State Learning Achievement Survey

Class-VIII

2014-2015

Supported
SSA-REMS FUND

State Council for Educationa
Research And Training
New Building,PSEB,E-Block,6th Floo
Phase-8,Ajitgarh,Punja
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ਰਾਜ ਵਿਦਿਅਕ ਖੋਜ ਅਤੇ ਸਿਖਲਾਈ ਸੰਸਥਾ

STATE COUNCIL FOR EDUCATIONAL RESEARCH AND TRAINING

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ਸਰਵ ਸਿੱਖਿਆ ਅਭਿਆਨ

ਪੜ੍ਹੇ ਸਾਰੇ ਵਧੇ ਸਾਰੇ

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 VIII SLAS, government and government-aided schools having Class IX were included in the sample frame. Class IX 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 3990 students, 133 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. After formation of

subject expert committee training was imparted for the development of testing tools. In order to measure reliably the achievement levels of class VIII students, tests in four subjects, viz. Language, Mathematics, Social Science and Science were developed. The first step was to collect the syllabuses and the text books of Language, Mathematics, Social Science and Science. 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 VIII 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 68 % and average scale value of state is 247.
- There is no significance difference between the average score of boys and girls.
- The significant difference of Bet, Border and Kandi area's average score is below than others area. It shows that the others area's students performance is better than the Bet, Border and Kandi area.
- The average score of General class is significantly above than SC and there have significant difference from BC. But there is no significant difference between the average score of General and others. It interprets that on an average general class performed better than SC and BC.
- The average score of Departments school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department 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 47 % and average scale value of state is 244.
- There is no significance difference between the average score of boys and girls.
- There have a significant difference among the average score of Others from Bet and Kandi, but there have no significance difference between the average score of others and border. On an average It shows that the others area's students performance is better than the Bet, Border and Kandi area.
- The average score of General class is significantly above than SC and there have significant difference from BC. But the average score of General is significantly below than the others. It interprets that on an average general class performed better than SC and BC.
- The average score of Departments school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.
- Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges.

Science

- The state average score is 55 % and average scale value of state is 250.
- There is no significance difference between the average score of boys and girls.
- There is no significant difference between the average score of Bet, Border, Kandi and others area.
- The average score of General class is significantly above than SC and there have significant difference from BC. But there is no significant difference between the average score of General and others. It interprets that on an average general class performed better than SC and BC.
- The average score of Departments school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.
- Districts also vary greatly in the range between their lowest and highest achieving students as revealed by their interquartile score ranges.

Social Science

- The state average score is 56 % and average scale value of state is 247.
- There is no significance difference between the average score of boys and girls.
- The average score of Bet & Border area is significantly below than Kandi & Others.
- 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 all.
- The average score of Departments school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.
- 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 VIII 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 VIII 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 3930 students in 131 schools across 13 Districts of Punjab. The subjects covered were Mathematics, Punjabi, Science and Social Science.

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 and government aided/recognized schools. This is achieved not only by applying standardised test to 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 through which consider educational reform and improvement Can be mode.

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) 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.

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 districts. 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 and 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 state to conduct their ower 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 the class II and III level, assessment was made in two subjects, i.e Mathematics and Language (Punjabi). For class VIII, four subjects was 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 reliably the learning levels of class VIII, these tools are important. The tests need to be pegged at the level that they measure the abilities developed in children across the states. Therefore, before undertaking the test development, it was necessary to know what was taught at class VIII. The first exercise, hence, was to collect the syllabus and the textbooks of Mathematics, Language (Punjabi), Social Science and Science. 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 frameworks were developed to 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 in 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, on the basis of text books and gidelines 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 Punjabi 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 Science

The work was guided by the draft specifications for the Science test prepared by SRG and text books used in schools for Science. The task covered the following activity:

- 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 Science subject:
  - Physics
  - Chemistry
  - Biology

The science 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'

1.2.4 Social Science

The work was guided by the draft specifications for the social Science test prepared by SRG and text books used in schools for social Science. The task covered the following activity:

- 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 social Science subject:
  - History
  - Geography
  - Civics
- The social science 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'

1.2.5 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.

1.2.6 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.

1.2.7 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.

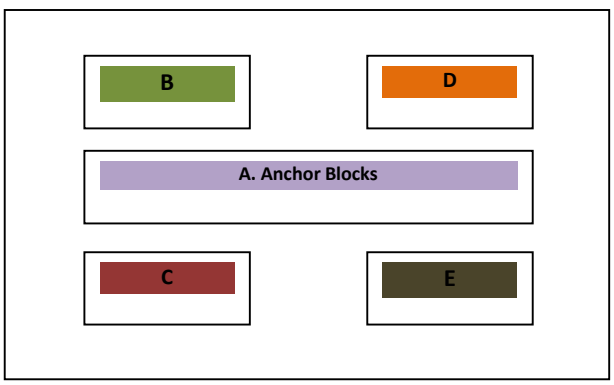
- Field investigators administered the piloting in the selected school. It took two days for the individual to complete the test as there were four subjects to be administered.
- Students responses were transferred to data sheets by the field investigators.
- The SCERT collected the data (Hard Copy)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

1.2.8 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.

1.2.9 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), Mathematics, Science and Social Science was as under.



In all the four subjects, the following domains were identified:

Language (Punjabi)	Mathematics	Science	Social Science
Listening	Arithmetic	Physics	History
Speaking	Algebra	Chemistry	Geography
Reading	Geometry	Biology	Civics

In each domain, there were a 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 VIII (SLAS), each test form for Language (Punjabi),Mathematics, Science and Social Science consisted of 40 multiple choice items. Thus, total 70 items were used in each subject to measure learning achievement. Answer keys were also developed for each test form.

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.

1.2.10 Questionnaires

Questionnaires for class VIII (SLAS) were developed 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 VIII (SLAS) was designed to investigate learning achievement in the Kandi, Bet, Border and other area at the District level. Hence, the targeted population for the survey was all class VIII children studying in government schools and government-aided schools/recognized schools.

In general, the three-stage cluster design for sampling which logist of 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 area 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 VIII 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 VIII 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, Bathinda, Fatehgarh, Faridkot, Kapurthala, Mansa, Moga, Muktsar and S.B.S. Nagar could not participate in this endeavor because of area classification. Among the 13 participating districts, we could not test class VIII students because of beginning of academic year. Therefore, it was decided to test class IX children (Target Group Class VIII).

Exclusions of sub-population from the total target population of SLAS class IX was 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 30 students were excluded. As a result of these exclusions, population coverage of the class IX sample varies from district to district.

1.5 Characteristics of Participating Districts

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, Firozepur each have population of more than 20, 00,000 whilst Roop Nagar, Mohali have fewer than 10, 00,000 inhabitants. Firozepur has a population density of just 382 people per square kilometer whilst the corresponding figure for Ludhiana is over 978.

Particulary important in this survey are the significant differences in the provision of education at the class VIII level. For example, the target population for this survey was all class IX students enrolled in government-run, government-aided and recognised schools. However, the proportion of class IX 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.

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	Firozepur	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	Roopnagar	6,84,627	915	82.19%	505	23692
9	Tarn taran	1,119,627	900	67.81 %	464	10564

[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.

10	Sangrur	16,55,169	885	67.99	457	16231
11	Mohali	994,628	879	83.80 %	909	12765
12	Fazilka[3]					9273
13	Pathankot					4930

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 districts designates 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 on how 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 response from test booklet to separate response sheet. These response sheets are collected by the district coordinators and passed on to the districts MIS coordinator after checking their number, coding of schools, and whether they have been properly filled by the investigators. These response were transferred from response sheets to E-from by district MIS coordinators and sent to state coordinator. Without the help, dedication, competence and experience of the Districts coordinators and their teams for which they should be 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.

[3] Districts Fazilka and Pathankot were not formed during the census 2011 so the information from column 3 to 6 it not available.

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 entered. 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 carried out 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 for this and future surveys 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 statistical connection 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 over all & district wise achievement in Language of class VIII students is presented. 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 VIII students know and can do in Language (Reading Comprehension and Language elements).

Chapter 4 (Achievement in Language: Mathematics): In chapters 4 over all & district wise achievement in Mathematics of class VIII students is presented. 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 VIII students know and can do in Mathematics.

Chapter 6 (Achievement in Language: Science): In chapter 6 achievement in Science of class VIII students is presented. Their achievement in Science 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 7 (What students know and can do: Science): Chapter 7 describe what class VIII students know and can do in Science.

Chapter 8 (Achievement in Language: Social Science): In chapter 8 over all & district wise achievement in Social Science of class VIII students is presented. In addition,

information about differences in achievement by students' gender, school location and social category is also provided.

Chapter 9 (What students know and can do: Social Science): Chapter 9 describe what class VIII students know and can do in Social Science.

Besides the above stated chapters, the report contains a number of appendices providing more information about sample design and procedures, scaling the SLAS data and estimating list of surveyed districts, schools, teachers and students, list of districts coordinators etc.

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 VIII 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, reading and writing skills):

The Language tests used in the SLAS included three categories of items ?. e reading comprehension, '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, social category and is provided.

2.1 Performance of districts in Punjabi

Tables 2.1 and 2.2 shows the distribution of student's achievement for the 13 participated districts. Within each Table, districts are listed in alphabetical order. Table 2.1 represent 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	Standard Error	Significant difference
Amritsar	255	13.6	No
Fazilka	269	12.7	Above
Ferozepur	243	6.5	No
Gurdaspur	262	3.9	Above
Hoshiarpur	247	16.5	No
Jalandhar	245	9.8	No
Ludhiana	238	4.0	No
Mohali	232	8.1	Below
Pathankot	228	15.0	Below
Patiala	268	3.4	Above
Roopnagar	249	8.8	No
Sangrur	243	38.1	No
TarnTaran	231	1.9	Below
State	**247**	**3.9**	

The state's average score is 247 (with a standard error of 0.6). The results reveal substantial differences in achievement of language between the highest performing district (269 for Fazilka) and the lowest performing district (228 for Pathankot).Three district's average score is significantly lower than state, whose as there are only Three districts

whose avg. score is significantly lower than state; and seven districts had average scores that were not significantly different from that of the state.

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

Districts	Average Score (In Percentage)	Standard Error	Significance Difference
Amritsar	71	0.7	No
Fazilka	75	1.5	Above
Ferozepur	67	1.1	No
Gurdaspur	73	0.6	Yes
Hoshiarpur	68	2.2	No
Jalandhar	68	0.7	No
Ludhiana	65	0.7	No
Mohali	64	1.6	Below
Pathankot	62	1.4	Below
Patiala	74	0.7	Above
Roopnagar	69	1.1	No
Sangrur	67	0.7	No
Tarn Taran	64	1.2	Below
State Average	**68**	**1.1**	

Note: Percentage may vary due to round off

The average score is 68% (with a standard error of 1.1). The results reveal substantial differences in achievement of language between the highest performing district (75% for Fazilka) and the lowest performing district (62% for Pathankot).Three districts had average scores significantly lower than that of the state; Three districts had average scores significantly below from state; and Seven 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 performance of different groups. Performance is compared by gender, school location, social category and management.

2.2.1 Gender related performance Punjabi

Table 2.3 compares the average score achieved by boys and girls in Punjabi. It shows that there has no significant difference in average score of boys and girls. The table shows that 54% boys and 46 % 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, and 'standard deviation' is given to indicate the how widely individuals in a group vary.

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

Gender	Percentage Participation	Average Score	SE	SD	Significance Difference
Boys	54	68	0.3	16.6	NO
Girls	46	70	0.3	15.5	

Note: Percentage may be 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 two districts were detected: Fazilka and Ferozepur, 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	254	13.6	256	13.3	No
Fazilka	256	11.6	295	12.3	Boys' Below
Ferozepur	237	0.0	248	3.3	Boys' Below
Gurdaspur	260	6.2	265	15.4	No
Hoshiarpur	244	14.6	251	18.6	No
Jalandhar	239	6.1	255	33.6	No
Ludhiana	237	44.8	238	14.1	No
Mohali	232	8.5	234	7.5	No
Pathankot	237	10.6	221	17.9	No
Patiala	263	9.9	275	9.2	No
Roop Nagar	243	7.8	255	19.3	No
Sangrur	237	39.2	250	34.9	No
TranTaran	228	3.1	239	9.5	No
State	**244**	**5.2**	**252**	**5.1**	**No**

Table 2.5, analysis through CTT shows that, there is no significant difference between the average score of boys and girls. In six districts: Fazilka, Ferozepur, Patiala, Roopnagar, Sangrur and TarnTaran, boy's score is below than that of girl's. But in Pathankot, there performance is significantly high 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	70	71	1.1	1	No
Fazilka	72	83	1.8	1.8	Below
Ferozepur	65	69	1.8	1.4	Below
Gurdaspur	72	73	0.9	1	No
Hoshiarpur	67	69	3	3.3	No
Jalandhar	66	71	0.9	1	No
Ludhiana	65	65	1	1	No
Mohali	63	65	1.9	2.9	No
Pathankot	65	60	2	1.9	Yes
Patiala	73	77	1	0.9	Below
Roopnagar	67	71	1.7	1.4	Below
Sangrur	65	69	1	1	Below
Tarn Taran	62	66	1.5	2.2	Below
State Average	**67**	**70**	**0.9**	**1.6**	**No**

Note: Percentage may be vary due to round off

2.2.2 Area related difference in Punjabi

Table 2.6 describes the analysis of average score according to area[4] selected. It is shows that the participating sample was 5% from Bet, 15% from Border 8% from Kandi and 72% from Others area and the average score of Bet , Border, Kandi and Others is 66%,67%,68% 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. Table 2.6 also shows that there is no significant difference between the average score of Bet, Border and Kandi area. But in context to Others area the whole scenario is via versa. The significant difference of Bet, Border and Kandi area's average score is below than Others area. It shows that the Others area's students performance is better than the Bet, Border and Kandi area.

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

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					Bet	Border	Kandi	Other
Bet	5	66	1.1	14.3	-	No	No	Below
Border	15	67	0.7	16.2	No	-	No	Below
Kandi	8	68	0.8	13.7	No	No	-	Below
Others	72	70	0.3	16.4	Yes	Yes	Yes	-

Note: Percentage may be vary due to round off

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

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	-	-	-	-	-	-	255	13.6
Fazilka	-	-	269	12.7	-	-	-	-
Ferozepur	242	0.0	240	13.2	248	7.6	-	-
Gurdaspur	236	0.0	254	13.1	-	-	274	0.0
Hoshiarpur	-	-	-	-	247	16.5	-	-
Jalandhar	232	0.0	-	-	-	-	246	8.9
Ludhiana	-	-	-	-	-	-	238	4.0
Mohali	-	-	-	-	232	8.1	-	-
Pathankot	-	-	218	38.5	247	9.9	-	-
Patiala	-	-	-	-	-	-	268	3.3
Roop Nagar	251	1.9	-	-	247	15.4	-	-
Sangrur	-	-	-	-	-	-	243	38.0
TaranTaran	-	-	231	1.9	-	-	-	-
State	**240**	**0.5**	**243**	**8.9**	**244**	**5.4**	**254**	**7.0**

Table 2.8, analysis through CTT shows that, average score of Bet, Border, Kandi and Others is 66%, 67%, 68% and 70% respectively. It shows that performance of Others area's students is higher than Bet, Border and Kandi area. For each score, the 'standard error' is given to indicate that 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[5] technique was adopted.

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

Districts	Area											
	Bet			Border			Kandi			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	-	-	-	-	-	-	-	-	-	71	0.7	15.1
Fazilka	-	-	-	75	1.5	12.3	-	-	-	-	-	-
Ferozepur	66	4.5	19.2	66	1.6	16.1	69	1.6	12.4	-	-	-

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

Gurdaspur	65	2	15.4	70	1.1	16.9	-	-	-	76	0.8	14.9
Hoshiarpur	-	-	-	-	-	-	68	2.2	17.3	-	-	-
Jalandhar	64	2.3	12.9	-	-	-	-	-	-	70	0.7	15.4
Ludhiana	-	-	-	-	-	-	-	-	-	65	0.7	16.8
Mohali	-	-	-	-	-	-	64	1.6	12.5	-	-	-
Pathankot	-	-	-	58	1.9	16.7	69	1.7	11.3	-	-	-
Patiala	-	-	-	-	-	-	-	-	-	74	0.7	15.9
Roopnagar	70	1.4	11.2	-	-	-	69	1.7	13.2	-	-	-
Sangrur	-	-	-	-	-	-	-	-	-	67	0.7	16.7
Tarn Taran	-	-	-	64	1.2	11.6	-	-	-	-	-	-
State Average	**66**	**1.3**	**2.6**	**67**	**2.8**	**6.3**	**68**	**0.9**	**2.1**	**70**	**1.6**	**4.1**

Note: Percentage may be vary due to round off

2.2.3 Social class related difference in Punjabi

Table 2.9 describes the analysis of average score according Social class. It shows that the participating sample was 35% from SC, 19% from BC, 43% from General and 3% from Others and the average score of SC, BC, General and Others is 66%, 68%, 72% and 74% 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 BC SC. But there is no significant difference between the average score of General and others. It interprets that on an average general class performed better than SC and BC.

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

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					SC	BC	GEN	Other
SC	35	66	0.4	15.7	-	No	Below	Below
BC	19	68	0.5	15.4	Yes	-	Below	Below
GEN	43	72	0.4	16.1	Above	Yes	-	No
Others	3	74	1.5	16.7	Yes	Yes	No	-

Note: Percentage may be vary due to round off

Table 2.10, analysis through IRT and it shows that, average scale score of SC, BC, General and Others is 238, 241, 257 and 263 respectively.

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

District	SC		BC		GEN		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	235	17.2	259	6.2	272	4.8	272	0.0
Fazilka	259	8.8	276	17.1	280	12.2	-	-
Ferozepur	231	6.8	237	11.2	260	6.6	-	-
Gurdaspur	240	41.7	255	39.8	273	37.0	315	0.0
Hoshiarpur	245	14.6	223	9.7	274	12.8	-	-
Jalandhar	246	4.2	225	47.6	255	11.6	-	-
Ludhiana	234	20.8	233	8.6	239	14.0	250	0.0
Mohali	227	11.6	247	5.0	223	4.5	282	0.0
Pathankot	226	30.0	202	56.3	239	6.0	246	0.0
Patiala	250	22.0	261	20.8	283	10.8	256	0.0
Roop Nagar	251	7.3	241	19.8	251	5.0	282	0.0
Sangrur	228	0.0	248	31.1	248	33.5	210	0.0
TranTaran	222	4.1	228	5.4	246	9.7	256	0.0
State	**238**	**5.1**	**241**	**7.5**	**257**	**4.5**	**263**	**0.0**

Table 2.11, analysis through CTT shows that, average score of SC, BC, General and Others is 66%, 68%, 72% and 74% respectively. It 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. An exception: the average score of SC and General was same in districts Roopnagar, was detected.

