2014-15

State Learning Achievement Survey
Class III

STATE COUNCIL FOR

EDUCATIONAL RESEARCH

AND TRAINING

New Building, PSEB, E-Block,

6th floor, Phase-8,

Ajitg

Supported
SSA-REMS FUND

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State Level Achievement Survey

Class III

2014-15

SUPPORTED BY

SSA-REMS FUND

FOREWORD

Sarva Shiksha Abhiyan in Punjab is implementing a number of educational enhancement programmes through various schemes towards achieving the critical goal in Universalization of Elementary Education (UEE). SSA focuses on providing quality elementary education to all children bridging along the social, regional and gender gaps with active participation of the community. Punjab is a pioneer state in implementing various programmes like State Level Achievement Survey, Performance Indicators, Advancement of Educational Performances through Teacher Support, Quality Monitoring Tools etc.,

Education evaluation has confirmation and judgment functions concerning how well the educational goal is realized, based on the goal originally defined. It also has information gathering and application functions necessary for making decisions regarding learners, educational methods and administrative assistance. To assess the achievement levels of children in the curricular areas and to explore areas for further strengthening the academic inputs needed to improve the learning capabilities of children, a state level specific assessment survey was conducted during 2013 as an initiative of the State.

During SLAS 2014-15, in order to overcome the limitations of Classical Test Theory, Item Response Theory (IRT) has been used to compare performance over time and to analyses the data competency wise. IRT uses a mathematical model to link a student's chance of answering correctly a particular item to two main factors: the student's level of ability and the item's level of difficulty. State Level Achievement Survey (SLAS) has been conducted in 2013-14 for class III and 2014-15 for Classes II, III and VIII in Punjab. The survey tested the competencies that ought to be attained by students in every class. Practicing teachers, teachers and DIET faculty were involved in framing the test items, testing, data gathering and discussions.

SLAS has successfully explored and analyzed all areas of strengthening the learning outcomes among children. The report of SLAS is a diagnostic presentation of the existing levels of competencies among students and also throws light upon the areas which need to be improved in future. This report is need-based and gives valuable inputs for policy making, curriculum construction, research and setting up educational standards in Elementary Education.

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Executive Summary

Introduction

The State Learning Achievement Survey (SLAS) is a process to find out hard spot and collect relevant data regarding health of education system. It helps to make policy for the remedial process. In the year 2013, the State Learning Achievement Survey (SLAS) conducted by SCERT for the first time in Punjab as an independent project, was incorporated into the Government's flagship projects Sarva Shiksha Abhiyan(SSA). SCERT is responsible for developing tools and conducting the surveys whilst funding is provided by the SSA under REMS.

In 2013, The SLAS of class III was conducted by the SCERT, according to the guidelines provided by NCERT. This year NCERT direct the state to conduct a sample survey of class II, III,& VIII. However, the importance of these surveys and the experience gained through the first survey made it clear that this programme should be an ongoing feature of the State education system.

Methodology

Sample Selection

For Class III SLAS, government and government-aided schools having Class IV were included in the sample frame. Class IV students was selected for sample because the survey was administer in the beginning of the session. The general selection procedure was:

- Selection of districts(Purposive and Simple random sampling)
- Selection of schools (PPS within each selected districts)
- Selection of students(Randomly with in selected schools)

The survey was administered to a sample of 3920 students, 196 schools and 13 districts.

Tool Development

For the survey, subject tools and three questionnaires (PQ,TQ and SQ) were developed. The tools employed need to be simple, understandable, accessible, valid and reliable. For the purpose a subject expert committee was made. These subject expert were from Lecturer DIETs and teachers from schools.

subject expert committee training was imparted for the development of testing tools. In order to measure reliably the achievement levels of class III students, tests in two subjects, viz. Language and Mathematics were developed. The first step was to collect the syllabuses and the text books of Language and Mathematics. These were then analysed from the point of view of the content areas covered and the competencies to be developed. In each subject, common core content and competencies were identified. Based on this analysis, subject-specific assessment frameworks were developed. These described the content areas and competencies to be covered and prescribed the number and type of items to be used for testing each domain. In order to provide sufficient information, two test forms were developed for each subject. For the Class III SLAS, each test consisted of 40 multiple-choice items. Of these, 10 were common 'anchor items' which appeared in both test forms. Thus, overall 60 unique items were used in each subject to measure learning achievement. Finally, answer keys were developed and checked for each test form in each subject.

Test administration

SLAS is conducted by the State Council of Educational Research and Training (SCERT). To coordinate the SLAS project in districts, SCERT takes the help of DIETs. For the current survey, each participating district designated a District Coordinator who was responsible for implementing the SLAS in their State/UT in accordance with SLAS guidelines. State coordinators were given training on how to collect data in the field. For this a detailed training manual was developed. Thereafter, State Coordinators provided training to district coordinators about the conduct of main achievement survey. In each selected district, district coordinators appointed field investigators. They were given a rigorous training about selection of sections and students in the sampled schools, administration of tools and transfer of responses from test booklets to separate response sheets. These response sheets were collected by the district coordinators and then data was entered by the district coordinators with the help of district MIS coordinators. State Coordinators and their teams are to be commended for their efforts. Without their help and professionalism, the massive task of data collection for the State learning Achievement Survey would not have been possible.

Monitoring

Monitoring of administration of tools was done at the state and districts levels. At state level SCERT faculty and at district level DIETs monitored the activities to ensure the quality of data.

Data Management and Analysis

The work of transferring the data from paper forms to electronic format was done by MIS wing of department. Keeping in mind the objectives of study, Data entry plan and analysis plan were developed. Data entry plan was provided to MIS wing for undertaking the assigned task in a systematic manner. The MIS provided soft copy of the data entered. The State project team checked and verified the quality of data and resolved the problems of mismatching information. Cleaned files were used for analysis. Data analysis was carried out by using Classical Test Theory (CTT) and Item Response Theory (IRT).

Main Finding

Language: Punjabi

- The state average score is 66 % and average scale value of state is 245.
- There is no significance difference between the average score of boys and girls.
- There is no significant difference between the average score of Bet and Kandi in context to others area. But the average score of other area is significantly above the border area. It shows that the others area's students performance is better than the Border area.
- The average score of General class is significantly above than SC and there have significant difference from BC and others. It interprets that on an average general class performed better than SC, BC and others.
- The average score of Departments and PRI school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department & PRI schools.
- Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges

Mathematics

- The state average score is 70% and average scale value of state is 246.
- There is no significance difference between the average score of boys and girls.
- The average score of border area is significantly below than bet, kandi and others areas, which shows that the performances of border area students are low.
- The average score of General class is significantly above than SC and there have significant difference from BC and others. It interprets that on an average general class performed better than SC, BC and others
- The average score of Aided / recognized school is significantly above the Department and PRI schools. It does interpret that aided/ recognized schools performed higher than department schools and PRI.
- Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges.

Limitations

This survey undoubtedly represents a significant step forward in the development of education in Punjab. However, as with all such enterprises, lessons have been learnt. In conducting the Class III SLAS, the following limitations have been noted so that they may be addressed in future achievement surveys:

- ❖ The survey used DISE 2013–14 data from the MIS- SSA Punjab as the primary sample frame. Once in the field, significant discrepancies between the DISE data and actual school enrolments were noticed.
- ❖ Due to discrepancies in the sample frame, deviation from agreed sampling procedures, and loss of information during administration, it was not possible to estimate sample weights for the survey.
- ❖ In all selected Districts, the coordinator was DIET's faculty. It was decided that the field investigator should be chosen from the senior most class of DIET's. On reflection, the training and hands-on practice given to these field investigators may not have been sufficient resulting in inefficiencies in the data collection procedure.
- ❖ In order to meet the key objectives of this survey, schools and students were sampled in a systematic fashion, meant that teachers could not be explicitly

sampled. As a result, the analysis of teacher-related variables vis-à-vis student attainment could not be made in a comprehensive manner.

- In this survey SCERT also used IRT for analysis of results. Therefore, results are reported in terms of scale scores rather than percentage. Whilst this is an important step towards emulating international best practice, unfamiliarity with this approach has undoubtedly made it more difficult for the lay reader to interpret results. It is hoped that understanding will improve of IRT with time.
- Difference between the research study and exam/test is not clear to the field.

Chapter 1
INTRODUCTION

This report summarises the findings of the State Learning Achievement Survey (SLAS) of class III students, conducted in 2014 by the State Council for Educational Research and Training (SCERT), Punjab It is based on information gathered through test and questionnaires administered to a sample comprising of 3920 students in 196 schools across 13 Districts of Punjab. The subjects covered were Mathematics and Punjabi.

This survey is the latest in an ongoing programme of such studies available to all districts of Punjab. The aim of SLAS is to provide reliable information on the achievement of the students in the elementary sector of education in Government, PRI and Government aided/Recognised School. This is achieved not only by applying standardized test to the students, but also collecting information about relevant background factors including the school environment, instructional practices, qualification and experience of teachers and the home background of students. The data from SLAS gives policy makers, curriculum specialists, researchers and most importantly school heads and teachers a 'snapshot' of what students are achieving in key subjects at a particular point in time. By repeating such measurement at regular intervals, trend can be explored providing an invaluable perspective from which can assist in educational reform and improvement.

It should be noted that whilst each SLAS provides achievement scores for the state, for each participating district and for certain group (e.g. Boys/Girls, students in rural schools, etc.), it does not give scores to individual students and schools.

1.1 SLAS in Punjab

The State Learning Achievement Survey (SLAS) is a process to find out hard spot and collect relevant data regarding health of education system. It helps to make policy for the remedial process. In the year 2013, the State Learning Achievement Survey (SLAS) was conducted by SCERT for the first time in Punjab as an independent project, was incorporated into the Government's flagship project Sarva Shiksha Abhiyan (SSA). SCERT

developing tools and conducting the surveys whilst funding is provided by the SSA under REMS.

Since 2001 National Council of Educational Research and Training (NCERT) has been periodically conducting National Achievement Surveys(NAS).The NAS reports gave a national and state level picture rather than scores for individual student, school or district. The purpose of these assessments is to obtain an overall picture of what students in specific class, knows and can do. These findings can also be used to identify gaps, areas that need improvement and to form policies. The finding can also be useful to invent the interventions for the improvement of children's learning under the SSA programme. But in 2013, the NCERT directed the states to conduct their own State Learning Achievement Survey (SLAS).

In 2013, The SLAS of class III was conducted by the SCERT, according to the guidelines provided by NCERT. This year NCERT directed the state to conduct a sample survey of class II, III & VIII. However, the importance of these surveys and the experience gained through the first survey made it clear that this programme should be an ongoing feature of the State education system.

At class II and III level, assessment is made in two subjects, i.e Mathematics and Language (Punjabi). For class VIII, four subjects were assessed i.e. Mathematics, Language (Punjabi), Social Science and Science. The comprehensiveness and coverage of these surveys provide very useful data to capture the progress of the education system as well as to enhance the quality of elementary education.

1.2 Development of tools

For any large survey, the tools employed need to be simple, understandable, valid and reliable. For measuring reliability the learning levels of class III are important. The tests need to be pegged at the level that they measure the abilities developed in children across the districts. Therefore, before undertaking the test development, it was necessary to know what was taught at class III. The first exercise, hence, was to collect the syllabus and the textbooks of Mathematics and Language (Punjabi) These were then analysed from the point of view of the content areas covered and competencies acquired. The common core content and competencies were identified for developing the tests.

Based on the analysis, assessment framework was developed for each subject. The frameworks described the competencies to be covered in the tests, the number and type of items to be used for testing each competency, the structure of the test forms and number of tests forms to be used.

For measuring each learning outcome with sufficient precision, it was necessary to construct multiple test forms in each subject. A three dimensional grid was prepared for each subject indicating the content areas to be covered, skills to be tested, the difficulty level of items under each skill along with the number of items.

Item writing workshop

General

The item writing workshop included plenary sessions on fundamental principles of test development and subject specific workshops for writing and reviewing/editing draft items.

The general principles covered were:

- **Characteristics of sample-based achievement surveys**
- **Test specifications and their role in test development**
- **Item writing rules and guidelines**
- **Procedures and checklists for reviewing the quality of items**
- **Introduction to classical item statistics.**

1.2.1 Language

There was one sub-group – Punjabi. The work was guided by the draft specifications for the language test prepared by SRG, text books and with the help of NAS. The tasks covered were:

- **The Working Group came to a common understanding of the main principles of item writing and quality control.**
- **The Working Group drafted more than 120 items.**
- **All these items were peer reviewed.**
- **The Working Group proposed the use of the following classification system for Language topics:**
    - **Reading texts and questions (4-option MCQ)**
    - **Fill in the blanks (4-option MCQ)**

- General Content based question (4-option MCQ)
- Discrete items on 'language structures' (4-option MCQ)

- Sufficient passages and discrete items prepared and reviewed to create two booklets for pre-testing/Piloting.

The next steps undertaken were:

- Entering all items, reading passages, marking keys etc. into the computer and checking.
- Selecting items for two booklets for Pre- testing.
- Reviewing, checking and proof reading all booklets.
- Language structure multiple-choice questions.
- Checking again before 'passing for print' to ensure that the versions were 'camera-ready'

1.2.2 Mathematics

The work was guided by the draft specifications for the Mathematics test prepared by SRG, and textbooks used in schools for Mathematics.

Activities carried out in Mathematics Group

- The Working Group came to a common understanding of the main principles of item writing and quality control.
- The Working Group drafted more than 120 items.
- All these items were peer reviewed.
- The Working Group proposed the use of the following classification system for Mathematics topics:
  - Number System
  - Computations (operations)
  - Measurement
  - Geometry
- The mathematics items were prepared in two mediums i.e Punjabi and English.

The next steps undertaken were:

- Entering all items, reading passages, marking keys etc. into the computer and checking.
- Selecting items for two booklets for Pre- testing.

- **Reviewing, checking and proof reading all booklets.**
- **Language structure multiple-choice questions.**
- **Checking again before 'passing for print' to ensure that the versions were 'camera-ready'**

1.2.3 Piloting of the test items

In order to standardise the tests, they were piloted to see how the items worked. The difficulty level (p-value) and discrimination index (DI) were computed. Item were carefully scrutinised to select suitable items for the final tests. By and large, the items having difficulty indices (p-values) between 0.2 and 0.8 were selected.

1.2.4 Sampling for piloting

The following procedure was used:

1. **A sampling strategy was developed based on District Information System for Education (DISE) data for the school (2013-14).**
2. **The sample was not random, but was based on the statistical requirement of having enough records for each item (for analysis) and at the same time, diversity of the students/schools in the education system.**
3. **Two booklets with different competences were designed (for all the subjects).**
4. **Two booklets were equally distributed among the students of selected section of the concerned class.**
5. **Mohali district was selected taking into account the diversity of socio-economic background variables i.e. keeping in mind the strata of area from urban and rural, the schools were selected**
6. **Except language, all the subjects were tested in two mediums.**

1.2.5 Administration of tools for piloting

- **For piloting, SRG developed a handout for Field investigators.**
- **Field investigators were trained on the required procedure.**

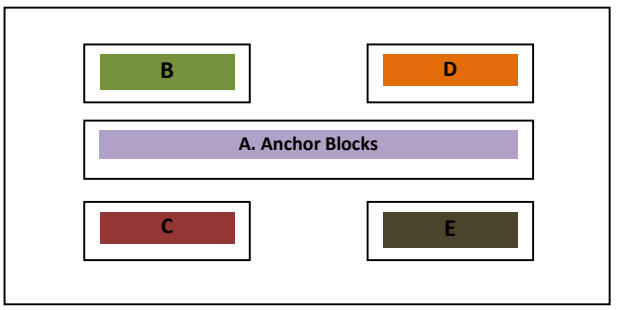
- The school (from the selected schools list) was assigned to the Field Investigator.
- Field investigators administered the piloting in the selected school. It took two days for the individual to complete the test as there were two subjects to be administered.
- Student is responses were transferred to data sheets by the field investigators.
- The SCERT collected the data (Hard Copy) from the field investigator after the compilation.

1.2.6 Data analysis

- Data entry of the compiled data (Hard Copy) was carried out by Data Entry Operator.
- Data was analysed by the outsourced consultant through IRT(Item response theory).
- Data was also analysed by the SRG through CTT (Classical test theory).
- Item parameters were used to select the items in the context of National Assessment Survey.
- Poorly performed and flawed items were rejected.

