.

Three versions of each subject test were prepared and each version was conducted to students of grade 5[7]. Three parallel forms (version) of each subject test were meant to provide ample option for test developers to select psychometrically suitable test items for the preparation of final subject tests. Each test comprised of 50 MCQs with four options each. Besides achievement tests background questionnaires for the teacher, head teacher, students and parents were also pilot tested.

The piloting of tools was conducted in 10 districts randomly selected. The selected districts for piloting were Faisalabad, Sargodha, Mandi Baha-ud-Din, Rawalpindi, Lahore, Chiniot, Sahiwal, Narowal, Bahawalpur and Kasur. Three schools from each district were selected which means a total of 30 schools participated in piloting. The data was collected by PEC test administrators in 3 days/district i.e. 10 schools each day. Each version of the subject achievement test was conducted in 10 schools and data was collected from 25 students

[7] Grade 5 was selected for piloting of subject tests because students of grade 4 were yet to complete their syllabus.

from each school. Each student took subject tests in Science, Mathematics, and English. It means each version of the subject test was taken by 250 students. A total of 2,250 solved scripts of the 9 versions of subject tests (three versions of Science, Mathematics and English tests each) were collected from 750 students from all 30 schools included in pilot testing. The piloting of tools took place simultaneously in all districts to ensure confidentiality and uniformity of administrative procedures.

SELECTION OF SCHOOLS

The schools for piloting were selected from data obtained from the Programme Monitoring Implementation Unit (PMIU). The sampling of schools was done by using gender and locale as strata. The distribution of schools by gender and locale was equal.

THE PROCEDURE OF DATA COLLECTION FOR PILOTING

PEC deputed 10 data collection officers from PEC office i.e. one officer for one selected district. Each officer spent 3 days in a district and collected data from one school per day. Thus each officer collected data from 3 schools. Twenty-five (25) students of grade 5 were selected systematically to take three subject tests as per schedule provided in the following table.

Table 19: Schedule of data collection from each sampled school for piloting of tools

TEST	NUMBER OF STUDENTS PER DAY IN A SCHOOL IN A DISTRICT	MINIMUM ESTIMATED TIME
Science	25	9:30 am – 10:30 am
Mathematics	25	10:30 am - 11:30 am
Break (11:30 am - 12:00 Noon)		
English	25	12:00 Noon – 1:30 pm

FINALIZATION OF TOOLS

The achievement tests were marked and item analysis was carried out to generate difficulty index, distracter analysis and discrimination power of each item. The item characteristics were found using Iteman software for analysis and placed three versions of tests in a table showing difficulty index, discrimination power and distracter analysis against each item to compare and identify the best item for the final test. This procedure went through by placing item descriptors under each item and the comparison of their characteristics.

The selection of items from this comparative analysis of three versions of each subject was made on the basis of descriptors mentioned against each item. The selection of items for the final test was made by selecting one item from three in line with content, SLO and cognitive domain by focusing on the difficulty index, discriminating power and distracter functioning. The items with difficulty index near to 0.5, discrimination starting from +0.2 to onward and comparatively better functioning distracters were included in the final tests.

TABLE OF SPECIFICATION

Two-way table of specification for achievement test is given in table 20. Contents are given vertically and levels of learning being measured are given horizontally. Table of specification typically depicts a preference set for PASL in assessment frameworks for each subject.

SCIENCE

Achievement test in Science was based on textbook prepared in light of National Curriculum 2006. The test comprised of 10 content areas covered in 10 units of the textbook according to their respective weightage in the textbook. The test focused on measuring higher order learning i.e. application and reasoning. Almost 25% of the items were included to measure knowledge because these questions formed the basis for asking higher order learning questions but marginal weightage was given to knowledge level items in terms of marks allocated.

Table 20: Distribution of test items by content area and level of learning in Science

SR.	CONTENT	K (25%)	APP (50%)	R (25%)	T
1	Understanding ourselves	2	2		4
2	Characteristics and needs of living things	1	3	2	6
3	Food and health	1	3	1	5
4	Living things and their environment	2	2	1	5
5	Matter and its states	1	2	2	5
6	Temperature and its measurement	1	2	2	5
7	Force and machines	1	3	1	5
8	Introduction to sound	1	3	2	6
9	Investigating electricity & magnetism	1	3	2	6
10	Movements of the Earth	1	1	1	3
Total items		**12**	**24**	**14**	**50**

Note: K= Knowledge; App= Application; R= Reasoning; T= Total items

MATHEMATICS

Mathematics content of grade 4 is divided into 7 content areas as given in table 21 along with textbook units in which content related to these areas is addressed. Questions related to application and reasoning were 75% of the total test. The test predominantly focused on measuring higher order learning as given in the assessment framework. Only 25% of the questions measured knowledge of students. These questions primarily formed the basis for developing questions measuring higher order learning in the respective topic/ area.

Table 21: Distribution of test items by content area and level of learning in Mathematics

SR.	CONTENT	K (25%)	APP (50%)	R (25%)	T
1	Numbers and arithmetic operations (Units 1-3)	3	3	2	8
2	Factors and multiples (Unit 4)	2	5	3	10
3	Fractions (Unit 5)	2	5	2	9
4	Decimals and fractions (Unit 6)	2	4	2	8
5	Measurements (Unit 7)	1	3	2	6
6	Geometry (Unit 8)	1	2	1	4
7	Information Handling (Unit 9)	1	3	1	5
Total items		**12**	**25**	**13**	**50**

Note. K= Knowledge; App= Application; R= Reasoning; T= Total items

ENGLISH

The content areas in the subject of English are not based on topic/unit but the curriculum is designed around skills and competencies. Thus table of specification was based on skills and questions were developed on each skill across the units in the textbook. Considering the difficulties faced by students in learning English in early grades, the test mostly included items of comprehension level. Only 10% of questions aimed at measuring students' ability to apply the learned knowledge.

Table 22: Distribution of test items by competencies and level of learning in English

SR.	CONTENT	K (14%)	C (76%)	App (10%)	T
1	C1: Reading and thinking skills	-	3	-	3
2	C2: Writing skills	1	9	1	11
3	C3: Oral communication skills	3	1	-	4
4	C4: Formal and lexical aspects of language	3	25	4	32
Total items		**7**	**38**	**5**	**50**

Note. K= Knowledge; C= Comprehension; App= Application; T=Total items

BACKGROUND QUESTIONNAIRES

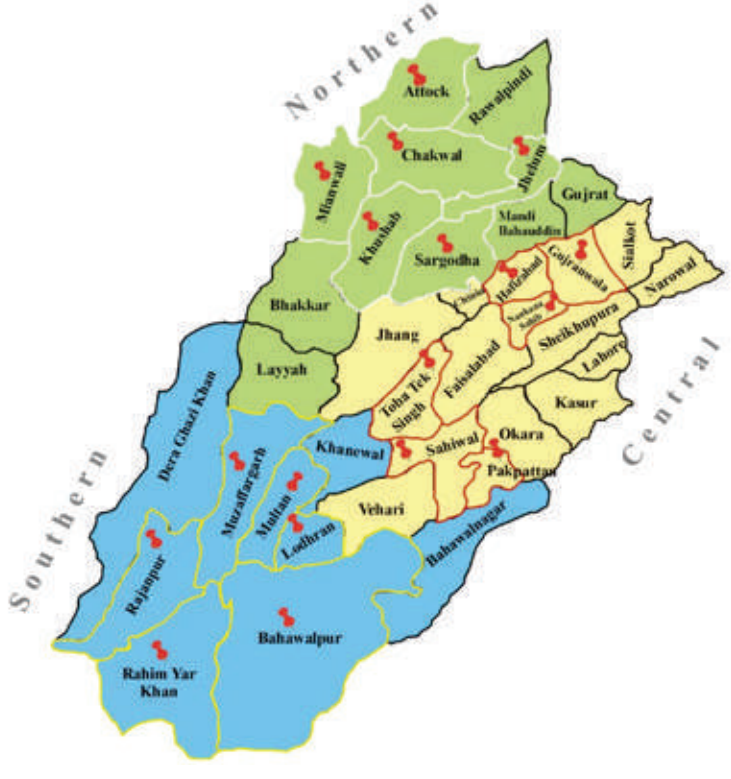
Three background questionnaires were used in the study i.e. questionnaire for students and parents, questionnaire for teachers and questionnaire for head teachers. Home, school, and classroom-related factors were included in the questionnaires. The sub-factors and indicators were also identified. The items were developed by competent item writers under supervision of PEC staff to assess the level of resources and other relevant material available in homes, schools, and classrooms. The items were developed in different formats like dichotomous (to know about the availability of some objects), Likert scale and open-ended as per nature of trait to be measured accordingly. These tools were presented and shared with the relevant stakeholders. Each item was discussed with stakeholders in a one-to-one interview to ascertain the relevance

of content, the suitability of language/expression used, and understandability with reference to item format. The comments of the stakeholders were used to improve the relevant parts of the background tools and tools were finalized after making suggested changes by the head teachers, teachers, and parents.

CHAPTER 4
SAMPLING PROCEDURE

The province of Punjab has 36 districts usually geographically divided into three zones i.e. northern, central and southern Punjab. There is no official distribution of districts in these zones but conventionally used allocation of districts in zones is given in figure 1.

Figure 1: Distribution of sample across three regions of Punjab



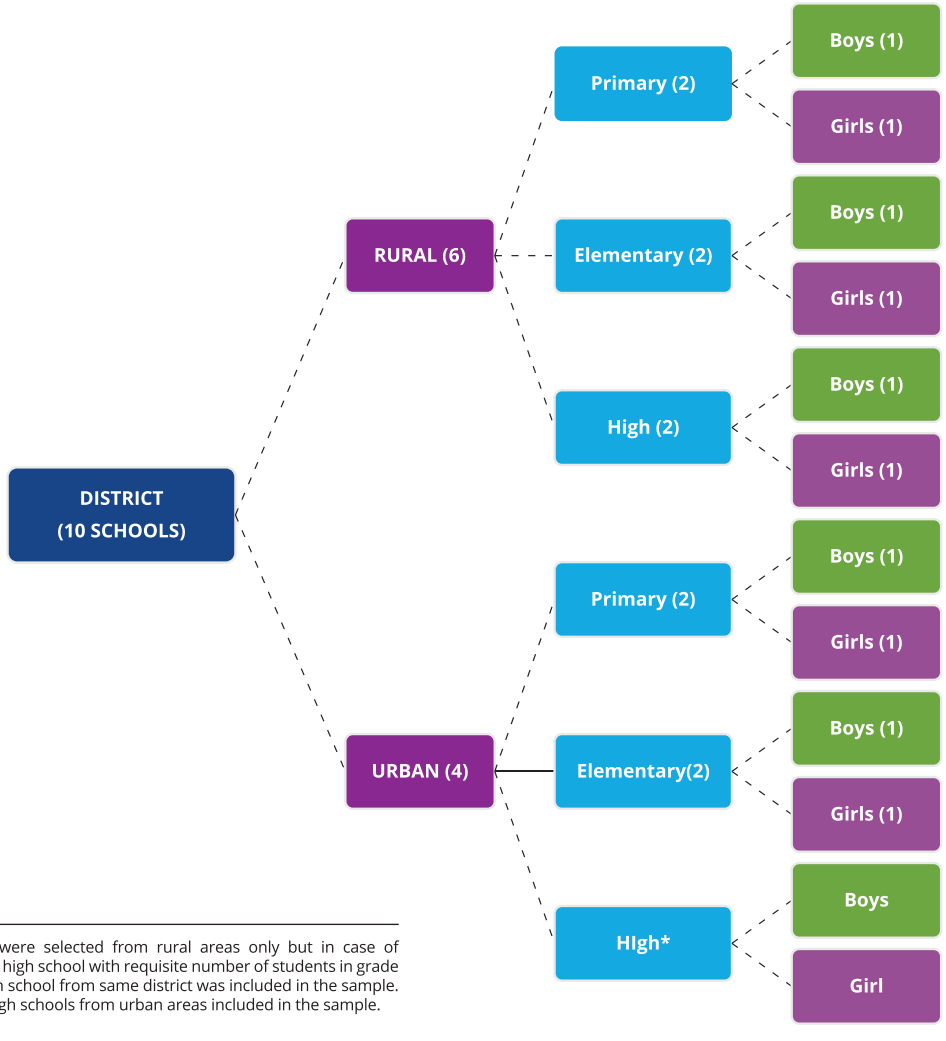
The sample of the study included 18 randomly sampled districts of Punjab. Six districts from each part (northern, central, southern) were sampled randomly to give equal representation to each part.

The school data from PMIU was obtained for selected districts. The sampling frame included information on the district, tehsil, school code, school name, availability of grade 4, enrollment, school gender, school locale, number of teachers, type of school, name of the head teacher, and contact details. Only those schools were filtered in which a minimum of 25 students was enrolled in grade 4.

