CHAPTER THREE
Design of the Study

3.1 Introduction
This chapter deals with the design, methodology, collection and analysis of data of the study. The quality of any study is depended on design and methodology. The design and methodology includes operational definitions of some important variables along with some terms used in this study, objectives, hypotheses, sampling and delimitation of the study. This chapter also describes the research tools and its validity and reliability, collection of data and statistical techniques used in analysis and interpretation of data.

3.2 Operational Definition of the Variables /Terms
3.2.1 Physical facilities of schools
To assess progress of States and Union Territories towards the goal of Universalisation of Elementary Education, an Educational Development Index (EDI), has been developed by National University of Educational Planning and Administration (NUEPA). The EDI has been developed on four broad parameters of access, infrastructure, teacher related indicators and elementary education outcomes. The EDI takes into account 22 indicators. Out of these indicators, the components namely teacher, classroom, pupil teacher ratio, school classroom ratio, status of professional qualification of teachers, building condition, availability of textbooks, availability of school dress, availability of midday meal, co-curricular activities, games and sports in school, health check up in school, library, playground, sanitation arrangement, and teaching –learning materials and drinking water arrangement are considered as physical facilities of schools in the present study.

3.2.2 Internal efficiency of school
Mehta, A. C. (2002) defined the internal efficiency of school as an optional relationship between the input and output. An activity is said to perform efficiently if a given quantity of output is obtained with the minimum inputs or given quantity of input yields the maximum output. Thus, by the internal efficiency of school means to get maximum output. The best system is one which has both the input and output
exactly the same, which is known as a perfect efficient system in education. Internal efficiency of school is the ratio of difference of output & input and input multiplied by 100. In the present study this definition has been used.

The indicators of internal efficiency are –

(i) Input-output ratio
(ii) Input per graduate
(iii) Wastage ratio.
(iv) Proportion of wastage on accounts of drop outs and repeaters.
(v) Average duration of stay: Graduates, Drop out and Cohort
(vi) Cohort survival and dropout rates.

3.2.3 Achievement of the student
Achievement level of student at a particular stage of education indicates to what extent the student has acquired the competency level which is necessary to bridge the next higher stage of education. The achievement level test is framed on the basis of that concept. So in this study, the scholastic achievement of student was measured through an achievement test of class IV students in Bengali, Mathematics and Environmental studies.

3.2.4 Primary education
In India, the total span of school education in West Bengal is divided into four stages namely: Primary (classes-I to IV), Upper Primary (classes V to VIII), Secondary (classes IX and X) and Higher Secondary (classes XI to XII). According to the provision of West Bengal Primary Education Act, 1973, class – V belongs to the primary level. But in practice an overwhelming large number of primary schools (about 43,000 out of total 52,000) teach only up to class – IV. In most cases class – V has become a part of the secondary school or junior high school. So Classes I – IV is considered as primary education for this study.

3.2.5 First phase and cohort I
In the study analysis is done in three phases. The 1st phase was a period before non detention policy i.e. the academic sessions from 1974 to 1981. The non-detention policy was declared by the government of West Bengal in 1981, so eight years back
i.e. the year 1974 was considered as the base year for the 1st phase. At that base year the enrolment of children in class I was taken and it was considered as ‘Cohort I’ and accordingly data were collected up to 1981. It is to be noted that the academic session in primary schools was from January to December in coterminous with the calendar year at that material point of time.

3.2.6 Second phase and cohort II
The 2nd phase was a period before SSA programme i.e. the academic sessions from 1990-91 to 1997-98. The SSA programme was implemented in 2002-03. So four years back this 2nd phase completed and obviously the year 1990-91 was considered as the base year for the 2nd phase. At that base year the enrolment of children in class I was taken and it was considered as ‘cohort II’ and accordingly data were collected up to 1997-98. It is to be noted that the academic session in primary schools was converted from May to April at that material period.