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

Districts	Social Class											
	SC			BC			GEN			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	64	1.2	15.2	72	1.6	14	76	1	13.2	77	3.5	10.6
Fazilka	73	1.9	11.2	77	3.8	13.9	78	2.7	12.7	-	-	-
Ferozepur	63	1.7	15.2	65	2.6	15.4	73	1.6	13.7	-	-	-
Gurdaspur	66	1.3	15.8	71	1.2	14.7	76	0.9	15.9	88	1.9	9.9
Hoshiarpur	68	3	15.3	60	4.5	18.9	76	3.6	15.3	-	-	-
Jalandhar	68	0.9	15.4	61	1.8	15.7	71	1.2	13.4	-	-	-
Ludhiana	64	1.2	15.8	64	2	15.4	65	1.1	18.3	70	1.5	8.6
Mohali	62	3.2	14	69	2.2	9.5	60	2.5	12	80	0.0	-
Pathankot	61	2.2	16	53	4.7	18.4	66	1.9	13.6	70	0.0	-
Patiala	69	1.4	16.8	72	1.5	14.5	79	0.9	13.9	72	3.5	20
Roopnagar	70	1.7	12.5	67	3	14.5	70	1.6	10.5	80	0.0	-
Sangrur	62	1.7	17.2	69	1.3	14.8	68	1	16.8	56	4.6	17.5
Tarn Taran	60	1.9	12.2	63	3.4	13	69	1.5	8.1	76	7.5	10.6
State Average	**66**	**1**	**3.9**	**68**	**1.7**	**6.3**	**72**	**1.5**	**5.6**	**74**	**2.9**	**8.9**

Note: Percentage may be vary due to round off

2.2.4 Managements related difference in Punjabi

Table 2.12 describes the analysis of average score according to Managements[6]. It shows that the participating sample was 47% from Department schools and 53% from Aided or recognised and the average score of Department schools is 66% and Aided or recognised 72%. 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 school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.

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

Management	Percentage Participation	Average Score	SE	SD	Significance Difference
Department	47	66	0.3	15.3	Below
Aided/Recognised	53	72	0.3	16.3	

Note: Percentage may be vary due to round off

table 2.13, analysis through CTT shows that, the average score of Department schools is 66% and Aided/Recognised is 72%. In six districts: Amritsar, Fazilka, Ferozepur, Gurdaspur, Pathankot and Patiala the average score of department schools are significantly below than Aided/Recognised schools. But in Jalandhar there is significance difference between the average score of Department and Aided/Recognised schools. It interprets that Jalandhar districts department schools perform higher than Aided/Recognised schools. In districts Ludhiana, Sangrur and Trantaran there is no significance difference between the average score of Department and Aided/Recognised schools.But in the case of district Hoshiarpur, Roopnagar and Mohali there is some delimitation. We can't select Aided or recognised schools for districts Hoshiarpur, Roopnagar and department for Mohali, due to PPS technique.

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

Table 2.13: District wise average score according to Management in Punjabi (Through CTT)

Districts	Management						Significance Difference
	Department			Aided/Recognised			
	Avg	SE	SD	Avg	SE	SD	
Amritsar	60	1	14	80	0.6	8.9	Below
Fazilka	71	1.6	11.2	85	2.1	9.4	Below
Ferozepur	63	1.3	15	76	1.6	12.1	Below
Gurdaspur	67	0.9	15.8	77	0.8	15.2	Below
Hoshiarpur	68	2.2	17.3	-	-	-	-
Jalandhar	71	0.8	11.3	65	1	17	Yes
Ludhiana	63	1.2	15.9	66	0.9	17.3	No
Mohali	-	-	-	64	1.6	12.5	-
Pathankot	60	1.6	16.3	72	1.7	8.9	Below
Patiala	69	1.1	16.1	79	0.8	14.5	Below
Roopnagar	69	1.1	12.2	-	-	-	-
Sangrur	66	1.2	16.7	67	0.9	16.6	No
Tarn Taran	64	1.8	13.2	62	1.5	8.3	No
State Average	**66**	**1.1**	**3.8**	**72**	**2.3**	**7.7**	**Below**

Note: Percentage may vary due to round off

2.3 Range score in Punjabi

The tables 2.14 and figure 2.1 that follows 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, Roopnagar has an inter-quartile range of just 13 whilst Ludhiana has a corresponding value of 25. These values suggest that the class VIII population in

Roopnagar is far more homogeneous than that of Ludhiana. In most districts, the range of performance for the middle group was between 10 and 25 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 25 (TarnTaran) to 48 (Ludhiana).

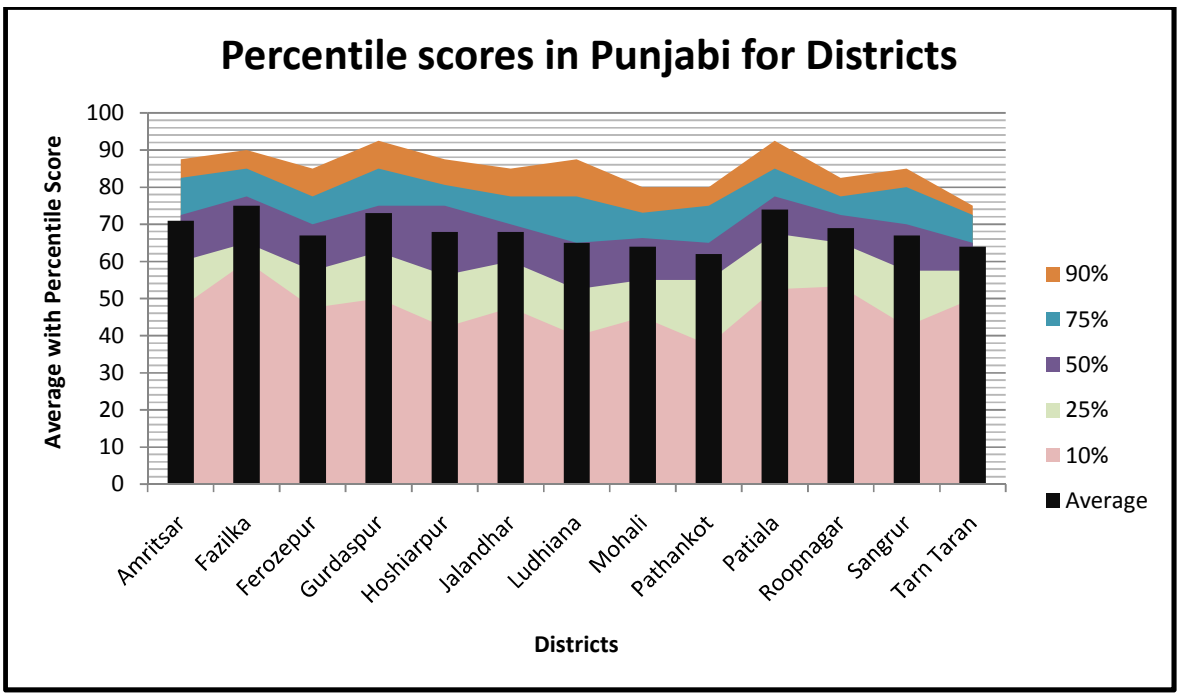
The percentiles provide additional information when comparing language performance amongst districts. For example, when the districts are arranged in order of average score, the differences between adjacent distiricts tend to be small. However, the range of scores may not be similar. For example, there is no significant difference between the median score of the Amritsar (73) and Roopnagar (73). However, the score ranges between the 25th and 75th percentiles are very different: Amritsar's range is 23 compared with Roopnagar's range of 13. This indicates that whilst average achievement is very similar in the two areas, Amritsar has a more heterogeneous group of class VIII students than the Roopnagar.

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

Districts	Average	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	71	48	60	73	83	88	23	40
Fazilka	75	60	65	78	85	90	20	30
Ferozepur	67	48	58	70	78	85	20	38
Gurdaspur	73	50	63	75	85	93	23	43
Hoshiarpur	68	42	56	75	81	88	24	45
Jalandhar	68	48	60	70	78	85	18	38
Ludhiana	65	40	53	65	78	88	25	48
Mohali	64	45	55	66	73	80	18	35
Pathankot	62	38	55	65	75	80	20	43
Patiala	74	53	68	78	85	93	18	40
Roopnagar	69	53	65	73	78	83	13	29
Sangrur	67	43	58	70	80	85	23	43
Tarn Taran	64	50	58	65	73	75	15	25

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 highly significant difference between outcomes in high scoring districts such as Fazilka (75%), Patiala (74%) and Gurdaspur (73%), and low scoring districts such as Pathankot (62%), TranTaran and Mohali (64%).

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 (13) and Tran Taran (15) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Ludhiana (25) and Hoshiarpur (24).

It was detected that there have no significance difference between the average score of boys and girls. Similarly, the average score of bet, border and kandi area is significantly below than others area.

The average score of General class is significantly above than SC and there have significant difference from BC. But there is no significant difference between the average score of General and others.But in the management concern the average score of department schools are significantly below than aided/ recognized schools.

The following chapter provides more information about what class VIII 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 VIII 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 'Retentivity (Knowledge of content)', Locating information, 'grasp ideas and interpret (Understanding of Content)' and 'infer and evaluate (application)'.

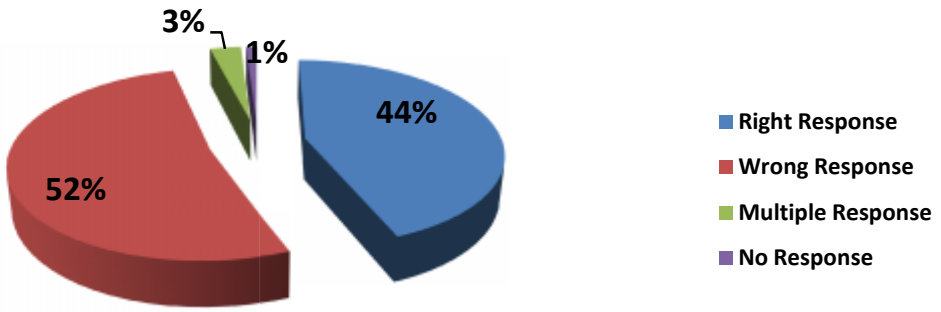
3.2 Sample Item

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 : Retentivity (Knowledge of content)	**Scale Score: 265**
ਖਾਲੀ ਥਾਂ ਭਰਨ ਲਈ ਸਹੀ ਸ਼ਬਦ ਉੱਪਰ ਸਹੀ ਦਾ √ ਨਿਸ਼ਾਨ ਲਗਾਓ । ਪ੍ਰਸ਼ਨ 13. ਇਕ ਸੱਜਣ ਫ਼ਰੀਦ ਜੀ ਕੋਲ ..... ਲੈ ਕੇ ਆਇਆ। 1. ਸੂਈ 2. ਕੈਂਚੀ 3. ਧਾਗਾ 4. ਲੋਟਾ	

This item requires students to have knowledge of content about the cause of an action. The scaled score of this item was 265, i.e., significantly above the average level of difficulty of items in the survey. Around 44% of students in the sample were able to select the correct answer. The figure 3.1 shows how the remaining 56% responded.

Figure 3.1: Percentage of Students Response



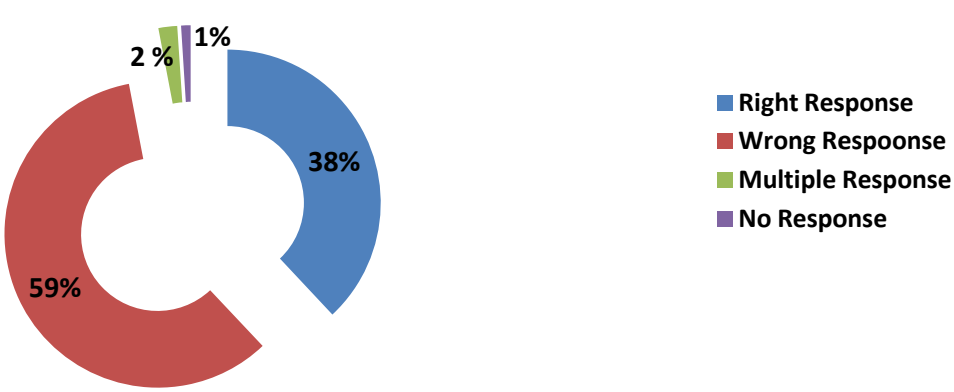
ıterpret (Understanding of Content)	**Scale Score: 283**

ਪ੍ਰਸ਼ਨ 20. ਮੇਲੇ ਵਿਚ ਦੁਕਾਨਾਂ ਲਾਉਣ ਲਈ:-

1. ਥਾਂ ਪਹਿਲਾਂ ਰੋਕੀ ਜਾਂਦੀ ।
2. ਥਾਂ ਖਰੀਦ ਲਈ ਜਾਂਦੀ ।
3. ਮਹੀਨਾ ਪਹਿਲਾਂ ਥਾਂ ਮੱਲ ਲਈ ਜਾਂਦੀ ਸੀ ।
4. ਮਹੀਨਾ ਪਹਿਲਾਂ ਤੰਬੂ ਗੱਡ ਲਏ ਜਾਂਦੇ ।

This item requires students to Interpret and grasp idea about the cause of an action. The scaled score of this item was 283, i.e., significantly above the average level of difficulty of items in the survey. Around 38 % of students in the sample were able to select the correct answer. The figure 3.2 shows how the remaining 62% responded.

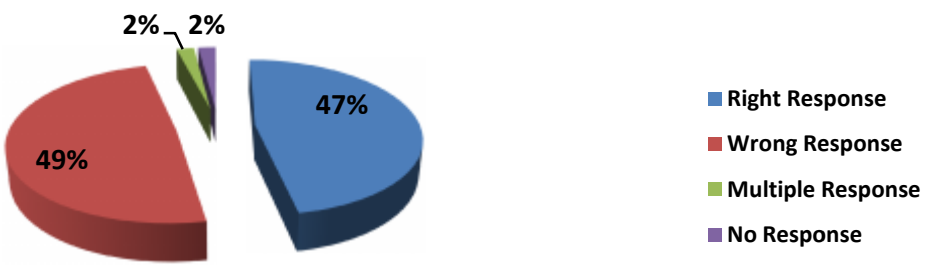
Figure 3.2: Percentage of Students Response



Sample Item :grasps ideas and interpret (Understanding of Content) **Scale Score: 257**
ਪ੍ਰਸ਼ਨ 24. ਸੱਖਣਾ ਦਾ ਅਰਥ ਹੈ:- 1. ਭਰਿਆ 2. ਖਾਲੀ 3. ਊਣਾ 4. ਦੇਰ

This item requires students to Interpret and grasp idea about the cause of an action. The scaled score of this item was 257, i.e., significantly above the average level of difficulty of items in the survey. Around 47% of students in the sample were able to select the correct answer. The figure 3.3 shows how the remaining 53% responded.

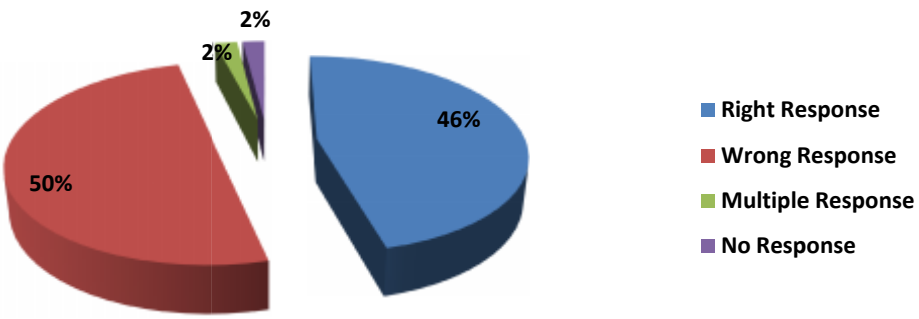
Figure 3.3: Percentage of Students Response



et (Understanding of Content) **Scale Score: 260**
ਕਹੜੀ ਕਿਸਮ ਹੈ ?

This item requires students to Interpret and grasp idea about the cause of an action. The scaled score of this item was 260, i.e., significantly above the average level of difficulty of items in the survey. Around 46 % of students in the sample were able to select the correct answer. The figure 3.4 shows how the remaining 54% responded.

Figure 3.4 : Percentage of Students Response

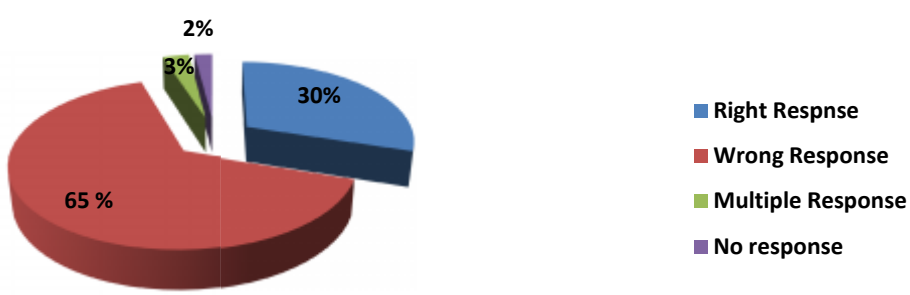


erpret (Understanding of Content) **Scale Score: 304**

ਾ ਸ਼ਬਦ ਦੇ ਅਰਥ ਉੱਤੇ √ ਦਾ ਨਿਸ਼ਾਨ ਲਗਾਓ ।

This item requires students to Interpret and grasp idea about the cause of an action. The scaled score of this item was 304, i.e., significantly above the average level of difficulty of items in the survey. Around 30 % of students in the sample were able to select the correct answer. The figure 3.5 shows how the remaining 70% responded.

Figure 3.5: Percentage of Students Response



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 'Retentivity (Knowledge of content)', Locating information, 'grasp ideas and interpret (Understanding of Content)' and 'infer and evaluate (application)'.The table given below shows that how the sample students perform in various itenm related to different cognitive process.

3.3.1 Grasp ideas and interpret (Understanding of Content)

Table 3.1 shows the performance of class VIII students on the cognitive process of grasp ideas and interpret.

Table 3.1: Performance class VIII students on the cognitive process of grasp ideas and interpret

Item No	Percentage Correct	Scale scores
14	62.1	217
15	72.5	185
18	89.2	112
20	37.8	283
21	52.2	244
22	78.0	166
23	55.9	234
24	47.4	257
25	61.2	219
28	50.7	248
29	52.4	244
33	46.3	260
37	67.6	201
44	84.8	138
49	77.8	168
51	60.6	222
52	67.0	204
53	30.9	304

54	33.4	296
55	51.7	246
58	57.6	230
59	77.4	169
60	42.3	271
61	60.5	222

On an average 59% sample students able to give right response on the cognitive process of grasp ideas and interpret.

3.3.2. Infer and evaluate (application)

Table 3.2 shows the performance class VIII students on the cognitive process of Infer and evaluate.

Table 3.2: Performance class VIII students on the cognitive process of infer and eveluate

Item ID	Percentage Correct	Scale scores
12	82.2	148
26	84.8	136
27	72.2	186
30	71.3	189
31	72.0	187
32	59.4	224
34	61.2	219
35	50.4	249
36	50.6	248
38	56.7	232
39	58.7	226
40	80.3	157
42	75.6	176
45	49.3	253
50	50.6	249
56	63.4	214
57	74.0	181
62	78.5	165
63	78.1	167
64	66.8	204
65	60.7	222

66	43.4	269
67	54.6	239
68	65.6	208
69	48.2	256
70	71.0	191

On an average 65% sample were students able to give right response on the cognitive process of infer and evaluate.

3.3.3. Locate information

Table 3.3 shows the performance class VIII students on the cognitive process of Locate information.