From each selected district 10 schools were selected using stratified random sampling method. The stratification was based on locale (urban and rural), gender (boys and girls) and type of schools (primary, middle and high). From each school at least 25 students of grade 4 were included in the sample. Thus, data

were collected from 4,500 students on each of the achievement test (Science, Mathematics, and English), 540 teachers also took the same achievement test in Science, Mathematics and English, 180 head teachers, 540[8] teachers and 4,500 parents responded on background questionnaires. Moreover, detail of sampling design is given below;

Figure 2: The design for the distribution of schools in sampled districts



*High schools were selected from rural areas only but in case of unavailability of high school with requisite number of students in grade 4, an urban high school from same district was included in the sample. There were 7 high schools from urban areas included in the sample.

SAMPLING ERROR

The students were the basic unit of sampling and 4,500 students participated in the study. If the sample size exceeds 4,000 irrespective of the population size, the margin of error is reduced to less than 1.5%[9]. Generally in survey studies 3% margin of error is assumed to be acceptable.

[8] There were schools in which less than 3 teachers were available, therefore, actual number is less than 540.

[9] What is a margin of error? Available at file:///F:/Data%20from%20All%20previous%20computers%20May%2018/MS%20Computer/17-Sep/KC%20RM%20data%20analysis%20course%2026%20Aug%2017/CSA%2041CTP/Lecture%207%2027-03-14/margin%20of%20error%20in%20sampling.pdf for further details.

SELECTION OF SCHOOLS

According to the distribution of schools given in the previous section, the following procedure was followed for the selection of schools across Punjab.

a. Data of schools was obtained from PMIU.

b. Total 180 schools were sampled using stratified random sampling at four levels i.e. district, type of school, gender and locale. The type of school was divided into three tiers (primary, elementary, high) and gender into two tiers (girls and boys) and location into two tiers (urban and rural). The distribution of 180 schools was comprised of 10 schools from each of 18 districts included in the study.

c. There was one alternative school to each selected school in the sample. In case the selected school becomes unavailable on the day of data collection for any unforeseen reason, the alternative school could be visited.

d. The data of the selected school was verified via e-mail from the district authority before finalizing the 10 schools and alternate schools selected in the sample.

CHAPTER 5
DATA COLLECTION, DATA ENTRY, AND CLEANING

A third party was involved for the purpose of data collection to avoid the conflict of interest and ensure uniform execution of the data collection activity across 18 districts. PEC used to collect data by hiring school teachers from within the Department of Education for studies in the past. In this two day activity, 180 field workers (third party) and 18 supervisory staff collected data across Punjab.

DATA COLLECTION TEAMS

The confidentiality and transparency of the data collection across selected districts were ensured by collecting data simultaneously using a pre-decided daily time schedule using 18 data collection teams. Each team comprised 10 field workers supervised by a team manager (PEC officer) deputed by PEC. Data collection was carried out under the supervision of PEC officer designated by PEC in specified districts. Field workers were having a master degree/BS 4 years in any social sciences subject and experience in field work was preferred. Considering the gender distribution of schools in the sample, data collection teams were comprised of 50% female field workers.

TRAINING OF DATA COLLECTION TEAMS

The test administration manual was prepared to lay down the SOPs of data collection for test administrators. The manual apprised test administrator/field workers about scope and work of this study, provided detailed daily plan of work during data collection activity, responsibilities of test administrators/field workers, important work expected from test administrator/field worker before, during and after the conduct of achievement test and background questionnaires, recording attendance of students taking test, and procedure of selection of 25 students from selected class for tests.

The training of 18 team leads designated by PEC, one representative from each district team nominated by Apex Consultants for data collection, field manager from third party, and representatives from UNICEF participated in the training session at PEC office. An orientation to the purpose of the PASL was given by Director (Research and Analysis) followed by consultants' detailed sessions on each tool to be used in the data collection. Each topic in the test administration manual was discussed to reach a shared understanding of SOPs to ensure uniformity of procedures and transparency in data collection.

Each team lead by designated officers of PEC, who conducted a replica of the training in their respective districts with 10 field workers nominated by the firm hired for data collection, one day before the data collection.

THE PROCEDURE OF DATA COLLECTION

The data was collected by 18 research teams simultaneously in all selected districts following the time schedule and test schedule as given in the data collection plan on both days of data collection. Each team was comprised of 10 field workers spending two days in one school. The head teachers of the selected schools were informed 2 days before the assessment to ensure the presence of students in grade 4. A PEC designated officer was heading each team. He/she was responsible for the collection of field tools and other logistics from PEC and return requisite data and materials back to PEC office. The test execution team had adopted the following action plan to conduct the test.

a. Opening meeting with the head of the institution and focal person from school assisting in logistics
b. Test administrators systematically selected 25 students from grade 4 by the attendance register.
c. The same group of 25 students in a school appeared in all three subject tests and responded to background questionnaires.
d. Student attendance for all subject tests was marked in the provided attendance sheet.
e. Test administrators briefed students on how to fill responses on OMR sheet with help of an example.
f. The students from each school completed the portion of the background questionnaire relevant to them in the class. They were allowed to take questionnaire to home for getting it filled by the parents at home and bring back next day.
g. Three teachers (Mathematics, Science, and English) from each school had filled up the Teacher's background questionnaire.
h. Each Head teacher of the selected school had also filled up the Head Teacher's background questionnaire.
i. Test administrator had ensured that Visitors/ Monitors fill the visitor form provided to them.
j. Closure meeting with the head of the school to thank him/her for the support provided.

The day wise details of the activities carried out by the test administrators in each school are listed in table 23 with distribution of time and sequence of activities.

Table 23: Detail of activities in schools during data collection

ACTIVITY	MINIMUM ESTIMATED TIME
DAY 1	
Test of Mathematics Filling of Head Teacher questionnaire Filling of Teachers questionnaires Filling of Students' part of Student-Parents background questionnaire. Handing over the parental portion of questionnaires to be filled at home.	90 minutes
DAY 2	
Test of Science	60 minutes
Test of English	60 minutes
Collection of Student-parents questionnaires from students.	

MONITORING OF DATA COLLECTION ACTIVITY

The PEC officer designated for each district had visited at least one school each day to ensure the data collection procedure and check if protocols of data collection listed in data collection manual were followed in letter and spirit. A Monitoring and Evaluation team including consultant capacity building, UNICEF officials, Director (Research and Analysis) PEC and other PEC officials had visited at least two sites during data collection to ensure the quality of data collected. Monitoring team officials filled their visit reports already available with test administrators to record their observations.

DATA ENTRY AND SCORING

The data entry was started immediately after data collection at PEC head office. Eighteen data entry operators were engaged to enter data.

OMR sheets were scored by the research assistants in the data center at PEC using the test keys prepared by the PEC subject experts. Initially, data was entered into excel files as the data entry team was proficient in using Excel sheets. After the confirmation of the correctness of the data entry and quality assurance by the data entry monitoring team, data was shifted in SPSS files already prepared by the PEC team in consultation with consultant from UNICEF. A committee formed by Director (Researcch and Analysis) had developed a mechanism to ensure the monitoring of the data entry process by counter-checking of at least 10% of the entered data randomly. The committee had given a certificate of accuracy at the end of the data entry process after a counter check from OMRs sheets comparative tabulation with computer entered data.

DATA CLEANING

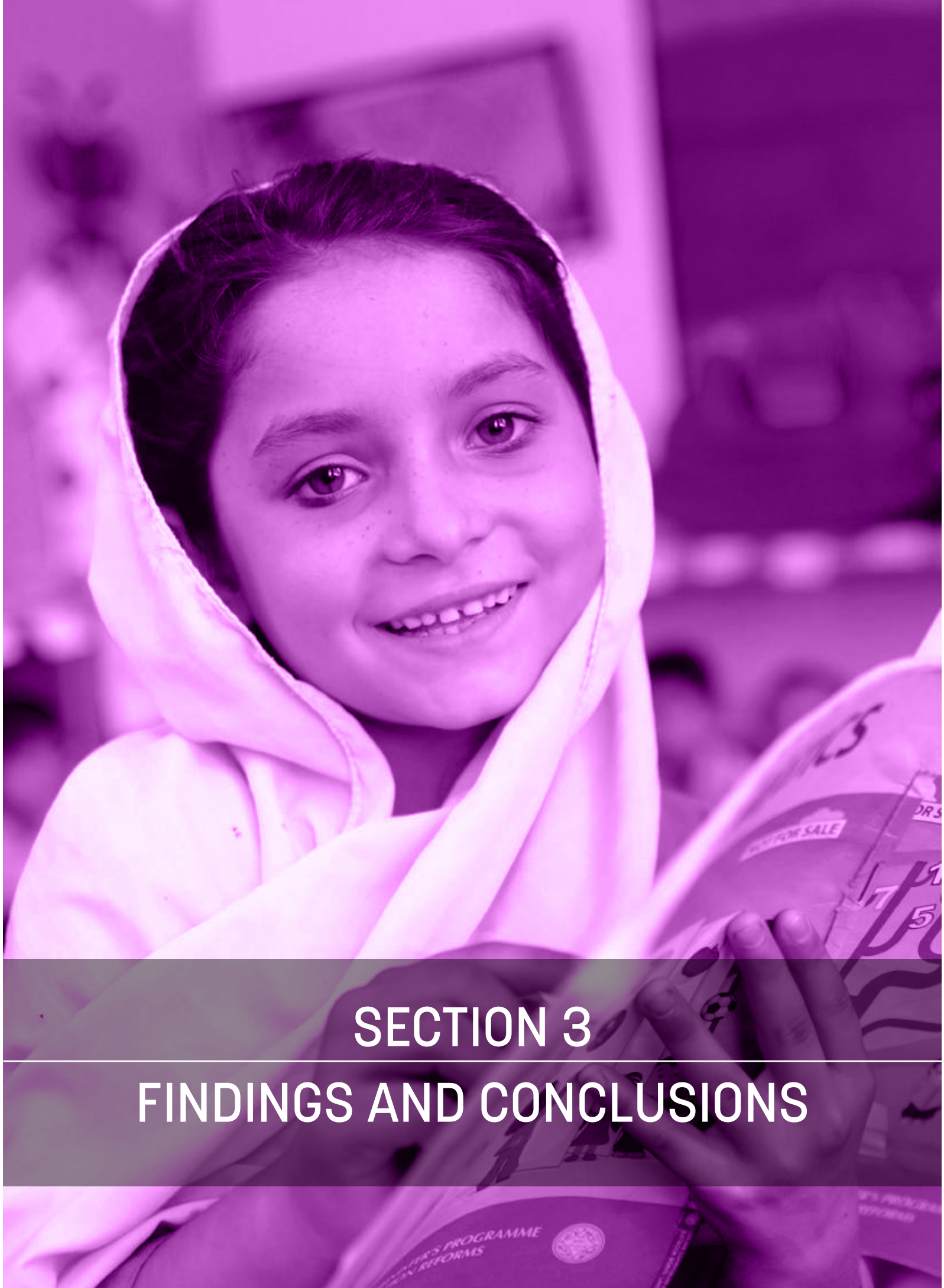
Data cleaning is an important step before embarking on data analysis. For this particular data set following steps were adopted.

a. Random entry check was carried out of 10% of the data to ensure correct entry from OMR sheets to data file

b. Detection of pattern data for background questionnaires was conducted by sorting data file entries in descending order to eliminate response pattern if noticed.

c. Missing data analysis in background information, variables and test items. For missing values in background information, logical connectivity of background details was used to fill in missing information to the possible extent.

d. Distribution of data for each question was checked using distribution curves, means and trimmed mean comparison, eliminating outliers, and examining skewness and kurtosis.



SECTION 3

FINDINGS AND CONCLUSIONS

CHAPTER 6
ACHIEVEMENT SCORE ANALYSIS

In this part, the analysis of achievement score is reported in a comparison of students and their respective teachers. The analysis is broken down into demographic variables of students. The analysis is further broken down by Locale, Gender, and Level of school.