1.2.7 Test booklet construction

For the construction of booklets for the main survey all the items were properly reviewed and it was decided that within a subject, all the two forms would contain 10 anchor items. The structure of the Language (Punjabi) and Mathematics was as under.



In the two subjects, the following domains were identified:

Language (Punjabi)	Mathematics
Listening	Arithmetic
Speaking	Algebra
Reading	Geometry

In each domain, there were number of sub-domains or topics. These items were again vetted by subject experts. Each test was reviewed in the light of the content area competency, appropriate language, estimated difficulty level and also the homogeneity of distracters.

Finally, for class III (SLAS), each test form for Language (Punjabi) and Mathematics, consisted of 40 multiple choice items. Thus, overall 70 items were used in each subject to measure learning achievement.

In the cover page of the test, instructions for students and examples indicating how to record responses and change the response in case of any mistake on the test booklet were also prepared.

1.2.8 Questionnaires

Questionnaires for class III (SLAS) were built upon experience from the earlier SLAS and NAS surveys. For this survey, three questionnaires were developed to collect information on

a) school

b) teacher and

c) pupils

The school and teacher questionnaires were produced in English medium only, as it was considered that school principals and teachers are proficient in this language.

The pupil questionnaire was strongly influenced by NAS. The pupil questionnaire contained questions pertaining to the home background of students. Areas touched upon included parents' level of education and occupation, help available at home for studies from parents and siblings, the study materials and resources available at home. The questionnaire also investigated the experience of pupils in school. This included questions about class work and homework given by teachers and whether they liked coming to school etc.

The school questionnaire sought information on the location, enrolment and structure of the school, the number of school days, the school's infrastructure and environment. Other questions related to teachers' job satisfaction and their professional development opportunities, curriculum transaction strategies and problems existing in schools.

The teacher questionnaire comprised questions regarding the age of teachers, academic and professional qualifications, training programmes attended, teaching and evaluation practices, teaching materials available to them, interaction with other teachers and the school head, and their job satisfaction.

1.3 The SLAS Sample

The class III (SLAS) was designed to investigate learning achievement in the Kandi, Bet, Border and other areas at the district level in state. Hence, the target population for the survey was all class III children, studying in government, PRI and government-aided/ Recognised schools.

In general, the sample design involved a three-stage cluster design which used a combination of two probability sampling methods. In the first stage, districts were selected using purposely and random sampling principles. This means that the probability of selecting a particular district depended on the areas selected. In the second stage, the requisite number of schools were selected in the chosen districts; for this PPS principles were used, so that large schools had a higher probability of selection than small schools. In the third stage, the required numbers of students in each school were selected using the Simple Random Sampling (SRS) method. In schools where class III had multiple sections, an extra stage of selection was added with one section being sampled at SRS.

In the survey, PPS sampling was based on class III enrolment data from the DISE. SRS sampling was conducted according to the class registers available in sampled schools. Although the DISE data was not free from criticism, it was used because it was considered to be the most complete and up-to-date enrolment data available at the time of sampling. Unfortunately, due to discrepancies in the DISE data, limitations in the sampling method and loss of information at the sampling and administration stages of the survey, it was impossible to estimate sample weights for the survey. Appendix I provide further details about the sampling procedures of the survey.

1.4 Participating Districts and Sample Coverage

The survey was intended to cover all 22 districts, but Barnala, Fatehgarh, Faridkot, Kapurthala, Mansa, Muktsar, S.B.S. Nagar, Roopnagar and Sangrur could not participate in this endeavor because of area classification. Among the 13 participating districts, we could not test class III students because of beginning of academic year. Therefore, it was decided to test class IV children (Target Group Class IV).

Exclusions of sub-populations from the total target population of SLAS class IV were made at the initial stage of sampling. Large scale educational surveys allow such exclusions for reasons such as ensuring administrative efficiency, as long as the excluded population does not critically affect the quality of the survey. For example, the exclusion of very small schools from a target population is often accepted. In addition to the small school exclusion, the schools having fewer than 20 students were excluded. As a result of these exclusions, population coverage of the class IV sample varies from district to district.

1.5 Characteristics of Participating Districts

Table 1.1: Physical, demographic and social indicators for the selected districts of Punjab

Sr. No.	District[1]	Population	Sex Ratio	Literacy	Density	Class IV Enrolment[2] (According to selected Area and Management)
1	Ludhiana	3,498,739	873	82.20 %	978	67199
2	Amritsar	2,490,656	889	76.27 %	928	41942
3	Gurdaspur	2,298,323	895	79.95 %	647	18650
4	Jalandhar	2,193,590	915	82.48 %	836	35760
5	Ferozepur	2,029,074	893	68.92 %	382	7298
6	Patiala	1,895,686	891	75.28 %	570	35385
7	Hoshiarpur	1,586,625	961	84.59 %	469	9509
8	Bathinda	1,388,525	868	68.28 %	414	23692
9	Tarn taran	1,119,627	900	67.81 %	464	10564
10	Moga	995,746	893	70.68 %	444	16231
11	Mohali	994,628	879	83.80 %	909	12765
12	Fazilka[3]					9273
13	Pathankot					4930

[1] Source from column 2 to 6 is : http://www.census2011.co.in/census/state/districtlist/punjab.html
[2] Source of information is UDISE 2013.
[3] Districts Fazilka and Pathankot were not formed during the census 2011 so the information from column 3 t

Table 1.1 shows that the districts that participated in this survey vary greatly in their physical, demographic and socio-economic characteristics. For example Ludhiana, Amritsar, Gurdaspur, Jalandhar, Ferozepur each have population of more than 20, 00,000 whilst Moga, Mohali have fewer than 10, 00,000 inhabitants. Bathinda has a population density of just 414 people per square kilometer whilst the corresponding figure for Ludhiana is over 978.

Of particular importance in this survey are the significant differences in the provision of education at the class III level. For example, the target population for this survey was all class IV students enrolled in government-run, PRI and government-aided/recognised schools. However, the proportion of class IV students in such schools varied significantly amongst districts.

These and associated factors are likely to influence student achievement and other educational outcomes. Therefore, when considering the findings of this survey and, in particular, when comparing the achievement levels of different districts, it is important to take the prevailing conditions into account to ensure that like is being compared with like.

1.6 Administration of Tools

When conducting SLAS, SCERT takes the help of districts agencies i.e. DIETs to coordinate survey activities in the districts. Each participating district designated a district coordinator, who has the responsibility of implementing the SLAS in his/her district in accordance with the SLAS guidelines. The State coordinators were given training to collect data from the field. For this, a detailed guideline-cum-training manual was developed by SRG. Further, state coordinators provide training to district coordinators about the administration of main achievement survey. In each selected district, district coordinators appoint the required field investigators. They were given rigorous training about selection of section and students in the sampled schools, administration of tools and transfer of responses from test booklet to separate response sheet. These response sheets were collected by the district coordinators and sent to the districts MIS coordinator after checking their number, coding of schools, and whether they have been properly filled by the investigators. These responses were transferred from response sheets to E-from by district MIS coordinators and passed to state coordinator. Without the help, dedication. competence and experience of the District coordinators and their teams for wh

commended, the massive task of data collection for the State Learning Achievement Survey would not have been possible.

1.7 Monitoring

For monitoring, it was communicated to the districts that the schools are to be monitored randomly during the actual conduct of the survey by the SCERT faculty. Similarly, 5–10 schools in each district are to be monitored by the District Institute of Education and Training (DIET) faculty.

It was found through the report received from SCERT and DIETs faculty that all the SCERT official and 95% DIETs faculty visited the schools.

1.8 Data Management

The transfer of data from paper forms to electronic format was done by the districts MIS Coordinators. Data entry and data analysis plan were developed in the department keeping in mind the objectives of the study. Both plans were provided to the State MIS Coordinators for doing the assigned task in a systematic manner. The State MIS Coordinators provided soft copy of the data. In the department, the SRG team checked and verified the quality of the data and resolved problems of mismatching files. Files of clean data were finalized for further analysis. Data analysis was carried out by using both Classical Test Theory (CTT) and IRT (Item Response Theory). The analysis of data is given in next section.

1.9 Analysis of Data

In earlier surveys (By NCERT), the learning achievement data was analysed using CTT and average scores were reported simply as the percentage of correct answers. This approach, whilst valid, has significant limitations. In particular, the results are linked to particular tests and groups of students so it was very difficult to use multiple tests or to link results from one year to another. Therefore, it was decided to analyse the data by using Item Response Theory (IRT) in addition to the classical approach.

As per the guidelines of the NCERT, the state has used IRT and CTT. In this survey, a two-parameter logistic model was used (Appendix II).The main reason for administering the tests in this study was to obtain an estimate of the overall ability of the students tested. IRT assumes that there is a st

between the difficulty of an item, the ability of the student and the probability of being successful on the item. Students with higher ability scale scores are more likely to succeed on any item than their peers of lower ability, while all students are less likely to succeed on items with higher difficulty scores. In fact, a student's probability of success on a particular item is dependent on the difference between the ability of the student and the difficulty of the item.

Whilst this method makes the analysis more complex than traditional method, it has many advantages. Firstly, it places students and test items on the same numerical scale. This enables us to produce meaningful 'maps' of items and students. Secondly, in IRT, the difficulty parameter for an item does not depend on the group of test takers. This allows us to use multiple test booklets which can be 'linked' or equated. This can also be used to compare scores from tests used in different years, an essential characteristic for monitoring progress over time.

SRG experts, after doing preliminary analyses, decided what kind of classical and IRT test analyses would be used for the analysis of the full dataset received from 13 districts. Under CTT, the performance of students on anchor items was carried out by computing percentage correct scores and averages, standard deviations of test scores, and t-values between different groups. Under IRT, a detailed analysis was carried out to determine the scaled scores, standard errors, significant differences between the groups etc. The detail of the IRT model used is provided in Appendix II.

1.10 Organisation of the Report

The report contains 10 chapters and appendices.

Chapter 1 (Introduction): Chapter 1 describes the background of SLAS, Piloting, Tool preparations, Sample and Methodology of survey etc.

Chapter 2 (Achievement in Language: Punjabi): In chapter 2 achievement in Language of class III students is presented. The overall and district were achievement in Language is reported. In addition, information about differences in achievement by students' gender, school location and social category is also provided.

Chapter 3 (What students know and can do: Punjabi): Chapter 3 describes what class III students know and can do in Language (Reading Comprehension and Language elements).

Chapter 4 (Achievement in Language: Mathematics): In chapter 4 achievement in Mathematics of class III students is presented. Their achievement in Mathematics is reported overall and districts wise. In addition, information about differences in achievement by students' gender, school location and social category is also provided.

Chapter 5 (What students know and can do: Mathematics): Chapter 5 describes what class III students know and can do in Mathematics.

1.11 Limitations

This survey undoubtedly represents a significant step forward in the development of education in Punjab. However, as with all such enterprises, lessons have been learnt. In conducting the Class III SLAS, the following limitations have been noted so that they may be addressed in future achievement surveys:

- **The survey used DISE 2013–14 data from the MIS- SSA Punjab as the primary sample frame. Once in the field, significant discrepancies between the DISE data and actual school enrolments were noticed.**
- **Due to discrepancies in the sample frame, deviation from agreed sampling procedures, and loss of information during administration, it was not possible to estimate sample weights for the survey.**
- **In all selected Districts, the coordinator was DIET's faculty. It was decided that the field investigator should be chosen from the senior most class of DIET's. On reflection, the training and hands-on practice given to these field investigators may not have been sufficient resulting in inefficiencies in the data collection procedure.**
- **In order to meet the key objectives of this survey, schools and students were sampled in a systematic fashion, meant that teachers could not be explicitly sampled. As a result, the analysis of teacher-related variables vis-à-vis student attainment could not be made in a comprehensive manner.**
- **In this survey SCERT also used IRT for analysis of results. Therefore, results are reported in terms of scale scores rather than percentage. Whilst this is an important step towards emulating international best practice, unfamiliarity with this approach has undoubtedly made it more**

difficult for the lay reader to interpret results. It is hoped that understanding will improve of IRT with time.

- Difference between the research study and exam/test is not clear to the field.

Chapter 2

Achievement in Language: Punjabi

Keeping in mind listening, speaking and reading. The Language tests used in the SLAS included three categories of items i.e. 'reading comprehension'; i.e. language-specific elements and grammar.

Overall achievement in language is reported for each of the participating districts. In addition, information about differences in achievement by student gender, school location and social category is provided.

2.1 Performance of districts in Punjabi

Tables 2.1 and 2.2 show the distribution of student's achievement for the 13 participated districts. Within each Table, districts are listed in alphabetical order. Table 2.1 represents the analysis done through IRT(Item response theory), The table shows each district's average score on a scale from 0 to 500. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process. Table 2.2 represents the analysis done through CTT (Classical test theory); the table shows each district's average in percentage. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process. Finally, the tables indicate whether a district's average score is significantly different from the state's average or not.

Table 2.1: Districts wise average score in Punjabi (Through IRT)

District	Average Score	SE	Significant difference
Amritsar	243	11.5	No
Bathinda	235	7.2	No
Fazilka	210	12.3	Below
Ferozepur	249	5.8	No
Gurdaspur	269	9.0	Above
Hoshiarpur	253	8.0	No
Jalandhar	244	8.0	No
Ludhiana	259	7.3	No
Moga	246	21.7	No
Mohali	213	25.6	No
Pathankot	257	4.9	Above
Patiala	251	8.1	No
TaranTaran	253	6.0	No
State	245	3.3	

The state's average score is 245 (with a standard error of 3.3). The results reveal substantial difference in achievement of language between the highest performing district (269 for Gurdaspur) and the lowest performing district (210 for Fazilka).Two district's average score is significantly higher than state where as there is only. One district significantly lower than state and Ten districts had average scores that were not significantly different from that of the state.

Table 2.2: Districts wise average score in Punjabi (Through CTT)

Districts	Average Score	Standard Error	Significance Difference
Amritsar	64	3.5	NO
Bathinda	62	1.2	NO
Fazilka	50	2.9	BELOW
Ferozepur	67	1.0	NO
Gurdaspur	75	1.0	YES
Hoshiarpur	69	1.1	NO
Jalandhar	65	1.2	NO
Ludhiana	72	1.2	YES
Moga	67	2.2	NO
Mohali	51	3.0	BELOW
Pathankot	71	1.1	YES
Patiala	69	1.1	NO
Tarn Taran	69	1.1	NO
State Average	66	2.0	

Note: Percentage may vary due to round off

The average score is 69% (with a standard error of 2.0). The results reveal substantial differences in achievement of language between the highest performing district (75% for Gurdaspur) and the lowest performing district (50% for Fazilka).Three districts had significant difference from state average score; Two districts had average scores significantly lower than state and Eight districts had average scores that are not significantly different from that of the state.

2.2 Performance of various groups

The table below compares the average performances of different groups. Performance is compared by gender, school location, social category and management.

2.2.1 Gender related performance in Punjabi

Table 2.3 compares the average score achieved by boys and girls in Punjabi. It shows that there was no significant difference in average score of boys and girls. The table shows that 53% boys and 47 % girls had participated in the survey. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process.

Table 2.3: Gender wise average score in Punjabi (Through CTT)

Gender	Participation Sample	% Participation	Average score	Standard Error	Significance difference
Boys	1886	53	67	0.48	No
Girls	1699	47	69	0.52	

Note: Percentage may vary due to round off

Table 2.4, analysis through IRT shows that, there is no significant difference between the average score of boys and girls. Only four districts were detected: Amritsar,Fazilka,Ferozepur and Pathankot, where boys performed significantly below than girls.

Table 2.4: Gender wise average score in Punjabi (Through IRT)

District	Boy (Average)	SE	Girl (Average)	SE	Significant difference
Amritsar	245	10.4	241	13.4	No
Bathinda	234	5.6	237	9.6	No
Fazilka	211	17.4	209	16.8	No
Ferozepur	249	6.3	248	6.6	No
Gurdaspur	265	9.2	273	10.7	No
Hoshiarpur	243	8.6	263	6.8	No
Jalandhar	243	7.8	245	10.2	No
Ludhiana	255	8.9	262	8.2	No
Moga	237	9.1	255	36.2	No
Mohali	206	24.8	221	26.3	No
Pathankot	258	4.8	255	7.4	No
Patiala	250	6.5	251	10.9	No
TaranTaran	251	5.9	255	6.7	No
State	242	3.1	247	4.3	No

Table 2.5, analysis through CTT shows that, there is no significant difference between the average score of boys and girls. In three districts: Hoshiarpur, Moga and Mohali, significant difference of boys score is below than girls.