Table 3.3: Performance class VIII students on the cognitive process of locate information

Item No	Percentage Correct	Scale scores
1	95.5	55
2	92.6	87
3	87.3	124
4	88.7	115
5	89.0	113
6	81.5	152
7	85.1	135
8	84.9	137
9	82.6	147
10	87.3	124

On an average 87% sample were students able to give right response on the cognitive process of Locate information.

3.3.4. Retentivity (Knowledge of content)

Table 3.4 shows the performance class VIII students on the cognitive process of retentivity (Knowledge of content).

Table 3.4: Performance class VIII students on the cognitive process of retentivity

Item No	Percentage Correct	Scale scores
11	55.6	235
13	44.4	265
16	76.7	171
17	63.6	213
19	92.2	89
41	64.8	210
43	62.6	216
46	69.9	195
47	80.8	156
48	61.9	219

On an average, 67% sample were students able to give right response on the cognitive process of retentivity (Knowledge of content).

Chapter 4
Achievement in Mathematics

This chapter summarises the achievement of class VIII 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 districts, a sample was drawn which was designed to be representative of the entire target population, i.e., all class VIII students studying in government and government-aided/recognized schools.

4.1 Performance of districts in Mathematics

The distribution of student achievement in Mathematics for the 13 participating 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 2.2 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 district's average or not.

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

District	Average Score	Standard Error	Significant difference
Amritsar	246	12.5	No
Fazilka	254	20.5	No
Ferozepur	225	11.7	No
Gurdaspur	264	11.2	No
Hoshiarpur	243	14.5	No
Jalandhar	234	5.8	No
Ludhiana	257	8.0	No
Mohali	233	7.9	No
Pathankot	262	20.4	No
Patiala	255	7.8	No

Roop Nagar	239	24.7	No
Sangrur	259	10.0	No
TaranTaran	207	16.5	Below
State Average	**244**	**4**	

The average score of the sample districts was 244 (with a standard error of 4). The results reveal substantial differences in Mathematics achievement between the highest performing districts (264 for Gurdaspur and 262 for Pathankot) and the lowest performing districts (207 for TranTaran and 225 for the Ferozepur). In Mathematics, one districts had average scores significantly below that of the group; and twelve 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	47	0.9	No
Fazilka	51	2.8	No
Ferozepur	40	1.2	Below
Gurdaspur	55	0.9	Yes
Hoshiarpur	47	1.5	No
Jalandhar	43	0.7	No
Ludhiana	52	0.8	Yes
Mohali	43	1.7	No
Pathankot	55	1.5	Yes
Patiala	51	0.8	No
Roopnagar	46	1.8	No
Sangrur	52	0.9	Yes
Tarn Taran	33	1.4	Below
State Average	**47**	**1.7**	**-**

Note: Percentage may vary due to round off

Table 4.2 shows the analysis done through CTT (Classical Test Theory). Through it was fourd that the state average is 47% (with a standard error 1.7). The results reveal substantial differences in Mathematics achievement between the highest performing districts (55% for Gurdaspur and 55% for Pathankot) and the lowest performing districts (207 for TranTaran and 225 for the Ferozepur).In Mathematics, four districts had average scores that were not significantly different from that of the group, two districts had average scores significantly below that of the group; and seven 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 has no significant difference in average score of boys and girls. The table also represent that 54% boys and 46 % 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, and 'standard deviation' is given to indicate the how widely individuals in a group vary.

Table 4.3: Gender wise average score in Mathematics

Gender	Percentage Participation	Average Score	SE	SD	Significance Difference
Boys	54	48	0.4	19.4	No
Girls	46	51	0.4	19.3	

Note: Percentage may vary due to round off

Table 4.4 shows the average scale score analysed through IRT. The Average scale score of boys' is 241(with a standard error 4.3) and girls' 249(with a standard error 4.2).There have 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)	Standard Error	Girl (Average)	Standard Error	Significant difference
Amritsar	240	12.7	251	14.8	No
Fazilka	256	17.5	249	25.9	No
Ferozepur	216	11.2	232	12.4	No
Gurdaspur	263	11.4	266	12.4	No
Hoshiarpur	239	14.9	247	14.4	No
Jalandhar	229	6.7	241	4.3	No
Ludhiana	256	11.1	258	9.8	No
Mohali	226	7.2	246	12.2	No
Pathankot	261	23.1	263	17.9	No
Patiala	253	8.9	257	7.3	No

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

Roop Nagar	246	32.2	233	23.5	No
Sangrur	250	8.6	271	13.0	No
TaranTaran	201	17.0	219	14.4	No
State	**241**	**4.3**	**249**	**4.2**	**No**

Table 4.5 shows that boys' average score is 46% (with a standard error 2) and girls' average score is 49% (with a standard error 1.5). The significant difference of boys' and Girls' average score is below. In mathematics, six districts had average scores significantly below that of the group; and seven districts had average scores that were not significantly different from that of the group.

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	45	49	1.4	1.3	Below
Fazilka	52	49	3.3	5.4	No
Ferozepur	37	43	1.8	1.5	Below
Gurdaspur	55	56	1.1	1.4	No
Hoshiarpur	45	49	2.3	1.8	No
Jalandhar	41	46	0.9	0.9	Below
Ludhiana	51	52	1.1	1.2	No
Mohali	39	48	2.1	2.5	Below
Pathankot	54	55	2.4	2	No
Patiala	51	52	1.1	1.2	No
Roopnagar	48	44	2.6	2.4	No
Sangrur	49	56	1.1	1.4	Below
Tarn Taran	31	36	1.6	2.4	Below

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 area. From the selected sample 5% Bet, 15% Border, 8% Kandi and 72% Others area students participated in the survey. The average score of Border and Others area is 48% and 50% (with the standard error 0.9 for Border and 0.3 for others) which had significant difference from the average score of Bet and Border i.e. 41% and 48%(with the standard error 1.3 for Bet and 0.9 for Kandi). 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	Percentage Participation	Average Score	SE	SD	Significance Difference			
					Bet	Border	Kandi	Other
Bet	5	41	1.3	17.7	-	Below	No	Below
Border	15	48	0.9	21.9	Yes	-	Yes	No
Kandi	8	46	0.9	15.6	No	Below	-	Below
Others	72	50	0.3	19.3	Yes	No	Yes	-

Note: Percentage may be vary due to round off

table 4.7, analysis was carried out through IRT and it shows that, average scale score of Bet, Border, Kandi and Others is 225, 245, 240 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							246	13
Fazilka			254	21				
Ferozepur	210	0	228	13	225	19		
Gurdaspur	254	40	267	17			264	15
Hoshiarpur					243	15		
Jalandhar	213	0					235	6
Ludhiana							257	8
Mohali					233	8		
Pathankot			271	18	247	27		
Patiala							255	8
Roop Nagar	225	9			253	50		
Sangrur							259	10
TaranTaran			207	17				
State	**225**	**10**	**245**	**8**	**240**	**12**	**253**	**4**

Table 4.8, analysis through CTT shows that, average score of Bet, Border, Kandi and Others is 41%, 48%, 46% and 50% respectively. It shows that performance of Others area's students 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 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											
	Bet			Border			Kandi			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	-	-	-	-	-	-	-	-	-	47	0.9	19.2
Fazilka	-	-	-	51	2.8	23.2	-	-	-	-	-	-
Ferozepur	35	2.8	11.9	41	1.8	18.5	40	1.7	13.4	-	-	-
Gurdaspur	52	2.7	21.3	57	1.5	22	-	-	-	55	1.2	21.8
Hoshiarpur	-	-	-	-	-	-	47	1.5	11.6	-	-	-
Jalandhar	35	1.8	10.1	-	-	-	-	-	-	44	0.7	15.2
Ludhiana	-	-	-	-	-	-	-	-	-	52	0.8	19.2
Mohali	-	-	-	-	-	-	43	1.7	12.7	-	-	-
Pathankot	-	-	-	58	2.1	18.5	49	1.8	12.3	-	-	-
Patiala	-	-	-	-	-	-	-	-	-	51	0.8	18.1
Roopnagar	40	1.8	14.1	-	-	-	52	2.9	22	-	-	-
Sangrur	-	-	-	-	-	-	-	-	-	52	0.9	20.4
Tarn Taran	-	-	-	33	1.4	12.8	-	-	-	-	-	-
State Average	**41**	**4.01**	**8.02**	**48**	**4.8**	**10.7**	**46**	**2.1**	**4.7**	**50**	**1.6**	**3.9**

Note: Percentage may vary due to round off

[8] The detailed explanation regarding PPS is mentioned in Appendix 1.

4.2.3 Social class related difference in Mathematics

Table 4.9 describes the analysis of average scores according to Social class. It shows that the participating sample was 35% from SC, 19% from BC, 43% from General and 3% from Others and the average score of SC, BC, General and Others is 42%, 49%, 54% and 59% 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 that how widely individuals in a group vary. The average score of General class is significantly above than that of SC and there is significant difference from BC. But the average score of general is significantly below than others.

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

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					SC	BC	GEN	Other
SC	35	42	0.4	17	-	Below	Below	Below
BC	19	49	0.7	20.5	Yes	-	Below	Below
GEN	43	54	0.4	19.02	Above	Yes	-	Below
Others	3	59	1.7	19.4	Above	Yes	Yes	-

Note: Percentage may vary due to round off

Table 4.10 given below, analysis through IRT shows that, average scale score of SC, BC, General and Others is 231,244,255 and 257 respectively.

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

District	SC		BC		GEN		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	234	16.2	252	23.5	254	10.6	243	5.8
Fazilka	224	9.8	264	27.3	292	18.4	-	-
Ferozepur	214	8.6	224	8.5	238	13.8	-	-
Gurdaspur	243	11.9	259	15.4	271	11.7	325	8.8
Hoshiarpur	241	18.4	238	4.9	251	9.4	-	-

Jalandhar	228	4.6	234	7.3	244	8.4	-	-
Ludhiana	229	8.7	251	11.4	273	14.0	267	29.6
Mohali	220	19.7	240	5.2	236	1.4	270	0.0
Pathankot	257	18.2	256	20.9	269	26.7	267	0.0
Patiala	232	12.8	239	9.2	271	8.0	276	13.3
Roop Nagar	234	27.1	248	23.3	241	27.5	214	0.0
Sangrur	233	8.8	271	17.6	266	7.5	222	40.4
TranTaran	210	14.3	193	3.8	208	24.3	228	0.0
State	**231**	**4.2**	**244**	**4.4**	**255**	**4.4**	**257**	**5.9**

Table 4.11, analysis through CTT shows that, average score of SC, BC, General and Others is 42%, 49%, 54% and 59% respectively. It shows that performance of general and others 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. Only in Trantaran district, there is one percent difference in the performance of GEN and SC student's. Except Trantaran, in all districts BC also perform better than SC students.

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

Districts	Social Class											
	SC			BC			GEN			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	43	1.5	19	50	2.6	23	50	1.4	17.1	47	2.9	8.9
Fazilka	40	2.6	14.8	55	7	25.5	66	5.1	24.1	-	-	-
Ferozepur	36	1.5	13.2	39	2.3	14.1	46	2.3	18.9	-	-	-
Gurdaspur	47	1.8	21.7	54	1.9	22.4	59	1.2	19.8	78	2.6	13.6
Hoshiarpur	45	2.5	12.6	46	2.1	8.9	50	2.9	12.6	-	-	-

Jalandhar	41	0.8	13.8	43	1.5	13.7	47	1.6	17.4	-	-	-
Ludhiana	42	1.2	15.3	50	2.3	17.3	58	1.2	19.8	56	2.4	13.8
Mohali	39	4.6	17.9	44	2.4	10.5	43	2.1	9.9	55	-	-
Pathankot	53	2.4	17.5	53	4.5	17.5	57	2.3	16.8	53	-	-
Patiala	42	1.3	16	45	1.8	17.1	57	1.09	16.3	62	3.3	18.8
Roopnagar	44	2.7	19.6	50	3.9	18.7	47	3.09	19.8	33	-	-
Sangrur	42	1.7	17.8	56	2.1	24.1	55	1.1	18.1	37	3.8	14.2
Tarn Taran	34	1.9	12.4	26	1.4	5.3	33	2.9	15.5	41	1.2	1.7
State Average	**42**	**1.3**	**4.7**	**49**	**2.2**	**8.1**	**54**	**2.3**	**8.5**	**59**	**4.6**	**13.8**

Note: Percentage may vary due to round off

4.2.4 Managements related difference in Mathematics

Table 4.12 describes the analysis of average score according Managements[9]. It shows that the participating sample was 47% from Department schools and 53% from Aided or recognised and the average score of Department schools is 43% and Aided or recognised 55%. 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 school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.

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

Management	Percentage Participation	Average Score	SE	SD	Significance Difference
Department	47	43	0.4	17	Below
Aided	53	55	0.4	19.6	

Note: Percentage may vary due to round off

[9] The definition regarding managements is mentioned in Appendix 1.

Table 4.13, analysis through CTT shows that, the average score of Department schools is 43% and Aided/Recognised is 55%. In six districts: Amritsar, Fazilka, Ferozepur, Gurdaspur, Jalandhar, Ludhiana, Pathankot, Patiala and Sangrur the average score of department schools are significantly below than Aided/Recognised schools. But in Jalandhar there is significant difference between the average score of Department and Aided/Recognised schools. In districts Trantaran there is significant difference between the average score of Department and Aided/Recognised schools.But in the case of district Hoshiarpur, Roopnagar and Mohali there is some delimitation. We can't select Aided or recognised schools for districts Hoshiarpur, Roopnagar and department for Mohali, due to PPS technique.

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

Districts	Management						Significance Difference
	Department			Aided			
	Avg	SE	SD	Avg	SE	SD	
Amritsar	40	1.3	18.5	53	1.2	17.8	Below
Fazilka	38	1.8	12.8	82	1.3	6.1	Below
Ferozepur	34	1.1	12.8	54	2	15.3	Below
Gurdaspur	51	1.3	22	59	1.2	20.9	Below
Hoshiarpur	47	1.5	11.6	-	-	-	-
Jalandhar	39	0.8	11.1	46	1	16.6	Below
Ludhiana	43	1.1	15.7	57	1	19.1	Below
Mohali	-	-	-	43	1.7	12.7	-
Pathankot	49	1.5	14.9	74	1.7	8.8	Below
Patiala	43	1.1	16.6	57	1	16.8	Below
Roopnagar	46	1.8	19.47	-	-	-	-
Sangrur	39	0.8	11.4	59	1.1	20.8	Below
Tarn Taran	36	1.8	13.7	26	1.4	8	Yes
State Average	**42**	**1.5**	**5.3**	**55**	**4.4**	**14.8**	**Below**

Note: Percentage may be vary due to round off

4.3 Range score in Mathematics

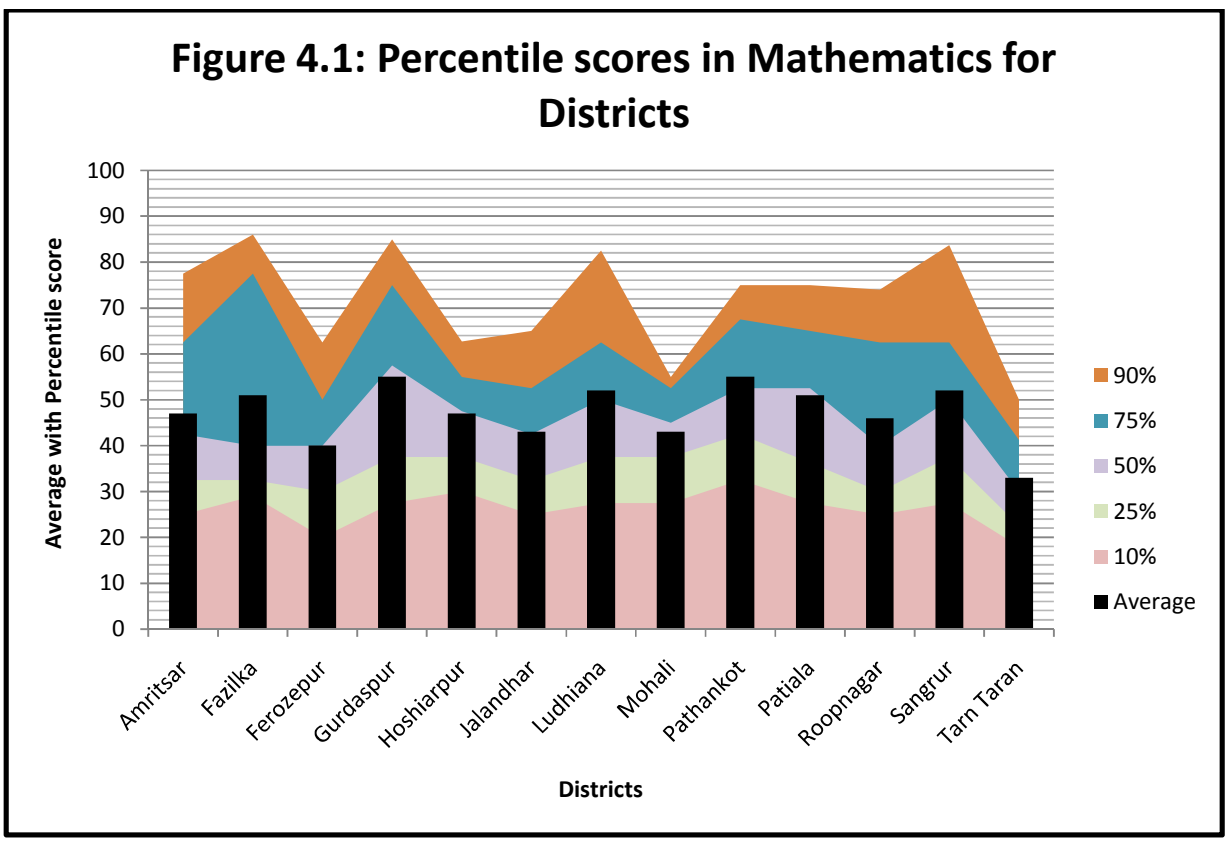
The tables 4.14 and figure 4.1 that follow illustrate the range of achievement of districts. The tables list the scores achieved by students at key percentiles. For example, the score at the 25th percentile is the score which 75% of students achieve or surpass; the score at the 90th percentile is the 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, Mohali has an inter-quartile range of just 15 whilst Fazilka has a corresponding value of 45. These values suggest that the class VIII population in Mohali is far more homogeneous than that of Fazilka. In most districts, the range of performance for the middle group was between 15 and 45 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 28 (Mohali) to 58 (Gurdaspur).

The percentiles provide additional information when comparing Mathematics 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 Fazilka (40) and ferozepur (40). However, the score ranging between the 25th and 75th percentiles are very different: Fazilka's range is 45 compared with Ferozepur's range of 20. This indicates that whilst average achievement is very similar in the two areas, Fazilka has a more heterogeneous group of class VIII students than that of Ferozepur.

Table 4.14: District wise Percentile score in Mathematics (Through CTT)

Districts	Average	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	47	25	33	43	63	78	30	53
Fazilka	51	29	33	40	78	86	45	57
Ferozepur	40	20	30	40	50	63	20	43
Gurdaspur	55	28	38	58	75	85	38	58
Hoshiarpur	47	30	38	48	55	63	18	33
Jalandhar	43	25	33	43	53	65	20	40
Ludhiana	52	28	38	50	63	83	25	55
Mohali	43	28	38	45	53	55	15	28
Pathankot	55	33	43	53	68	75	25	43
Patiala	51	28	36	53	65	75	29	48
Roopnagar	46	25	30	40	63	74	33	49
Sangrur	52	28	38	50	63	84	25	56
Tarn Taran	33	18	23	30	41	50	19	32



4.4 Conclusion

The average achievement of students in Mathematics varies greatly across the districts of Punjab. There is a highly significant difference between outcomes in high scoring districts such as Pathankot & Gurdaspur (55%), and Ludhiana & Sangrur (52%) and low scoring districts such as Jalandhar and Mohali (43%) and Tarn Taran (33%).