COMPARISON BETWEEN THE OVERALL PERFORMANCE OF STUDENTS AND THEIR TEACHERS

Figure 3: Achievement of Students in English, Science and Mathematics tests

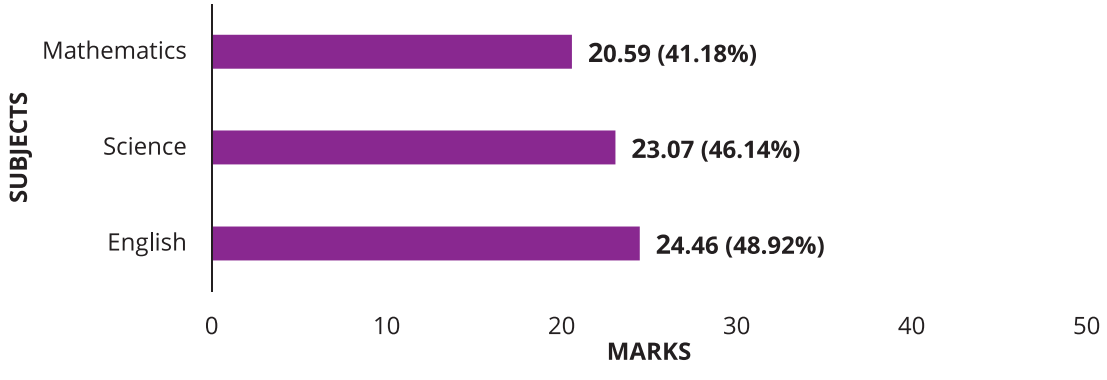
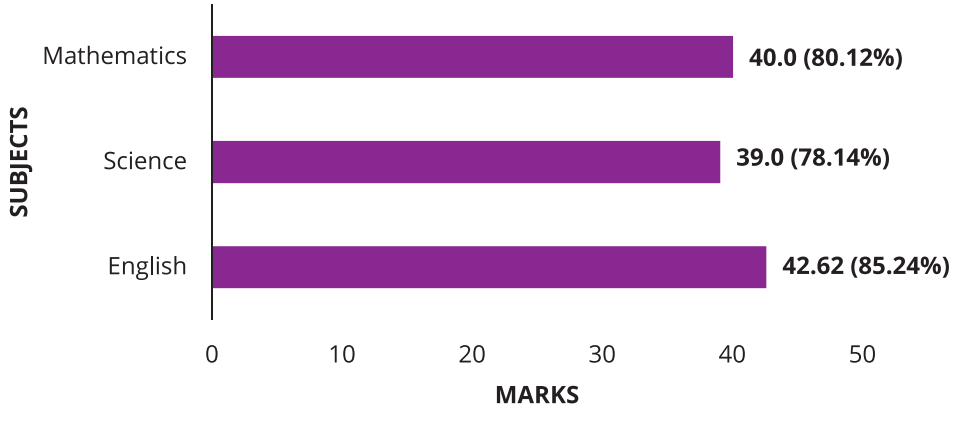


Figure 3 shows that students' performance is below 50% in all subjects. In a test of 50 marks, students mean score was 24.46, 23.07 and 20.59 in English, Science, and Mathematics respectively. Students performed relatively better in English than Science and Mathematics but still performed below 50% in each subject.

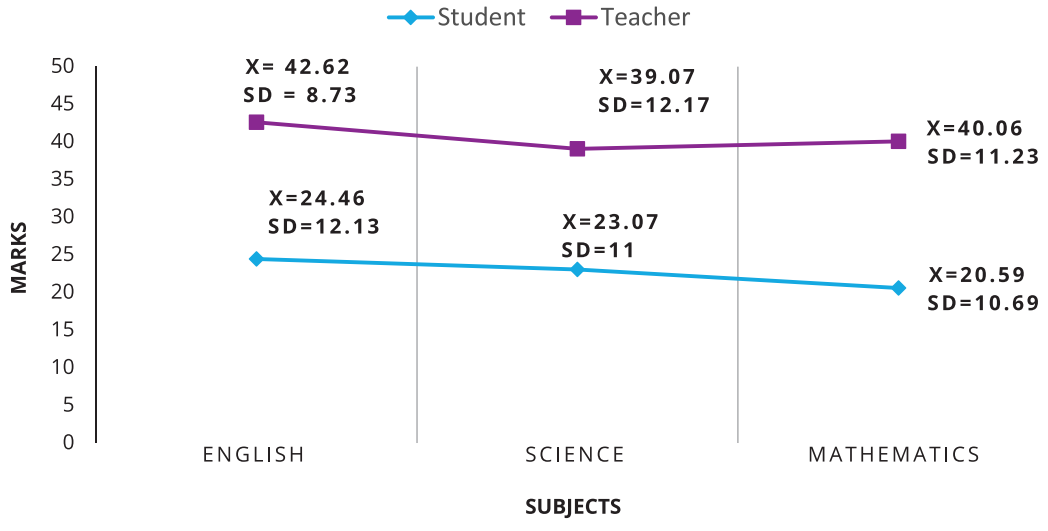
Figure 4: Achievement of Teachers in English, Science and Mathematics tests



TEACHER PERFORMANCE IS YET TO TRANSLATE IN STUDENT PERFORMANCE

Figure 5 shows that there is a wide gap in the performance of students and teachers performance. It reflects that government policy to recruit a teacher with a higher content qualification in school in the last decade paid off and our teachers know their subjects better than that of their students now.

Figure 5: Comparative trend in performance of students and teachers

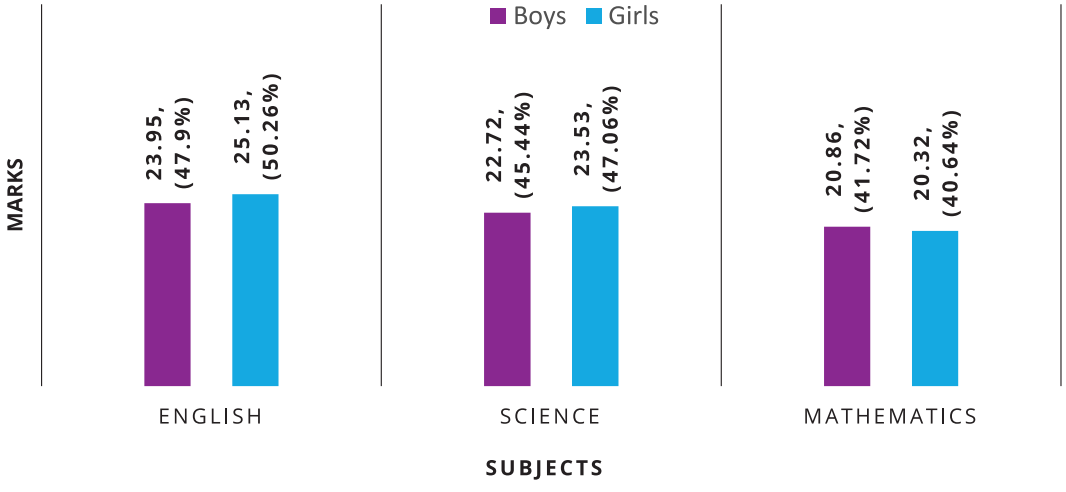


It is worth mentioning that improved teacher competence in content is yet to bring any change in student performance. This brings back the importance of pedagogical competence as an important element of teaching. In light of the findings of NEAS studies, the government concluded that pre-service teacher training is contributing negligibly in the teaching skills of the professionally trained teachers, thus it was decided to recruit teachers having subject competence even with no professional training. It was thought that any teacher competent in the subject matter can be a good teacher and the ability to teach is accessible to all teachers competent in their subjects. Data from this research revealed that despite being competent in subject matter, being able to teach cannot be taken for granted. Professional training of teacher is as necessary as competence in the subject matter. The recruitment policy for teachers in schools needs to make a professional teaching degree as part of eligibility rather than preference.

COMPARISON OF PERFORMANCE BY GENDER

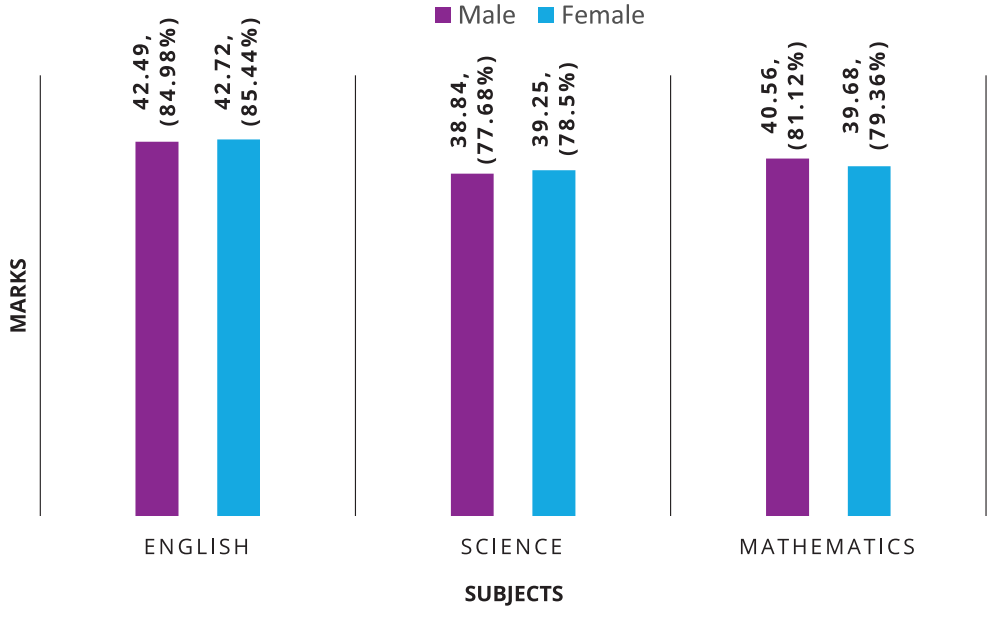
Gender disparity has remained a challenge for the educational institution since long. There have been conscious efforts by the School Education Department (SED) to reduce the gap. The results of this study reveal that the gap in student performance has largely reduced as a result of measures taken by SED.

Figure 6: Comparison of students' performance by gender



In fact, girls have marginally performed better than boys in English and Science while boys are still slightly better in Mathematics. But the difference in mean performance is less than one point in Science and Mathematics.

Figure 7: Comparison of teachers' performance by gender



The performance of teachers is almost the same in all three subjects by gender. The process of recruitment of teachers is the same for male and female teachers which mean teachers of almost the same competence are recruited. It is only that some are posted in rural schools from among them.

The t-test was applied to find the statistical difference in the performance of boys and girls in English, Science, and Mathematics. Although the mean scores are quite close the difference in performance is statistically significant in English and Science in favor of girls. Table 24 shows that the difference in the performance of Mathematics is statistically non-significant.

Table 24: Comparison of student's performance in the subject of English, Science, and Mathematics by gender

SUBJECT	GENDER	N	MEAN	SD	T	DF	P
English	Boy	2420	23.95 (47.9%)	11.67	-3.25	4226.96	.001
	Girl	2052	25.13 (50.26%)	12.59			
Science	Boy	2421	22.72 (45.44%)	11.02	-2.46	4471	.014
	Girl	2052	23.53 (47.06%)	10.92			
Mathematics	Boy	2421	20.86 (41.72%)	10.94	1.69	4418.76	.091
	Girl	2052	20.32 (40.64%)	10.34			

Table 25 shows that there was no statistically significant difference between the performance of male and female teachers in all three subjects. The performance of teachers remains the same irrespective of their gender.

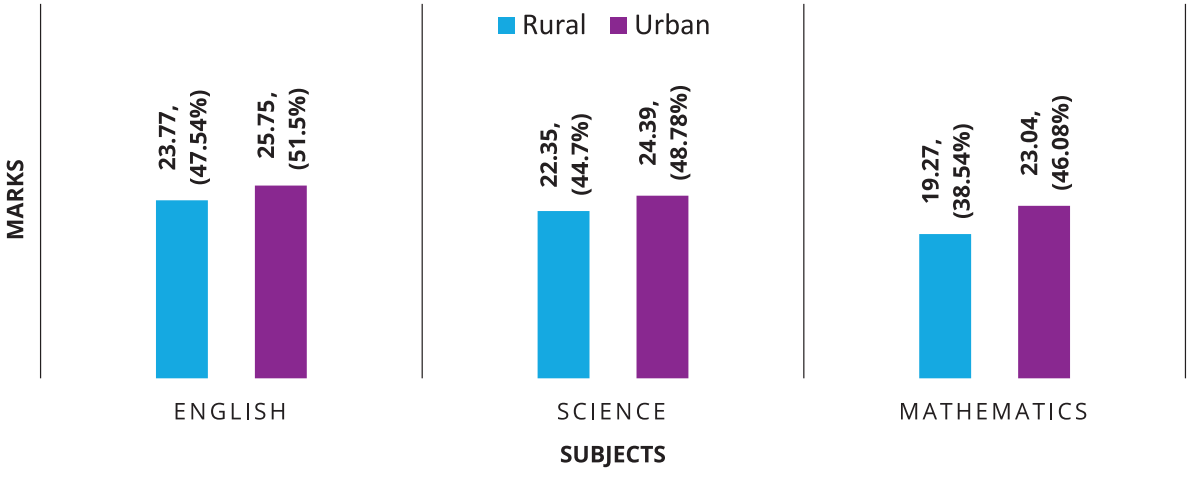
Table 25: Comparison of teacher's performance in the subject of English, Science, and Mathematics by gender

SUBJECT	GENDER OF TEACHERS	N	MEAN	SD	T	DF	P
English	Male	75	42.49 (84.98%)	8.39	-.167	169	.868
	Female	96	42.72 (85.44%)	9.03			
Science	Male	75	38.84 (77.68%)	13.12	-.218	169	.828
	Female	96	39.25 (78.5%)	11.44			
Mathematics	Male	75	40.56 (81.12%)	12.02	.509	169	.611
	Female	96	39.67 (79.34%)	10.62			

COMPARISON OF PERFORMANCE BY LOCALE

It is quite evident from figure 8 that students from urban areas performed significantly better than students from rural area. The performance of students from urban schools is 1.98, 2.04, 3.77 mean points higher than students from rural schools in English, Science, and Mathematics respectively.

Figure 8: Comparison of mean scores of students by locale



t-test was used to examine the statistical significance of the difference in the performance of urban and rural students. The results shown in Table 26 revealed that the difference in student performance is significant in all three subjects. It means locale is a source of variation in the performance of students.