3.2.7 Third phase and cohort III
In this study the academic session 2007-08 to 2013 were treated as the 3rd phase i.e. the period after the implementation of SSA policy which was scheduled to be completed in 2010. But the programme is still continuing as it was extended by central government. The period 2007-08 has been considered as the base year for following children in class I for this 3rd phase. At that base year the enrolment of children was in class I was taken and it was considered as ‘cohort III’ and accordingly data were collected up to 2013. It is to be noted that the academic session in primary schools was converted again from January to December in coterminous with the calendar year from 2011.

3.2.8 Dropout
The students who have not completed class IV and left the school at any class in between class I to Class IV have been considered as dropout.

3.2.9 Wastage
According to Encyclopaedic Dictionary and Directory of education, Volume I, Biswas, A. and Agarwal, J.C. (1971) have given the meaning of wastage as “the term
used to imply the infructuous expenditure of time, energy and resources on the students who permanently withdraw from the schools. In the primary stage it is measured by comparing the total number of students enrolled in class I in a particular year to the total number of students reaching class IV in 4 years or class V in 5 years whichever be the final year of the primary stage. In the Statistical Measurement of Educational Wastage, UNESCO (1970) it is defined as “Incidence in a country’s educational system from the point of view of its efficiency, of factors such as premature school leaving and retardation or repetition.” In the present study wastage for both premature school leaving and for repetition has been considered.

3.2.10 Repetition
The Encyclopaedic Dictionary and Directory of education, Volume I, Biswas, A and Agarwal, J.C (1971) defined the term stagnation as retention of a student in a class for a period of more than one year. The Education commission (1964-66) has described the stagnation for a particular class in a year as the excess period spent by the pupil in that class beyond one year i.e. the normal period. In the present study, repetition is considered as stagnation irrespective of completion or non completion of primary education.

3.2.11 Completion
Completion of primary education successfully is considered as completion in the present study. It is differed from survival. Survival is considered as survival in primary education irrespective of completion or non completion of primary education.

3.2.12 Primary graduate
The student who has successfully completed class IV i.e. primary stage of his study is treated as primary graduate.

3.2.13 Government aided primary school
The schools under the District Primary Councils which are overall under the control of West Bengal Board of Primary Education and get all required financial assistance from State Government are considered as Government aided primary school.
3.3 Significance of the study
Sarva Shiksha Abhijan (SSA) is Government of India’s flagship programme for achievement of Universalization of Elementary Education (UEE) in a time bound manner, as mandated by 86th amendment to the Constitution of India making free and compulsory Education to the Children of 6-14 years age group, a ‘Fundamental Right’. SSA is being implemented in partnership with State Governments to cover the entire country and address the needs of about 192 million children in 1.1 million habitations.

The Right of Children to Free and Compulsory Education Act or Right to Education Act (RTE), which was passed by the Indian parliament on 4 August 2009, describes the modalities of the provision of free and compulsory education for children between 6 and 14 in India under Article 21A of the Indian Constitution. India became one of 135 countries to make education a fundamental right of every child when the act came into force on 1 April 2010.

The states will have to make an objective assessment of their prevalent education system including educational administration, achievement levels in schools, financial issues, decentralisation and community ownership, review of State Education Act, rationalization of teacher deployment and recruitment of teachers, monitoring and evaluation, status of education of girls, SC/ST and disadvantaged groups, policy regarding private schools and Early Childhood Care and Education. Many states have already carried out several changes to improve the delivery system for elementary education.

There are several extrinsic motivators in the programme (such as infrastructural facilities including drinking water and sanitation facilities, book grant, in service teachers’ training, teacher deployment – both regular and Para, Teaching-Learning Material Grant, and all expenditure in Kasturba Gandhi Balika Vidyalaya hostel, Alternative/Innovative Education Centre, Rabindra Mukta Vidyalaya centres, Bridge Course Centre etc.), but all the efforts would go in vain if intrinsic motivation cannot be generated among the learners. About one decade has been devoted to this programme and it is still running, it is assumed that beside external factor there are
intrinsic factors for qualitative achievement. A review of related literature shows that SSA Programme has taken a crucial role in educational and social change. In India, SSA Programme has been running since 2002, but surprisingly, till date there are no comprehensive research works to probe into impact of SSA Programme on school efficiency and scholastic achievement of student at primary level in rural West Bengal particularly changes occurred in those areas during SSA period.