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 Mohali (15) and Hoshiarpur (18) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Gurdaspur (38) and Fazilka (45).

There is no significance difference between the average score of boys and girls. There have a significant difference among the average score of Others from Bet and Kandi, but there have no significance difference between the average score of others and border. On an average It shows that the others area's students performance is better than the Bet, Border and Kandi area.

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

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

The following chapter provides more information about what class VIII students at various levels of achievement know and can do in Mathematics.

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, translating, interpreting, giving descriptions, and stating the main ideas

- Translation
- Interpretation
- Extrapolation

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

[10] Source regarding cognitive process/Domain :- 1. https://en.wikipedia.org/wiki/Bloom%27s_taxonomy
2. Teaching of Social Science by Dr. Renu Gupta.

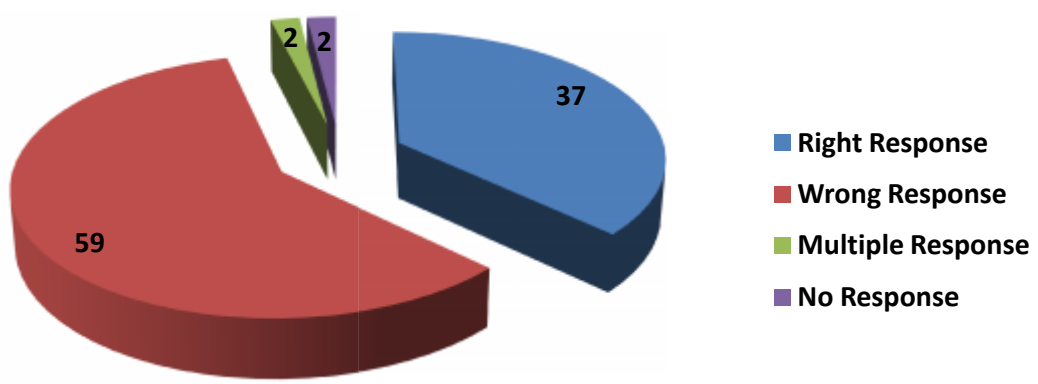
5.2 Sample Item

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

Scale Score: 271
ਨਾਲ ਬੰਨਿਆ ਹੈ। ਉਸਦੇ ਚਰਨ ਲਈ ਵਧ ਤੋਂ ਵਧ ਚਕਰਾਕਾਰ

The scaled score of this item was 271, 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 5.1 shows how the remaining 63% respondent.

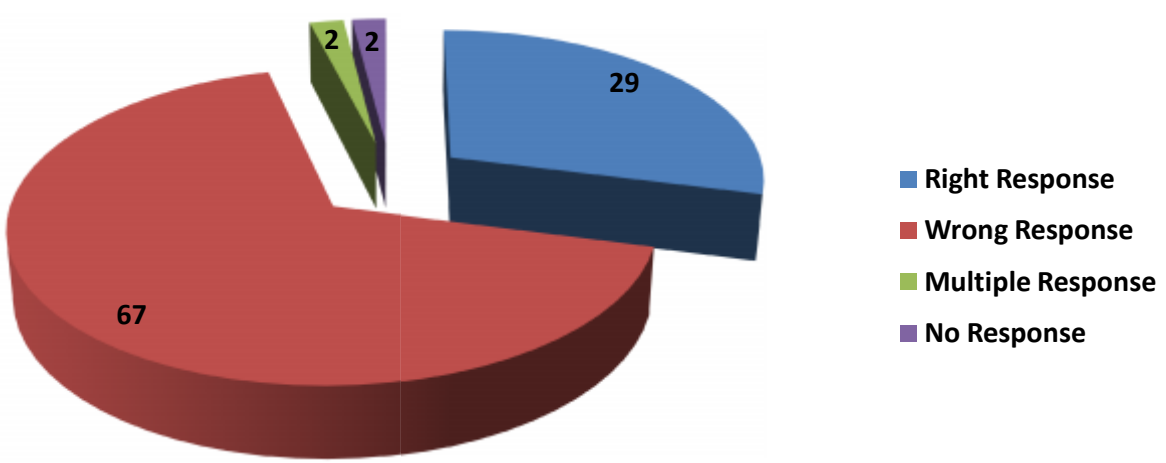
Figure 5.1: Percentage of Students Response



Scale Score: 288
' ਅਤੇ ਖ਼ਰੀਦਮੁਲ 200 ਰੁਪਏ ਹੈ ਤਾਂ ਲਾਭ %ਹੋਵੇਗਾ:

The scale score of this item was 288, i.e., significantly above the average level of difficulty of items in the survey. Around 29% of students in the sample were able to select the correct answer. The figure 5.2 shows how the remaining 73% responded.

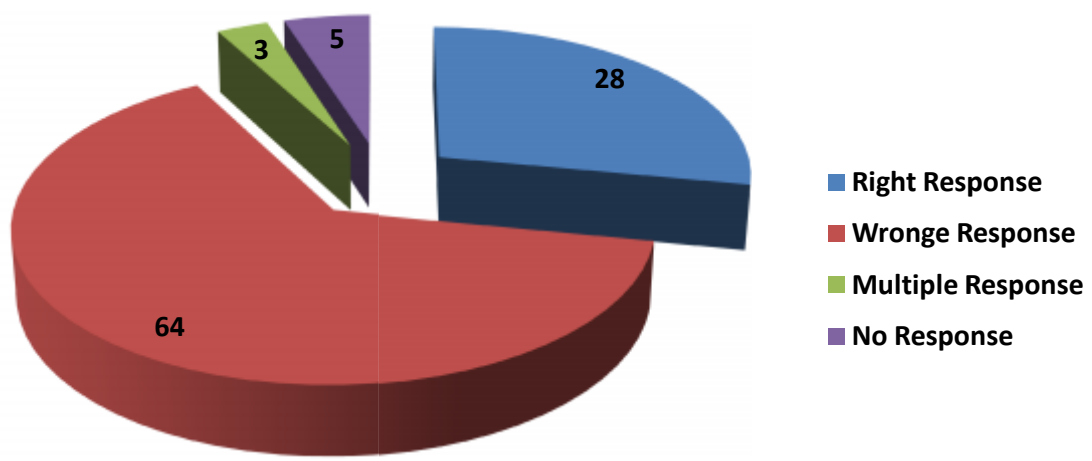
Figure 5.2 : Percentage of Students Response



Scale Score: 304
10% ਸਲਾਨਾ ਦਰ ਨਾਲ ਮਿਸ਼ਰਧਨ ਹੋਵੇਗਾ:

This scaled score of this item was 304, i.e., significantly above the average level of difficulty of items in the survey. Around 28% of students in the sample were able to select the correct answer. The figure 5.3 shows how the remaining 72% responded.

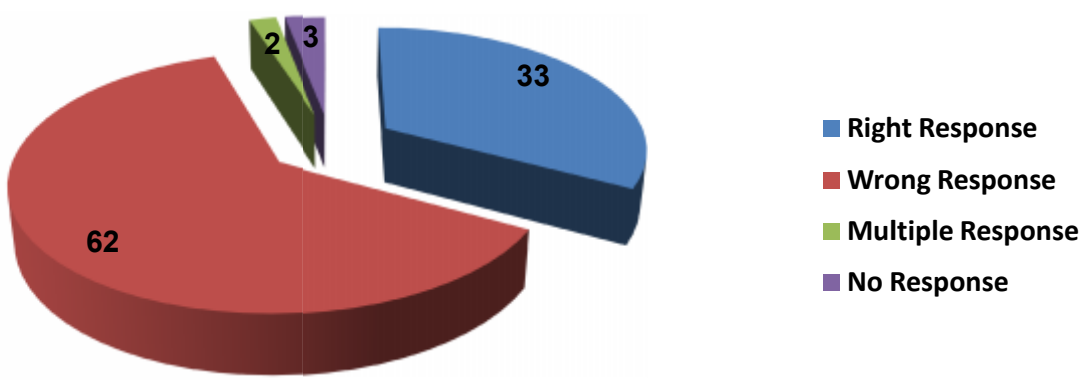
Figure 5.3: Percentage of Students Response



Scale Score: 281
।ਵਿਆਸ ੪ ਸਮ ਅਤੇ ਉਚਾਈ ੬ ਸਮ ਹੈ ।ਸ਼ੰਕੂ ਦੀ ਤਿਰਛੀ ਉਚਾਈ

This scaled score of this item was 281, i.e., significantly above the average level of difficulty of items in the survey. Around 33% of students in the sample were able to select the correct answer. The figure 5.4 shows how the remaining 67% responded.

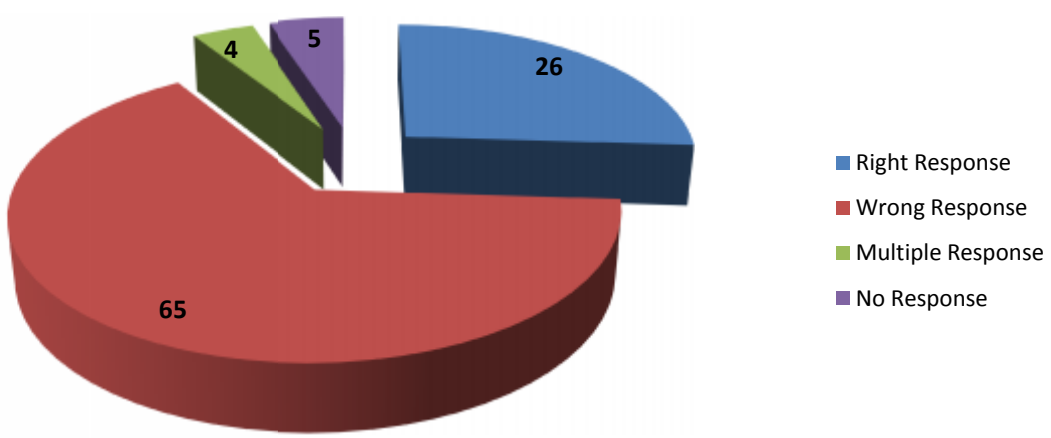
Figure 5.4 : Percentage of Students Response



Scale Score: 304
ਖ਼ੇਤਰਫਲ 616 ਵਰਗ ਸਮ ਹੈ ਤਾਂ ਅਰਧ ਵਿਆਸ ਹੋਵੇਗਾ:

This scaled score of this item was 304, i.e., significantly above the average level of difficulty of items in the survey. Around 26% of students in the sample were able to select the correct answer. The figure 5.5 shows how the remaining 74% responded.

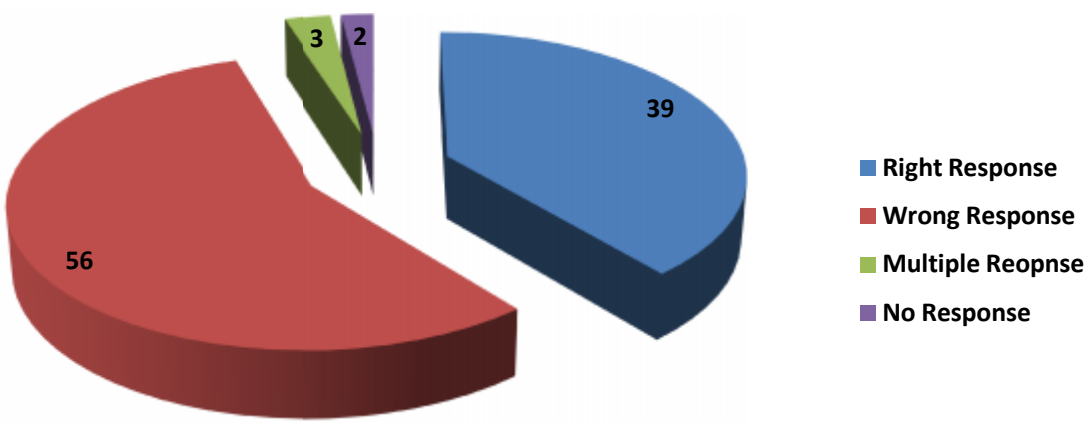
Figure 5.5 : Percentage of Students Response



Scale Score: 288
ਧ ਵਿਆਸ ਹੋ ਸਕਦੇ ਹਨ:

This scaled score of this item was 288, i.e., significantly above the average level of difficulty of items in the survey. Around 39% of students in the sample were able to select the correct answer. The figure 5.6 shows how the remaining 61% responded.

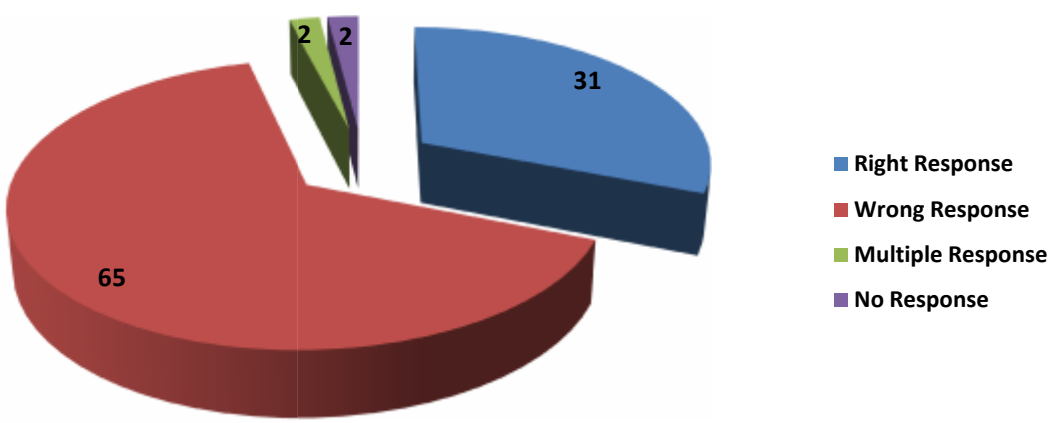
Figure 5.6: Percentage of Students Response



	Scale Score: 347
	ਾ ਖੇਤਰਫਲ 64 ਵਰਗ ਮੀਟਰ ਹੈ, ਉਸ ਦੀ ਭੁਜਾ ਹੋਵੇਗੀ:

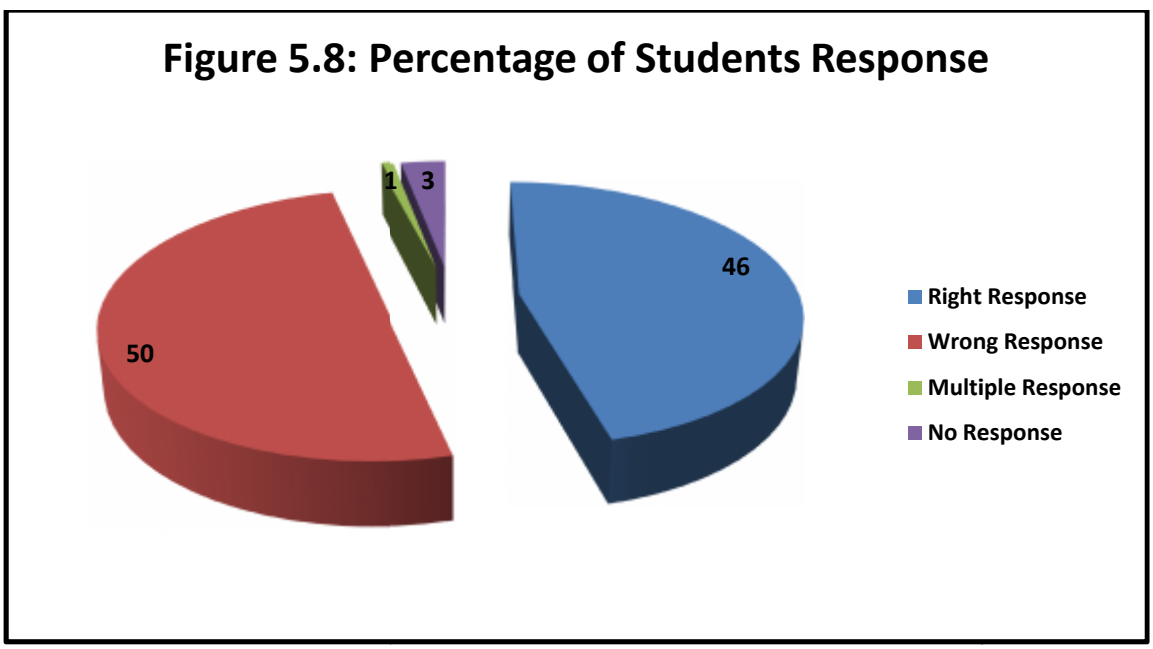
This scaled score of this item was 347, i.e., significantly above the average level of difficulty of items in the survey. Around 31% of students in the sample were able to select the correct answer. The figure 5.7 shows how the remaining 69% responded.

Figure 5.7 : Percentage of Students Response



Scale Score: 265
ਭਰ ਹਨ:

This scaled score of this item was 265, i.e., significantly above the average level of difficulty of items in the survey. Around 46% of students in the sample were able to select the correct answer. The figure 5.8 shows how the remaining 54% responded.



Chapter 6
Achievement in Science

This chapter summarises the achievement of class VIII students in Science 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 districts, a sample was drawn which was designed to be representative of the entire target population, i.e., all class VIII students studying in government and government-aided/recognized schools.

6.1 Performance of districts in Science

The distribution of student achievement in Mathematics for the 13 participating districts is given in Tables 6.1 and 6.2. Within each Table, districts are listed in alphabetical order. Table 6.1 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 6.2 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 district's average or not.

Table 6.1: District wise average score in Science (Through IRT)

District	Average Score	SE	Significant difference
Amritsar	257	24.5	No
Fazilka	266	31.2	No
Ferozepur	242	8.6	No
Gurdaspur	261	15.3	No
Hoshiarpur	274	5.9	Above
Jalandhar	245	10.9	No
Ludhiana	239	3.7	No
Mohali	213	11.6	Below

Pathankot	260	18.3	No
Patiala	246	51.7	No
Roop Nagar	260	34.8	No
Sangrur	253	29.0	No
TaranTaran	228	10.8	No
State	**250**	**6.6**	

The table 6.1 the average score was 250 (with a standard error of 6.6). The results reveal substantial differences in achievement of Science between the highest performing districts (274 for Hoshiarpur) and the lowest performing districts (213 for Mohali).One district had average scores significantly above from state; One district had average scores significantly below from state; and Eleven districts had average scores that were not significantly different from that of the state.

Table 6.2: District wise average score in Science (Through IRT)

Districts	Average Score	Standard Error	Significance Difference
Amritsar	58	0.7	No
Fazilka	60	1.7	Yes
Ferozepur	52	1	No
Gurdaspur	59	0.8	Yes
Hoshiarpur	64	1.6	Above
Jalandhar	53	0.6	No
Ludhiana	52	0.8	No
Mohali	44	1.8	Below
Pathankot	58	1.1	No
Patiala	53	0.7	No
Roopnagar	59	1.6	No
Sangrur	56	0.7	No
Tarn Taran	46	1.3	Below
State Average	**55**	**1.5**	

Note: Percentage may vary due to round off

The average score was 55% (with a standard error of 1.5). The results reveal substantial differences in achievement of language between the highest performing districts

(64% for Hoshiarpur) and the lowest performing districts (44% for Mohali). One district had average scores significantly above from state; Two district had average scores significantly below from state; and Ten districts had average scores that were not significantly different from that of the state.