Table 26: Comparison of students' performance by locale

SUBJECT	LOCALE	N	MEAN	SD	T	DF	P
English	Rural	2907	23.75 (47.5%)	11.94	-5.18	3112.98	.000
	Urban	1570	25.75 (51.5%)	12.39			
Science	Rural	2908	22.35 (44.7%)	10.93	-5.93	4476	.000
	Urban	1570	24.39 (48.78%)	11.01			
Mathematics	Rural	2908	19.27 (38.54%)	10.05	-11.01	2890.56	.000
	Urban	1570	23.04 (46.08%)	11.38			

Figure 9 shows that the performance of male and female teachers is quite similar in all three subjects in contrast to the difference in the performance of students. The difference in performance is 0.68, 0.23, and 1.01 in English, Science, and Mathematics respectively.

Figure 9: Comparison of mean score of teachers by locale

Teachers appointed in rural areas performed the same as teachers appointed in urban areas which show that the difference in student performance by locale is not due to a difference in subject matter competence of their teachers. t-test also confirmed that the difference in means of students' performance by locale is statistically non-significant.

Table 27: Comparison of performance of teachers by locale

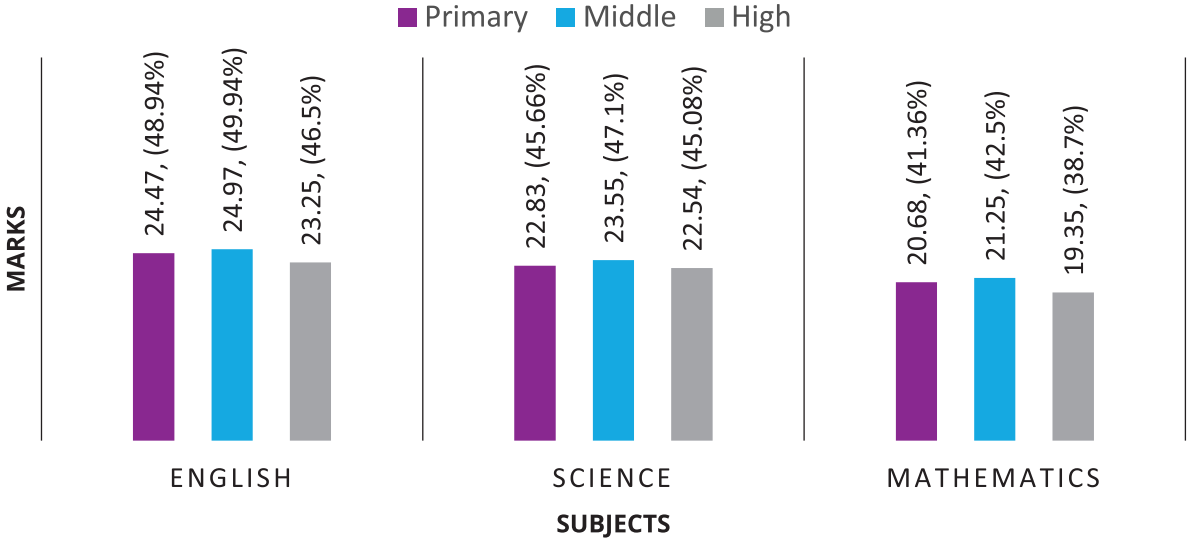
SUBJECT	LOCALE	N	MEAN	SD	T	DF	P
English	Rural	111	42.86 (85.72%)	7.83	.48	169	.632
	Urban	60	42.18 (84.36%)	10.25			
Science	Rural	111	38.99 (77.98%)	11.90	-.12	169	.908
	Urban	60	39.22 (78.44%)	12.13			
Mathematics	Rural	111	39.71 (79.42%)	12.13	-.56	169	.578
	Urban	60	40.72 (81.44%)	9.39			

It is evident from the analysis that teacher competence in subject matter is quite good in both urban and rural schools. In this case, the difference in student performance can be attributed to the disparity in access to recourses, educational support at home and community level, the value attributed to education by parents and community, educational guidance, etc. It is not possible to substantially improve any of the conditions listed above as a probable reason for the disparity in the performance of the student in the short run. But tailoring in-service training for a teacher coming from rural areas or teachers to be posted in rural areas with skills to the engaging community, utilizing local resources, involving community elders, pooling community resources and sharing resources among schools in the same vicinity can bring improvement in student performance.

COMPARISON OF PERFORMANCE OF STUDENTS BY SCHOOL TYPE

Sample of the study included primary, middle and high schools in which grade 4 is offered. The analysis shows that students enrolled in middle schools performed better, than that of the students who enrolled in primary and high schools, in all three subjects. They were followed by students enrolled in primary schools and the performance of students studying in grade 4 of high schools scored least.

Figure 10: Comparison of mean score of students by level of their schools



One way ANOVA was carried out to compare the performance of students in English, Science, and Mathematics by type of schools to know the statistical significance of the mean differences in students' scores. The results confirmed that there exists a statistically significant difference in the performance of grade 4 students on basis of the level of schools they are enrolled in.

Table 28: Comparison of student performance by level of their schools

		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.
English	Between Groups	1982.73	2	991.36	6.776	.001
	Within Groups	618034.85	4224	146.32		
	Total	620017.57	4226			
Science	Between Groups	750.56	2	375.28	3.074	.046
	Within Groups	515852.08	4225	122.10		
	Total	516602.64	4227			
Mathematics	Between Groups	2422.91	2	1211.45	10.434	.000
	Within Groups	490545.23	4225	116.11		
	Total	492968.14	4227			

It was generally perceived that grade 4 placed in high schools is most well placed as high schools have better physical resources, teaching-learning environment, and teachers but data revealed that students in grade 4 in middle schools and primary schools perform better than them. This leads to conclude that despite being

in high school, students in lower grade do not get same importance and attention as school heads are more focused on higher classes (grade 8, 9 and 10) on the basis of which the performance of school is generally evaluated. Resources and better teachers are diverted to higher classes. Middle schools turned out to be the best environment for grade 4 students because it offers better resources (physical and academic) as compared to primary school. Students get better attention from headteacher and teachers being senior grade in middle and primary schools.

CHAPTER 7
ACHIEVEMENT BY LEVEL OF LEARNING AND CONTENT AREAS

The student learning outcomes represent the depth of learning expected from students as a result of teaching in different content areas. Students' difficulties in learning vary across different content areas within each subject. It is valuable for educational planners to know content areas in which students perform as expected and even more crucial is to know content areas in which students feel difficulty in learning in different subjects. Similarly, curricular goals cannot be attained unless our assessment presents a blend of the level of learning (present complexity of learning) expected as an outcome of the teaching-learning process. The findings in this chapter have implications for curriculum planners, teacher training, textbook developers and policy makers.

MATHEMATICS

A comparison of student and teacher performance by the level of learning shows that mean performance of students on each level of learning remained more or less 50% while teachers' performance is between 84% and 88%. Generally, performance against a lower level of learning like knowledge remains higher than application and reasoning (higher order learning levels) but in this study, it remained same across the levels of learning because the questions measuring knowledge, application, and reasoning were constructed from an independent set of SLOs. The SLOs from which knowledge level questions were included had nothing in common with the SLOs from which questions to measure student ability to apply were constructed and likewise questions of reasoning. If it is intended to measure comparative performance with increasing level of learning, sequential multiple choice questions should be constructed i.e. all level of learning should be assessed using same content/topic/concept by adding depth in subsequent parts of the questions. Table 29 shows similar performance at lower level learning and higher-order learning.

Table 29: Comparison of the achievement of teachers and students in Mathematics on the basis of their level of learning

LEVEL OF LEARNING	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Knowledge	4477	26	12.55 (48.2%)	6.43	171	26	21.92 (84.3)	4.73
Application	4478	12	6.09 (50%)	3.29	171	12	10.53	2.31
Reasoning	4478	12	5.83 (48.5%)	3.12	171	12	10.17	2.20

Mathematics textbook is divided into three major areas with reference to content coverage i.e. numbers, measurement and geometry, and information handling. Content area wise analysis is as follows;

CONTENT AREA: NUMBERS

Numbers are an important sub-area of learning in Mathematics. Learning numbers is the basis for the learning of Mathematics in higher grades, thus multiple chapters are devoted to concepts related to numbers.

Table 30: Comparison of student and teacher performance in the area of numbers

TYPE OF RESPONDENT	MAX. MARKS	N	M	SD
Student	36	4478	14.97 (41.6%)	7.75
Teacher	36	171	29.11 (80.9%)	8.30

Students' performance is 41.6% which needs improvement and teachers' performance shows that they know these concepts quite well. So, if a teacher can be trained in how to teach concepts related to numbers, student performance can be improved.

The analysis of students' and teachers' performance conducted by units within the area of numbers shows that the student performance in fractions and the decimal & fraction is even lower than their overall performance in the area of numbers. Fractions are traditionally assumed as a difficult concept for students to grasp and results reiterate the need to think about introducing pedagogical innovation, interesting teaching aids to be used in class activities allowing students to practically experience problem related to fraction, and/or working on the presentation of content in the Mathematics textbook.

Table 31: Unit-wise analysis of the Mathematics achievement of teachers and students

MATHEMATICS CONTENT	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Numbers and arithmetic operations	4478	8	3.94 (49.3%)	2.25	171	8	6.69	2.01
Factors and Multiples	4478	11	4.54 (41.3%)	2.72	171	11	8.56	2.56
Fractions	4478	9	3.29 (36.6%)	2.23	171	9	7.09	2.42
Decimals and Fractions	4478	8	3.19 (39.9%)	2.33	171	8	6.77	2.11

CONTENT AREA: MEASUREMENTS AND GEOMETRY

There were 9 MCQs in test related to measurement and geometry. There is a huge gap in the performance of students and teachers which shows teacher know the content in the textbook. But the overall performance of both students and teachers has a lot of room for improvement; student's performance particularly needs attention as they performed even below 40%.

Table 32: Comparison of Students and Teachers performance in Measurement and Geometry

TYPE OF RESPONDENT	MAX. MARKS	N	MEAN	SD
Student	9	4478	3.46 (38.4%)	2.38
Teacher	9	171	6.80 (75.6%)	2.09

Table 33 shows the students' performance in measurement and geometry as 37.8% and 39.2% respectively. Teacher performance in geometry is particularly very low i.e. 67%. This area requires immediate attention, in terms of measures to improve both content knowledge and pedagogical skills among teacher for enabling better student learning.

Table 33: Unit-wise analysis of the Mathematics achievement of Students and Teachers

MATHEMATICS CONTENT	STUDENTS				TEACHERS			
	N	Max. Marks	M	SD	N	Max. Marks	M	SD
Measurements	4478	5	1.89 (37.8%)	1.60	171	5	4.12	1.46
Geometry	4478	4	1.57 (39.2%)	1.13	171	4	2.68 (67%)	0.88

CONTENT AREA: INFORMATION HANDLING

Information handling is a very crucial area in Mathematics but introduced to a very basic level in grade 4. The textbook aims at sensitizing students about this domain of Mathematics. Student performance is again below 50% but slightly better as compared to student performance in other areas of Mathematics.

Table 34: Comparison of Students and Teachers performance in the area of Information Handling

MATHEMATICS CONTENT	STUDENTS				TEACHERS			
	N	Max. Marks	M	SD	N	Max. Marks	M	SD
Information Handling	4478	5	2.16 (43.2%)	1.67	171	5	4.15 (83%)	1.26

When student performance is analyzed at the unit level, it is important to keep in mind the number of questions representing an area is quite few which might have excluded some important aspect of the content area under discussion to keep the test manageable for students of grade 4. The results need to be used and interpreted with said caution in mind.

SCIENCE

The analysis of student performance in Science conducted to understand student and teacher performance at a different level of learning addressed in the Science test. Moreover, analysis is also conducted to identify the content areas in Science in which students and teachers need support for improving student success.

Table 35: Comparison of achievement of Students and Teachers in Science on on level of their learning

LEVEL OF LEARNING	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX.	M	SD
Knowledge	4478	7	3.36 (48%)	1.87	171	7	5.71 (81.57%)	1.81
	4478	11	5.10 (46.4%)	2.69	171	11	8.29 (75.4%)	3.08
Application	4478	23	10.31 (44.8%)	5.21	171	23	17.70 (77%)	5.70
Analysis	4478	9	4.30 (47.7%)	2.39	171	9	7.37 (81.8%)	2.20

Distribution of marks in the test, as shown in table 35, clarifies that emphasis was on the measurement of students' learning at understanding and application level. Students' ability to analyze was also part of the Science test. Student performance at all level of learning is average i.e. more or less 50%. This performance still has ample room for improvement to raise the level of student learning.

Teacher performance is visibly better than students but teachers are expected to demonstrate better understanding and ability to apply and deliver the learned knowledge that is what shown in table 35. It is appreciable that both students and teachers performed comparatively better on questions measuring the ability to analyze.

Science as a subject was divided into three major areas i.e. life sciences, physical sciences, and earth sciences. Each of the listed areas was further divided into four, five and one units respectively.