Table 2.5: District wise average score according to gender in Punjabi (Through CTT)

Districts	Average Score		Standard error		Significance Difference
	Boy's	Girl's	Boy's	Girl's	
Amritsar	66	63	1.9	2.1	NO
Bathinda	62	62	1.7	1.6	NO
Fazilka	50	50	3.6	4.6	NO
Ferozepur	67	67	1.3	1.5	NO
Gurdaspur	73	76	1.4	1.5	NO
Hoshiarpur	65	74	1.6	1.4	BELOW
Jalandhar	66	65	1.5	2	NO
Ludhiana	70	74	1.7	1.7	NO
Moga	62	71	2.9	3.2	BELOW
Mohali	46	56	4.4	4	BELOW
Pathankot	72	71	1.4	1.8	NO
Patiala	69	62	1.4	1.6	NO
TarnTaran	69	71	1.5	1.5	NO

Note: Percentage may vary due to round off

2.2.2 Area related performance in Punjabi

Table 2.6 describes the analysis of average score according to the area[4]. It shows that the participating sample was 5% from Bet, 7% from Border, 15% from Kandi and 73 % from Other areas. The average score of Bet , Border, Kandi and Others is 67%, 67%, 62% and 69% respectively. For each score, the 'standard

[4] The definition of Bet, Border and kandi area is mentioned in Appendix 1.

error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the individual group variation. Table 2.6 also shows that there is no significant difference between the average score of Bet and Kandi in context to other areas, but the average score of other areas is significantly higher than border area. It shows that the other areas student's performance is better than the Border area.

Table 2.6: Area wise average score in Punjabi (Through CTT)

Area	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference			
					Bet	Kandi	Border	Others
Bet	5	67	1.7	22.9	-	No	Yes	No
Kandi	7	67	1.2	21.3	No	-	Yes	No
Border	15	62	1	23	Below	Below	-	Below
Others	73	69	0.4	20.6	No	No	Above	-

Note: Percentage may vary due to round off

Table 2.7, analysis through IRT shows that average scale score of Bet, Border, Kandi and Others is 240, 243, 244 and 254 respectively.

Table 2.7: Area wise average score in Punjabi (Through IRT)

District	Bet		Border		Kandi		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	-	-	222	21.9	-	-	250	12.8
Bathinda	-	-	-	-	-	-	235	7.2
Fazilka	-	-	210	12.3	-	-	-	-
Ferozepur	262	9.7	245	8.5	255	0.0	247	13.9

Gurdaspur	232	21.2	250	12.2	-	-	280	11.1
Hoshiarpur	-	-	-		265	19.1	250	8.8
Jalandhar	261	32.2	-	-	-	-	241	5.9
Ludhiana	228	0.0	-	-	-	-	261	7.9
Moga	-	-	-	-	246	21.7	-	-
Mohali	-	-	-	-	213	25.6	-	-
Pathankot	-	-	235	13.0	258	22.4	262	5.4
Patiala	-	-	-	-	-		251	8.1
TaranTaran	-	-	-	-	233	29.6	257	6.5
State	246	9.9	232	7.3	247	8.9	253	2.9

Table 2.8 analysis, through CTT shows that, average score of Bet, Border, Kandi and Others is 67%, 67%,62% and 69% respectively. It shows that performance of other areas student's is higher than Bet, Border and Kandi area. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate that how widely individuals in a group vary. For the selection of area PPS[5] technique was adopted.

Table 2.8: District wise average score according to Area in Punjabi (Through CTT)

Districts	Area											
	Kandi			Bet			Border			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	-			-			56	3.05	27.3	67	1.5	23.05
Bathinda	-			-			-			62	1.1	21
Fazilka	-			-			50	2.88	22.3	-		
Ferozepur	70	4.7	21	74	2.1	16.6	66	1.4	21	66	1.7	23.1
Gurdaspur	-			60	3.03	22.5	69	2.2	17.1	78	1.1	19.2

[5] The detailed explanation regarding PPS is mention in the Appendix 1.

Hoshiarpur	75	2.09	18.2	-			-			69	1.4	19.5
Jalandhar	-			69	4.5	30	-			65	1.1	19
Ludhiana	-			59	4.5	20.2	-			73	1.2	18.8
Moga	67	2.2	17.4	-			-			-		
Mohali	51	3	23.1	-			-			-		
Pathankot	72	2.5	19	-			62	3.04	22.8	74	1.2	18.8
Patiala	-			-			-			69	1.06	18.1
TarnTaran	-			-			60	3.1	23.6	71	1.09	19.1
State Average	67	4.2	9.4	67	3.6	7.2	62	2.8	6.9	69	1.4	4.7

Note: Percentage may vary due to round off

2.2.3 Social class related performance in Punjabi

Table 2.9 describes the analysis of average scores according to the Social class. It shows that the participating sample was 43% from SC, 19% from BC, 36% from General and 2% from Others and the average score of SC, BC, General and Others is 66%, 68%, 71% and 65% respectively. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary. The average score of General class is significantly higher than SC and there is significant difference from BC and others. It interprets that on an average, general class performed better than SC, BC and others.

Table 2.9: Social Class wise average score in Punjabi (Through CTT)

Social Group	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference			
					SC	BC	General	Others
SC	43	66	0.6	22.5	-	No	Below	No
BC	19	68	0.8	21.5	Yes	-	No	No
General	36	71	0.5	19.5	Above	Yes	-	Yes
Others	2	65	2.3	21.5	No	No	No	-

Note: Percentage may vary due to round off

Table 2.10, analysis through IRT shows that, average scale score of SC, BC, General and Others is 240, 246, 249 and 240 respectively.

Table 2.10: Social Class wise average score in Punjabi (Through IRT)

District	SC		BC		General		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	247	18.2	235	5.8	244	6.8	217	74.7
Bathinda	229	9.7	232	12.4	244	11.4	209	0.0
Fazilka	209	0.0	216	14.4	207	0.0	-	-
Ferozepur	245	8.3	247	7.0	257	5.8	222	97.6
Gurdaspur	268	8.0	267	10.1	275	15.4	227	2.2
Hoshiarpur	253	14.2	256	9.5	252	5.4	255	36.7
Jalandhar	237	6.8	256	41.3	250	12.6	259	15.5
Ludhiana	254	10.5	260	12.1	264	10.3	257	7.3
Moga	-	-	-	-	-	-	246	21.7
Mohali	181	27.9	226	13.7	235	17.4	250	0.0
Pathankot	262	5.5	255	9.3	251	8.7	245	0.0
Patiala	256	20.5	242	7.2	252	6.4	254	28.2
TaranTaran	243	5.4	258	23.5	264	5.0	250	0.0
State	240	4.0	246	4.8	249	3.1	240	12.0

The Table 2.11 analysis through CTT shows that performance of general student's is higher than SC and BC. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate that how widely individuals in a group vary. Some exception: the average score of SC and General is same in districts Gurdaspur and Hoshiarpur, in Fazilka and Patiala SC student's average is higher than general, was detected.

Table 2.11: District wise average score according to Social Class in Punjabi (Through CTT)

Districts	Social Class											
	SC			BC			General			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	65	2	26.7	62	2.7	22	66	2.6	20.5	53	8.1	28.1
Bathinda	59	1.7	20.8	62	3.6	22.7	66	1.8	20.1	50	11.2	19.5
Fazilka	49	3.1	21.6	54	8.2	27.3	45	0	-	-	-	-
Ferozepur	66	1.4	23.1	67	2.3	19.4	71	1.6	18.4	52	15	30.1
Gurdaspur	76	1.9	17.2	74	1.6	19	76	1.8	22.8	58	4.2	17.1
Hoshiarpur	69	1.7	23	70	2.7	18.6	69	1.5	18.9	68	12.7	28.5
Jalandhar	63	1.5	20	68	4.7	27.8	69	1.9	17.9	74	6.1	18.4
Ludhiana	70	1.9	19.4	73	2.8	17.4	74	2.1	19.7	71	3.9	20.2
Moga	-	-	-	-	-	-	67	2.2	17.4	-	-	-
Mohali	36	4.6	21	58	3.9	20.2	60	10.3	25.3	69	5.5	12.3
Pathankot	73	1.6	19	71	2.2	21.3	69	1.9	20.1	70	5	7
Patiala	71	2.2	18.5	65	2.3	20	70	1.3	16.9	75	5	7
TarnTaran	65	1.5	20.5	69	3.6	24.9	75	1.4	17.3	67	8	13.9

Note: Percentage may vary due to round off

2.2.4 Managements related difference in Punjabi

Table 2.12 describes the analysis of average score according to Management[6]. It shows that the participating sample was 35% from Department schools, 46% from Aided or recognised and 19% from PRI and the average score of Department schools is 66%, Aided or recognised 71% and PRI schools is 19%. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary. It also shows that the average score of Departments and PRI school's are significantly below than Aided/ Recognised schools. It interprets that aided/ recognized schools performed higher than department schools.

Table 2.12: Management wise average score in Punjabi (Through CTT)

Managements	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference		
					Dept.	PRI	Aided
Department	35	66	0.6	22	-	No	Below
PRI	19	65	0.8	23	No	-	Below
Aided	46	71	0.4	20	Yes	Yes	-

Note: Percentage may vary due to round off

The Table 2.13, analysis through CTT shows that, the average score of Department schools is 66%, PRI schools is 65% and Aided/Recognised is 71%. In eight districts: Amritsar, Fazilka, Ferozepur, Gurdaspur, Jalandhar, Ludhiana, Patiala and TarnTaran the average score of Department schools are significantly below than Aided/Recognised schools. But in Hoshiarpur and Pathankot, there is significant difference between the average score of Department and Aided/Recognised schools. It interprets that in Hoshiarpur and Pathankot districts, Department schools performed higher than Aided/Recognised schools.But in the case of district Fazilka, Moga and Mohali there are some

[6] The definition regarding management is mentioned in the Appendix 1.

delimitations. We couldn't select PRI schools for districts Fazilka and department and PRI for Moga and Mohali, due to PPS technique.

Table 2.13: District wise average score according to Management in Punjabi

Districts	Managements								
	Department			PRI			Aided		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	58	2.2	26	70	3	26	68	1.9	19
Bathinda	65	2.1	21.3	49	2.7	21.6	65	1.4	18.5
Fazilka	38	2.4	15.5	-	-	-	75	1.9	8.6
Ferozepur	64	1.6	21.4	66	2.05	24	72	1.4	18.3
Gurdaspur	72	1.6	19.6	71	1.8	14	77	1.6	22.3
Hoshiarpur	71	2	23.4	67	2.04	18.2	69	1.5	19.6
Jalandhar	63	1.7	16.2	56	2.7	20.2	70	1.7	21.5
Ludhiana	67	2.1	21.3	72	2.1	15.8	77	1.8	17.7
Moga	-	-	-	-	-	-	67	2.2	17.4
Mohali	-	-	-	-	-	-	51	3.01	23.1
Pathankot	75	1.4	16.2	63	4.1	26	70	1.6	20
Patiala	61	1.8	18.5	89	1	6.8	68	1.2	15.5
TarnTaran	70	1.7	18.4	50	1.9	16.6	77	1.3	17.5
State Average	66	3	10	65	3.7	12	71	1.9	6.9

Note: Percentage may vary due to round off

2.3 Range score in Punjabi

The tables 2.14 and figures 2.1 that follow illustrate the range of achievement of districts. The tables list the scores achieved by students at key percentiles. For example, the score at the 25th percentile is the score which 75% of students achieve or surpass; the score at the 90th percentile is the

students achieve or surpass. The range between the 25th and 75th percentiles (the inter-quartile range) represents the performance of the middle 50% of students.

The inter-quartile range (i.e. the range between the 75th and 25th percentiles) is highly variable. For example, Pathankot has an inter-quartile range of just 27 whilst Amritsar has a corresponding value of 36. These values suggest that the class III population in Pathankot is far more homogeneous than that of Amritsar. In most districts, the range of performance for the middle group was between 27 and 36 points. Performance at the 10th and 90th percentiles respectively shows extremes in low and high achievement. The range between these two points, which includes 90 percent of the population, is highly variable ranging from 43 (Moga) to 65 (Amritsar).

The percentiles provide additional information when comparing language performance amongst districts. For example, when the districts are arranged in order of average score, the differences between adjacent districts tend to be small. However, the range of scores may not be similar. For example, there is no significant difference between the median score of the Amritsar (65) and Bathinda (65). However, the score ranges between the 25th and 75th percentiles are very different: Amritsar's range is 36 compared to Bathinda's range of 30. This indicates that whilst average achievement is very similar in the two areas, Bathinda has a more heterogeneous group of class III students than the Amritsar.

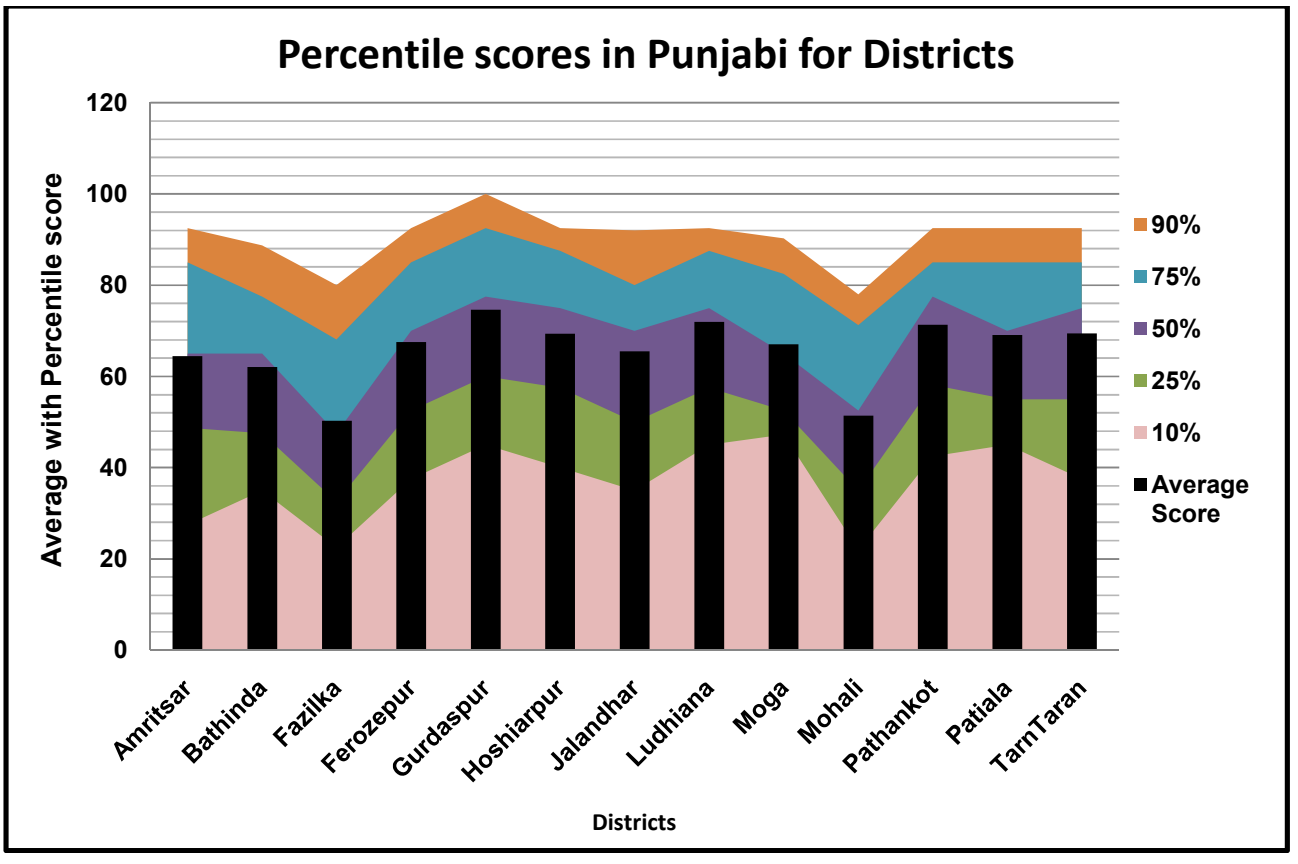
Table 2.14: District wise Percentile score in Punjabi (Through CTT)

Districts	Average Score	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	64	28	49	65	85	93	36	65
Bathinda	62	35	48	65	78	89	30	54
Fazilka	50	23	33	48	68	80	36	58
Ferozepur	67	38	53	70	85	93	33	55
Gurdaspur	75	45	60	78	93	100	33	55

Hoshiarpur	69	40	58	75	88	93	30	53
Jalandhar	65	35	50	70	80	92	30	57
Ludhiana	72	45	58	75	88	93	30	48
Moga	67	47	53	65	83	90	30	43
Mohali	51	22	35	53	71	78	36	56
Pathankot	71	43	58	78	85	93	27	50
Patiala	69	45	55	70	85	93	30	48
TarnTaran	69	38	55	75	85	93	30	55

Note: Percentage may vary due to round off

Figure 2.1: District wise Percentile score in Punjabi (Through CTT)



2.4 Conclusion

The average achievement of students in Punjabi varies greatly across the districts of Punjab. There is a significant difference between outcomes in high scoring districts such as Gurdaspur (75%), Ludhiana (72%) and Pathankot (71%), and low scoring districts such as Fazilka (50%) and Mohali (51%).

Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges. Some Districts such as Patiala (30) and Pathankot (27) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Amritsar (36) and Fazilka (36).

It was detected that average achievement of boys and girls has no significant difference. There is no significant difference between the average score of Bet and Kandi in context to others area. But the average score of other area is significantly above the border area. It shows that the others area's students performance is better than the Border area.

The average score of General class is significantly above than SC and there have significant difference from BC and others. It interprets that on an average general class performed better than SC, BC and others.

The average score of Departments and PRI school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department & PRI schools.

The following chapter provides more information about what class III students at various levels of achievement know and can do in the domain of language Punjabi.

Chapter 3

What students know and can do: Punjabi

3.1 Overview of the Language Tests: Punjabi

In language, class III students were tested with two test booklets, which contained informational reading passage, items related to grammar and curriculum. The passage was used as 'anchor' so that the different test booklets could be linked together and hence all items could be placed on a common scale. The items were designed to test a range of relevant *cognitive processes*. These are classified as Knowledge, Locating information, Understanding and application.

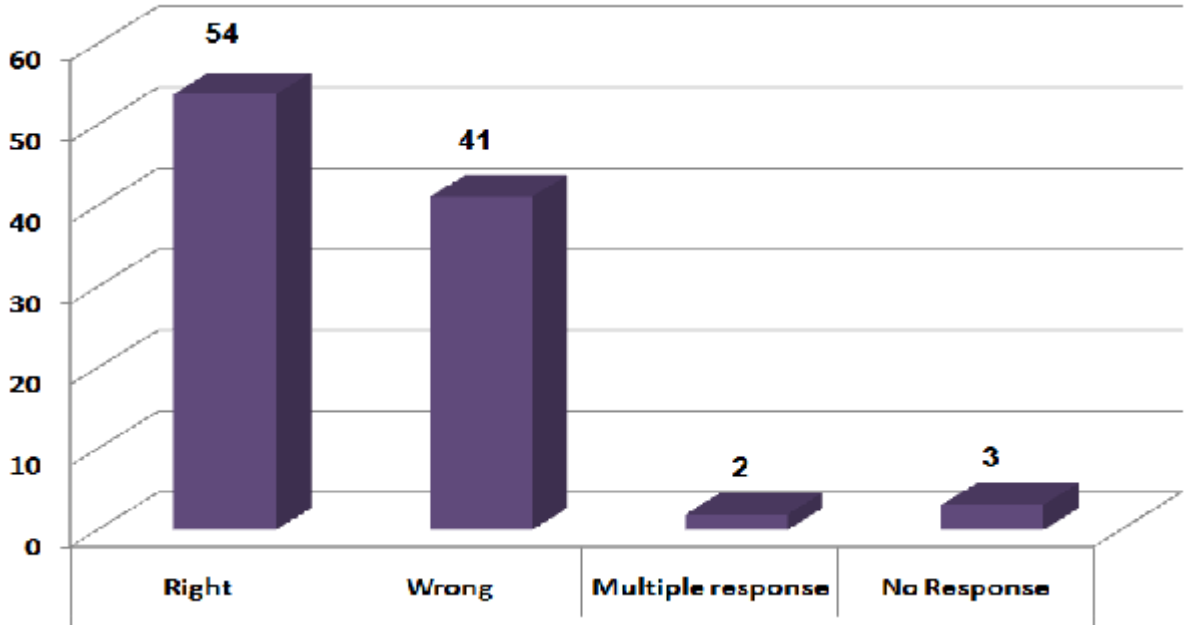
3.2 Sample Item

The items reproduced below were used in one of the tests of language Punjabi. Statistics showing how students responded to these items are given.

Sample Item: Application	**Scale Score: 244**
ਪ੍ਰਸ਼ਨ 9. ਮੈਂ ਬਾਜ਼ਾਰ ਕੇਲੇ ਖਰੀਦਣ ..... ਰਿਹਾ ਹਾਂ ।	
1. ਪਾਉਣ	
2. ਲਈ	
3. ਬੀਜਣ	
4. ਜਾ	

This item requires students to have ability to infer or evaluate content about the cause of an action. The scaled score of this item was 244, i.e., significantly below the average level of difficulty of items in the survey. Around 54% of students in the sample were able to select the correct answer. The figure 3.1 shows how the remaining 46% responded.

Figure 3.1: Percentage of students response



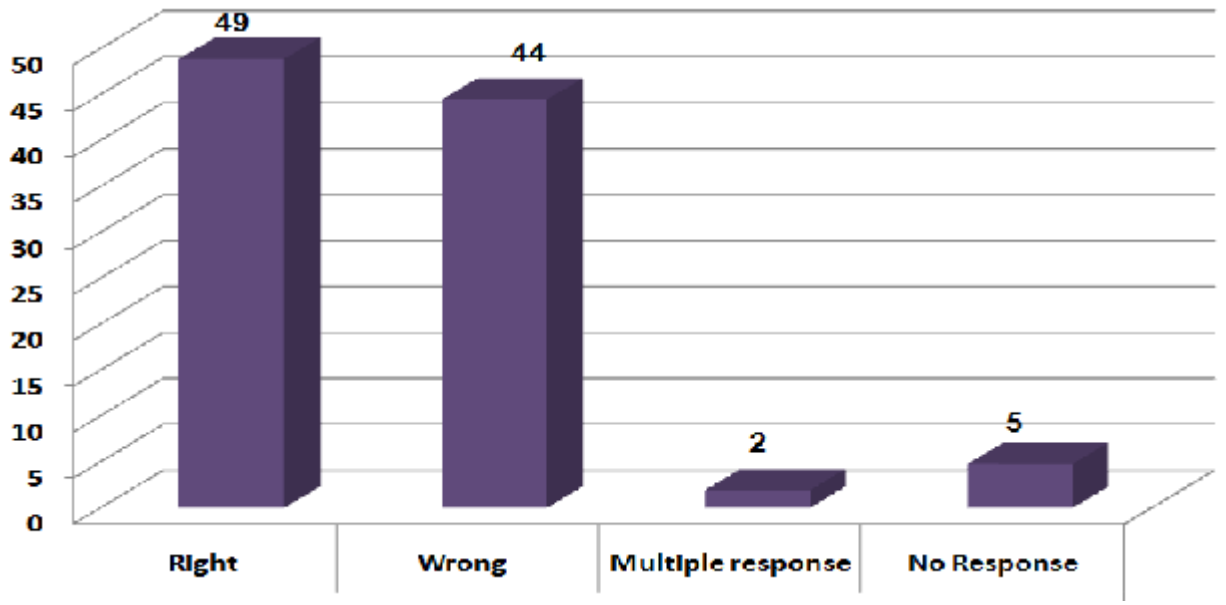
Sample Item: Understanding	**Scale Score: 250**

ਪ੍ਰਸ਼ਨ 16. ਚਰਖਾ ਕੱਤਣ ਵਾਲੀਆਂ ਕੁੜੀਆਂ ਦਾ ਇਕੱਠ:

1. ਤੀਆਂ
2. ਸਾਂਝੀ
3. ਤ੍ਰਿੰਞਣ
4. ਗਿੱਧਾ

This item requires students to have understood the content about the cause of an action. The scaled score of this item was 250, i.e., at significant level of the average level of difficulty of items in the survey. Around 49% of students in the sample were able to select the correct answer. The figure 3.2 shows how the remaining 51% responded.

Figure 3.2: Percentage of students response



Sample Item : Application	Scale Score : 235

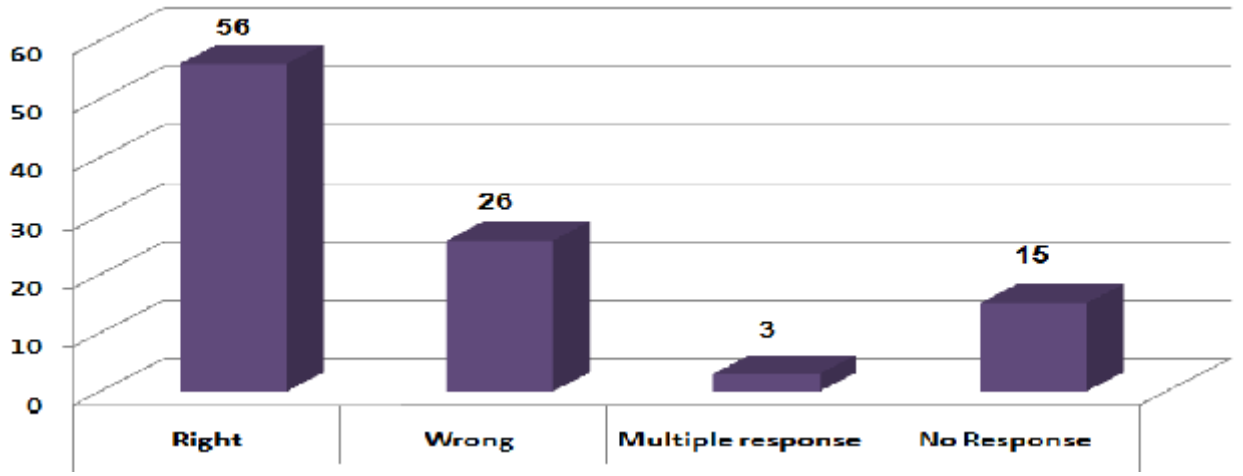
ਹੇਠ ਲਿਖੇ ਵਾਕਾਂ ਨੂੰ ਚਾਰ ਹਿੱਸਿਆਂ ਵਿਚ ਵੰਡਿਆ ਗਿਆ ਹੈ । ਹਰੇਕ ਵਾਕ ਵਿਚ ਇਕ ਹਿੱਸਾ ਗਲਤ ਹੈ, ਉਸ ਤੇ (×) ਦਾ ਨਿਸ਼ਾਨ ਲਗਾਓ:–

ਪ੍ਰਸ਼ਨ 21. ਬੱਚਾ / ਕੋਲ / ਗੇਂਦ / ਹੈ ।

1 2 3 4

This item requires students to have ability to infer or evaluate the content. The scaled score of this item was 235, i.e., significantly below the average level of difficulty of items in the survey. Around 56% of students in the sample were able to select the correct answer. The figure 3.3 shows how the remaining 44% responded.

Figure 3.3: Percentage of students response



Sample Item: Understanding	**Scale Score: 251**

ਦਿੱਤੇ ਗਏ ਸ਼ਬਦ ਦੇ ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ ਤੇ ਸਹੀ (√) ਦਾ ਨਿਸ਼ਾਨ ਲਗਾਓ:–

ਪ੍ਰਸ਼ਨ 27. ਖੁਸ਼ੀ

1. ਗਮੀ
2. ਦੁਖੀ
3. ਉਦਾਸ
4. ਪ੍ਰਸੰਨਤਾ

This item requires students to have grasp the meaning and got the idea about the content. The scaled score of this item was 251, i.e., at significant level of the average level of difficulty of items in the survey. Around 49% of students in the sample were able to select the correct answer. The figure 3.4 shows how the remaining 51% responded.

Figure 3.4: Percentage of students response

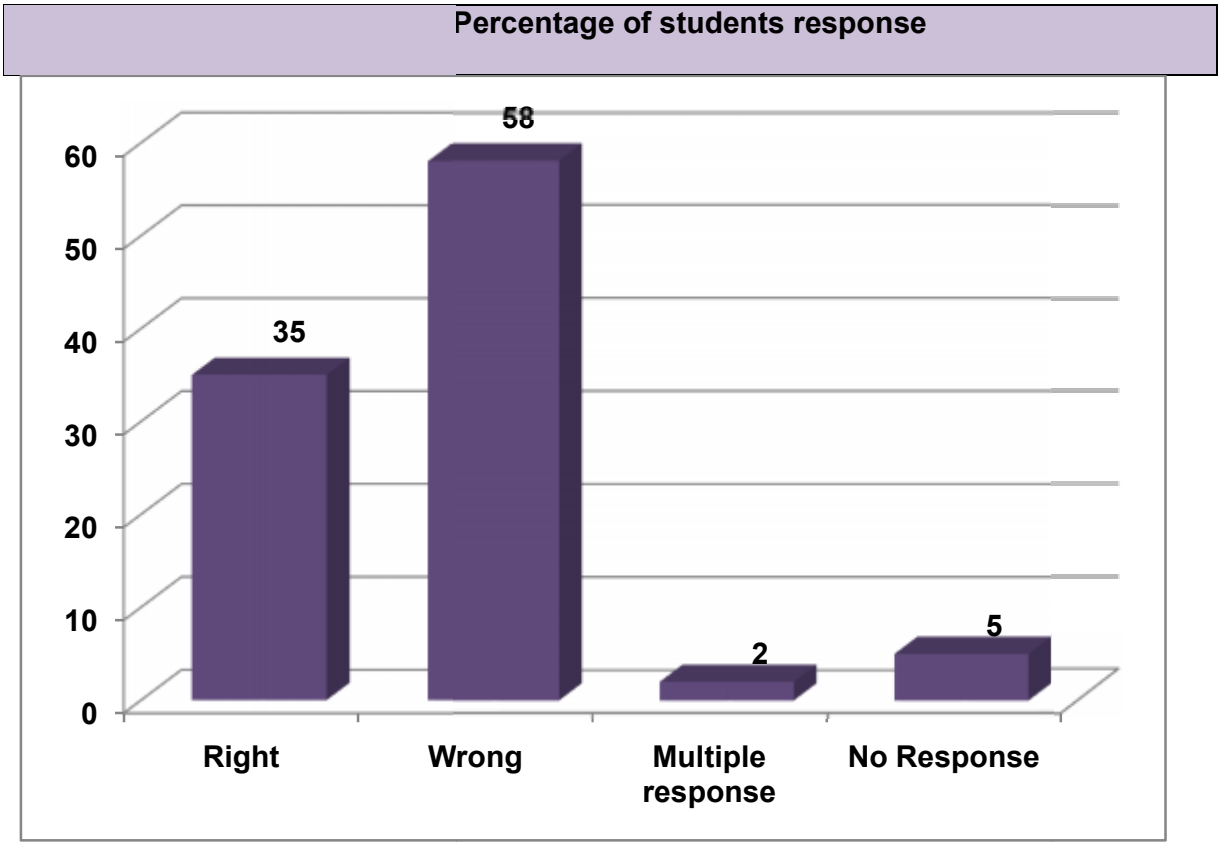
Sample Item :Understanding	Scale Score:280

ਦਿੱਤੇ ਗਏ ਸ਼ਬਦ ਦੇ ਸਮਾਨਾਰਥਕ ਸ਼ਬਦ ਤੇ ਸਹੀ (√) ਦਾ ਨਿਸ਼ਾਨ ਲਗਾਓ:–

ਪ੍ਰਸ਼ਨ 30. ਦਿਨ

1. ਰਾਤ
2. ਤਾਰੇ
3. ਸੂਰਜ
4. ਦਿਵਸ

This item requires students to have grasp the meaning and got the idea about the content. The scaled score of this item was 280 i.e., at significant above the average level of difficulty of items in the survey. Around 35% of students in the sample were able to select the correct answer. The figure 3.5 shows how the remaining 65% responded.