6.2 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

6.2.1 Gender related difference in Science

Table 6.3 compares the average score achieved by boys and girls in Punjabi. It shows that there has no significant difference in average score of boys and girls. The table also represent that 54% boys and 46 % 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, and 'standard deviation' is given to indicate the how widely individuals in a group vary

Table 6.3: Gender wise average score in Science (Through CTT)

Gender	Percentage Participation	Average Score	SE	SD	Significance Difference
Boys	54	54	0.3	17.3	No
Girls	46	57	0.4	16.2	

Note: Percentage may be vary due to round off

Table 6.4, analysis through IRT shows that, there is no significant difference between the average score of boys and girls.

Table 6.4: Gender wise average score in Science (Through IRT)

District	Boy (Average)	SE	Girl (Average)	SE	Significant difference
Amritsar	252	26.3	261	21.4	No
Fazilka	264	35.5	272	24.2	No
Ferozepur	245	0.0	240	7.5	No
Gurdaspur	258	11.2	266	20.6	No
Hoshiarpur	279	7.0	269	4.9	No
Jalandhar	243	5.3	246	31.6	No
Ludhiana	241	17.4	237	1.4	No
Mohali	213	11.2	214	12.8	No
Pathankot	247	8.8	271	28.2	No
Patiala	241	69.0	252	30.6	No
Roop Nagar	265	24.0	256	53.5	No

Sangrur	245	26.7	261	27.5	No
TaranTaran	225	9.1	234	16.2	No
State	**248**	**7.2**	**252**	**7.0**	**No**

Table 6.5, analysis through CTT shows that, there is no significant difference between the average score of boys and girls. In three districts: Pathankot, Patiala and Sangrur, significant difference of boy's score is below than girls.

Table 6.5: District wise average score according to gender in Science (Through CTT)

Districts	Average Score		Standard Error		Significance Difference
	Boy's	Girl's	Boy's	Girl's	
Amritsar	56	59	1.1	1	No
Fazilka	60	61	2.2	2.9	No
Ferozepur	53	52	1.6	1.2	No
Gurdaspur	58	60	1.1	1.1	No
Hoshiarpur	65	63	2.3	2.4	No
Jalandhar	53	54	0.9	1	No
Ludhiana	52	52	1.2	1	No
Mohali	44	45	2.1	3.4	No
Pathankot	54	61	1.4	1.6	Below
Patiala	52	55	1.1	1	Below
Roopnagar	60	57	2.4	2.2	No
Sangrur	54	60	0.9	1.2	Below
Tarn Taran	45	48	1.4	2.5	No
State Average	**54**	**57**	**1.6**	**1.5**	**No**

Note: Percentage may vary due to round off

6.2.2 Area related difference in Science

Table 6.6 describes the analysis of average score according area[11] selected. It shows that the participating sample was 5% from Bet, 15% from Border 8% from Kandi and 72% from Other areas and the average score of Bet , Border, Kandi and Others is 54%,55%,56% and 55% 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. Table 6.6 also shows that there is no significant difference between the average score of Bet, Border, Kandi and other areas.

Table 6.6: Area wise average score in Science (Through CTT)

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					Bet	Border	Kandi	Other
Bet	5	54	1.2	16.5	-	No	No	No
Border	15	55	0.7	16.8	No	-	No	No
Kandi	8	56	0.9	15.5	No	No	-	No
Others	72	55	0.3	17	No	No	No	-

Note: Percentage may vary due to round off

Table 6.7, analysis through IRT shows that, average scale score of Bet, Border, Kandi and Others is 249, 252, 251 and 250 respectively.

Table 6.7: Area wise average score in Science (Through IRT)

District	Bet		Border		Kandi		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar							257	24.5
Fazilka			266	31.2				
Ferozepur	269	0.0	233	27.6	250	7.8		
Gurdaspur	270	0.0	259	13.0			262	0.0
Hoshiarpur					274	5.9		
Jalandhar	219	0.0					246	9.1
Ludhiana							239	3.7
Mohali					213	11.6		
Pathankot			274	0.9	235	8.5		

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

Patiala							246	51.7
Roop Nagar	240	1.2			281	40.9		
Sangrur							253	29.0
TaranTaran			228	10.8				
State	**249**	**0.3**	**252**	**9.0**	**251**	**8.9**	**250**	**10.8**

Table 6.8, analysis through CTT shows that, average score of Bet, Border, Kandi and Others is 54%, 55%, 56% and 55% respectively. It also shows that there is no significance difference between the averages of all 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 the how widely individuals in a group vary. For the selection of area PPS[12] technique was adopted.

Table 6.8: Area wise average score in Science (Through CTT)

Districts	Area											
	Bet			Border			Kandi			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar										58	0.7	15.5
Fazilka				60	1.7	14.5						
Ferozepur	60	1.8	7.8	49	1.5	15.1	53	1.2	9.4			
Gurdaspur	61	2.6	20.2	58	1.3	18.9				60	1.1	19.8
Hoshiarpur							64	1.6	12.9			
Jalandhar	44	1.4	7.6							54	0.7	14.8
Ludhiana										52	0.8	17.7
Mohali							44	1.8	14			
Pathankot				63	1.4	12.5	49	1.2	8.4			
Patiala										53	0.7	17
Roopnagar	52	1.8	14				66	2.3	18			
Sangrur										56	0.7	16.6
Tarn Taran				46	1.3	11.7						
State Average	**54**	**3.9**	**7.9**	**55**	**3.2**	**7.3**	**56**	**4.2**	**9.5**	**55**	**1.4**	**3.1**

Note: Percentage may vary due to round off

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

6.2.3 Social class related difference in Science

Table 6.9 describes the analysis of average score according Social class. It shows that the participating sample was 35% from SC, 19% from BC, 43% from General and 3% from others and the average score of SC, BC, General and Others is 52%, 55%, 58% and 55% 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 have significant difference from BC. But there is no significant difference between the average score of General and others. It interprets that on an average general class performed better than SC and BC.

Table 6.9: Social Class wise average score in Science (Through CTT)

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					SC	BC	GEN	Other
SC	35	52	0.4	15.6	-	Below	Below	Below
BC	19	55	0.6	16.6	Yes	-	Below	No
GEN	43	58	0.4	16.5	Above	Yes	-	No
Others	3	55	2.3	24.9	No	No	No	-

Note: Percentage may vary due to round off

Table 6.10, analysis through IRT shows that, average scale score of SC, BC, General and Others is 239, 252, 257 and 243 respectively.

Table 6.10: Social Class wise average score in Science (Through IRT)

District	SC		BC		GEN		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	246	61.3	255	14.9	269	15.2	271	0.0
Fazilka	235	6.4	294	20.9	295	23.0	-	-
Ferozepur	235	30.7	242	2.7	251	9.3	-	-
Gurdaspur	250	2.0	254	5.4	265	22.0	321	0.0
Hoshiarpur	273	5.3	281	1.8	269	8.1	-	-
Jalandhar	239	7.8	252	9.2	252	23.0	-	-
Ludhiana	223	5.0	223	10.7	255	10.4	207	0.0
Mohali	197	14.9	228	6.8	214	8.4	251	0.0

Pathankot	263	9.8	279	34.4	253	16.7	213	0.0
Patiala	229	51.3	234	70.2	258	40.1	251	0.0
Roop Nagar	256	38.4	261	24.9	266	36.5	199	0.0
Sangrur	228	0.0	257	45.2	262	14.0	206	0.0
TarnTaran	231	10.9	213	9.1	227	11.8	266	0.0
State	**239**	**7.5**	**252**	**7.6**	**257**	**5.8**	**243**	**0.0**

Table 6.11, analysis through CTT shows that, average score of SC, BC, General and Others is 52%, 55%, 58% and 55% respectively. It 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. An exception: the average score of SC students is higher than General in district Hoshiarpur, Pathankot and Tarn taran, was detected.

Table 6.11: District wise average score according to Social Class in Science (Through CTT)

Districts	Social Class											
	SC			BC			GEN			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	55	1.2	15.7	57	2.1	18.6	62	1.1	13.4	64	2.4	7.4
Fazilka	52	1.1	6.6	67	4.2	15.1	69	3.3	15.5	-	-	-
Ferozepur	50	1.6	13.9	52	2.4	14.7	56	1.3	11.2	-	-	-
Gurdaspur	55	1.4	16.9	56	1.5	18.6	61	1.2	20.4	77	2.6	14
Hoshiarpur	65	2.3	11.5	67	3.6	15.2	61	2.9	12.5	-	-	-
Jalandhar	51	0.9	15.1	57	1.3	12.1	56	1.3	14.3	-	-	-
Ludhiana	47	1.2	15.4	48	2.2	16.3	57	1.1	17.9	41	2.8	15.6
Mohali	38	4.1	18	49	2.3	10	45	2.4	11.6	56	-	-
Pathankot	59	1.6	11.8	64	4.4	17.3	56	1.6	12	45	-	-

Patiala	49	1.4	16.1	49	1.6	14.6	57	0.9	13.6	55	5.9	33.5
Roopnagar	58	2.3	16.7	58	3	14.3	61	3	19.8	35	-	-
Sangrur	48	1.5	15	59	1.4	15.9	59	1	16.2	39	2.8	10.6
Tarn Taran	48	2	12.7	41	1.4	5.2	45	2.3	12.1	59	1.2	1.7
State Average	**52**	**1.8**	**6.7**	**55**	**2.1**	**7.7**	**58**	**1.8**	**6.5**	**55**	**4.5**	**13.5**

Note: Percentage may vary due to round off

6.2.4 Managements related difference in Science

Table 6.12 describes the analysis of average score according Managements[13]. It shows that the participating sample was 47% from Department schools and 53% from Aided or recognised and the average score of Department schools is 53% and Aided or recognised 59%. 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 school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.

Table 6.12: Management wise average score in Science (Through CTT)

Management	Percentage Participation	Average Score	SE	SD	Significance Difference
Department	47	53	0.3	15.7	Below
Aided	53	59	0.4	17.3	

Note: Percentage may vary due to round off

Table 6.13, analysis through CTT shows that, the average score of Department schools is 53% and Aided/Recognised is 59%. In eight districts: Amritsar, Fazilka, Ferozepur, Gurdaspur, Ludhiana, Pathankot, Patiala and Sangrur, the average score of Department schools are significantly below than Aided/Recognised schools. But in Jalandhar there have significance difference between the average score of Department and Aided/Recognised schools. In districts Jalandhar and Tran Taran there have no significance difference between the average score of Department and Aided/Recognised schools.But in the case of district Hoshiarpur, Roopnagar and Mohali there have some delimitation. We

[13] The definition regarding managements is mention in the Appendix 1.

can't select Aided or recognised schools for districts Hoshiarpur, Roopnagar and Department for Mohali, due to PPS technique.

Table 6.13: District wise average score according to Management in Science (Through CTT)

Districts	Management						Significance Difference
	Department			Aided			
	Avg	SE	SD	Avg	SE	SD	
Amritsar	51	1.1	15.3	64	0.9	13	Below
Fazilka	52	0.9	6.4	81	0.8	3.6	Below
Ferozepur	50	1.2	13.8	58	1.4	10.5	Below
Gurdaspur	56	1.1	18.2	62	1.1	20	Below
Hoshiarpur	64	1.6	12.9				
Jalandhar	54	1	14.1	53	0.9	15	No
Ludhiana	47	1.2	15.9	55	1	18	Below
Mohali				44	1.8	14	
Pathankot	56	1.4	13.7	65	0.8	4.4	Below
Patiala	48	1.1	15	57	1	17.5	Below
Roopnagar	59	1.6	17.5				
Sangrur	47	0.9	12.4	62	0.9	16.1	Below
Tarn Taran	47	1.8	13.3	44	1.4	7.5	No
State Average	**53**	**1.5**	**5.4**	**59**	**3.1**	**10.3**	**Below**

Note: Percentage may vary due to round off

6.3 Range score in Science

The tables 6.14 and figures 6.1 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 score that 10% of students achieve or surpass. The

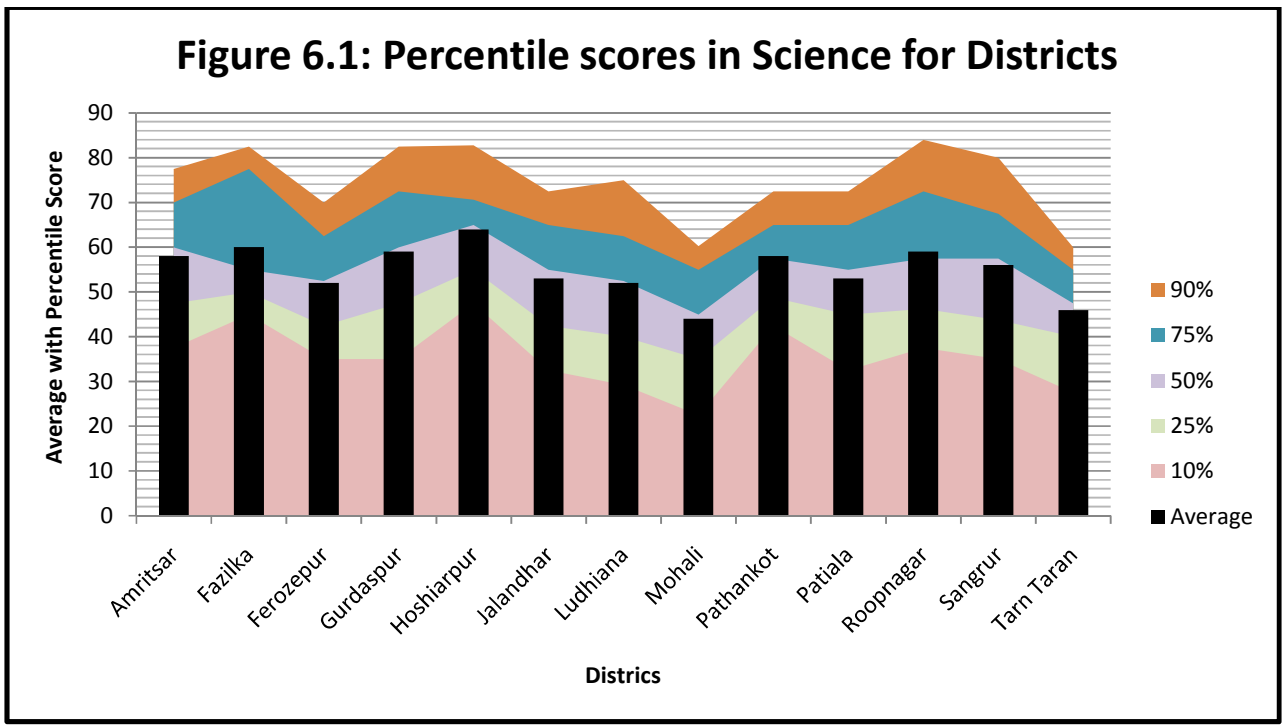
range between the 25th and 75th percentiles (the inter-quartile range) represents the performance of the middle 50% of students.

The inter-quartile range (i.e. the range between the 75th and 25th percentiles) is highly variable. For example, TarnTaran has an inter-quartile range of just 15 whilst Fazilka has a corresponding value of 28. These values suggest that the class VIII population in Tarntaran is far more homogeneous than that of Fazilka. In most districts, the range of performance for the middle group was between 20 and 25 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 30 (Pathankot) to 48 (Gurdaspur).

The percentiles provide additional information when comparing Science 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 Pathankot (58) and Roopnagar (58). However, the score ranges between the 25th and 75th percentiles are very different: Pathankot's range is 16 compared with Roopnagar's range of 26. This indicates that whilst average achievement is very similar in the two areas, Roopnagar has a more heterogeneous group of class VIII students than the Pathankot.

Table 6.14: District wise Percentile score in Science (Through CTT)

Districts	Average	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	58	38	48	60	70	78	23	40
Fazilka	60	45	50	55	78	83	28	38
Ferozepur	52	35	43	53	63	70	20	35
Gurdaspur	59	35	48	60	73	83	25	48
Hoshiarpur	64	48	55	65	71	83	16	35
Jalandhar	53	33	43	55	65	73	23	40
Ludhiana	52	29	40	53	63	75	23	46
Mohali	44	23	35	45	55	60	20	38
Pathankot	58	43	49	58	65	73	16	30
Patiala	53	33	45	55	65	73	20	40
Roopnagar	59	38	46	58	73	84	26	47
Sangrur	56	35	44	58	68	80	24	45
Tarn Taran	46	28	40	48	55	60	15	33



6.4 Conclusion

The average achievement of students in Science varies greatly across the districts of Punjab. There is a highly significant difference between outcomes in high scoring district such as Hoshiarpur (64%), and Ludhiana & Sangrur (52%) and low scoring district such as Tarn Taran (46%).

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 (16) and Trantaran (15) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Roopnagar (26) and Fazilka (28).

There is no significance difference between the average score of boys and girls. There is no significant difference between the average score of Bet, Border, Kandi and others area. The average score of General class is significantly above than SC and there have significant difference from BC. But there is no significant difference between the average score of General and others. It interprets that on an average general class performed better than SC and BC.

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

The following chapter provides more information about what class VIII students at various levels of achievement know and can do in Science.

Chapter 7
What students know and can do: Science

7.1 Overview of the Science tests

The Science 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 Science assessment instrument comprised 60 unique items.

The items in each text booklet were chosen to cover the following range of scientific domains from the science curriculum: Physics, Chemistry and Biology. In addition to the content domains listed above, items were constructed to test a range of cognitive processes/domain[14] (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 Science

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, translating, 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.

[14] Source regarding cognitive process/Domain :- 1. https://en.wikipedia.org/wiki/Bloom%27s_taxonomy
2. Teaching of Social Science by Dr. Renu Gupta.

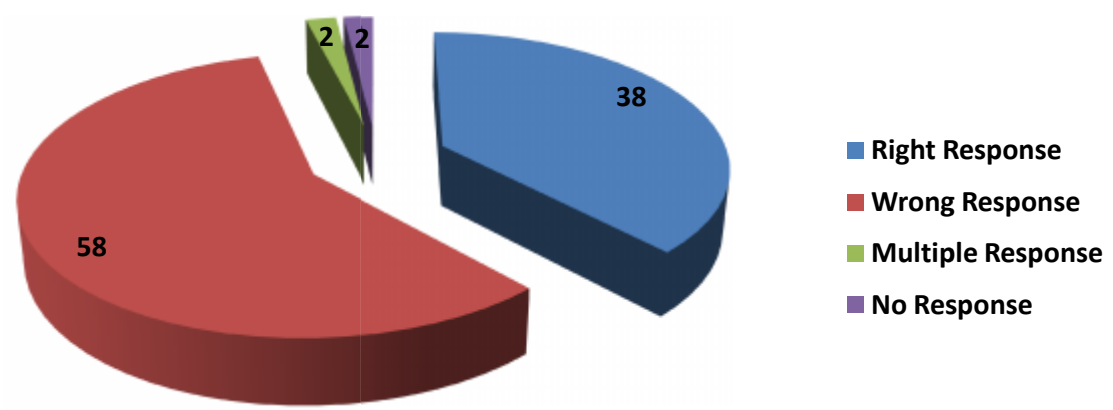
7.2 Sample Item

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

Scale Score: 312
ਧਮ ਦਾ ਤਾਰਾ ਕਿਹਾ ਜਾਂਦਾ ਹੈ?