CONTENT AREA: LIFE SCIENCE

Student performance in all units of life science remained close to average i.e. 50% except in unit on "Food and Health". Teacher performance is also on the same pattern as in Mathematics but it is noticeable that teacher performance in "Food and Health" is also quite low i.e. 65.2 %.

Table 36: Unit-wise analysis of performance in Life Science by Teachers and Students

SCIENCE CONTENT	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Understanding Ourselves	4478	4	1.96 (49%)	1.30	171	4	3.20 (80%)	1.11
Characteristics & needs of living things	4478	6	2.88 (48%)	1.67	171	6	4.81 (80%)	1.69
Food and health	4478	5	2.01 (40.2%)	1.34	171	5	3.26 (65%)	1.41
Living things & their environment	4478	5	4.30 (47.7%)	1.58	171	5	3.82 (76%)	1.57

Both students and teachers are performing low in "Food and Health" which emphasizes the need for a review of the quality of textbook content, in-service training material on the topic, and teaching pedagogies related to this area.

Students' weak performance in some of the content areas in which their teachers are generally performing well means our policy to teach the same set of pedagogies for teaching all and any subject area/topic or all subjects needs reconsideration. Subject/content/topic specific teaching pedagogies are important to be introduced in our pre-service and in-service training.

CONTENT AREA: PHYSICAL SCIENCE

Student performance in units included in Physical Science is less than average except in "Introduction to Sound". Teachers' performance is above 80% in all units which is quite good. There is a need to improve student performance in general as in all other subjects and content areas. Teachers may be provided training on subject-specific pedagogies to teach these content areas to enable them to bring improvement in student learning in areas where they are good in content.

Table 37: Unit-wise analysis of performance in Physical Science by Teachers and Students

SCIENCE CONTENT	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Matter and its states	4478	5	2.36 (47.2%)	1.62	171	5	4.13 (82.6%)	1.53
Temperature and its	4478	5	2.41 (48.2%)	1.57	171	5	4.05 (81%)	1.46
Force and Machines	4478	5	2.31 (46.2%)	1.60	171	5	4.06 (81.2%)	1.49
Introduction to Sound	4478	6	3.01 (50.1%)	1.94	171	6	4.89 (81.5%)	1.82
Electricity and Magnetism	4478	6	2.80 (46.7%)	1.78	171	6	4.85 (80.8%)	1.50

CONTENT AREA: EARTH SCIENCE

The performance of students and teachers follows the same pattern as in previous areas of Science except in case of performance on questions related to "Movements of the Earth". It is noticeable that both students and teachers performed poorly in this particular unit.

Table 38: Unit-wise analysis of performance in Earth Science by Teachers and Students

SCIENCE CONTENT	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Movements of the Earth	4478	3	1.13 (37.7%)	0.98	171	3	1.99 (66%)	1.03

The review of the curriculum and textbook while selecting SLOs for test showed that content related to the unit on, "Movements of the Earth" does not correspond to the SLOs on the same topic in the curriculum. The content in the textbook was too basic while the SLOs required higher order learning from students.

ENGLISH

English test primarily focused on measuring understanding of various competencies of students and teachers in the subject of English. There are a few questions about the measurement of skills about the ability to apply the learned knowledge in unforeseen real-life situations.

Table 39 shows that students' performance at all levels remained average in comparison to teachers performing very good on questions at all levels of learning. Teachers need to be trained in subject-specific pedagogies leading to improvement in student learning and enhancing teachers' capacity to communicate their knowledge to students.

Table 39: Comparison of achievement of Teachers and Students in English on level of their learning

SCIENCE CONTENT	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Knowledge	4478	8	3.68 (46%)	2.17	171	8	6.43 (80.4%)	1.51
Understanding	4477	37	18.35 (49.6%)	9.29	171	37	32.05 (86.6%)	6.66
Application	4478	5	2.44 (48.8%)	1.47	171	5	4.14 (82.8%)	1.14

The curriculum of English is structured by competencies addressed across chapters of the textbook. In order to measure these competencies cross-cutting questions from various chapters of the textbook was appropriate. The curriculum listed reading skills, writing skill, oral communication skills and formal and lexical aspects of language as core competencies to be developed in students. The results indicate a need for improvement in all areas of language learning as in other subjects. Student performance is average in three out of four competencies focused on the curriculum.

Table 40 shows that oral communication of students is very poor and requires immediate attention.
There were very few questions in the test for measuring oral communication skill but still, it is an indicator of problems faced by our students in communicating in English despite learning reading, writing and grammatical aspects of language.

Table 40: Content-wise analysis of performance in English competencies by Teachers and Students

COMPETENCIES	STUDENTS				TEACHERS			
	N	MAX. MARKS	M	SD	N	MAX. MARKS	M	SD
Reading Skills	4478	10	4.94 (49.4%)	2.79	171	10	7.69 (76.9%)	2.01
Writing Skills	4478	8	3.75 (46.9%)	2.25	171	8	6.56 (82%)	1.45
Oral communication skills	4478	2	0.35 (17.5%)	0.11	171	2	1.71 (85.5%)	0.22
Formal and lexical aspects of language	4478	30	13.19 (44%)	8.33	171	30	26.7 (89%)	6.77

CHAPTER 8
BACKGROUND FACTOR AFFECTING STUDENT PERFORMANCE

Literature has affluent evidence that student performance is influenced by background factors supportive of learning. This study recorded information on contextually relevant selected factors associated with a student performance by using the following research tools:

1. Questionnaire for Head Teachers
2. Questionnaire for Teachers
3. Questionnaire for Parents and Students

The data was collected from students, their parents, three teachers of respective subjects from each school and head teacher of the same school. The background questionnaire framework addressed all possible factors, sub-factors, indicators, and statements helpful in devising clear guidelines to develop tools to capture evidence of variation through relevant stakeholders. The framework was mainly based on three main areas;

1. Home related factors
2. School related factors
3. Classroom related factors

HOME RELATED FACTORS

Parents/ guardians are mainly responsible for the upbringing of children and their success in education in schools. The effect of parental contribution can be better understood through home related background information on students' achievement in Mathematics, Science, and English.

STUDENT PERFORMANCE IMPROVES IF TAUGHT IN THE LANGUAGE OF THE COMMUNITY

The medium of instruction has remained a debate since the inception of Pakistan; we have shifted between Urdu and English as a medium of instruction more than once. English as a medium of instruction is argued because English is an international language used officially and spoken in the developed world while Urdu is supported as a national language and a language which is understood by people across Pakistan. Psychologists have proven time and again that native language is the best to teach in the early years of a child's life for proficient cognitive development.

Table 41: Language spoken by Father

LOCALE OF SCHOOL			ENGLISH	SCIENCE	MATHEMATICS
RURAL	Urdu	Mean	22.01 (44.02%)	21.6 (43.2%)	18.74 (37.48%)
		N	503	503	503
		SD	11.53	10.65	9.52
	Native	Mean	24.41 (48.82%)	22.67 (45.34%)	19.47 (38.94%)
		N	2268	2269	2269
		SD	11.93	10.84	10.04
URBAN	Urdu	Mean	26.34 (52.68%)	24.33 (48.66%)	22.13 (44.26%)
		N	524	524	524
		SD	12.36	9.79	10.92
	Native	Mean	25.9 (51.8%)	24.81 (49.62%)	23.84 (47.68%)
		N	982	982	982
		SD	12.29	11.36	11.43

In this survey, the students were asked about language used by their father (table 41), mother (table 42), playmates in street (table 43), playmates in school (table 44) and siblings (table 45). Information was meant to have comprehensive information about the language of the community in which a child grows.

The language spoken by a student at home and school was further split by the locale of school, as students in urban or rural areas can have the different impact of the language spoken to them in school or at home. Collected data included a number of local languages spoken to and by the students which were combined for the purpose of analysis into national (Urdu) and native language.

Table 42 shows a very interesting trend, students who speak a native language with their father in rural areas performed better than those who speak Urdu. It can be assumed that native language which is dominant in rural areas if spoken at home and school can improve the quality of learning.

Table 42: Language spoken by Mother

LOCALE OF SCHOOL			ENGLISH	SCIENCE	MATHEMATICS
RURAL	Urdu	Mean	21.81 (43.62%)	21.81 (43.62%)	18.77 (37.54%)
		N	488	488	488
		SD	11.11	10.47	9.26
	Native	Mean	24.46 (48.92%)	22.62 (45.24%)	19.5 (39%)
		N	2287	2288	2288
		SD	12.01	10.88	10.09
URBAN	Urdu	Mean	26.71 (53.42%)	24.47 (48.94%)	21.95 (43.9%)
		N	517	517	517
		SD	12.45	9.98	10.96
	Native	Mean	25.68 (51.36%)	24.77 (49.54%)	23.98 (47.96%)
		N	992	992	992
		SD	12.24	11.3	11.4

Whereas this trend was not shown by students in urban areas, it can be assumed that use of native language or Urdu as spoken language at home does not cause any change in performance of the students. It shows that rural culture is more homogenous in use of language at school, home and community level by father, mother, playmates, and siblings as compared to urban communities where a mix of languages is experienced by the student. Urban communities are quite heterogeneous in composition where people of different languages live in the same community, thus compulsorily exposing students to multiple languages simultaneously. In such communities, the impact of national and native language becomes indistinguishable.

Table 43: Language spoken in street by playmates

LOCALE OF SCHOOL			ENGLISH	SCIENCE	MATHEMATICS
RURAL	Urdu	Mean	21.95 (43.9%)	21.53 (43.06%)	18.23 (36.46%)
		N	550	550	550
		SD	11.16	10.58	9.08
	Native	Mean	24.48 (48.96%)	22.68 (45.36%)	19.65 (39.3%)
		N	2206	2207	2207
		SD	11.99	10.86	10.13
URBAN	Urdu	Mean	25.68 (51.36%)	24.78 (49.56%)	21.44 (42.88%)
		N	552	552	552
		SD	12.54	10.42	10.45
	Native	Mean	26.13 (52.26%)	24.52 (49.04%)	24.2 (48.4%)
		N	941	941	941
		SD	12.11	11.16	11.59

Similar findings are noticed for rural as well as urban areas when student performance is seen in the context of language they use to communicate with their playmates at school and outside schools.

Table 44: Language spoken in school by playmates

LOCALE OF SCHOOL			ENGLISH	SCIENCE	MATHEMATICS
RURAL	Urdu	Mean	23.88 (47.76%)	20.88 (41.76%)	19.19 (38.38%)
		N	1771	1771	1771
		SD	11.94	10.81	9.86
	Native	Mean	23.98 (47.96%)	21.6 (43.2%)	19.75 (39.5%)
		N	975	976	976
		SD	11.76	10.79	10.14
URBAN	Urdu	Mean	25.25 (50.5%)	25.23 (50.46%)	23.52 (47.04%)
		N	1187	1187	1187
		SD	12.54	10.96	11.3
	Native	Mean	25.86 (51.72%)	21.6 (43.2%)	21.69 (43.38%)
		N	292	292	292
		SD	11.04	9.86	11.13

Language of communication with siblings is an important component of the language environment in which student experiences early years of life. The analysis of the language used by students and their counterparts at home, school, and community when communicating with each other consistently endorses that when the same language is used for communication and it is the native language, the student performs better in studies. The performance of the student has affected adversely if he/she uses or others use different languages with his/her in daily life.

Table 45: Language spoken by siblings

LOCALE OF SCHOOL			ENGLISH	SCIENCE	MATHEMATICS
RURAL	Urdu	Mean	21.6 (43.2%)	21.22 (42.44%)	18.52 (37.04%)
		N	777	777	777
		SD	11.19	10.5	9.68
	Native	Mean	24.86 (49.72%)	22.97 (45.94%)	19.71 (39.42%)
		N	1971	1972	1972
		SD	12.01	10.9	10.03
URBAN	Urdu	Mean	26.1 (52.2%)	24.36 (48.72%)	22.48 (4496%)
		N	741	741	741
		SD	12.41	10.68	11.06
	Native	Mean	25.84 (51.68)	24.76 (49.52%)	23.98 (47.96%)
		N	742	742	742
		SD	12.25	11.05	11.4

It can be concluded that the language of the community is the best choice as a medium of instruction. The findings of this study revealed that local/native language is the language of the community in rural areas while in urban areas it is not possible to determine community level because of the cosmopolitan nature of cities. In such cases, Urdu seems a feasible option because it is understood by all members irrespective of the native language.

Although the native language is the most suitable option coming out of data analyzed in this research and supported by the literature as well practically Urdu appears as the feasible option. It is not possible to have textbooks in all local/native languages. Urdu being a common language connecting all people across the country seems a politically correct and feasible option.

HOME RESOURCES

The home environment is a key factor in determining students' performance. The conducive home environment is an arbitrary and contextual factor determined in a different manner by different researches. In this research, it is measured through proxy variables such as parent's level of education, income, occupation and availability of reading material other than textbooks available at home.

For the purpose of analysis, three levels of home resources were determined using cumulative scores of individual on questions related to home resources. The distribution into levels (low, medium and high) is arbitrary and typically used for this particular research.