There are some studies on a single or two or three aspects like ‘Out of School Children’, Teachers’ training, Students’ performance etc. Considering all aspects together in totality in pre SSA period and during SSA period in the same frame of reference a single study is highly is needed.

So the study is very significant and helpful to evaluate the changes have taken place due to ongoing SSA programme particularly in the context of the Right of Children to Free and Compulsory Education Act or Right to Education Act (RTE) 2009.

3.4 Objectives of the Study
1. To compare the internal efficiency of school before and after implementation of SSA Programme.
2. To study the changes in physical facilities in Primary schools before and after implementation of SSA Programme.
3. To compare the rate of repetition and completion of primary education among the first, second and third phases
4. To compare the achievement level of class IV students before and after implementation of SSA Programme.
5. To study the changes of socioeconomic background of class IV students before and after implementation of SSA Programme.
6. To find out the constraints of proper and effective implementation of SSA Programme.

3.5 Hypotheses
1. There is a significant difference in the internal efficiency of schools before and after implementation of SSA programme .
2. There is a significant difference in the physical facilities in primary school before and after implementation of SSA programme.

3. There is a significant difference in the rate of repetition in primary school before and after implementation of SSA programme.

4. There is a significant difference in the rate of completion in primary school before and after implementation of SSA programme.

5. There is a significant difference in the achievement of class IV student before and after implementation of SSA programme.

6. There is a significant difference in the socio economic background of class IV student before and after implementation of SSA programme.

3.6 Methodology of the Research
This is an empirical longitudinal survey type of study.

3.6.1 Population of the Study
The students of Government aided Primary Schools in Rural West Bengal are considered as population.

3.6.2 Sampling techniques and Sample
A study was done in 2001 to find out the stagnation and drop out, socioeconomic background, implementation of non-detention policy and achievement level of class IV students selecting 18 Schools. Schools were selected in 6 Blocks of three districts namely South 24 Parganas, Paschim Medinipur and Mursidabad in Rural West Bengal. The samples were selected on the basis of stratified random selection. Subsequently, along with other parts of India in West Bengal also SSA Programme has been running since 2002 and SSA Programme has taken a crucial role in educational and social changes. So this research work is conducted to probe into impact of SSA Programme on school efficiency and scholastic achievement of student at primary level in rural West Bengal particularly changes occurred in those schools during SSA period. In the present study, those 18 Schools are selected to compare and analyze the changes occurred before and after implementation of SSA. So technique of purposive sampling is adopted. To fulfil the objective number 1 and 3, in all these 18 schools all 539 pupil enrolled in class I in 1974, 830 in 1990-91 and 786 in 2007-08
sessions constitute the sample. To fulfil the objective no 2, all 18 schools were taken. To fulfil the objective no 4, for achievement test, 12 students in class IV from each school in 2001 and in 2011 all 538 students in class IV of all 18 schools present on the date of test were taken as sample. 4 student of each school in each phase 144 (72+72) in total were sampled out for class IV student to meet the objective no 5. To fulfil the objective no 6, six Blocks of three districts namely South 24 Parganas, Paschim Medinipur and Mursidabad in Rural West Bengal were taken as sample. Sample Districts were shown in the following maps of West Bengal.
Design for the selection of the sample School

West Bengal

District 1

Block 1

G.P_1  G.P_2  G.P_3

School 1

Distri

Block 2

G.P_1  G.P_2  G.P_3

School 2

Block 1

G.P_1  G.P_2  G.P_3

School 3

Block 2

G.P_1  G.P_2  G.P_3

School 4

District 2

School 5

District 3

School 6
West Bengal

Paśc. Medinipur
South 24 Pgs
Murshidabad

(District advanced rate of literacy)
(District with medium rate of literacy)
(District with low rate of literacy)