This item requires students to recall the knowledge about the fact. The scaled score of this item was 312, i.e., significantly above the average level of difficulty of items in the survey. Around 38 % of students in the sample were able to select the correct answer. The figure 7.1 shows how the remaining 62% responded.

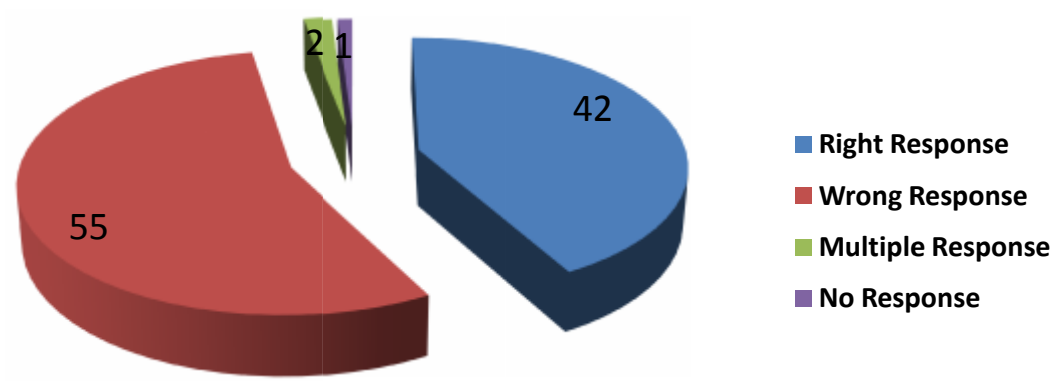
Figure 7.1 : Percentage of Students Response



Scale Score: 272
ਾ ਸਕਦਾ ਹੈ: ਆਂ ਫ਼ਸਲਾਂ ਾਰਾ

This item requires students to grasp idea about the cause of an action. The scaled score of this item was 272, i.e., significantly above the average level of difficulty of items in the survey. Around 42% of students in the sample were able to select the correct answer. The figure 7.2 shows how the remaining 58% responded.

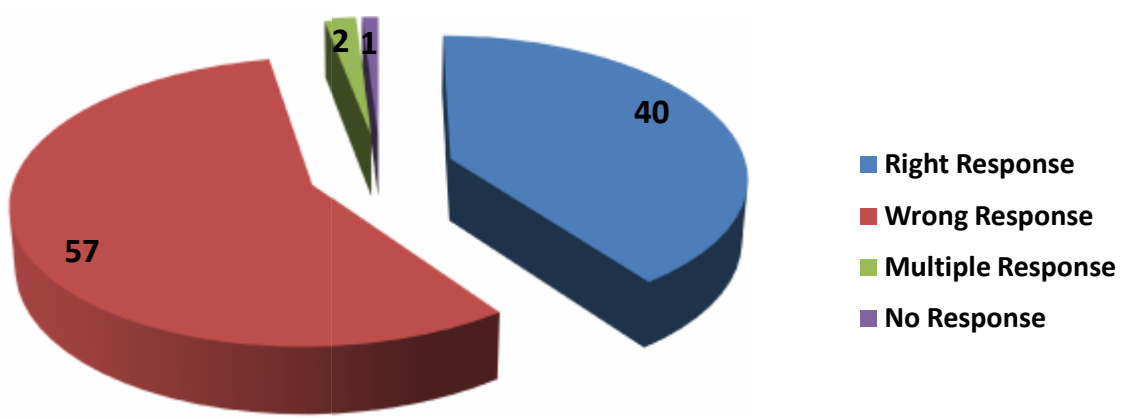
Figure 7.2 : Percentage of Students Response



Scale Score: 311
ਲੀਅਸ ਦਾ ਵਿਆਸ ਹੁੰਦਾ ਹੈ ਲਗਭੱਗ:

This item requires students to grasp idea and interpret about the cause of an action. The scaled score of this item was 311, i.e., significantly above the average level of difficulty of items in the survey. Around 40% of students in the sample were able to select the correct answer. The figure 7.3 shows how the remaining 60% responded.

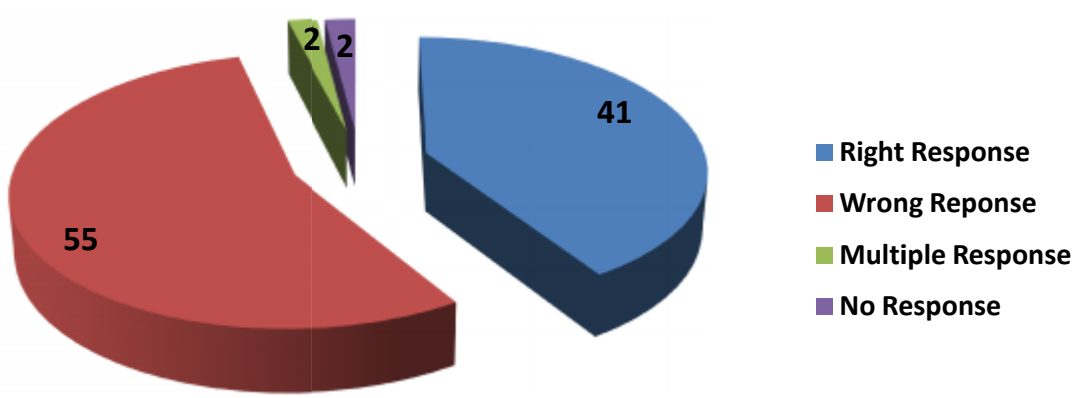
Figure 7.3 : Percentage of Students Response



Scale Score: 279
ਂ ਊਰਜਾ ਦਾ ਪੂਰਤੀ ਯੋਗ ਸੋਮਾ ਕਿਹੜਾ ਹੈ?

This item requires students to recall and retain about the cause of an action. The scaled score of this item was 279, i.e., significantly above the average level of difficulty of items in the survey. Around 41% of students in the sample were able to select the correct answer. The figure 7.4 shows how the remaining 59% responded.

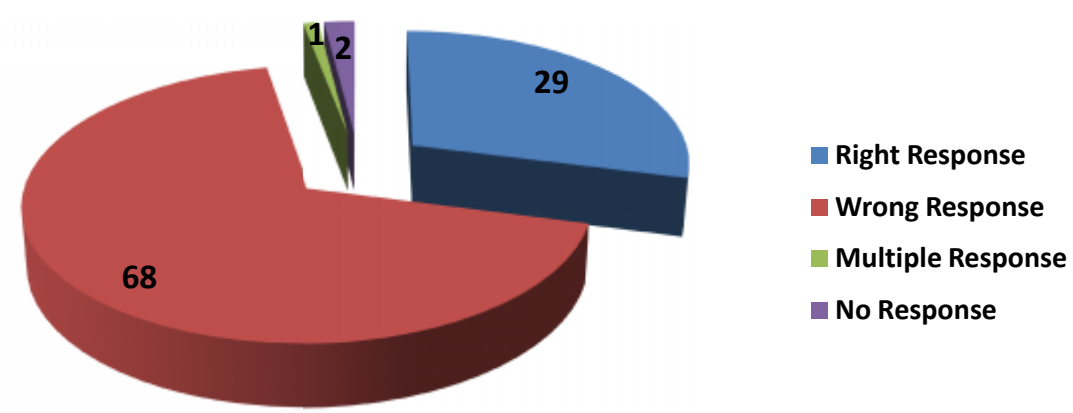
Figure 7.4 : Percentage of Students Response



Scale Score: 368
। ਉੱਪਰ ਤਰਲ ਪਦਾਰਥ ਪਿਘਲਨ ਲੱਗ ਪੈਂਦਾ ਹੈ ਉਸਨੂੰ.....ਕਹਿੰਦੇ

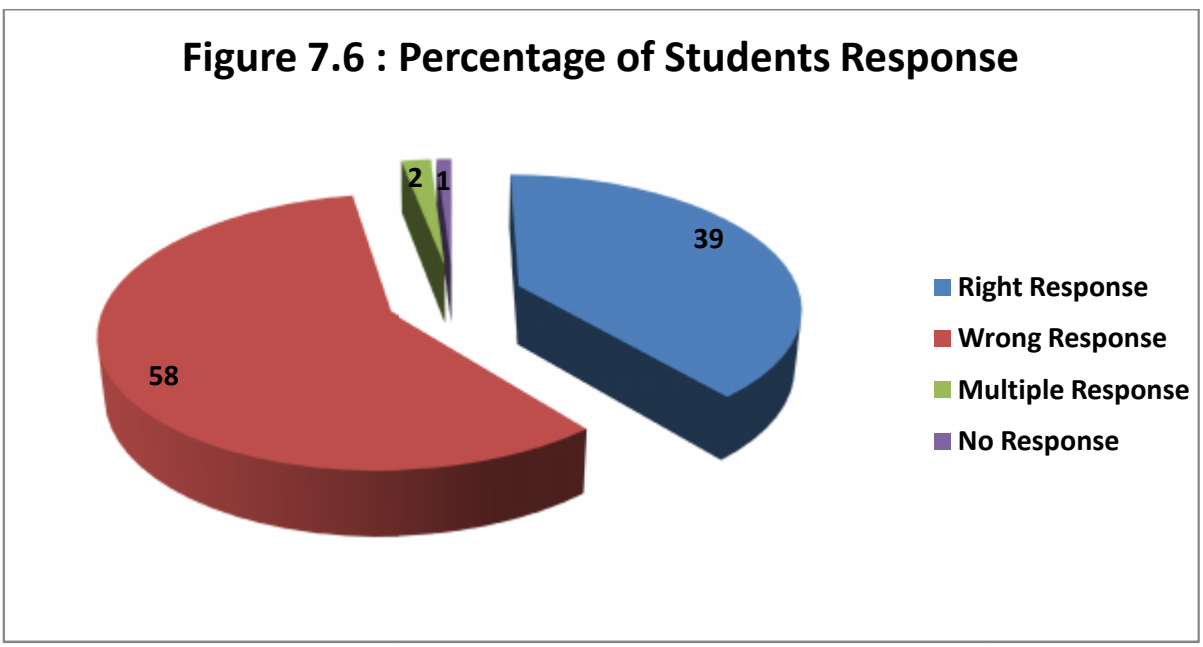
This item requires students to recall and retain about the cause of an action. The scaled score of this item was 368, i.e., significantly above the average level of difficulty of items in the survey. Around 29% of students in the sample were able to select the correct answer. The figure 7.5 shows how the remaining 71% responded.

Figure 7.5: Percentage of Students Response



Scale Score: 285
ਸ ਹਰ ਸਾਲ..... ਨੂੰ ਮਨਾਇਆ ਜਾਂਦਾ ਹੈ।

This item requires students to recall and retain about the cause of an action. The scaled score of this item was 368, i.e., significantly above the average level of difficulty of items in the survey. Around 29% of students in the sample were able to select the correct answer. The figure 7.5 shows how the remaining 71% responded.



7.3 What can students do in Science?

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

7.3.1 Cognitive Process: Knowledge

Table 7.1 shows the performance of class VIII students on the cognitive process of Knowledge.

Table 7.1: Performance of class VIII students on the cognitive process of Knowledge

Item No	% Correct	Scale scores	Domain of Science Curriculum	Item No	% Correct	Scale scores	Domain of Science Curriculum	Item No	% Correct	Scale scores	Domain of Science Curriculum
22	49	253	Biology	5	52	244	Chemistry	1	80	163	Physics
24	71	198	Biology	13	44	271	Chemistry	6	38	312	Physics
60	52	244	Biology	48	41	279	Chemistry	11	66	212	Physics
61	44	273	Biology	50	58	232	Chemistry	16	54	239	Physics
62	39	285	Biology	54	53	241	Chemistry	26	75	182	Physics
63	72	191	Biology					43	46	268	Physics
67	75	177	Biology					46	51	248	Physics
70	64	216	Biology					56	68	206	Physics
								57	49	254	Physics

Biology:

- Only 44% students know about the crops cultivated in the months of June to October. (Item 61)
- Only 39% students were aware about the wetland day i.e on 2 February.(Item 62)
- 75 % students were aware about the dairy farming.(item 67)
- 72% students were knows that which organism cannot be seen with naked eye.(item 63)

Chemistry:

- Only 41% students know that Bio gas is the renewable source of energy.(Item 48)
- 58% students know that diamond is the hardest form of carbon.(Item 50)

Physics:

- Only 38% students know that mercury is known as the day or night star.(item no 6)
- Only 46% students know that electron is the positive charge particle present in an atom (Item 43).
- 75% students knows that 71% surface of earth is covered by water.(Item no 26)
- 80% students knows that there have two type of lens.(Item no 1)

7.3.2 Cognitive Process: Understanding

Table 7.2 shows the performance of class VIII students on the cognitive process of Understanding.

Table 7.2: Performance of class VIII students on the cognitive process of Understanding

Item No	% Correct	Scale scores	Domain of Science Curriculum	Item No	% Correct	Scale scores	Domain of Science Curriculum	Item No	% Correct	Scale scores	Domain of Science Curriculum
19	72	169	Biology	14	53	241	Chemistry	2	63	196	Physics
20	60	220	Biology	15	50	248	Chemistry	3	48	255	Physics
29	64	210	Biology	18	55	232	Chemistry	4	62	203	Physics
59	59	222	Biology	25	52	243	Chemistry	7	77	177	Physics
65	62	218	Biology	27	78	171	Chemistry	8	47	258	Physics
66	36	305	Biology	45	45	267	Chemistry	12	51	244	Physics
68	48	257	Biology	49	44	274	Chemistry	30	66	206	Physics
				52	47	261	Chemistry	41	51	247	Physics
				69	51	248	Chemistry	42	59	232	Physics
								44	46	263	Physics
								47	55	230	Physics
								53	29	368	Physics
								58	51	250	Physics

Biology:

- Only 36% students able to tell about endangered species.(Item No. 36)
- Only 48% students classify the medicinal plant.(Item No. 38)
- 72% students were able to define the soil erosion. (Item No. 19)

Chemistry:

- Only 44% students able to tell about the Nuclear Fission (Item No. 49)
- 78% students are aware about the artificial material pollutes.(Item No. 27)

Physics:

- Only 29% students are aware about boiling point.(Item No 53)
- 77% are aware about sources of energy. (Item No. 7)

7.3.3 Cognitive Process: Application

Table 7.3 shows the performance of class VIII students on the cognitive process of Application.

Table 7.3: Performance of class VIII students on the cognitive process of Application

Item No	% correct	Scale scores	Domain of Science Curriculum	Item No	% correct	Scale scores	Domain of Science Curriculum	Item No	% correct	Scale scores	Domain of Science Curriculum
21	42	272	Biology	10	53	238	Chemistry	9	50	249	Physics
23	56	231	Biology	17	48	261	Chemistry	55	49	255	Physics
28	39	298	Biology	51	56	235	Chemistry				
64	58	231	Biology								

Biology:

- Only 39% were aware about the Law passed by the government for environment. (item 28)
- 58% able to analysis the situation related to water phobia.(item 64)

Chemistry:

- Only 48% able to tell that graphite can be used to decrease the wearing of the parts of the machine.(Item 17)
- 56% were aware that CO_2 is filled in the soda water bottle.(Item 51))

Physics:

- Only 49% able to analyses the diagram or picture correctly.(Item 5**5**)
- Only 50% able to interpret the correct answer from the given picture.(Item 9)

Chapter 8
Achievement in Social Science

This chapter summarises the achievement of class VIII students in Social Science 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 districts, a sample was drawn which was designed to be representative of the entire target population, i.e., all class VIII students studying in government and Government-Aided/Recognized schools.

8.1 Performance of districts in Social Science

The distribution of student achievement in Social Science for the 13 participating districts is given in Tables 8.1 and 8.2. Within each Table, districts are listed in alphabetical order. Table 8.1 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 8.2 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 district's average or not.

Table 8.1: District wise average score in Social Science (Through IRT)

District	Average Score	SE	Significant difference
Amritsar	241	5.8	No
Fazilka	243	8.8	No
Ferozepur	235	6.5	No
Gurdaspur	251	9.2	No
Hoshiarpur	269	2.6	Above
Jalandhar	244	8.5	No
Ludhiana	255	10.8	No

Mohali	212	28.3	No
Pathankot	264	12.9	No
Patiala	254	7.0	No
Roop Nagar	263	23.2	No
Sangrur	259	11.6	No
TaranTaran	227	19.1	No
State	**247**	**3.8**	

The table 8.1 the average score is 247 (with a standard error of 3.8). The results reveal substantial differences in achievement of Social Science between the highest performing districts (269 for Hoshiarpur) and the lowest performing districts (212 for Mohali).One district had average scores significantly above from state and twelve districts had average scores that were not significantly different from that of the state.

Table 6.2: District wise average score in Social Science(Through CTT)

Districts	Average Score	Standard Error	Significance Difference
Amritsar	53	0.7	No
Fazilka	59	1.5	No
Ferozepur	54	1.1	No
Gurdaspur	55	1.08	No
Hoshiarpur	70	2.5	Above
Jalandhar	55	1.06	No
Ludhiana	57	1.1	No
Mohali	43	2.8	Below
Pathankot	61	1.3	No
Patiala	58	1.2	No
Roopnagar	60	2.2	No
Sangrur	59	1.1	No
Tarn Taran	50	1.9	No
State Average	**56**	**1.7**	**-**

Note: Percentage may vary due to round off

The average score was 56% (with a standard error of 1.7). The results reveal substantial differences in achievement of Social Science between the highest performing districts (70% for Hoshiarpur) and the lowest performing districts (43% for Mohali). One district had average scores significantly above from state; one district had average scores

significantly below from state; and Eleven districts had average scores that were not significantly different from that of the state.

8.2 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

8.2.1 Gender related difference in Social Science

Table 8.3 compares the average score achieved by boys and girls in Social Science. It shows that there has no significant difference in average score of boys and girls. The table also represent that 54% boys and 46 % 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, and 'standard deviation' is given to indicate the how widely individuals in a group vary

Table 8.3: Gender wise average score in Social Science (Through CTT)

Gender	Percentage Participation	Average Score	SE	SD	Significance Difference
Boys	54	55	0.4	17.8	No
Girls	46	57	0.4	16.5	

Note: Percentage may be vary due to round off

Table 8.4, analysis through IRT shows that, there is no significant difference between the average score of boys and girls.

Table 8.4: Gender wise average score in Social Science (Through IRT)

District	Boy (Average)	SE	Girl (Average)	SE	Significant difference
Amritsar	239	6.9	243	8.1	No
Fazilka	238	9.7	255	9.3	No
Ferozepur	233	9.8	236	8.0	No
Gurdaspur	250	10.6	252	8.7	No
Hoshiarpur	267	4.6	272	0.2	No
Jalandhar	244	11.2	244	7.3	No
Ludhiana	256	11.6	253	10.4	No
Mohali	211	28.0	213	29.6	No
Pathankot	252	3.0	273	20.9	No
Patiala	250	7.8	259	7.8	No
Roop Nagar	264	31.6	261	16.0	No
Sangrur	249	8.7	272	14.2	No

TaranTaran	223	18.2	235	20.4	No
State	**244**	**4.1**	**251**	**4.0**	**No**

Table 8.5, analysis through CTT shows that, there is no significant difference between the average score of boys and girls. In Eight districts: Amritsar, Ferozepur, Gurdaspur, Hoshiarpur, Jalandhar, Ludhiana, Mohali and Roopnagar, there have no significant difference between the average score of boy's and girl's.