3.3 What can students do in Language: Punjabi

The items were designed to test a range of relevant *cognitive processes*. These are classified as 'Knowledge', Locating information, 'Understanding' and 'Application'. The table given below shows that how the sample students perform in various item related to different cognitive process.

3.3.1. Cognitive processes: Knowledge

Table 3.1 shows the performance class III students on the cognitive process of Knowledge of content.

Table 3.1: Performance class III students on the cognitive process of Knowledge

Item No	Percentage Correct	Scale scores
11	90	138
12	60	229

13	68	211
14	73	199
15	75	194
51	88	148
52	83	167
53	64	216
54	81	171
55	60	227

On an average 74% sample students were able to give right response on the item related to cognitive process of Knowledge.

3.3.2 Cognitive processes: Understanding

Table 3.2 shows the performance class III students on the cognitive process of understanding.

Table 3.2: Performance class III students on the cognitive process of Understanding

Item No	Percentage Correct	Scale scores
16	65	220
17	75	194
18	87	155
19	74	197
20	60	230
26	59	233
27	60	231
28	70	207
29	79	183
30	77	188
56	49	250
57	83	165
58	77	185
59	71	202
60	59	228
66	61	225
67	49	251
68	71	

69	70	204
70	35	280

On an average 66% sample students able to give right response on the item related to cognitive process of understanding.

3.3.3. Cognitive processes: Application

Table 3.3 shows the performance class III students on the cognitive process of application.

Table 3.3: Performance class III students on the cognitive process of Application.

6	74	198
7	80	179
8	81	177
9	54	244
10	77	188
21	68	212
22	64	222
23	66	218
24	72	201
25	64	221
46	72	198
47	77	185
48	65	215
49	71	200
50	83	168
61	56	235
62	69	207
63	70	204
64	63	219
65	56	236

On an average 69% sample students able to give right response on the item related to cognitive process of Application.

3.3.4. Locate information

Table 3.4 shows the performance class III students on the cognitive process of Locate information.

Table 3.4: Performance class III students on the cognitive process of locate information

Item No	% Correct	Scale scores
1	90	139
2	80	180
3	72	203
4	81	175
5	78	187
41	77	187
42	58	231
43	50	248
44	44	261
45	66	212

On an average 69% sample students able to give right response on the item related to cognitive process of Locate information.

Chapter 4
Achievement in Mathematics

This chapter summarises the achievement of class III students in Mathematics in the State Learning Achievement Survey conducted in 2014. Overall achievement for each of the participating districts is reported. In addition, information about differences in achievement by student gender, school location, social category and management is provided. For each district, a sample was drawn which was designed to be representative of the entire target population, i.e., all class III students studying in government, PRI and government-aided/recognized schools.

4.1 Performance of districts in Mathematics

The distribution of student achievement in Mathematics for the 13 participated districts is given in Tables 4.1 and 4.2. Within each Table, districts are listed in alphabetical order. Table 4.1 represent the analysis done through IRT(Item response theory), The table list each district's average score on a scale from 0 to 500. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process.

Table 4.2 represents the analysis done through CTT (Classical test theory); the table lists each district's average in percentage. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process. Finally, the tables indicate whether a district's average score is significantly different from the State's average or not.

Table 4.1: District wise average score in Mathematics(Through IRT)

District	Average Score	SE	Significant difference
Amritsar	240	9.1	No
Bathinda	240	8.4	No
Fazilka	222	15.7	No
Ferozepur	246	6.2	No
Gurdaspur	267	7.9	Above
Hoshiarpur	255	9.6	No

Jalandhar	248	8.6	No
Ludhiana	254	6.1	No
Moga	251	12.7	No
Mohali	210	17.0	Below
Pathankot	267	4.7	Above
Patiala	244	4.9	No
TranTaran	248	5.6	No
State	246	2.7	

The table 4.1 shows that the average score of the sample districts was 246 (with a standard error of 2.7). The results reveal substantial differences in Mathematics achievement between the highest performing districts (267 for Gurdaspur and Pathankot) and the lowest performing districts (210 for Mohali and 222 for the Fazilka). In Mathematics, one district had average score significantly below than that of the group; two districts had average score significantly above than that of the group and ten districts had average scores that were not significantly different from that of the group.

Table 4.2: District wise average score in Mathematics(Through CTT)

Districts	Average Score	Standard error	Significance Difference
Amritsar	67	1.3	NO
Bathinda	68	1.1	NO
Fazilka	60	3.0	BELOW
Ferozepur	71	0.9	NO
Gurdaspur	78	0.9	YES
Hoshiarpur	74	1.0	NO
Jalandhar	71	1.2	NO
Ludhiana	74	1.1	NO
Moga	73	1.9	NO
Mohali	55	3.1	BELOW
Pathankot	78	1.0	YES
Patiala	71	1.0	

TarnTaran	71	1.1	NO
State Average	70	1.8	

Note: Percentage may vary due to round off

Table 4.2 shows the analysis done through CTT (Classical Test Theory). Through CTT, it was found that the state average is 70 % (with a standard error 1.8). The results reveal differences in Mathematics achievement between the highest performing districts (78% for Gurdaspur and Pathankot) and the lowest performing districts (55% for Mohali and 60% for the Fazilka). In Mathematics, two districts had average scores significantly below than that of the group; two districts had average score significantly different than that of the group and nine districts had average scores that were not significantly different from that of the group.

4.2 Performance of various groups

The table below compares the average performances of different groups. Performance is compared by gender, school location, social category and management.

4.2.1 Gender related difference in Mathematics

Table 4.3 compares the average score achieved by boys and girls in Mathematics. It shows that there was no significant difference in average score of boys and girls. The table also represents that 53% boys and 47 % girls were participating in the survey. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process.

Table 4.3: Gender wise average score in Mathematics

Gender	Participation Sample	% Participation	Average score	Standard Error	Significance difference
Boys	1887	53	72	0.5	No
Girls	1701	47	72	0.5	

Note: Percentage may vary due to round off

Table 4.4 shows the average scale score analysed through IRT of boys' is 244(with a standard error 2.5) and girls' 247(with a standard error 3.4).There is no significant difference between boys' and girls' average score.

Table 4.4: District wise average score according to gender in Mathematics (Through IRT)[7]

District	Boy (Average)	SE	Girl (Average)	SE	Significant difference
Amritsar	239	8.5	240	10.1	No
Bathinda	239	7.4	241	10.1	No
Fazilka	223	18.1	220	19.3	No
Ferozepur	250	6.4	241	6.7	No
Gurdaspur	263	8.6	271	8.2	No
Hoshiarpur	249	9.5	261	10.0	No
Jalandhar	246	10.1	250	8.0	No
Ludhiana	256	7.4	252	6.9	No
Moga	245	6.4	257	19.7	No
Mohali	211	12.0	208	24.1	No
Pathankot	264	4.4	271	5.7	No
Patiala	242	4.1	246	7.4	No
TaranTaran	248	6.0	248	5.7	No
State	244	2.5	247	3.4	No

Table 4.5 shows that boys' average score is 72% (with a standard error 1.8) and girls' average score is also 72% (with a standard error 1.9).There is no significant difference between the average score of boys and girls. In mathematics, one district had an average score significantly below than that of the girls score; and one district had an average score that was significantly different from that of the girls score .During analysis it was also found that in district Ferozepur, Ludhiana and Mohali boys average score is higher than girls

[7] The IRT analysis carried out by an outsource consultant.

score, which indicates that boys performed better than girls. But in district Patiala and Trantaran average score of boys and girls is same, which indicates that, the performance of boys and girls is same at a particular scale.

Table 4.5: District wise average score according to gender in Mathematics

Districts	Average Score		Standard error		Significance Difference
	Boy's	Girl's	Boy's	Girl's	
Amritsar	67	68	1.9	1.8	NO
Bathinda	67	69	1.6	1.6	NO
Fazilka	59	61	4.1	4.5	NO
Ferozepur	73	69	1.1	1.4	YES
Gurdaspur	77	80	1.3	1.2	NO
Hoshiarpur	72	76	1.4	1.3	BELOW
Jalandhar	69	73	1.6	1.7	NO
Ludhiana	75	73	1.5	2.2	NO
Moga	72	74	2.9	2.4	NO
Mohali	56	54	4.3	4.4	NO
Pathankot	77	79	1.3	1.5	NO
Patiala	71	71	1.3	1.4	NO
TarnTaran	71	71	1.4	1.4	NO
State Average	72	72	1.8	1.9	NO

Note: Percentage may vary due to round off

4.2.2 Area related difference in Mathematics

Table 4.6 shows the percentage participation and average score of selected areas. From the selected sample 5% Bet, 15% Border, 7% Kandi and 73% others area students participated in the survey. The average score of Bet, Border, Kandi and other area are 73%, 74%,64% and 73% respectively. The average score of border area is significantly below than that of Bet, Kandi and others areas, which shows that the performances of border area students is low. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary.

Table 4.6: Area wise average score in Mathematics

Area	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference			
					Bet	Kandi	Border	Others
Bet	5	73	1.5	20.0	-	No	Yes	No
Kandi	7	74	1.3	21.5	No	-	Yes	No
Border	15	64	0.9	21.8	Below	Below	-	Below
Others	73	73	0.3	18.7	No	No	Above	-

Note: Percentage may vary due to round off

Table 4.7, analysis through IRT shows that, average scale score of Bet, Border, Kandi and Others is 248, 229, 259 and 253 respectively.

Table 4.7: Area wise average score of districts in Mathematics(Through IRT)

District	Bet		Border		Kandi		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	-	-	218	22.8	-	-	247	9.2

Bathinda	-	-	-	-	-	-	240	8.4
Fazilka	-	-	222	15.7	-	-	-	-
Ferozepur	259	21.0	238	8.1	283	0.0	248	12.4
Gurdaspur	249	16.7	252	18.2	-	-	273	10.2
Hoshiarpur	-	-	-		274	37.9	250	7.4
Jalandhar	261	22.1	-	-	-	-	246	8.7
Ludhiana	224	0.0	-	-	-	-	256	7.3
Moga	-	-	-	-	251	12.7	-	-
Mohali	-	-	-	-	210	17.0	-	-
Pathankot	-	-	233	19.5	277	11.8	273	5.9
Patiala	-	-	-	-	-		244	4.9
TaranTaran	-	-	-	-	211	29.5	255	6.0
State	248	8.7	229	8.2	259	9.0	253	2.6

Table 4.8, analysis through CTT shows that, average score of Bet, Border, Kandi and Others is 73%, 64%, 74% and 73% respectively. It shows that performance of Border area's students is lower than Bet, Kandi and other areas. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary. For the selection of area PPS[8] technique was adopted.

Table 4.8: Area wise average score of districts in Mathematics

Districts	Area											
	Kandi			Bet			Border			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	-			-			59	3	25.2	70	1.4	22
Bathinda	-			-			-			68	1.1	20

[8] The detail explanation regarding PPS is mention in the Appendix 1.

Fazilka	-			-			60	3	23.2	-		
Ferozepur	87	1.7	7.6	76	2.2	18	68	1.2	19	71	1.4	20
Gurdaspur	-			72	3	22.5	74	2	16	80	0.9	16.4
Hoshiarpur	79	2.6	23	-			-			73	1	17.4
Jalandhar	-			75	3.2	20.5	-			70	1.2	20
Ludhiana	-			62	3.3	15	-			75	1.1	17.4
Moga	73	1.8	15	-			-			-		
Mohali	55	3.05	23.4	-			-			-		
Pathankot	82	1.8	14	-			64	3.1	23.6	81	1	15.2
Patiala	-			-			-			71	0.9	16.3
TarnTaran	-			-			54	2.9	22.7	74	1.05	18.3
State Average	74	6	12.3	73	3.1	6.3	64	2.9	7.1	73	1.3	4.3

Note: Percentage may vary due to round off

4.2.3 Social class related difference in Mathematics

Table 4.9 describes the analysis of average score according to social class. It shows that the participating sample was 43% from SC, 19% from BC, 36% from General and 2% from others and the average score of SC, BC, General and Others is 69%, 71%, 76% and 70% respectively. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary. The average score of general class is significantly above than SC and there is significant difference from BC and others.

Table 4.9: Social Class wise average score in Mathematics (Through CTT)

Social Group	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference			
					SC	BC	General	Others
SC	43	69	0.5	21.6	-	No	Below	No
BC	19	71	0.8	20.5	Yes	-	Below	No
General	36	76	0.5	16.2	Above	Yes	-	Yes
Others	2	70	2.2	20.2	No	No	No	-

Note: Percentage may vary due to round off

In table 4.10 given below, analysis was carried out through IRT and it shows that, average scale score of SC, BC, General and Others is 240, 244, 255 and 250 respectively.

Table 4.10: Social Class wise average score in Mathematics (Through IRT)

District	SC		BC		General		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	241	14.4	237	10.8	240	4.8	239	92.9
Bathinda	224	7.9	258	12.1	251	11.8	257	0.0
Fazilka	216	14.8	244	14.6	226	0.0	-	-
Ferozepur	243	8.3	245	8.1	253	7.8	232	102.0
Gurdaspur	269	7.4	263	8.0	274	14.3	216	1.6
Hoshiarpur	254	15.2	248	15.9	257	4.0	288	34.7
Jalandhar	236	8.2	240	48.5	273	7.0	267	7.5
Ludhiana	250	10.6	254	9.2	259	6.4	249	4.3
Moga	-	-	-	-	-	-	251	12.7
Mohali	197	52.4	203	10.3	246	3.6	259	0.0

Pathankot	269	7.0	266	8.1	265	5.6	301	0.0
Patiala	248	22.7	228	5.9	251	3.6	186	9.4
TaranTaran	237	6.4	246	23.5	263	5.6	260	0.0
State	240	5.5	244	5.3	255	2.2	250	13.0

Table 4.11, analysis through CTT shows that, performance of general student's is higher than SC, BC and others. Some exceptions found: in Amritsar, Fazilka, Gurdaspur and Pathankot the average performance of SC and General Students is almost the same. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate that how widely individuals in a group vary.

Table 4.11: District wise average score according to Social Class in Mathematics

Districts	Social Class											
	SC			BC			General			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	68	1.7	23.7	67	2.9	24.1	67	2.3	18.5	64	9.1	31.6
Bathinda	62	1.5	18.9	74	3.5	22.2	73	1.6	18.4	75	6.2	10.8
Fazilka	58	3.3	22.9	68	7.6	25.3	58	0	-	-	-	-
Ferozepur	69	1.3	22	71	1.8	15.3	74	1.2	14	59	14	28
Gurdaspur	80	1.4	13.4	78	1.4	17.2	80	1.4	18.4	58	4.9	19.7
Hoshiarpur	73	1.5	20.4	71	2.8	19.2	75	1.3	16.9	84	6.7	15
Jalandhar	66	1.5	20.2	64	4.7	28	81	1.1	10.7	80	3	9.2
Ludhiana	73	1.9	19.2	75	2	12.5	76	1.9	18.1	72	3	15.3
Moga	-	-	-	-	-	-	73	1.8	14.5	-	-	-
Mohali	48	5	22.9	53	4.8	24.9	71	3	7.5	75	3.8	8.6

Pathankot	78	1.6	19.8	77	1.9	18.1	79	1.4	14.9	89	1.2	1.7
Patiala	71	2.4	19.9	65	1.9	16.4	74	1	13.4	48	13	17.6
TarnTaran	67	1.6	22	69	3.4	23.8	77	1.2	14.9	78	7.9	13.7

Note: Percentage may vary due to round off

4.2.4 Managements related difference in Punjabi

Table 4.12 describes the analysis of average score according to Managements[9]. It shows that the participating sample was 35% from Department schools, 19% from PRI and 46 % from Aided or Recognised and the average score of Department schools is 70% , PRI Schools is 68% and Aided or Recognised 76%. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard deviation' is given to indicate the how widely individuals in a group vary. It also shows that the average score of Aided / Recognized school is significantly above than the Department and PRI schools. It interprets that Aided/ Recognized schools performed higher than department schools and PRI.

Table 4.12: Management wise average score in Mathematics (Through CTT)

Managements	Participation (In percentage)	Average (In percentage)	Standard Error	Standard Deviation	Significance Difference		
					Dept.	PRI	Aided
Department	35	70	0.5	21	-	Yes	Below
PRI	19	68	0.8	21.5	No	-	Below
Aided	46	76	0.4	17.1	Above	Above	-

Note: Percentage may vary due to round off

Table 4.13, analysis through CTT shows that, the average score of Department schools is 70%, PRI schools is 68% and Aided/ Recognised is 76%.