Table 46: Availability of learning resources at home

		N	MEAN	SD
English	Low	215	24.25 (48.5%)	12.67
	Medium	1142	25.17 (50.34%)	11.88
	High	727	24.33 (48.66%)	11.96
	Total	**2084**	**24.78 (49.56%)**	**12.01**
Science	Low	215	24.9 (49.8%)	11.51
	Medium	1142	23.66 (47.32%)	10.91
	High	727	23.14 (46.28%)	10.56
	Total	**2084**	**23.6 (47.2%)**	**10.89**
Mathematics	Low	215	22.53 (45.06%)	11.07
	Medium	1142	21.52 (43.04%)	10.46
	High	727	20.59 (41.18%)	10.35
	Total	**2084**	**21.3 (42.6%)**	**10.51**

Table 46 shows that there is hardly any difference in student performance due to a difference in the availability of learning resources at home. One-way analysis of variance was applied to check the statistical significance of the mean score differences observed in student performance coming from groups different in degree of availability of home resources. Table 47 shows that variation in home resources has no significant bearing upon student performance except in Mathematics.

Table 47: Effect of availability of resources at home with student performance in English, Mathematics, and Science

		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.
English	Between Groups	385.512	2	192.756	1.339	.262
	Within Groups	299630.181	2081	143.984		
	Total	**300015.693**	**2083**			
Science	Between Groups	521.712	2	260.856	2.198	.111
	Within Groups	246918.562	2081	118.654		
	Total	**247440.274**	**2083**			
Mathematics	Between Groups	743.613	2	371.806	3.377	.034
	Within Groups	229106.612	2081	110.094		
	Total	**229850.225**	**2083**			

Table 48: Reading material available at home (Books, dictionaries)

RESOURCES AT HOME		LOW			MEDIUM			HIGH		
Reading Habit		English	Science	Math	English	Science	Math	English	Science	Math
Often	M	22.14	23.23	19.01	22.69	22.94	20.29	25.02	24.13	20.61
	N	90	90	90	236	236	236	350	350	350
	SD	10.51	10.63	8.64	11.15	10.13	9.82	12.33	10.74	10.43
Sometimes	M	26.99	23.87	22.22	28.13	25.92	23.37	24.10	23.80	20.65
	N	126	126	126	357	357	357	419	419	419
	SD	12.98	11.24	11.30	12.17	10.85	10.99	11.85	10.78	10.37
Never	M	25.81	25.42	23.65	23.80	22.94	21.22	23.05	23.16	20.95
	N	72	72	72	99	99	99	91	91	91
	SD	12.83	12.50	11.17	11.77	12.28	10.59	11.50	10.34	10.84
Rarely	M	24.72	19.95	21.98	25.79	23.12	23.32	24.69	23.32	20.26
	N	83	83	83	139	139	139	148	148	148
	SD	12.42	9.07	10.12	11.75	10.97	10.42	11.86	10.59	10.13

Availability of additional supportive home resource is associated positively with students' performance but it is conditioned with classroom instruction and assessment practices encouraging students to work beyond textbooks. Students are pushed to use study material beyond textbooks by engaging them class activities beyond textbooks. It is reinforced if such instruction is followed by formative and summative assessments beyond textbooks.

Unfortunately, our schools do not demand rather discourage any such instructional and assessment activities for several reasons. The teacher is limited to ascertain memorization of content given in textbooks and ensure memorization of the textbooks because only in this manner students score higher grades in examination. It is students' grades which matter in determining teacher performance, student performance and earning prestige in society. In such culture, this analysis carries very limited meaning rather can misguide if used in the literal meaning. It is suggested to use this result to reiterate the importance of revamping our instructional and assessment practices is the meaningful takeaway.

REASONS FOR STUDENT ABSENTEEISM

Students were asked to select the reason for being absent from school whenever they cannot attend school. A list of probable reasons was provided in the questionnaire and students were allowed to choose as many as applicable options in their case. Figure 11 shows the response against each reason chosen by the students.

It is worth noting that despite consistent efforts of the government, child labor (56%, N=4478) is still a reason for not attending schools. Students have to be absent from school for earning a livelihood (24.72%, N=4478) and during harvesting (31.73%, N=4478) season they remain absent to earn some extra money for addressing some needs.

Figure 11: Reasons for student absenteeism

Despite legislation and related measures, there is a need to work on the elimination of child labor and ensure retention of all students in school. Another measure required to facilitate girls students who skip school because they have to take care of siblings at home in the absence of parents requires the establishment of daycare/ECE rooms in existing schools. This will increase the enrollment and retention rate of girls.

EDUCATION OF PARENTS

Education of parents plays a pivotal role in the education of children. The education level of the parents was categorized in two levels i.e. below matric and above matric for father and mother. Parents' education directly relates to the performance of students.

Table 49: Impact of educated parents (who teach their children) on academic achievements of students

			N	M	SD	T	DF	P
Father	English	Below matric	628	23.82 (47.64%)	11.99	-2.825	937	.005
		Matric or above	311	26.14 (52.28%)	11.46			
	Science	Below matric	628	21.53 (43.06%)	10.61	-4.997	937	.000
		Matric or above	311	25.23 (50.46%)	10.79			
	Mathematics	Below matric	628	20.23 (40.46%)	10.89	-2.105	937	.036
		Matric or above	311	21.81 (43.62%)	10.86			
Mother	English	Below matric	603	23.96 (47.92%)	12.57	-2.205	894	.028
		Matric or above	293	25.9 (51.8%)	11.96			
	Science	Below matric	603	22.85 (45.7%)	10.77	-2.462	894	.014
		Matric or above	293	24.7 (49.4%)	10.16			
	Mathematics	Below matric	603	20 (40%)	10.73	-1.982	894	.048

Table 49 shows that educated parents have a significant role in better performance of their children. t-test shows a statistically significant difference in the result of students with below matric and above matric educated parents. There are a large number of parents whose qualification is below matric and it is not possible to educate these parents in short term but they can be appraised about ways and mean to support and create a conducive conducive for the education of their children.

FAMILY INCOME

Provision of financial resources is important for families to invest in the education of children. Father and mother income was recorded in given income brackets. Low income (Up to Rs.10,000 per month) of father relates negatively to student performance. Students from families with income ranging between Rs. 10,000 – 40,000 per month performed better than others. But interestingly student from families earning more than Rs. 40,000/month performed lower than all other categories.

Table 50: Effect of family income on academic achievement of student

INCOME RANGE (RS.)		FATHER INCOME			MOTHER INCOME		
		ENGLISH	SCIENCE	MATHEMATICS	ENGLISH	SCIENCE	MATHEMATICS
1-5000	M	24.69 (49.38%)	22.86 (45.72%)	20.76 (41.52%)	24.5 (49%)	22.66 (45.32%)	20.55 (41.1%)
	N	1570	1571	1571	2228	2229	2229
	SD	12.32	10.92	10.66	12	10.81	10.51
5001-10000	M	24.77 (49.54%)	22.86 (45.72%)	20.18 (40.36%)	24.23 (48.46%)	22.14 (44.28%)	20.23 (40.46%)
	N	1386	1386	1386	491	491	491
	SD	11.75	10.71	10.2	12.32	10.61	10.97
10001-20000	M	25.83 (51.66%)	24.44 (48.88%)	22.46 (44.92%)	23.09 (46.18%)	22.13 (44.26%)	20.69 (41.38%)
	N	706	706	706	182	182	182
	SD	12.06	11	11.13	12.19	10.07	10.18
20001-40000	M	24.93 (49.86%)	25.5 (51%)	21.37 (42.74%)	21.21 (42.42%)	22.53 (45.06%)	18.91 (37.82%)
	N	200	200	200	57	57	57
	SD	12.21	11.23	11.09	11.6	10.57	8.67
more than 40000	M	21.48 (42.96%)	23.17 (46.34%)	19.52 (39.04%)	20.68 (41.36%)	22.95 (45.9%)	19.56 (39.12%)
	N	190	190	190	88	88	88
	SD	10.78	9.07	10.1	11.3	10.34	10.79

Thus, it can be concluded in students belonging to very low and high-income families relate negatively to their performance. Students from middle-income families perform the highest among these groups. It shows that deficiency and affluence of financial resources are not good for the education of students. Students getting appropriate financial provisions remain focused on their study.

Student performance is decreased as the income of mothers increase. It seems that mothers dedicated time to children's study matters more. Mothers earning more are probably giving more time to their job thus not being able to give proper time to the studies of their children.

STUDY TIME AT HOME

Study time after school hours is an important determinant of student performance in studies. Parents were asked to report the time their children give to study after they come from school. It is assumed that study time at home is directly related to student performance and the data supports this assumption. Table 51 shows that students giving more time to study at home after school out-performed students giving less time to study.

Table 51: Time given to studies at home reported by parents

TIME		ENGLISH	SCIENCE	MATHEMATICS
Less than an hour	Mean	15.8 (31.6%)	16.86 (33.72%)	16.35 (32.7%)
	N	49	49	49
	SD	7.41	8.1	8.71
one hour	Mean	15.83 (31.66%)	17.5 (35%)	16.5 (33%)
	N	128	128	128
	SD	7.58	8.53	9
2 hours	Mean	17.58 (35.16%)	20.35 (40.7%)	17.04 (34.08%)
	N	159	159	159
	SD	7.23	8.59	8.88
3 hours	Mean	18.6 (37.2%)	19.73 (39.46%)	16.59 (33.18%)
	N	75	75	75
	SD	9.4	9.15	7.45
4 hours or more	Mean	25.37 (50.74%)	23.58 (47.16%)	21.08 (42.16%)
	N	3977	3978	3978
	SD	12.19	11.04	10.73

SCHOOL RELATED FACTORS

School activities include co-curricular activities in school and the school's perception among parents and the community. Co-curricular activities play an important role in the academic and personal development of the student. Perception about school in community, parents, and students is central to the community attitude towards school and admitting students in school.

CO-CURRICULAR ACTIVITIES

Co-curricular activities included morning assembly, sports, competitions, debates, drama, student societies, Bazam-e-Adab, celebrations of national/important days, etc. Table 52 shows that most of the schools very rarely organize such events in schools. Students' performance is better in schools organizing fewer co-curricular activities. This apparently shows that students' performance can be improved by making them focused on studies only and co-curricular activities are a distraction for studies, which is an illusion because they are not very organized or well managed. Hence, the result is a shortage of time. If organized, they should be done in a systematic way but not at the cost of students' learning.

In fact, our assessment system to measure student performance is skewed towards paper pencil examination and does not value student participation in learning activities beyond this examination. This practice has depicted co-curricular least important and extra when it comes to learning.

Table 52: Effect of co-curricular activities on students' performance

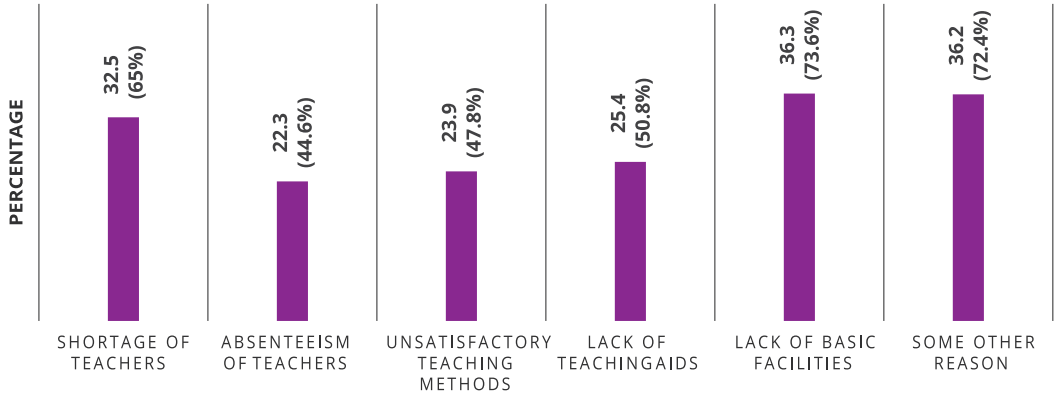
		N	MEAN	SD
English	Once a year or never	443	25.23 (50.46%)	11.59
	At least once in six months	2148	25.03 (50.06)	12.06
	At least once in three months	626	24.71 (49.42%)	12.70
	Total	3217	25 (50%)	12.12
Science	Once a year or never	443	24.62 (49.24)	11.30
	At least once in six months	2148	23.14 (46.28%)	10.87
	At least once in three months	627	24.17 (48.34%)	10.75
	Total	3218	23.55 (47.1%)	10.92
Mathematics	Once a year or never	443	22.14 (44.28%)	10.35
	At least once in six months	2148	20.94 (41.88%)	10.55
	At least once in three months	627	22.06 (44.12%)	11.25
	Total	3218	21.32 (42.64%)	10.68

This trend is depriving our students of learning some essential traits like collaboration, teamwork, sacrifice, helping others, decision making, problem-solving, etc. The revival of co-curricular activities in schools is as essential as any other co-curricular activity.

PARENTS' PERCEPTION OF SCHOOLS

Government has improved the physical infrastructure of schools, recruited qualified teachers, and enhanced school budget to bring improvement in the quality of learning in public schools but the public image of schools has not improved correspondingly.