Table 8.5: District wise average score according to gender in Social Science

Districts	Average Score		Standard Error		Significance Difference
	Boy's	Girl's	Boy's	Girl's	
Amritsar	52	54	1.1	1	No
Fazilka	53	58	1.8	2.9	Below
Ferozepur	50	50	1.4	1.3	No
Gurdaspur	56	57	1.1	1	No
Hoshiarpur	62	64	3	2.6	No
Jalandhar	54	54	1	1	No
Ludhiana	58	57	1.2	1.1	No
Mohali	43	45	2.2	2.7	No
Pathankot	56	63	1.1	1.5	Below
Patiala	56	59	1.2	1	Below
Roopnagar	61	60	2.7	2	No
Sangrur	55	63	1	1.3	Below
Tarn Taran	46	51	1.6	3	Below

Note: Percentage may vary due to round off

8.2.2 Area related difference in Social Science

Table 8.6 describes the analysis of average score according area[15] selected. It is shows that the participating sample was 5% from Bet, 15% from Border 8% from Kandi and 72% from Others area and the average score of Bet , Border, Kandi and Others is 53%,53%,57% and 57% respectively. For each score, the 'standard error' is given to indicate the degree of imprecision arising from the sampling process, and 'standard

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

deviation' is given to indicate the how widely individuals in a group vary. Table 8.6 also shows that average score of Bet & Border area is significantly below than Kandi & Others.

Table 8.6: Area wise average score in Social Science (Through CTT)

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					Bet	Border	Kandi	Other
Bet	5	53	1.1	15	-	No	Below	Below
Border	15	53	0.7	16.2	No	-	Below	Below
Kandi	8	57	0.9	16.5	Yes	Yes	-	No
Others	72	57	0.3	17.6	Yes	Yes	No	-

Note: Percentage may vary due to round off

Table 8.7, analysis through IRT shows that, average scale score of Bet, Border, Kandi and Others is 240, 241, 254 and 252 respectively.

Table 8.7: Area wise average score in Social Science (Through IRT)

District	Bet		Border		Kandi		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar							241	5.8
Fazilka			243	8.8				
Ferozepur	252	0.0	229	9.2	239	5.0		
Gurdaspur	248	9.0	245	10.8			255	15.6
Hoshiarpur					269	2.6		
Jalandhar	218	0.0					246	8.6
Ludhiana							255	10.8
Mohali					212	28.3		
Pathankot			263	18.4	265	12.1		
Patiala							254	7.0
Roop Nagar	241	12.8			285	44.6		
Sangrur							259	11.6
TaranTaran			227	19.1				
State	**240**	**3.9**	**241**	**6.3**	**254**	**10.9**	**252**	**4.2**

Table 8.8, analysis through CTT shows that, average score of Bet, Border, Kandi and Others is 53%, 53%, 57% and 57% respectively. It shows that performance of Others and Kandi area's students is higher than Bet & Border area's. 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[16] technique was adopted.

Table 8.8: Area wise average score of districts in Social Science(Through CTT)

Districts	Area											
	Bet			Border			Kandi			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar										53	0.7	15.2
Fazilka				54	1.5	13						
Ferozepur	56	1.5	6.6	48	1.5	15.5	51	1.1	8.7			
Gurdaspur	54	2.2	17.3	54	1.2	18.4				58	1.1	18.7
Hoshiarpur							63	2	15.6			
Jalandhar	45	2.3	12.9							55	0.7	16
Ludhiana										57	0.8	18.6
Mohali							43	1.7	13.6			
Pathankot				59	1.3	12	61	1.4	9.6			
Patiala										57	0.8	17.7
Roopnagar	52	1.8	14.2				69	2.3	17.7			
Sangrur										59	0.8	18.6
Tarn Taran				48	1.5	13.5						
State Average	**53**	**2.3**	**4.7**	**53**	**2**	**4.6**	**57**	**4.6**	**10.3**	**57**	**0.8**	**2.1**

Note: Percentage may vary due to round off

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

8.2.3 Social class related difference in Social Science

Table 8.9 describes the analysis of average score according to Social class. It shows that the participating sample was 35% from SC, 19% from BC, 43% from General and 3% from Others and the average score of SC, BC, General and Others is 52%, 57%, 59% and 50% 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 have significant difference from BC and Others.

Table 8.9: Social Class wise average score in Social Science (Through CTT)

Area	Percentage Participation	Average Score	SE	SD	Significance Difference			
					SC	BC	GEN	Other
SC	35	52	0.4	16	-	Below	Below	No
BC	19	57	0.6	17.3	Yes	-	Below	Yes
GEN	43	59	0.4	17.2	Above	Yes	-	Yes
Others	3	50	2	21.6	No	Below	Below	-

Note: Percentage may be vary due to round off

Table 8.10 given below, analysis through IRT shows that, average scale score of SC, BC, General and Others is 238, 251, 254 and 245 respectively.

Table 8.10: Social Class wise average score in Social Science (Through IRT)

District	SC		BC		GEN		Other	
	Average Score	SE	Average Score	SE	Average Score	SE	Average Score	SE
Amritsar	235	6.2	235	10.1	251	7.4	244	5.7
Fazilka	221	0.8	267	7.8	262	7.8	-	-
Ferozepur	222	3.2	235	7.5	248	8.3	-	-
Gurdaspur	238	7.4	246	10.2	257	11.5	276	9.8
Hoshiarpur	259	2.6	278	15.6	275	3.6	-	-
Jalandhar	237	10.2	255	10.5	252	9.6	-	-
Ludhiana	239	7.8	251	11.7	270	12.0	206	4.2

Mohali	199	30.1	225	23.0	210	25.5	263	0.0
Pathankot	264	15.5	267	33.9	262	7.2	240	0.0
Patiala	246	13.9	252	10.3	263	6.1	233	11.8
Roop Nagar	268	20.4	259	19.0	258	30.7	269	0.0
Sangrur	238	10.2	272	13.8	264	13.1	199	5.9
TranTaran	224	25.6	219	3.6	232	12.2	272	0.0
State	**238**	**4.1**	**251**	**4.3**	**254**	**3.9**	**245**	**2.0**

Table 8.11, analysis was carried out through CTT. 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. It was detected that in most of districts SC students perform lower than GEN, but an exception was found in case Pathankot and Trantaran .In Pathankot the average score of SC & GEN is same and in Trantaran SC students perform better than GEN students.

Table 8.11: District wise average score according to Social Class in Social Science

Districts	Social Class											
	SC			BC			GEN			Others		
	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD	Avg	SE	SD
Amritsar	51	1.2	15.3	50	1.9	16.9	57	1.1	13.6	53	5.6	17
Fazilka	47	1.6	9.1	63	2.9	10.5	61	2.7	13	-	-	-
Ferozepur	45	1.5	13.3	50	2.1	12.7	55	1.3	10.9	-	-	-
Gurdaspur	52	1.3	15.1	55	1.4	17.5	59	1.2	20.2	64	3.1	16.1
Hoshiarpur	60	3.2	16	66	4.1	17.2	64	3.1	13.4	-	-	-
Jalandhar	51	1	16.8	58	1.4	12.4	57	1.4	15.3	-	-	-
Ludhiana	52	1.1	13.9	57	2.7	20.4	62	1.2	19.2	40	2	10.9
Mohali	39	2.3	10.1	48	3.2	13.9	43	3.2	15	60	-	-

Pathankot	60	1.7	12.3	61	3.6	14.3	60	1.2	9.1	53	-	-
Patiala	54	1.6	18.8	56	1.7	15.8	60	0.9	14.3	80	-	-
Roopnagar	63	2.2	16.1	59	3.2	15.3	59	3.4	21.9	60	-	-
Sangrur	52	1.6	16.2	63	1.7	19.3	60	1.1	18.1	37	2.4	9.1
Tarn Taran	47	2.3	14.7	45	3.5	13.4	49	2.2	11.4	64	3.7	5.3

Note: Percentage may vary due to round off

8.2.4 Managements related difference in Social Science

Table 8.12 describes the analysis of average score according Managements[17]. It shows that the participating sample was 47% from Department schools and 53% from Aided or Recognised and the average score of Department schools is 54% and Aided or Recognised 58%. 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 school's are significantly below than Aided/ Recognised schools. It does interpret that Aided/ Recognized schools performed higher than department schools.

Table 8.12 Management wise average score in Social Science

Management	Percentage Participation	Average Score	SE	SD	Significance Difference
Department	47	54	0.3	15.9	Below
Aided	53	58	0.4	18.2	

Note: Percentage may vary due to round off

Table 8.13, analysis was carried out through CTT. In three districts: Gurdaspur, Jalandhar and Pathankot, there have no significance difference between the average score of department and Aided/Recognized schools. But in Tarntaran there have significance difference between the average score of Department and Aided/Recognised school .But in the case of district Hoshiarpur, Roopnagar and Mohali there have some delimitation. We

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

can't select Aided or Recognised schools for districts Hoshiarpur, Roopnagar and department for Mohali, due to PPS technique.

Table 8.13: District wise average score according to Management in Social Science

Districts	Management						Significance Difference
	Department			Aided			
	Avg	SE	SD	Avg	SE	SD	
Amritsar	49	1.2	16.4	57	0.9	12.8	Below
Fazilka	48	1.4	10	68	1.6	7.4	Below
Ferozepur	46	1.1	12.5	58	1.3	10	Below
Gurdaspur	57	0.9	15.8	56	1.1	20.6	No
Hoshiarpur	63	2	15.6				
Jalandhar	55	1.1	15.9	53	0.9	16	No
Ludhiana	51	1.1	15.1	61	1	19.5	Below
Mohali				43	1.7	13.6	
Pathankot	60	1.2	12	58	1.4	7.5	No
Patiala	55	1.2	17.1	58	1	17.9	Below
Roopnagar	61	1.6	18.1				
Sangrur	50	1	13.2	63	1	19.5	Below
Tarn Taran	51	1.9	13.8	41	1.9	10.3	Yes

Note: Percentage may vary due to round off

8.3 Range score in Social Science

The tables 8.14 and figure 8.1 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 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.

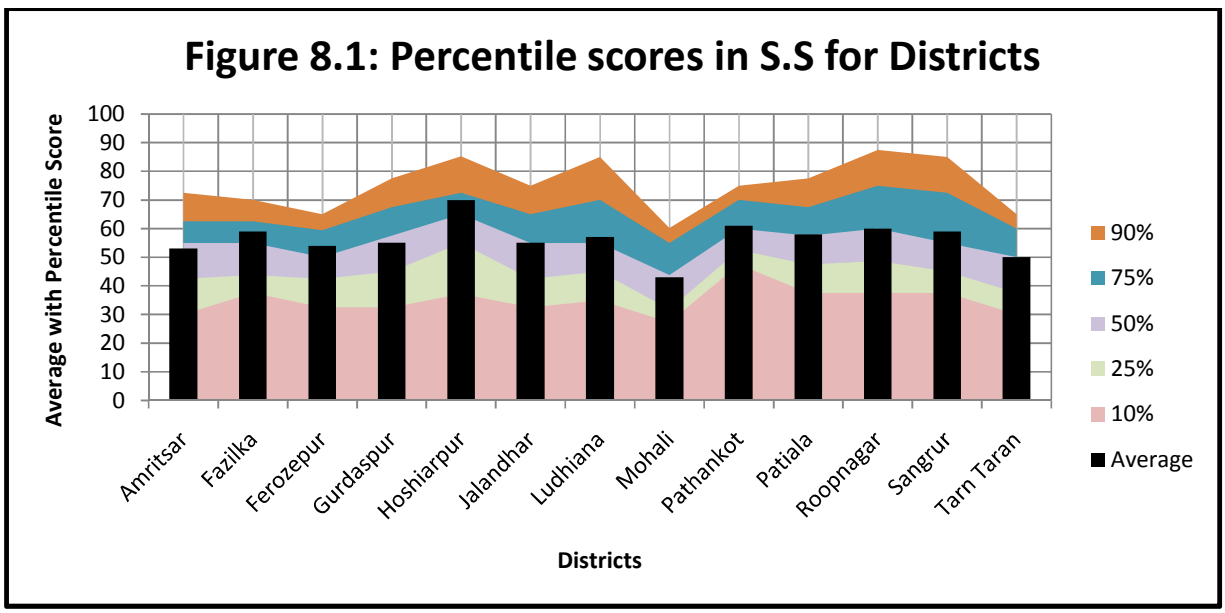
The inter-quartile range (i.e. the range between the 75th and 25th percentiles) is highly variable. For example, Ferozepur has an inter-quartile range of just 17 whilst Sangrur has a corresponding value of 28. These values suggest that the class VIII population in Ferozepur is far more homogeneous than that of Sangrur. In most districts, the range of performance for the middle group was between 18 and 26 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 28 (Pathankot) to 50 (Roopnagar and Ludhiana).

The percentiles provide additional information when comparing Mathematics 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 Ferozepur (50) and Tarntaran (50). However, the score ranges between the 25th and 75th percentiles are very different: Trantaran's range is 23 compared with Ferozepur's range of 17. This indicates that whilst average achievement is very similar in the two areas, Ferozepur has a more heterogeneous group of class VIII students than the Tarntaran.

Table 8.14: District wise Percentile score in Social Science

Districts	Average	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Range 75-25	Range 90-10
Amritsar	53	30	43	55	63	73	20	43
Fazilka	59	38	44	55	63	70	19	33
Ferozepur	54	33	43	50	59	65	17	33
Gurdaspur	55	33	45	58	68	78	23	45
Hoshiarpur	70	37	55	65	73	85	18	48
Jalandhar	55	33	43	55	65	75	23	43
Ludhiana	57	35	45	55	70	85	25	50
Mohali	43	27	32	44	55	60	23	33
Pathankot	61	48	53	60	70	75	18	28
Patiala	58	38	48	58	68	78	20	40

Roopnagar	60	38	49	60	75	88	26	50
Sangrur	59	38	45	55	73	85	28	48
Tarn Taran	50	30	38	50	60	65	23	35



8.4 Conclusion

The average achievement of students in Social Science varies across the districts of Punjab. There is a highly significant difference between outcomes in high scoring district such as Hoshiarpur (70%) and low scoring district such as Mohali (43%) and Tarn Taran (43%).

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 Ferozepur (17) and Hoshiarpur & Pathankot (18) have relatively homogeneous cohorts whilst others have far more diverse outcomes, e.g., Sangrur (28).

There is no significance difference between the average score of boys and girls. The average score of Bet & Border area is significantly below than Kandi & Others. 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 all. The average score of Departments school's are significantly below than Aided/ Recognised schools. It does interpret that aided/ recognized schools performed higher than department schools.

The following chapter provides more information about what class VIII students at various levels of achievement know and can do in Social Science.

Chapter 9
What students know and can do: Social Science

9.1 Overview of the Social Science tests

The Social Science 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 Social Science assessment instrument comprised 60 unique items.

The items in each text booklet were chosen to cover the following range of scientific domains from the Social Science curriculum: History, Geography and Civics. In addition to the content domains listed above, items were constructed to test a range of cognitive processes/domain[18] (Classified by Bloom in 1956) or parameters in a variety of contexts. These were classified as Knowledge, Understanding, Application and Skill as described below:

Parameters classification for test construction in Social Science

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, translating, interpreting, giving descriptions, and stating the main ideas

- Translation
- Interpretation
- Extrapolation

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

Skill: It includes Analysis, Synthesis and Evaluation of acquired knowledge.

Analysis: Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations

- Analysis of elements
- Analysis of relationships
- Analysis of organizational principles

[18] Source regarding cognitive process/Domain :- 1. https://en.wikipedia.org/wiki/Bloom%27s_taxonomy
2. Teaching of Social Science by Dr. Renu Gupta.

Synthesis: Builds a structure or pattern from diverse elements; it also refers the act of putting parts together to form a whole (Omari, 2006). Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.

- Production of a unique communication
- Production of a plan, or proposed set of operations
- Derivation of a set of abstract relations

Evaluation: Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria

- Judgments in terms of internal evidence
- Judgments in terms of external criteria

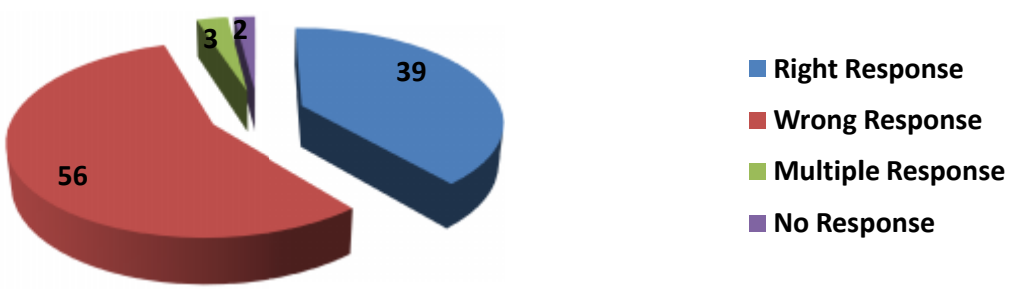
9.2 Sample Item

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

Scale Score: 281
ਗਿਆ ?

This item requires students to recall the knowledge about the fact. The scaled score of this item was 281, i.e., significantly above the average level of difficulty of items in the survey. Around 39 % of students in the sample were able to select the correct answer. The figure 9.1 shows how the remaining 61% responded.

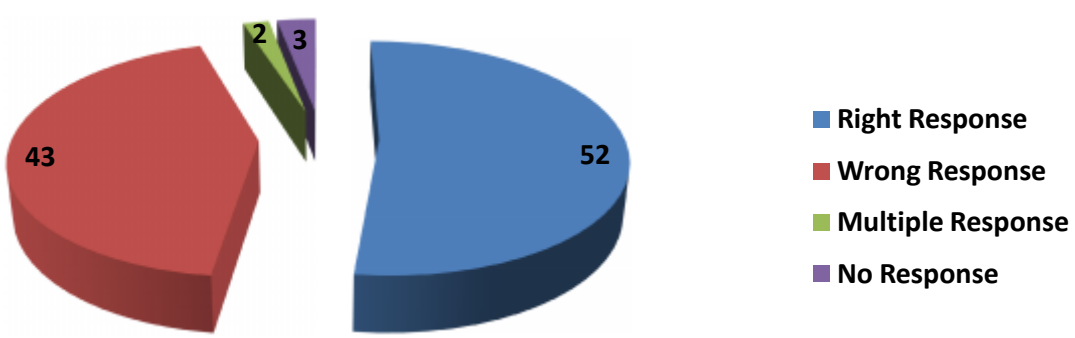
Figure 9.1: Percentage of Students Response



Scale Score: 240
ਜਹਾ ਹੈ ? ਹੇ ਹਨ ਹਾ ਹੈ

This item requires students to analyses the fact. The scaled score of this item was 240, i.e., significantly below the average level of difficulty of items in the survey. Around 52 % of students in the sample were able to select the correct answer. The figure 9.2 shows how the remaining 48 % responded.