[9] The definition regarding managements was mention in the Appendix 1.

In all selected district except Pathankot Aided school perform better than Department schools and In PRI concern except Patiala, all selected districts perform lower than aided schools. But in the case of district Fazilka, Moga and Mohali there have some delimitation. We can't select PRI schools for districts Fazilka, and department & PRI for Moga and Mohali, due to PPS technique.

Table 4.13: District wise average score according to Management in Mathematics

Districts	Managements								
	Department			PRI			Aided		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	64	2.1	25	68	2.7	24.2	72	1.8	18.1
Bathinda	69	1.9	19.4	55	2.4	19.1	72	1.4	18.4
Fazilka	47	2.6	16.5	-	-	-	86	1.4	6.3
Ferozepur	69	1.4	19.6	68	2	23.5	75	1.06	13.4
Gurdaspur	77	1.5	19.2	75	1.9	15.4	80	1.2	16.8
Hoshiarpur	70	1.9	23.2	75	1.9	17.3	77	1.1	14.3
Jalandhar	68	1.8	17.5	63	2.2	16.7	75	1.7	21
Ludhiana	70	1.9	19.3	72	2.3	17.6	79	1.4	14.1
Moga	-	-	-	-	-	-	73	1.8	14.5
Mohali	-	-	-	-	-	-	55	3.05	23.4
Pathankot	82	1.4	17	64	4.09	25.6	78	1.1	14.9
Patiala	64	1.8	18.5	80	1.8	12.7	73	1.1	13.8
TarnTaran	68	1.8	19.7	56	2.5	22	80	1.1	15.1
State Average	68	2.6	8.7	68	2.6	8.2	75	2	7.2

Note: Percentage may vary due to round off

4.3 Range score in Punjabi

The table 4.14 and figure 4.1 illustrates the range of achievement of districts. The tables list the scores achieved by students at key percentiles. For example, the score at the 25th percentile is the score which 75% of students achieve or surpass; the score at the 90th percentile is the score that 10% of students achieve or surpass. The range between the 25th and 75th percentiles (the inter-quartile range) represents the performance of the middle 50% of students.

The inter-quartile range (i.e. the range between the 75th and 25th percentiles) is highly variable. For example, Moga has an inter-quartile range of just 16, whilst Fazilka has a corresponding value of 39. These values suggest that the class III population in Moga is far more homogeneous than that of Fazilka. In most districts, the range of performance for the middle group was between 23 and 30 points. Performance at the 10th and 90th percentiles respectively shows extremes in low and high achievement. The range between these two points, which includes 90 percent of the population, is highly variable ranging from 35 (Moga) to 63(Fazilka).

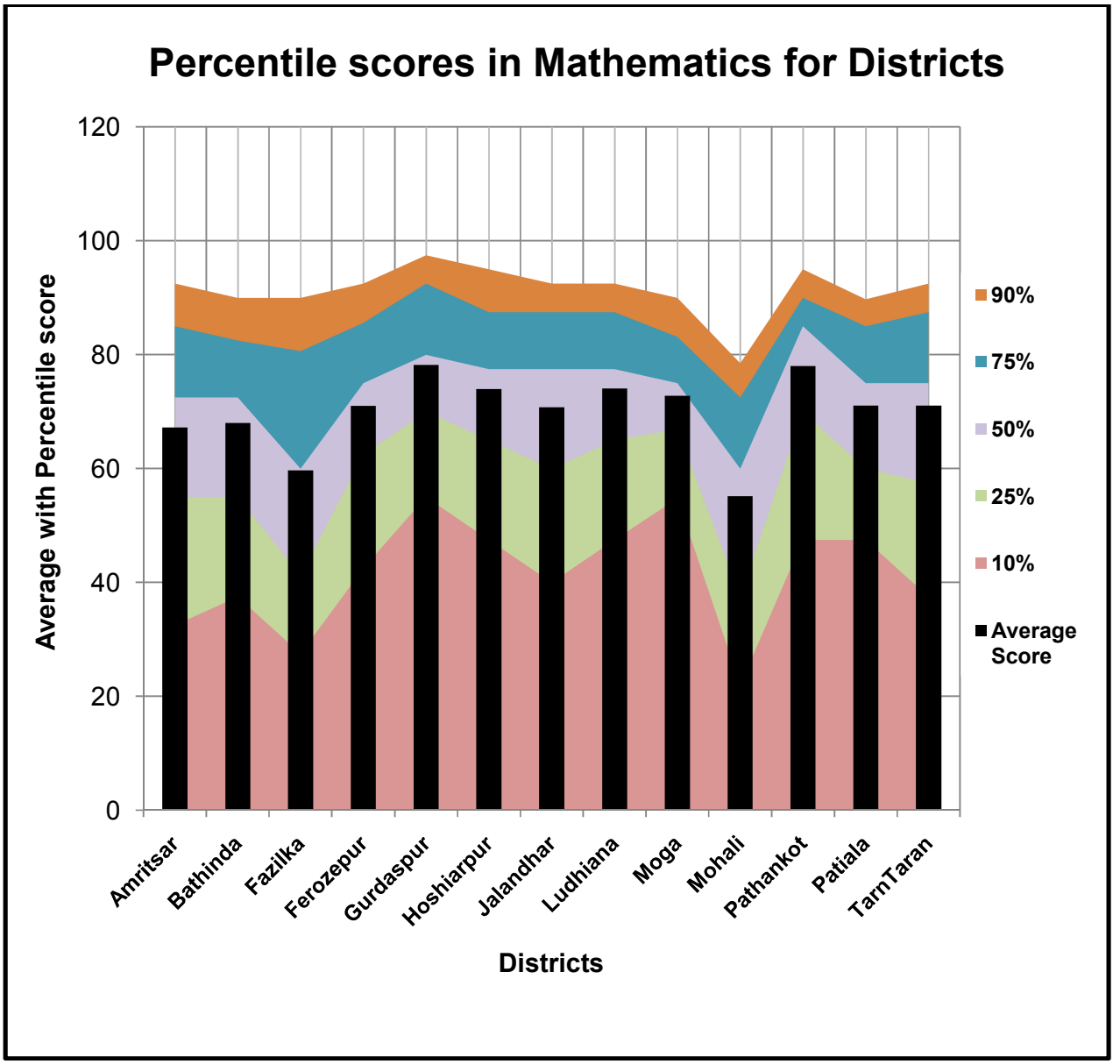
The percentiles provide additional information when comparing Mathematical performance amongst districts. For example, when the districts are arranged in order of average score, the differences between adjacent distiricts tend to be small. However, the range of scores may not be similar. For example, there is no significant difference between the median score of the Patiala (75) and Tarntaran (75). However, the score ranges between the 25th and 75th percentiles are very different: Patiala's range is 25 compared to TarnTaran's range of 30. This indicates that whilst average achievement is very similar in the two areas, Tarntaran has a more heterogeneous group of class III studen

Table 4.14: Percentile scores in Mathematics for Districts

Districts	Average Score	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	67	33	55	73	85	93	30	60
Bathinda	68	38	55	73	83	90	28	53
Fazilka	60	28	41	60	81	90	39	63
Ferozepur	71	43	63	75	86	93	23	50
Gurdaspur	78	55	70	80	93	98	23	43
Hoshiarpur	74	48	65	78	88	95	23	48
Jalandhar	71	40	60	78	88	93	28	53
Ludhiana	74	48	65	78	88	93	23	45
Moga	73	55	67	75	83	90	16	35
Mohali	55	22	38	60	73	79	35	57
Pathankot	78	48	70	85	90	95	20	48
Patiala	71	48	60	75	85	90	25	42
TarnTaran	71	38	58	75	88	93	30	55

Note: Percentage may vary due to round off

Figure 4.1: District wise Percentile scores in Mathematics(Through CTT)



4.4 Conclusion

The average achievement of students in Mathematics varies across the districts of Punjab. There is a highly significant difference between outcomes in high scoring districts such as Gurdaspur (78%) and Pathankot (78%), and low scoring districts such as Fazilka (60%) and Mohali (55%).

Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges. Some districts such as Pathankot(20) and Moga (16) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Mohali (35) and Fazilka (39).It was detected that average achievement of boys and girls has no significant difference. The average score of border area is significantly below than bet, kandi and others areas, which shows that the performances of border area students are low.

The average score of General class is significantly above than SC and there have significant difference from BC and others. It interprets that on an average general class performed better than SC, BC and others. But in the management concern, the average score of Department schools and PRI are significantly below than aided/ recognized schools.

The following chapter provides more information about what class III students at various levels of achievement know and can do in the domain of language Punjabi.

Chapter 5

What students know and can do: Mathematics

5.1 Overview of the Mathematics tests

The Mathematics achievement survey given to class VIII students consisted of two test booklets, each containing 40, four-option multiple choice items. Ten items were common across all test forms. These served as 'anchors' so that the different test booklets could be linked together and hence, all items could be placed on a common scale. In total, the Mathematics assessment instrument comprised 60 unique items.

The items in each text booklet were chosen to cover the following range of mathematical domains from the Mathematics curriculum: the number system, basic operations, measurement, geometry and patterns. In addition to the content domains listed above, items were constructed to test a range of cognitive processes/domain[10] (Classified by Bloom in 1956) or parameters in a variety of contexts. These were classified as Knowledge, Understanding and Application as described below:

Parameters classification for test construction in Mathematics

Knowledge: In items testing this process, students are expected to answer using simple knowledge (recall) or recognition of terms and/or concepts familiar from their lessons.

Comprehension/Understanding: Demonstrate understanding of facts and ideas by organizing, comparing, interpreting, giving descriptions, and stating the main ideas

Application: Using acquired knowledge. Solve problems in new situations by applying acquired knowledge, facts, techniques and rules.

5.2 Sample Item

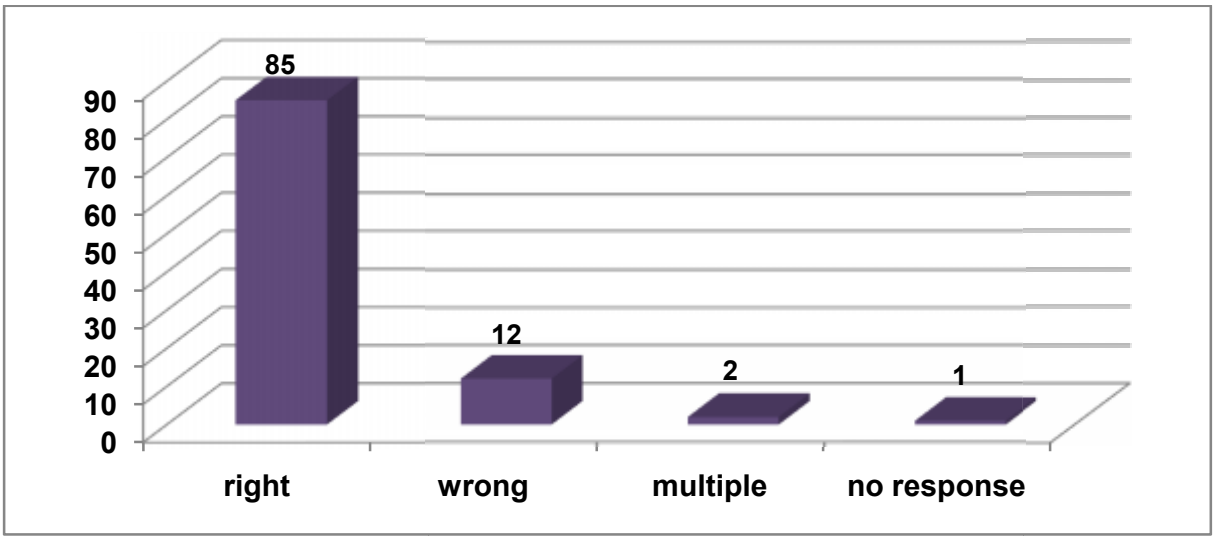
The items reproduced below were used in one of the tests of Mathematics. Statistics showing how students responded to these items are given.

[10] Source regarding cognitive process/Domain :- 1. https://en.wikipedia.org/wiki/Bloon
2. Teaching of Social Science by Dr. Re

	Scale Score:141
hn:	

The scaled score of this item was 141, i.e., significantly below the average level of difficulty of items in the survey. Around 85 % of students in the sample were able to select the correct answer. The figure 5.1 shows how the remaining 15% responded

Figure 5.1: Percentage of responses given by students

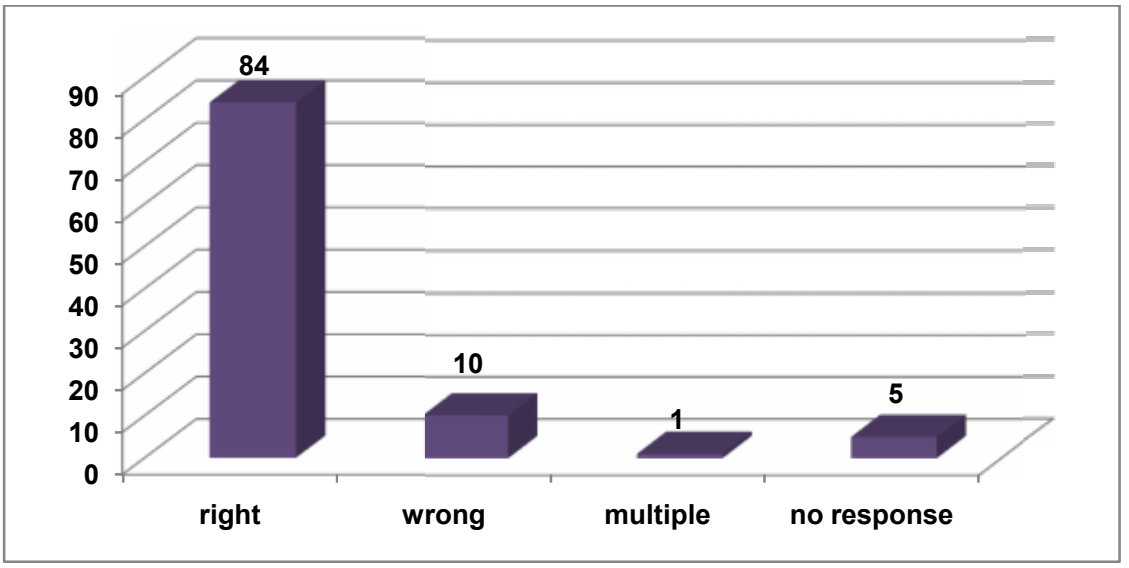


.

Scale Score : 166

The scaled score of this item was 166, i.e., significantly below the average level of difficulty of items in the survey. Around 84 % of students in the sample were able to select the correct answer. The figure 5.2 shows how the remaining 16% responded.

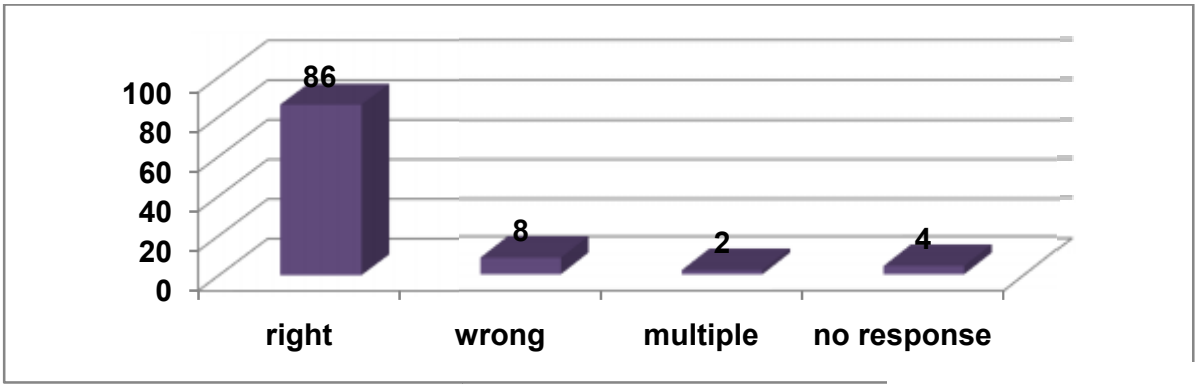
age of responses given by students



Scale Score:154
₹ s r j d Awkwr n dr swaldw h?