Figure 12: Level of satisfaction of parents towards schools



Parents were asked to report their level of satisfaction about various aspects of school improvement shown in Figure 12. The data showed that parents are dissatisfied with the basic facilities in the schools. Their perception is that the school in which their child / children are studying has a shortage of teachers, teachers remain absent, teachers are not competent to use appropriate teaching methods, and teaching aids are not available in schools.

There is need that school authorities through officers at district level increase their level of interaction with parents, local leaders and community members beyond School Councils. Appraising community about government initiatives for school improvement and improvements in various aspects of school administration, facilities, and academic activities to restore public confidence in schools and quality of education offered in these schools.

CLASSROOM RELATED FACTORS

Teaching and learning process mainly happens in the classroom; however better learning is likely to be influenced by the classroom environment and learning activities. Classroom factors selected for study in this research included teacher behavior towards students, utilization of homework as a teaching tool, being accessible to students after class, activity-based teaching, use of the white/black board and use of corporal punishment in the classroom.

TEACHER BEHAVIOR TOWARDS STUDENTS

Students were asked to report about their teacher's behavior towards them. Acceptability of teachers among students is a pre-requisite for the teacher to be able to teach in class. If a person is not accepted by the students as a teacher, they would not learn effectively from him/her. Therefore, teacher behavior is pivotal for teaching-learning activity.

Table 53: Effect of teacher behavior on student performance

		ENGLISH	SCIENCE	MATHEMATICS
Unfriendly	Mean	22.04 (44.08%)	20.37 (40.74%)	16.97 (33.94%)
	N	114	114	114
	SD	11.9	11.3	9.84
Friendly	Mean	26.76 (53.52%)	24.67 (49.34%)	22.95 (45.9%)
	N	1675	1676	1676
	SD	12.55	11.21	11.7
Total	Mean	26.46 (52.92%)	24.4 (48.8%)	22.56 (45.12%)
	N	1789	1790	1790
	SD	12.56	11.26	11.68

The result in table 53 shows that students' learning is better from teachers having friendly behavior towards students. It implies that despite having teaching competence and content expertise, it is also important to have a friendly attitude towards students. Students' performance in Science, Mathematics, and English is quite higher as compared to students who are dissatisfied with teacher behavior.

FEEDBACK ON HOMEWORK

Homework is a common practice in schools to engage students in teaching-learning activities. Most of the time, teachers give homework but do not find to give timely feedback to students. Without feedback, homework loses its utility and improvement in teaching-learning cannot be realized as envisioned.

Table 54: Comparison of student performance based on feedback on homework

HOMEWORK		ENGLISH	SCIENCE	MATHEMATICS
Feedback not given	Mean	21.88 (43.76%)	21.23(42.46%)	19.62 (39.24%)
	N	536	536	536
	SD	10.92	9.94	10.01
Feedback Given	Mean	25.03 (50.06%)	23.44 (46.88%)	20.85 (41.7%)
	N	3755	3756	3756
	SD	12.17	10.97	10.68
Total	Mean	24.64 (49.28%)	23.16 (46.32%)	20.7 (41.4%)
	N	4291	4292	4292
	SD	12.07	10.87	10.6

Students receiving feedback on homework showed better results as compared to those who did not receive feedback. The difference in performance is quite significant in English and Science. It is fair to mention that school teachers teach 7 out of 8 periods in an ordinary school day and have only one period to perform all out of class activities. It is impossible to manage to mark student homework at that time, especially in urban schools in which a large number of students are enrolled. a dedicated time needs to be allocated for making homework an effective teaching and learning tool.

SUPPORTING STUDENT LEARNING BEYOND CLASSROOM

Classroom instruction is not sufficient for all students but they need help after class hours. There is no official arrangement in schools for such support and teachers are supposed to help students in their free time. The support included guidance on academic problems, psychological, social and emotional issues faced by students. Table 55 shows that if this support is extended to students by teachers, their performance improves substantially in all subjects.

Teachers volunteer for this support to their students but they are not trained, counselors. Keeping in view the benefit of this support to students, teachers can be given some training on academic, psychological, social and emotional management techniques to perform their task professionally. Moreover, student counselor can be recruited for each school or a cluster of schools to assist students when required while subject teachers can continue to provide academic support to students.

Table 55: Effects of teachers interest in solving students problems affect student performance

HOMEWORK		ENGLISH	SCIENCE	MATHEMATICS
Do not Support after class/ school time	Mean	22.66 (45.32%)	21.69 (43.38%)	19.36 (38.72%)
	N	912	912	912
	SD	11.32	10.61	10.1
Supports after class/ school time	Mean	25.24 (50.48%)	23.56 (47.12%)	21.01 (42.02%)
	N	3351	3352	3352
	SD	12.25	10.91	10.69
Total	Mean	24.68 (49.36%)	23.16 (46.32%)	20.65 (41.3%)
	N	4263	4264	4264
	SD	12.1	10.87	10.58

INTERACTIVE CLASSROOM AND TEACHING

Students were asked to report if teachers engage them in interactive activities in the classroom as the government has emphasized activity-based teaching, particularly in Science and Mathematics. Textbooks also include material supportive for learning through classroom activities.

Table 56: Student learning and interactive activities in the classroom

		ENGLISH	SCIENCE	MATHEMATICS
Often	Mean	25.1 (50.2%)	23.44 (46.88%)	20.86 (41.72%
	N	3692	3692	3692
	SD	12.16	10.81	10.61
Sometimes	Mean	22.8 (45.6%)	23.68 (47.36%)	20.52 (41.04%)
	N	366	366	366
	SD	11.45	11.54	10.81
Rarely	Mean	22.33 (44.66%)	19.89 (39.78%)	19.71 (39.42%)
	N	188	189	189
	SD	11.2	10.57	10.35
Never	Mean	19.09 (38.18%)	19.24 (38.48%)	17.05 (34.1%)
	N	74	74	74
	SD	9.18	9.85	8.64
Total	Mean	24.68 (49.36%)	23.23 (46.46%)	20.71 (41.42%)
	N	4322	4323	4323
	SD	12.06	10.88	10.59

Table 56 shows that students often/sometimes taught by teachers using classroom activities performed better in all three subjects. The students rarely exposed to activities in the classroom could not perform as good as their fellow students exposed to class activities.

INTERACTIVE USE OF WHITE/BLACK BOARD

White/black board is the most widely available and used AV aid in schools. It is available in even remotest schools. It is already known that almost all teachers use it as AV aid but its judicious use can be using it for two-way communication with students rather than limiting it to one-way communication of information by teacher.

Table 57: Use of white/black board and student performance

TEACHER USES WHITE/BLACK BOARD		ENGLISH	SCIENCE	MATHEMATICS
Always	Mean	25.14 (50.28%)	23.57 (47.14%)	20.91 (41.82%)
	N	2975	3380	4047
	SD	12.2	10.89	10.64
Often	Mean	24.14 (48.28%)	22.26 (44.52%)	18.05 (36.1%)
	N	661	433	183
	SD	11.57	10.75	9.75
Sometimes	Mean	22.99 (45.98%)	22.04 (44.08%)	16.85 (33.7%)
	N	368	217	55
	SD	11.34	10.51	8.7
Never	Mean	17.66 (35.32%)	16.54 (33.08%)	11.75 (23.5%)
	N	71	41	8
	SD	9.56	8.89	9.27
Total	Mean	24.66 (49.32%)	23.28 (46.56%)	20.72 (41.44%)
	N	4075	4071	4293
	SD	12.04	10.87	10.61

White/black board can be used by the teacher for conducting interactive classroom activities in which students can present their ideas and can comment on others' ideas in group work situations. Teachers can be trained for interactive use of white/black board in Science, Mathematics, and English particularly. Especially, teachers of rural areas where availability of AV aids is limited, can be trained to optimally use a white/black board as an interactive tool. Optimal use of white/black board for interaction between student-teacher and student-student is the next step.

CORPORAL PUNISHMENT

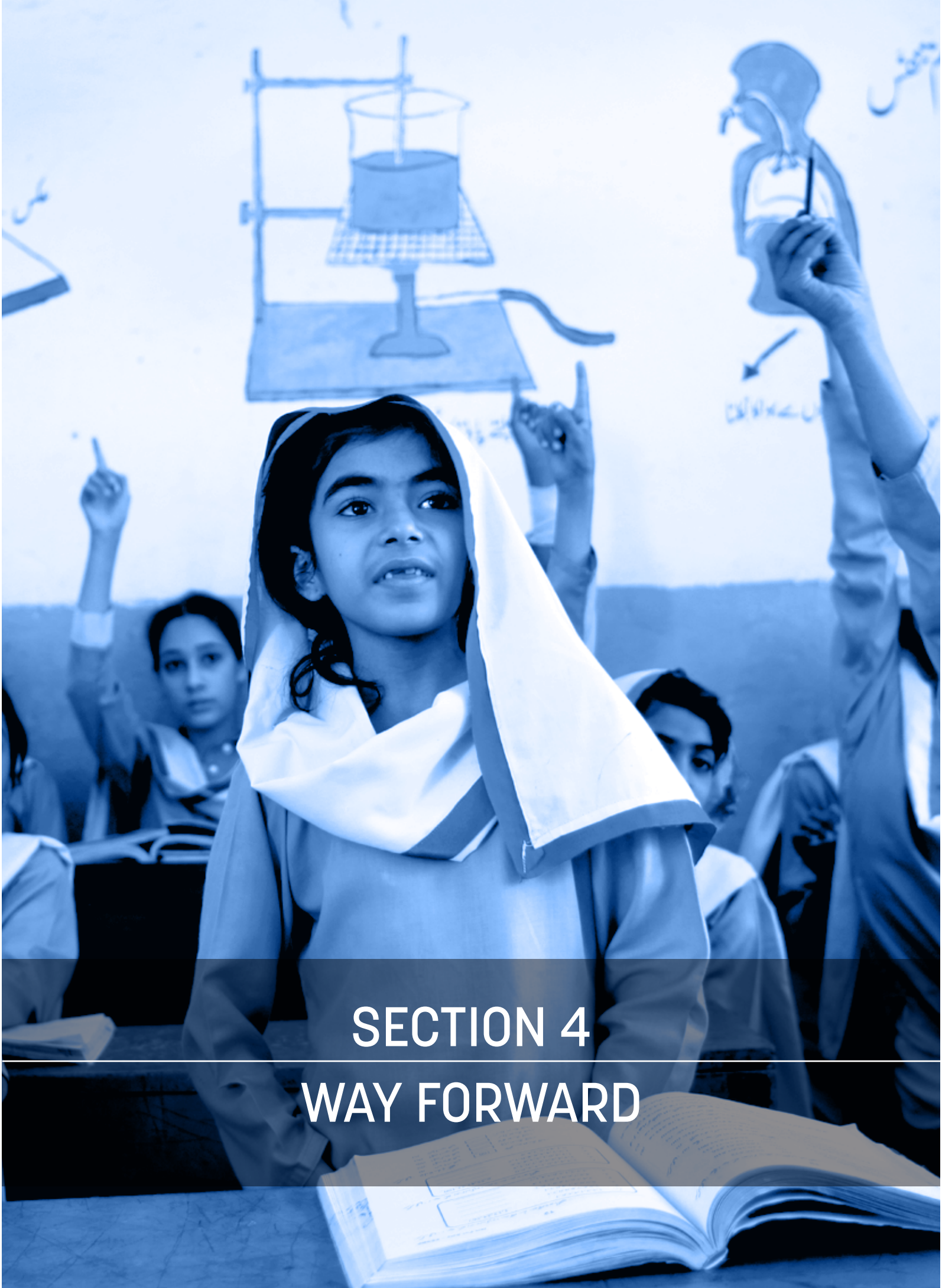
Physical punishment to students in schools was declared illegal by the Government of Punjab and a slogan, "Maar Nahi Pyar" was placed outside all schools for sensitizing communities and teachers about the importance of issue. It is assumed that success was met in this regard. But data in this study revealed that students are still physically punished by teachers in a considerable number of schools.

Table 58 shows that the adverse effect of corporal punishment used in the classroom on the performance of students. The student performs better if they are not subjected to corporal punishment by the teachers. Almost 36% of students reported that they are either often or sometimes physically punished by their teachers.

Table 58: Corporal punishment in schools

		ENGLISH	SCIENCE	MATHEMATICS
Often	Mean	21.59 (43.18%)	21.8 (43.6%)	18.65 (37.3%)
	N	432	433	433
	SD	11.28	10.83	9.92
Sometimes	Mean	22.51 (45.02%)	22.65 (45.3%)	18.83 (37.66%)
	N	1141	1141	1141
	SD	11.45	11.1	9.74
Rarely	Mean	24.82 (49.64%)	24.24 (48.48%)	21.99 (43.98%)
	N	857	857	857
	SD	11.82	11.11	10.81
Never	Mean	26.58 (53.16%)	23.45 (46.9%)	21.69 (43.38%)
	N	1874	1874	1874
	SD	12.37	10.64	10.9
Total	Mean	24.65 (49.3%)	23.23 (46.46)	20.69 (41.38%)
	N	4304	4305	4305
	SD	12.07	10.9	10.59

When teachers are stopped from physically punishing their students by law, they should have been trained in strategies to engage students and psychologically manage students when they get out of control. Student behavior can be modified by counseling, motivation and building an affectionate relationship by the teacher but this all requires training.