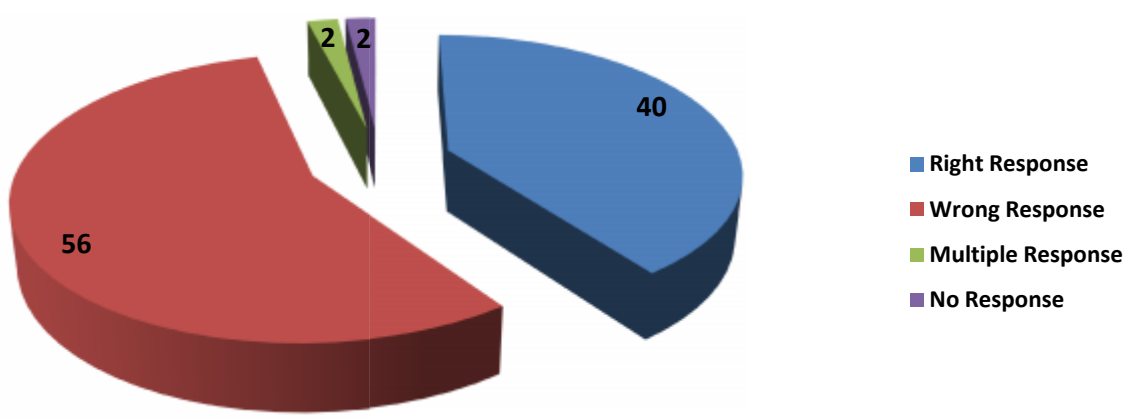
Figure 9.2 : Percentage of Students Response



Sample Item: Understanding	Scale Score: 289
ਾਰੇ ਕੀ ਵਿਚਾਰ ਸਨ ? ; ਪੱਛਮੀ ਸੱਭਿਅਤਾ ਨੂੰ ਉੱਤਮ ਮੰਨਣਾ ਸ਼ੁਰੂ ਕਰ ਦਿੱਤਾ ਹੈ ਅਤੇ ਪਾਠ ਪੁਸਤਕਾਂ ਤੇ ਜ਼ੋਰ ਦਿੱਤਾ ਜਾਂਦਾ ਹੈ ਅਤੇ ਜੀਵਨ ਅਨੁਭਵਾਂ ਅਤੇ ਵਿਵਹਾਰਕ ਲ਼ਣ ਦਾ ਮੂਲ ਕਾਰਨ ਹੈ	

This item requires students able to grasp the idea about the fact. The scaled score of this item was 289, i.e., significantly above the average level of difficulty of items in the survey. Around 40% of students in the sample were able to select the correct answer. The figure 9.3 shows how the remaining 60 % responded.

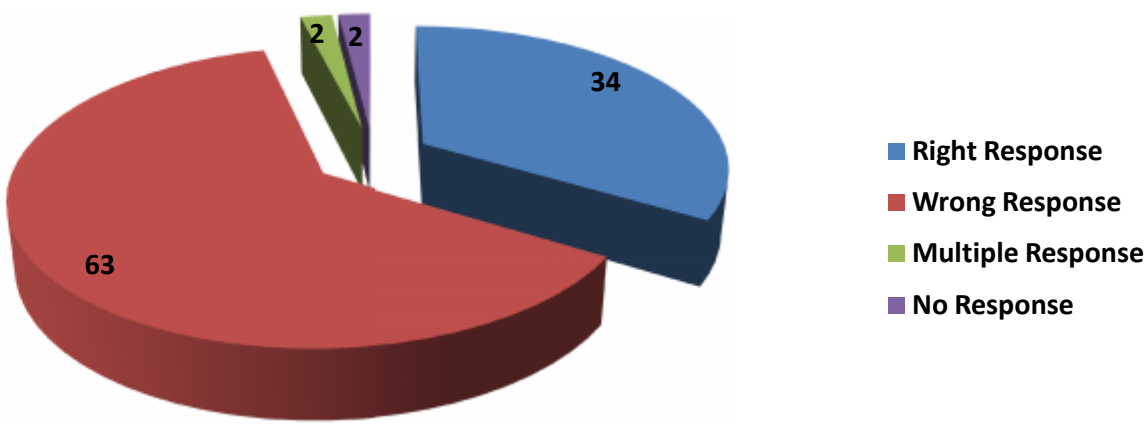
Figure 9.3 : Percentage of Students Response



Sample Item: Understanding	Scale Score: 337
ਾਰਤ ਦੇ ਕਿਸ ਹਿੱਸੇ ਵਿੱਚ ਸਥਾਪਤ ਕੀਤੀਆਂ ਸਨ ?	

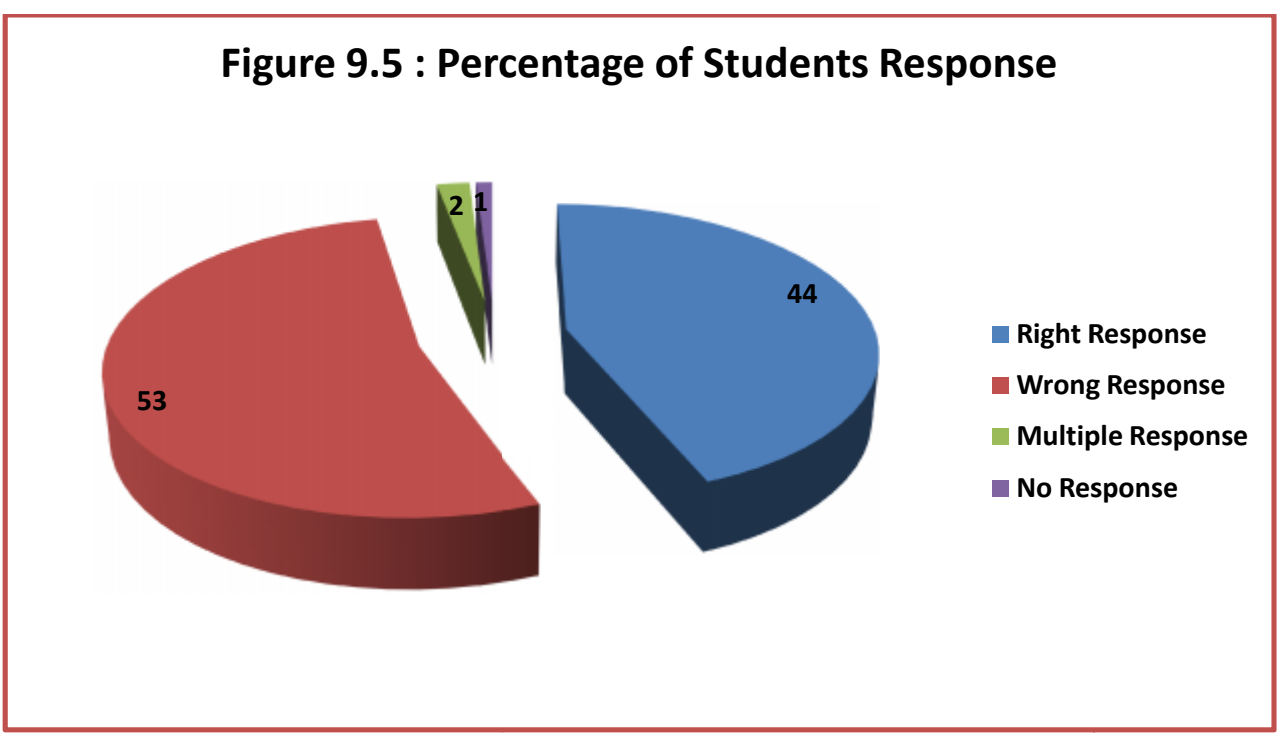
This item requires students able to grasp the idea about the fact. The scaled score of this item was 337, i.e., significantly above the average level of difficulty of items in the survey. Around 34% of students in the sample were able to select the correct answer. The figure 9.4 shows how the remaining 66 % responded.

Figure 9.4 : Percentage of Students Response



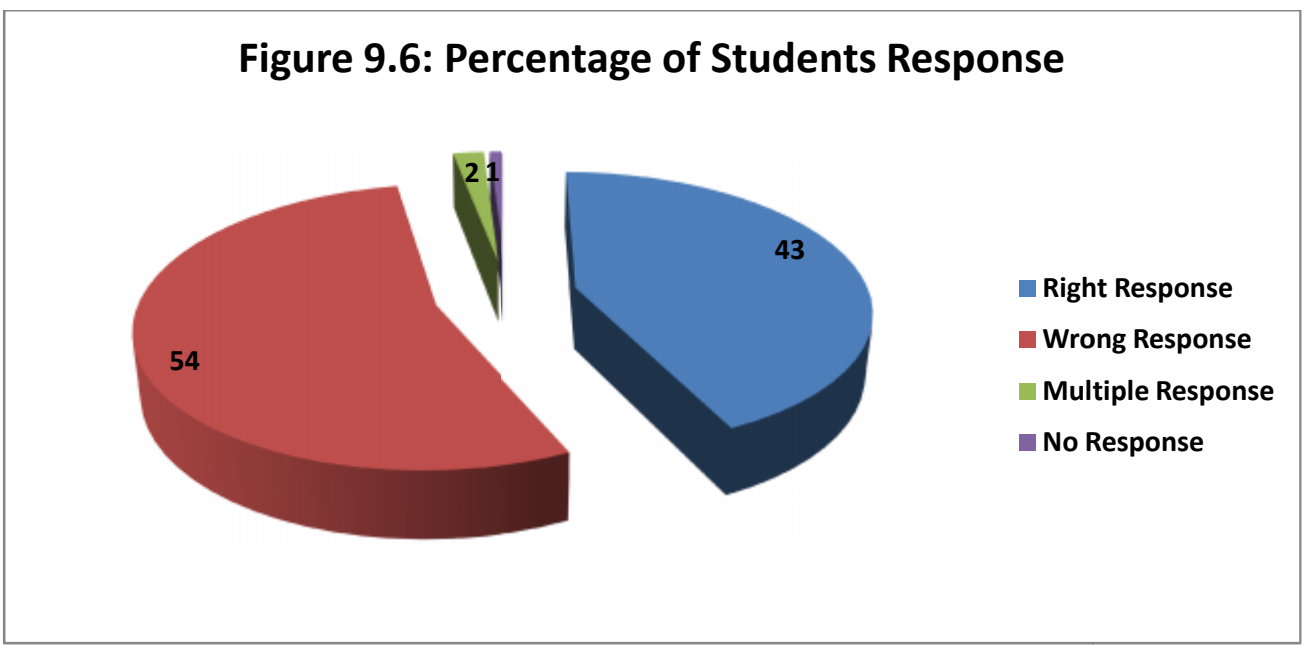
Scale Score: 270
ਤੁਸੀਂ ਉਮਰ ਤੱਕ ਕਰ ਸਕਦੇ ਹੋ ?

This item requires students able to apply the knowledge about the law. The scaled score of this item was 270, i.e., significantly above the average level of difficulty of items in the survey. Around 44% of students in the sample were able to select the correct answer. The figure 9.5 shows how the remaining 56 % responded.



Sample Item :Understanding	Scale Score: 278

This item requires students able to grasp the idea about fact. The scaled score of this item was 278, i.e., significantly above the average level of difficulty of items in the survey. Around 43% of students in the sample were able to select the correct answer. The figure 9.5 shows how the remaining 56 % responded.



9.3 What can students do in Social Science?

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

9.3.1 Cognitive Process: Knowledge

Table 9.1 shows the performance of class VIII students on the cognitive process of Knowledge.

Table 9.1: Performance of class VIII students on the cognitive process of Knowledge

Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum
11	65	199	Civics	1	66	208	Geography	13	57	227	History
20	56	227	Civics	2	54	230	Geography	16	41	271	History
21	56	231	Civics	3	48	252	Geography	18	45	259	History
23	58	219	Civics	7	62	210	Geography	22	40	281	History
24	51	244	Civics	26	50	245	Geography	47	75	172	History
25	55	233	Civics	41	56	229	Geography	53	43	286	History
27	78	162	Civics	42	52	247	Geography	54	45	278	History
51	55	236	Civics	43	61	221	Geography	56	46	273	History
59	71	193	Civics	48	57	237	Geography	61	58	223	History
63	68	205	Civics								
64	65	215	Civics								

Civics

- 51% students knows that 2 Anglo Indian members can be nominated by the president in Lok Sabha.(Item No 24)
- 78% students know that Supreme Court of India is situated at New Delhi.(Item No 27)

Geography

- Only 48% students knows that there have 6 major types of soil in India.(Item No 3)
- 66% students knows that Alluvial soil is most abundant in Punjab.(Item No 1)

History

- Only 40% knows that Pitt's India Act was passed in 1784.(Item No 22)
- 75% knows that Jalianwala Bagh massacre was occurred in 1919 AD (Item No 47)

9.3.2 Cognitive Process: Understanding

Table 9.2 shows the performance of class VIII students on the cognitive process of Understanding.

Table 9.2: Performance of class VIII students on the cognitive process of Understanding

Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum
17	56	221	Civics	10	55	228	Geography	4	69	188	History
19	77	170	Civics	45	58	231	Geography	9	56	230	History
58	43	278	Civics					46	34	337	History
65	61	227	Civics					50	45	274	History
66	46	269	Civics					57	57	234	History
70	49	256	Civics					60	61	220	History

Civics

- Only 43% students able to told that constitution is supreme out of Prime Minister, President, chief Justice of Supreme Court and constitution .(Item No 58)
- 77% students able to grasp the idea related to work of SSA.(Item No 19)

Geography

- 55% students able to tell that Intensive farming is used in Punjab.(Item No 10)
- 58% students able to tell that Iron and steel industry is known as the basic or first grade industry.(Item No 45)

History

- Only 34% knows that Portuguese establish their colonies in the southern part of India.(Item No 46)
- 69% able to tell the reason of started the doctrine of lapse in India by British. (Item No 4)

9.3.3 Cognitive Process: Application

Table 9.3 shows the performance of class VIII students on the cognitive process of Application.

Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum	Item No	% Correct	Scale scores	Domain of Social Science Curriculum
28	33	326	Civics	49	49	255	Geography	5	65	202	History
55	44	270	Civics	52	70	193	Geography	8	46	262	History
67	68	198	Civics					12	47	255	History
68	64	221	Civics								

Civics

- Only 33% students are aware about Shagun scheme.(Item No 33)
- 68% students were aware about the justification of discrimination based on caste system.(Item No 67)

Geography

- Only 49% students were aware about the way to protect wild animals.(Item No 49)
- 70% students were knows that In India there have 80,000 type of animals are found. (Item No 52)

History

- Only 46% students were aware about the reason of Indian farmers' revolt against the British rule. (Item No 8)
- 65% students were aware about the reason behind the introducing agriculture commercialization in India by British.(Item No 5)

9.3.4 Cognitive Process: Skill

Table 9.4 shows the performance of class VIII students on the cognitive process of Skill.

Item No	% correct	Scale scores	Domain of Social Science Curriculum	Item No	% correct	Scale scores	Domain of Social Science Curriculum	Item No	% correct	Scale scores	Domain of Social Science Curriculum
15	59	217	Civics	6	62	217	Geography	14	56	229	History
29	52	240	Civics	44	54	243	Geography				
62	45	270	Civics	30	42	282	Geography				
69	57	232	Civics								

Civics

- Only 45% students were able to respond that how to stop untouchability in India.(Item No 62)
- 59% students were able to respond about Prohibition of Alcohol Act.(Item No 15)

Geography

- Only 42% students were able to find out the required place in the Map.(Item No 30)
- 62% students were able to pair out the correct information.(Item No 6)

History

- 56% students were able to pair out the correct information.(Item No 14)

Appendix – I

Sample Procedure

This appendix of the class VIII 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 VIII SLAS: Target Population

The class VIII SLAS was designed to investigate learning achievement. But, the target population was all class IX students because the survey was administer in the beginning of the session. Sample schools included those managed by the Department of Education, Private-but-government-aided schools and recognised. This follows the classification categories of the District Information System for Education (DISE). Schools run by the central, state or local governments are referred to as 'government' schools. Schools run by private managements but funded largely or recognised by government are known as 'aided' schools or recognised. The survey was administered in 13 districts. Because the area i.e Kandi, Bet, Border 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[19] :- 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 portion of Punjab that share the border of country and other states like Pathankot, Gurdaspur, Amritsar, TarnTaran, Firozepur, Fazilka, Muktsar, Bathinda, Mansa, Sangrur, Patiala, Mohali, Ropar and Hoshiarpur.

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 IX having fewer than thirty students excluded. In addition to this 'small school exclusion', the survey excluded 'Upper Primary Only' schools due to a classification error.

[19] Information regarding Area like Kandi, Bet, LOC and Border are collected from the http://en.wikipedia.org.

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

Sample Design and Selection

In general, developing the sample for each districts 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 IX 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 Districts. 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 VIII (SLAS) covered two subjects: Language (Punjabi) Mathematics, Science and Social Science.

At the third stage, the required number of students in each school was selected using SRS. In schools where class IX 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 30. 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 SLAS data and estimating sampling variance

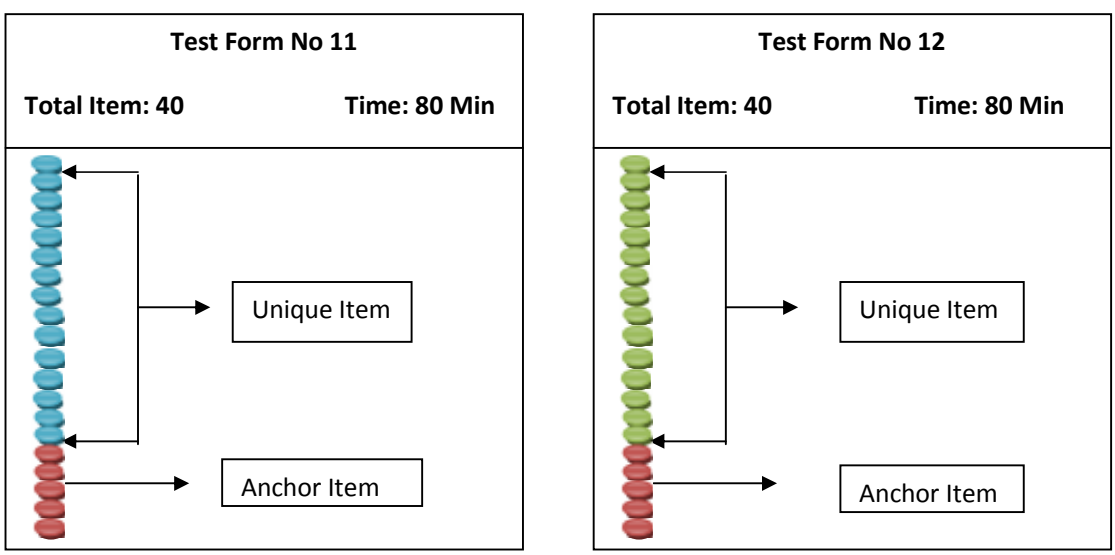
IRT scaling of the SLAS data

The aim of the SLAS 2014 survey was to achieve an assessment of a wide coverage of the class VIII curricula in Language (Punjabi), Mathematics, Science and Social Science. This meant that a relatively large number of items were required to cover the curriculum adequately. Thus, there were a total of 70 items in each subject. 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 eight 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 other subjects.

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

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

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

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).

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

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

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).

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

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

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 not included in the 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.