The scaled score of this item was 154, i.e., significantly below the average level of difficulty of items in the survey. Around 86 % of students in the sample were able to select the correct answer. The figure 5.3 shows how the remaining 14% responded.

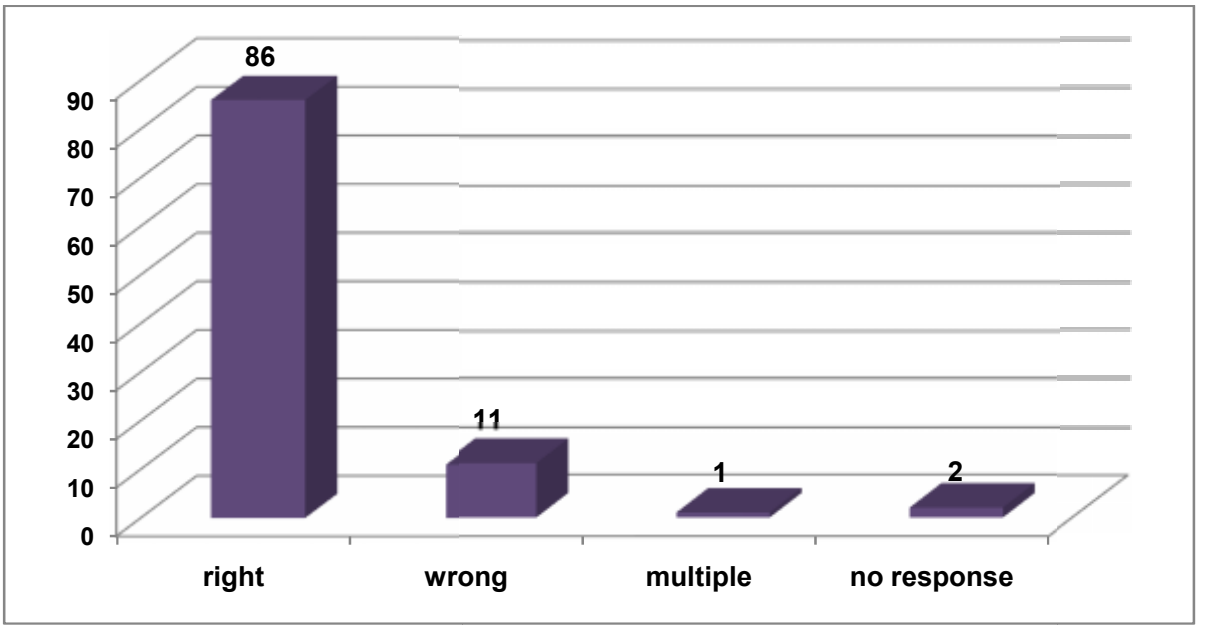
age of responses given by students



Scale Score: 170

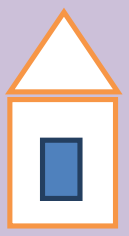
The scaled score of this item was 170, i.e., significantly below the average level of difficulty of items in the survey. Around 86 % of students in the sample were able to select the correct answer. The figure 5.4 shows how the remaining 14% responded.

age of responses given by students



Scale Score:229

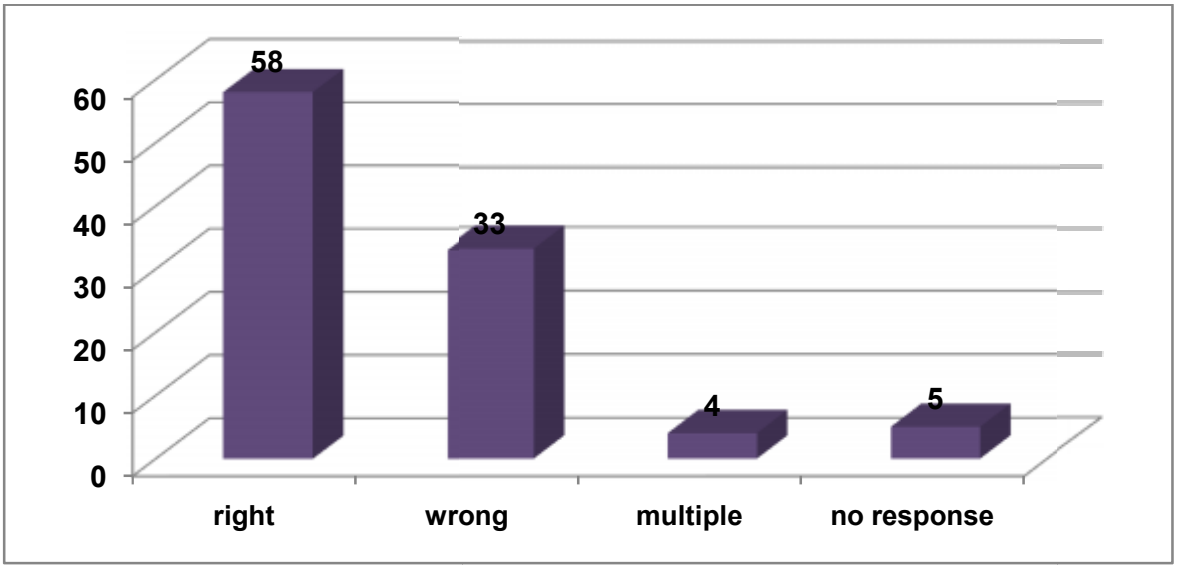
प्रश्न 21. idq icqr ivc JhpVl d drvwz dw Akwr h:



1. ckr
2. vrg
3. iqkx
4. Awieq

The scaled score of this item was 229, i.e., significantly below the average level of difficulty of items in the survey. Around 58 % of students in the sample were able to select the correct answer. The figure 5.5 shows how the remaining 42% responded.

Figure 5.5: Percentage of responses given by students

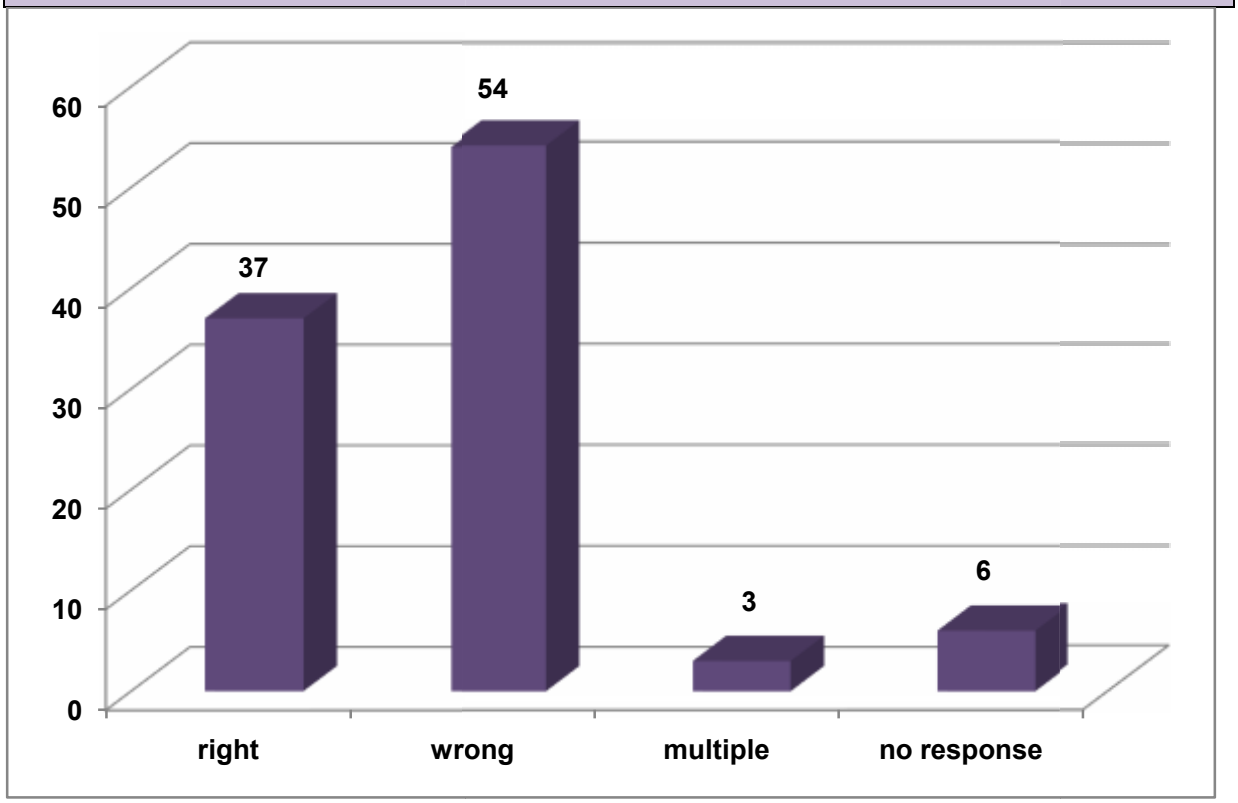


Scale Score: 326

ਸ ਦੀ ਹੁੰਦੀ ਹੈ?

The scaled score of this item was 326, i.e., significantly above the average level of difficulty of items in the survey. Around 37 % of students in the sample were able to select the correct answer. The figure 5.6 shows how the remaining 63% responded.

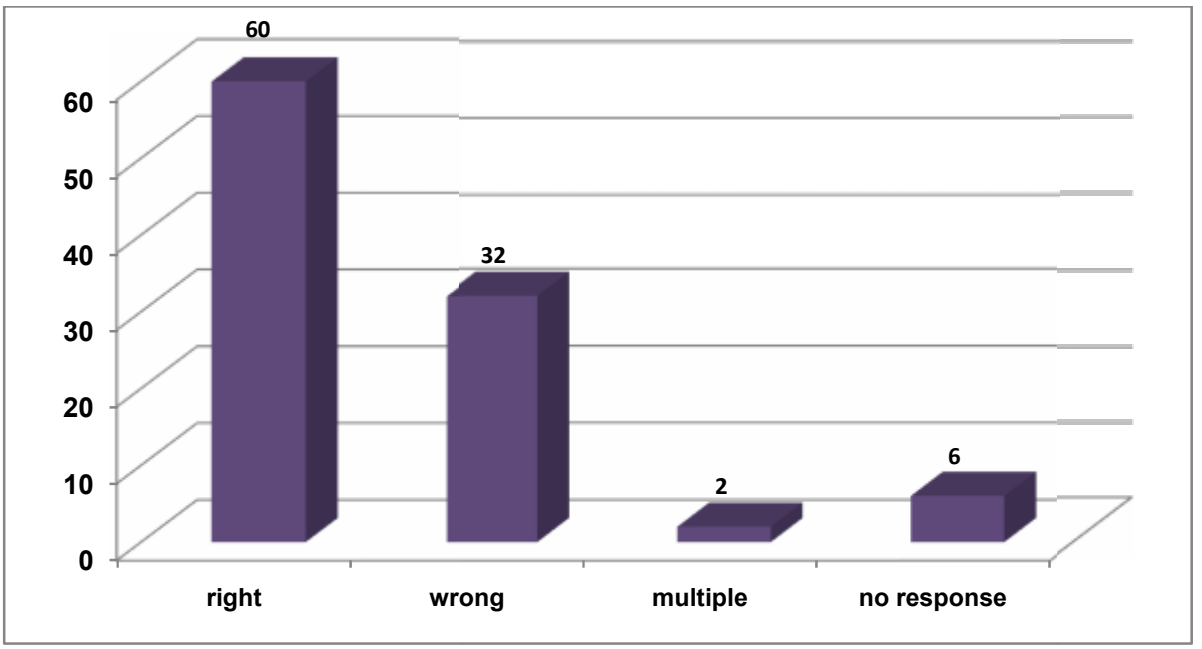
Figure 5.6: Percentage of responses given by students



Scale Score: 226
ਏ ਹੈ ਤਾਂ15 ਪੈਨਾਂ ਦੀ ਕੀਮਤ ਹੈ:

The scaled score of this item was 226, i.e., significantly below the average level of difficulty of items in the survey. Around 60% of students in the sample were able to select the correct answer. The figure 5.7 shows how the remaining 40% responded.

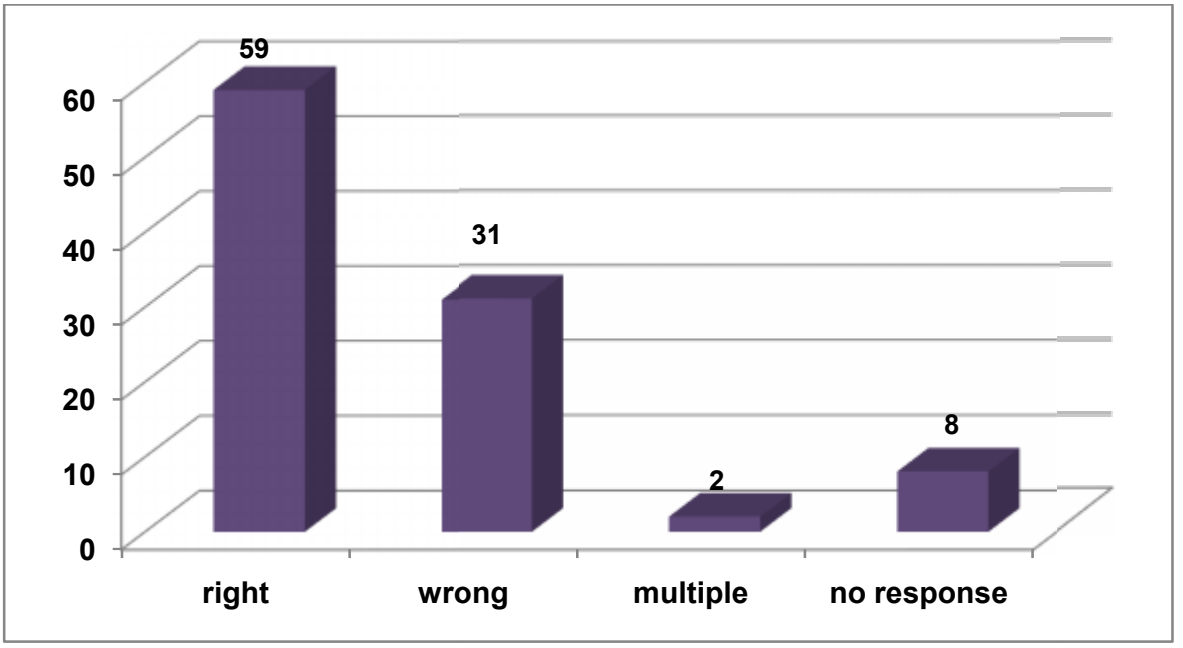
Figure 5.7: Percentage of responses given by students



Scale Score: 227
ਾਨਕ ਮੁੱਲ ਹੈ:

The scaled score of this item was 227, i.e., significantly below the average level of difficulty of items in the survey. Around 59% of students in the sample were able to select the correct answer. The figure 5.8 shows how the remaining 41% responded.