SECTION 4
WAY FORWARD

CHAPTER 9
WAY FORWARD

The results presented in section 3 of the report have some interesting findings which have implications for the improvement of student performance. The ultimate aim of all initiatives, innovations and administrative measures by School Education Departments (SED) and its affiliated departments is to ensure school improvement aimed to raise the student's learning. This section puts forward evidence-based suggestions for change in policy, curriculum/ textbooks, teacher training, assessment of learning and school environment to further strengthen these departments for improved delivery of services to the school education.

POLICY

SED is directly responsible for formulating policy guidelines for its affiliated departments and schools to improve the quality of education in schools.

1. MEDIUM OF INSTRUCTION

There has been ample evidence in cognitive psychology that mother tongue is best for teaching and learning in early grades. We have experimented a lot in the past by randomly shifting medium of instruction between Urdu and English. As suggested in the findings of the study, it is overwhelmingly evident that instruction in native language yields the best performance from students. But considering limitations of our departments in producing learning materials in local languages, variety of local languages and importance of having Urdu as common language of communication in the country, it is feasible to declare Urdu as medium of instruction and practicing lenient policy for teachers to use a mix of local language and Urdu in classroom for explaining concepts, especially in rural areas.

Importance of English as a global language cannot be denied, therefore, a well-designed subject of English as a second language to be taught by teachers proficient in reading, writing, and speaking should be encouraged.

2. ELIMINATION OF CHILD LABOR

Child labor is banned in Pakistan but actually, it still prevails in our urban and rural areas. It prevents school-age children from going to school or retaining those who are in schools. Implementation of the law is more important for change than the law itself. SED in coordination with labor department should ensure bringing out of school children to schools and more importantly reduce the probability of at-risk students leaving schools.

Students reported staying away from schools for earning a livelihood for their families after school hours and in rural areas, students temporarily leave schools in harvesting season to earn money. SED requires identifying schools in which this phenomenon exists and providing awareness, motivation, alternate income generation opportunities through relevant government departments and continuous parent engagement with schools to reduce child labor practices in the community.

3. HOMEWORK AND FEEDBACK ON HOMEWORK

Teachers in schools need to be given an appropriate proportion of work time to give timely feedback to students on homework and classwork regularly. If manageable, dedicated staff (Assistant teachers) should be provided in schools for feedback on student homework and ensuring compliance.

4. CAPACITY BUILDING OF UNEDUCATED/LEAST EDUCATED PARENTS

There are a large number of parents having education below matric. There is evidence that student performance is negatively affected due to parents' inability to help them in their studies. It is acknowledged that these parents cannot teach their children but they can provide an environment conducive for their education. The role of School Councils should be extended to engage them in activities expected of them to support the education of their children.

5. PROVISION OF PRIMARY/MIDDLE SCHOOLS

Students in Primary and Middle schools performed better in studies as compared to students of the same grades in High schools. It shows that Primary/Middle schools are better places for children in lower grades. Provision of primary and middle schools in close vicinity to home can bring better student performance and improved access (especially for girls), even in case the establishment of such schools is financially not viable as per current SOPs followed by SED to open new school. Provision of elementary level education is the responsibility of the state and it should adhere to it.

6. ESTABLISHMENT OF EARLY CHILDHOOD CENTERS

Students reported taking care of siblings as one of the reasons for being absent from schools. The phenomenon prevails in communities where both parents belong to labor class and working. When mothers go out for minor jobs, the elder child has to stay at home to take care of siblings. ECE Centers/ECE rooms/ daycare centers need to be set up with primary schools where parents can leave infants for care while their older children can be relieved of this duty to continue their education.

7. MANAGING PUBLIC PERCEPTION OF SCHOOLS

Despite several infrastructural, administrative and academic improvements in government schools in recent years, the public still holds negative perception about schools. School management is required to maintain close liaison with parents and community to manage public perception of improvements brought in schools by the SED. Holding events in schools, opening schools for community visit, arranging open days, etc. can be some avenues for changing public perceptions towards schools.

8. TEACHER RECRUITMENT POLICY

It is encouraging to see that teachers' subject matter knowledge has improved as a result of the recruitment of highly qualified teachers. But this positive development is yet to be translated into student performance because student performance is still below expectation in all three subjects. This indicates that our assumption that a teacher qualified in content automatically knows how to teach and/or short term induction training can be a replacement of pre-service teacher training; needs to be revisited. Professional qualification of teachers is as important as professional training. It may suggest that the government should continue the recruitment

of highly qualified teachers but a professional degree in education should also be made eligibility criterion to become a teacher. The policy to recruit untrained teachers did not work for the improvement of student performance.

9. PROVISION OF MINIMUM ACADEMIC RESOURCES

The income disparity among families causes a lack of necessary provisions for children coming from low-income families. This is creating a partition between children from very early years. Schools should ensure minimum academic resources for each child coming to school to minimize the effect of disparity in resources faced by students at home (library, learning games, materials to experience learning activities, etc.). At a later stage, facilities may be extended to include co-curricular materials, meals during school hours and health facilities in schools to minimize the disparities from the early years.

10. REVISITING CHILD'S SCHOOL EXPERIENCE

The concept of student performance in schools needs to be revisited and focus on academic score needs to be rationalized. Overemphasis on examination results has undermined value of co-curricular activities. Physical sports activities, social work, and community service must be made a mandatory part of school life and all related provisions to be ensured in schools.

CURRICULUM AND TEXTBOOKS

The curriculum is the selection of learning experiences students go through in school life. This forms core academic activities and co-curricular activities which are necessary for cognitive, social, moral and personal development of children in school life.

TEXTBOOK REVISION

The results revealed that student performance in some content areas lagged behind in Science, Mathematics, and English. The poor performance cannot be concretely associated with issues in textbooks on the basis of data collected in this survey. But this issue can be addressed by reviewing textbooks and improving teacher training.

Mathematics

Textbook need to reconsider the content, presentation of content, contextual relevance and examples used in chapters on Fraction, Decimals and Fractions, Factors and Multiples, Measurements, Geometry in Mathematics.

Science

In general, student performance on content areas in Science remained average except on questions about Food and Health, particularly on questions related to higher order learning. Reconsidering the content of this chapter to confirm sufficient depth and demand in the topics for students to apply and analyze need to be ensured. It is noticed that contents given in the chapter "Movements of the Earth do not address SLOs given in the curriculum". This chapter is one case which suggests textbook need to be revisited to confirm that content related to all SLOs is appropriately included in the textbook. Correspondence of content to the level of learning desired in the SLOs needs attention.

English

English curriculum is competency-based and focuses on the development of reading, writing, oral communication and formal and lexical aspects of language. Oral communication skills and understanding of formal and lexical aspects of the language need improvement. The textbook needs to address content aimed at strengthening grammar as the tool for oral and written communication. Explanatory text, supportive activities, exercises on the use of correct grammar, appropriate vocabulary, speech, and cohesive and coherent written composition require attention.

QUALITY ACTIVITIES IN TEXTBOOKS

The improvement in the textbooks, to support activity-based teaching in classroom, needs attention. Activities are meant to connect learning to life, provide space for creativity and innovation, and offer the opportunity for collaborative learning besides many other characteristics. The textbooks should be reviewed to ascertain that given learning activities are aligned with these objectives. Teacher's guides on using activities and provision of related facilities can allow teachers to make optimal use of textbooks. Learning activities and self-assessment tasks in textbooks need novelty and relevance to student observations/ experiences in daily life to prepare them for assessments beyond textbooks.

TEACHER TRAINING

The single and most crucial element in creating an effective learning experience is a teacher[10]. Importance of competent and trained teachers cannot be denied. The pre-service and in-service training in enabling teachers through CPD has a central role. Quaid-e-Azam Academy for Educational Development (QAED) has a well-established and tested program of In-service teacher training. Developing a strong research-based decision making in QAED and utilization of huge data collected by QAED over the years to inform, update and ascertain the relevance of training can bring improved and desired results.

USE OF LOCAL RESOURCES

Teacher training on the use of localized resources needed, especially for teachers posted in rural areas where commercially developed educational resources are not available. National Educational Equipment Center (NEEC) has a very important role to play in this regard.

TRAINING ON DEVELOPING FRIENDLY RELATIONSHIP

Teacher training has primarily focused on the development of content expertise and pedagogical skills among teachers. As noticed in results, student performance is greatly influenced by teacher behavior towards students. Friendly teachers care better and are accepted by the students, thus creating more impact on student performance. Therefore, training on listening to student social, psychological, emotional and personal problems is important for teachers to develop mutual trust and respect.

CLASS MANAGEMENT

Despite government orders, corporal punishment is still practiced as a tool of classroom management by some teachers. Training is required to equip teachers with skills other than physical abuse of students for

[10] OECD (2005). TEACHERS MATTER: ATTRACTING, DEVELOPING and RETAINING EFFECTIVE TEACHERS, ISBN-92-64-01802-6 OECD 2005

managing class discipline. It is important for teachers to understand and use the psychological means of class management to ensure conducive learning environment.

HIGHER ORDER LEARNING

Student performance on SLOs related to higher order learning is not very enviable. Teachers need to be trained in subject-specific higher order learning techniques during in-service training courses. Higher order learning involves learning to apply, analyze, synthesize and evaluate using the content included in textbooks. Teachers can only engage students in tasks of this nature when they themselves have exposure to activities leading to higher order learning. Assessment techniques to measure the development of higher order learning need to be focused during teacher training.

CONTENT SPECIFIC PEDAGOGIES

Instead of training on pedagogies without relating to the content to be taught, training should focus on content specific pedagogies. It needs to be considered that pedagogies for teaching Social Studies are different than pedagogies for the teaching of Mathematics and so on. Even within the subject/content area pedagogies change as the nature and complexity of content changes. One pedagogy fits for all topics has lost its value and is no more assumed an effective approach in teacher training.

USE OF WHITE/BLACK BOARD AS AN INTERACTIVE TOOL

Use of AV aids is important for effective teaching. The most commonly available and used AV aid in our schools is white/black board. It is essential to provide contemporary AV aids other than white/black boards in schools but it will take time. Till then it is important to train teachers in techniques to use white/black board as a tool of two-way interactivity instead of just using it a display tool for one-way communication from teacher to students.

ASSESSMENT

Assessments are meant to measure what is being taught in the classroom but unfortunately, in our system, we have started teaching what is being measured in assessments. This has promoted teaching to test approach at all levels. The scope of our assessments is also limited to questions given in the textbooks.

ASSESSMENT BEYOND TEXTBOOK

It is important for the measurement of higher order learning to include questions in tests beyond textbooks. The practice of developing tests from textbooks is quite old and any immediate change can be difficult for teachers and students to adopt but if we start curriculum-based tests for students in early grades now and then extend the practice to subsequent grades every year to ensure a gradual change in coming 4-5 years in all assessments/examinations. This transition can become feasible for teachers and students. Training of teachers in the development of assessment tasks beyond books will be important for a successful transition from textbook-based assessment to curriculum-based assessment. Assessments in schools and external examinations (if any) using sequential tasks help us in knowing the quality of student learning (e.g. by Bloom's level of learning). Instead of standalone MCQ type questions. Assessment beyond textbook should be encouraged and implemented.

SCHOOL

School improvement is the only mean for engaging students in constructive activities beyond teaching for the development of their personalities and connecting to the society or community in which they are living. A positive perception of the school among community members and ownership of school activities in the society is a key factor for school to be able to dispense its responsibilities.

PROMOTION OF READING AND WRITING SKILLS

Schools can be a source of revival of practices fading out for some reason but they value for the development of students. For example, the data in this study revealed that the culture of reading and writing is becoming weak gradually. Writing should be encouraged through writing competitions, creative writing exercises, valuing student work, making original writing part of classroom assessment, discouraging the reproduction of memorized writings, etc. Provision of reading material, reading circles, reading and writing competitions, valuing reading beyond textbooks is to be made part of school culture.

SCHOOL SERVICES

A school is a place for the development of whole personality of a child. Academic learning is one part of the development; schools need to ensure that it caters all requirements of social, psychological, emotional and personal development of students. Students in need of special attention should be catered by arranging of remedial classes, providing guidance and counseling services to students, and counseling services, diagnostic study support need to be added in schools.

LIAISON WITH COMMUNITY

A close connection between school and society can enable the school to function smoothly; count on resources of the society and serve the community better. It is important that schools are perceived as the best place for their children to groom by the community members. The data in this study revealed that public perception about school is not close to reality. Several good initiatives taken by the government to improve the teaching-learning environment in schools is not appreciated by the community. The schools should not only work on the improvement of school facilities but also keep the community aware of the developments to change their perception about public schools. For this purpose, the schools can manage to hold events on important national days, open days, festivals where parents and important community members are invited to join and see by themselves the measures that school have taken for improving their services. The role of School Councils (SC) can be extended to manage these activities and work as a bridge between schools and society.

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