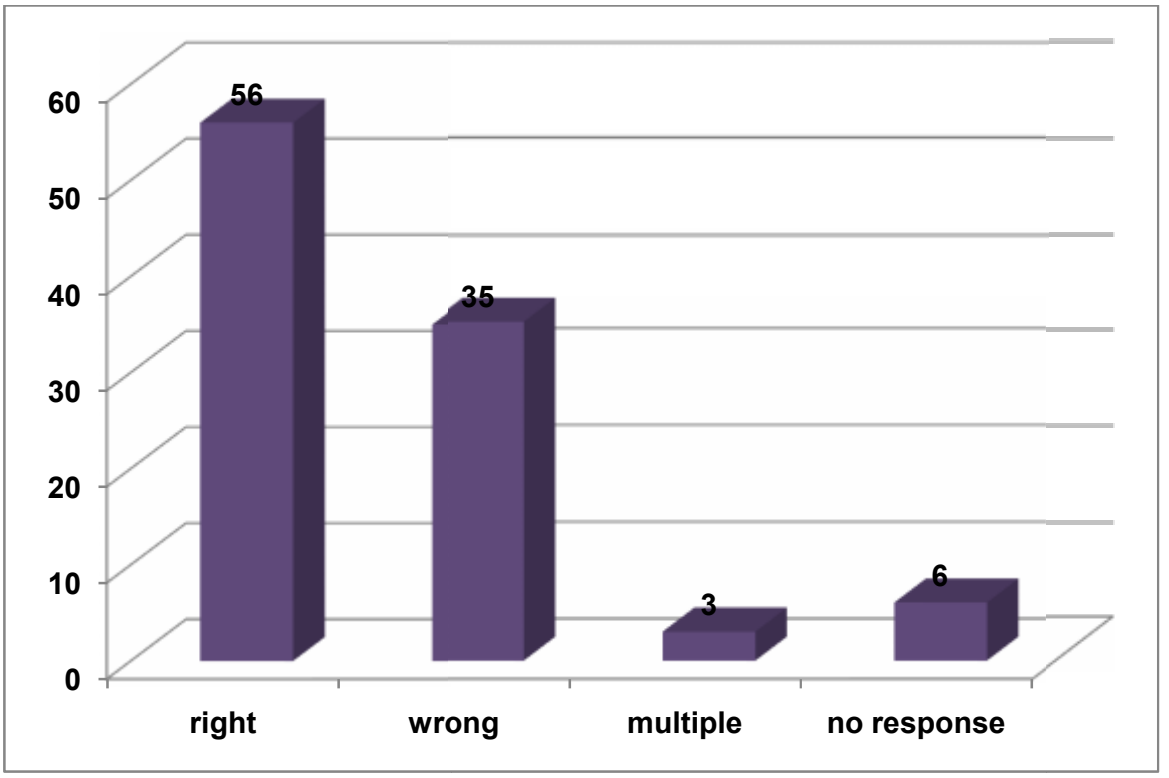
Figure 5.8: Percentage of responses given by students



Scale Score: 235
ਵਿੱਚ ਸਭ ਤੋ ਵੱਡਾ ਹੈ:

The scaled score of this item was 235, i.e., significantly below the average level of difficulty of items in the survey. Around 56% of students in the sample were able to select the correct answer. The figure 5.9 shows how the remaining 44% responded.

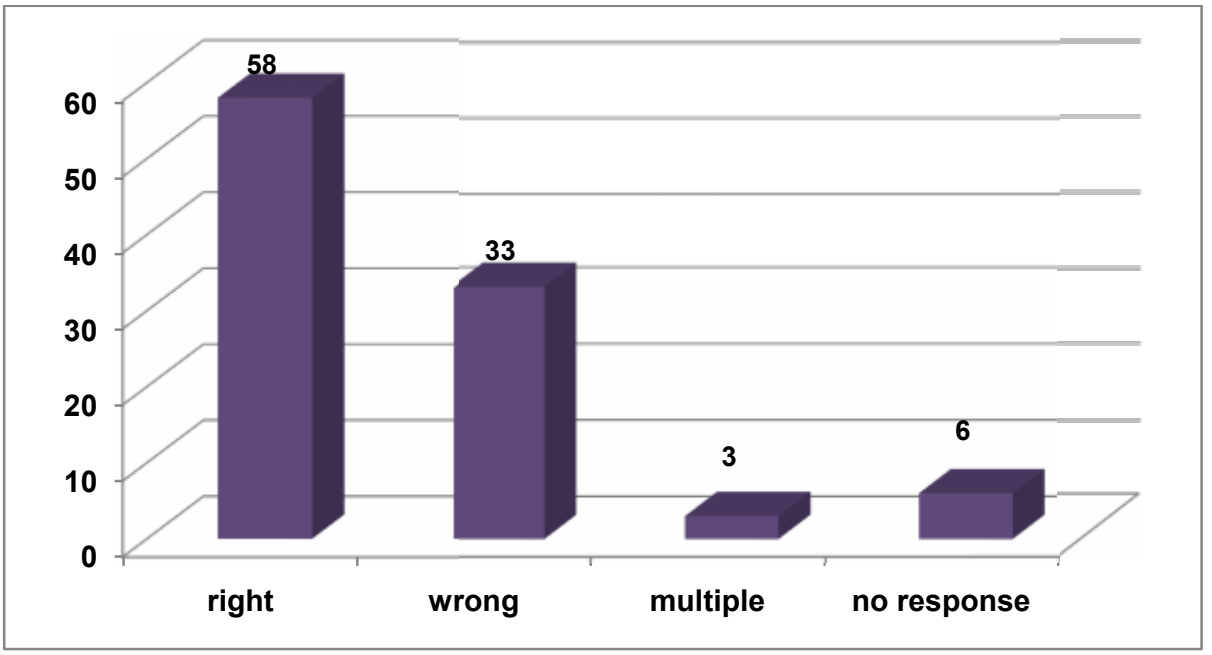
Figure 5.9: Percentage of responses given by students



	Scale Score:233

The scaled score of this item was 233, i.e., significantly below the average level of difficulty of items in the survey. Around 58% of students in the sample were able to select the correct answer. The figure 5.10 shows how the remaining 42% responded.

ntage of responses given by students



Appendix – I

Sample Procedure

This appendix of the class III State Learning Achievement Survey (SLAS) report explains the sampling methods of the survey. It describes the target and sample populations and the sample selection procedures. It sets out the necessary exceptions and their impact on the achieved sample.

Class III (SLAS) Target Population

The class III (SLAS) was designed to investigate learning achievement. But, the target population was all class IV children studying in government, PRI and government-aided/Recognised schools because the survey was administer in the beginning of the session. Sample schools included those managed by the Department of Education, Zila Parishad and Private-but-government-aided schools and recognized by Punjab education department. This follows the classification categories of the District Information System for Education (DISE). *Zila Parishad* (ZPH) is a local government body at the district level in Punjab. It looks after the administration of the rural area of the district and its office is located at the district headquarters. ZPH translates to District Council. These schools are established, supervised and funded by the ZPH district level authorities. ZPH schools provide education for students from grades 1-5. Schools run by the central, state or local governments are referred to as 'government' schools. Schools run by private managements but funded largely by government grant-in-aid are known as private aided or just 'aided' schools.

The survey was administered in 13 districts. Because the area i.e Kandi, Bet, Boarder and others which was defined for the survey was not available in all Districts of Punjab. The definition of Kandi, Bet and Border are as follows:-

1. Kandi Area[11] :- The area lying below the mountains is called Kandi and runs across eastern portions of Hoshiarpur and Balachaur tehsil of Nawanshahr District.

2. Bet Area: - The portion of Doaba that lies in the area between the river tract falling between the Beas and Black Bein is called "Bet". Any area near a river is also called Bet and therefore, there are Bet areas in all area of Punjab which adjoin a river.

3.Border Area: - The area lying near the line of control is known as LOC area. It includes districts Pathankot, Gurdaspur, Amritsar, Tarn Taran, Firozpur, Fazilka.

[11] Information regarding Area like Kandi, Bet, LOC and Border are collected from the ht

Population Exclusions

As is the case in other large-scale educational surveys, some sub-populations were excluded from the total target population at the initial stage of sampling. For logistical reasons, the class III (SLAS) excluded schools with fewer than twenty students depending on the enrolment characteristics of the Districts. In addition to this 'small school exclusion', the survey excluded 'Upper Primary Only' schools due to a classification error.

As a result of these exclusions, population coverage of the class IV (Who have passed class III recently) sample varied from districts to districts.

Sample Design and Selection

In general, developing the sample for each districs involved a three-stage cluster design which used a combination of probability sampling methods, Probability Proportional to Size (PPS) sampling and Simple Random Sampling (SRS). In SRS, all sampling units have an equal probability of being selected. When PPS is applied, larger sampling units have a higher probability of selection than smaller units.

At the first stage of sampling, districts were selected using Purposive and random sample principles. This means that the probability of selecting a particular district depended on the area selected.

At the second stage, in the chosen districts, the requisite number of schools was selected using the PPS principles. The measure of size was based on class IV enrolment data from the District Information System for Education (DISE) 2013-14. The number of schools to be sampled from a district was determined by the total number of students required for testing and the average class size within the state. The number of selected schools for each district varied between districts to districts. One replacement school was assigned for each sample school, with one of each pair being selected and the other being utilised as a reserve, in case it was not possible to collect data from the original. The class III (SLAS) covered two subjects: Language (Punjabi) and Mathematics.

At the third stage, the required number of students in each school was selected using SRS. In schools where class IV had multiple sections, an extra stage of selection was added with one section being sampled at random. The maximum number of students to be tested from a school was set as 20. Once students were selected, they were tested in the assigned subjects of their schools. Two different test forms of each subject were evenly distributed among selected students.

Appendix – II

Scaling the NAS data and estimating sampling variance

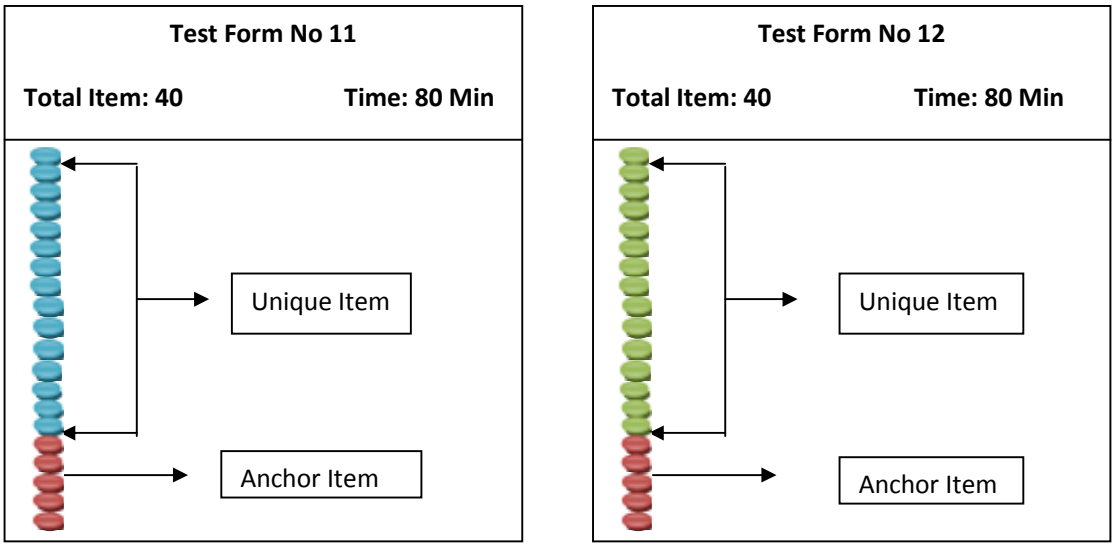
IRT scaling of the NAS data

The aim of the SLAS 2014 survey was to achieve an assessment of a wide coverage of the class III curricula in Mathematics and Language. This meant that a relatively large number of items was required to cover the curriculum adequately. Thus, there were a total of 70 items in Mathematics and Language. Since the number of items in each subject was far too many to present in a single test booklet, a complex matrix-sampling booklet design was adopted with individual students responding to a subset of the items in the assessment and not the entire assessment item pool. This meant that the entire set of items was taken - but not by any single student.

The survey used Item Response Theory (IRT) scaling to describe student achievement on the assessment. This allowed comparable achievement scores to be calculated for each student, even though individuals responded to different parts of the item pool.

A total of four assessment booklets were prepared, two for each subject, covering the entire set of items and linked to each other by a set of 'anchor' items which were included in all two booklets for any subject. An example is given in Figure A-2.1 below. This is for language, but the design is different for Maths.

Figure A-2.1



The IRT scaling approach used here is similar to that used in the international survey Trends in Mathematics and Science Study (TIMSS). This was originally developed in the US by the Educational Testing Service (ETS) for use in the National Assessment of Educational Progress (NAEP) and in the UK by the National Foundation for Educational Research for the Assessment of Performance Unit (Beaton [ed.], 1987; Foxman, Hutchison and Bloomfield, 1993).

Three distinct IRT models, depending on item type and scoring procedure, are most generally used in the analysis of assessment data. These are the one-parameter, two-parameter and three-parameter logistic models. Each is a 'latent variable' model that describes the probability that a student will respond in a specific way to an item in terms of the student's unobserved attainment level and various characteristics of the item. For a description of IRT scaling, see Hambleton and Swaminathan (1985), Thissen & Wainer (2001).

One-parameter logistic model (1-PL model)

The expression for P_{ij} the probability of the i^{th} examinee, ability q*i*, being successful on the j^{th} item, difficulty *bj* is given by

$$P_{ij} = \frac{exp\ (\theta - b_j)}{1 + exp\ (\theta - b_j)}$$

$$= \frac{1}{1 + exp\ [-(\theta - b_j)]}$$

There is only one parameter for each item, namely the difficulty b_j. The one parameter logistic model is mathematically equivalent to the Rasch model (Andrich, 1988).

Two-parameter logistic model (2-PL model)

The expression for P_{ij} the probability of the i^{th} examinee, ability q_i, being successful on the j^{th} item, difficulty b_j is given by (Thissen and Wainer, 2002).

$$P_{ij} = \frac{exp\ [a_j(\theta - b_j)]}{1 + exp[a_j\ (\theta - b_j)]}$$

$$= \frac{1}{1 + exp\ [-a_j\ (\theta - b_j)]}$$

This is comparable to the 1-PL model with the addition of a scaling or slope parameter a_j which varies between items. (This parameter is related to the item's power of discrimination across the ability scale.)

Three-parameter logistic model (3-PL model)

The expression for P_{ij} the probability of the i^{th} examinee, ability q, being successful on the j^{th} item, difficulty b_j is given by (Thissen and Wainer, 2002).

$$P_{ij} = c_j + (1-c_j)\frac{exp\,[a_j(\theta - b_j)]}{1 + exp[a_j(\theta - b_j)]}$$

$$= c_j + (1-c_j)\frac{1}{1 + exp\,[-a_j(\theta - b_j)]}$$

Where a_j is a scaling parameter which varies between items and c_j is the lower asymptote, or 'pseudo-guessing' parameter.

The 2-PL model was used to calibrate the test items. Under assumptions of the 2-PL model, the probability of a response to an item is modeled based on the examinee's ability, the item difficulty, and the item discrimination. While other models are available for calibrating the items, the 2-PL model was chosen over the 1-PL or Rasch Model because upon inspection of the item characteristics, the item discriminations were not seen as comparable across the pool of items (an assumption of the Rasch model). The 2-PL was chosen over the 3-PL model because the 3-PL model has stricter assumptions over the other models and also has higher requirements with regards to sample size and coverage of the ability distribution in order to be able to obtain reliable estimates of all item parameters, in particular, the 'guessing' parameter. This results in unstable and often inestimable parameters for some of the test

items. The 2-PL model offered a widely acceptable compromise between the lesser and more restrictive IRT models available.

Item calibration for the class III (SLAS) 2014 was conducted using the commercially-available BILOG software (Zimowski et al., 1996) through private consultant. All student samples were weighted so that each districts contributed equally to the item calibration.

Omitted and Not-Reached Responses

The matrix-sampling design meant that each student only got the opportunity to see the items in the booklet which they were given. Items which were

booklet taken were treated as 'not presented', i.e., they were ignored in the analysis of the data. However, students could also fail to provide an answer to an item which was in their test booklet and which, in principle, they could have seen. There are various possible reasons for this: they could fail to make an attempt on an item by mistake because they didn't feel it was worth attempting or because they had given up or run out of time before reaching the end of the test. An item was considered 'not reached' when the item itself, all subsequent items and the item immediately preceding it were not answered.

Such 'not reached' items were treated differently in estimating item parameters and student proficiency scores. In estimating the values of the item parameters, items in the assessment booklets that were considered not to have been reached by students were treated as if they had not been administered. Conversely, 'not-reached' items were considered as incorrect responses when student achievement scores were generated.

Item Fit

The fit of the 2-PL model to the items was examined graphically and using a chi-squared fit index. Items identified as problematic were investigated to see if there were any obvious faults and where possible, these were rectified. If it proved impossible to remedy the problems of an item, then that item was dropped from the scoring.

Reliability

Reliability of the test score scales was estimated from the IRT scaling BILOG (Zimowski et al., 1996) runs. For simplicity and familiarity, the marginal reliability coefficient is quoted here, rather than showing test information graphs (Thissen and Wainer, 2001). This is given by

$$\bar{\rho} = \frac{\sigma_\theta^2 - \sigma_e^2}{\sigma_\theta^2}$$

Where s_q^2 is the variance of the test score scale in the sample and s_e^2 is the mean error variance of scores, both available from BILOG output. The values estimated here are 245 for Language and 246 for Mathematics.