Kakdwip Block
Falta Bl

Pratapaditya
Madhusudhanpur
Suryanagar
Belsinngh
Fatepur
Falt

Nagar G.P.
G.P.
G.P.
G.P.
G.P.
P. G

Kakdip Primary
Sambhuchandrapur
Anandanagar
Kotaldanga
Fatepur
Chakkrishnarampur

School
Prathamik Vidyalaya
Prathamik Vidyalaya
Primary School
Prathamik School

Pingla Block
Daspur I Block

Pindri
Gobardhanpur
Jalchak No. I
Basudevpur
Rajnagar Daspur 2

G.P.
G.P.
G.P.
G.P.
G.P.

Harma
Prathamik
Brambhanipur
Lakshimbari
Baikinthalpur
Rajnagar Board

Vidyalaya
Prathamik Vidyalaya
Prathamik Vidyalaya
Primary School
Prathamik Vidyalaya
Primary School

Nabagram Block
Murchidabad Ziagange Blk

Kiriteswari
5 No. Narayanpur
N. Dhakishin
Natungram
Prasadpur
5 No. Tatulia

G.P.
G.P.
G.P.
G.P.
G.P.

Nagra Primary
Bholadanga Adibasi
Amatpur
Natungram
Prasadpur
Indradanga

School
Primary School
Primary School
Prathamik Vidyalaya
Primary School
Nimnabuniyadi Vidyalaya
Table 3.1: School wise number of sample students of class IV for achievement test

<table>
<thead>
<tr>
<th>School No</th>
<th>Pre SSA</th>
<th>Post SSA</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>26</td>
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<tr>
<td>4</td>
<td>11</td>
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<td>5</td>
<td>10</td>
<td>17</td>
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<td>6</td>
<td>11</td>
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<td>7</td>
<td>11</td>
<td>20</td>
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<td>8</td>
<td>10</td>
<td>15</td>
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<td>9</td>
<td>9</td>
<td>19</td>
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<tr>
<td>10</td>
<td>12</td>
<td>29</td>
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<tr>
<td>11</td>
<td>5</td>
<td>53</td>
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<tr>
<td>12</td>
<td>24</td>
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<td>15</td>
<td>63</td>
<td>16</td>
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<td>16</td>
<td>50</td>
<td>17</td>
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<tr>
<td>17</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>18</td>
<td>7</td>
<td>35</td>
</tr>
</tbody>
</table>

3.7 Delimitation of the study

18 Schools were selected in 6 Blocks of three districts namely South 24 Parganas, Paschim Medinipur and Mursidabad in Rural West Bengal. So the study is limited to rural West Bengal excluding the hilly and forest region of northern and extreme western part of West Bengal. The study observed scholastic achievement and socioeconomic background of students and internal efficiency, repetition and dropout rate and availability of physical facilities of only Government aided primary schools. In this study, the scholastic achievements of students were measured by an achievement test of class IV students in Bengali, Mathematics & Environmental studies only. Socioeconomic background was limited to observe the demographic characteristics, occupations, educational background of parents of class IV students. Internal efficiency of schools is measured through limited six indicators such as Input-output ratio, Input per graduate, Wastage ratio, Proportion of wastage on accounts of drop outs and repeaters, Average duration of stay of Graduates, Drop out and Cohort, Cohort survival and dropout rates. Only number of student , number of teacher, number of classroom, drinking water facilities, sanitation arrangement, availability of playground , availability of common TLM, midday meal, free school uniform and health check up facilities were taken as physical facilities in the study.

3.8 Tools and Their Administration

In the present study, five tools were used. All tools are finalized on the basis of findings of pilot study. All tools were translated in Bengali and were administered in Bengali. The researcher administered the questionnaire and schedule and filled up them according the response.
3.8.1 Schedule on general information of the school
This Schedule was constructed to collect the general information like name and address of the school, location, and medium of instruction, teachers and other physical facilities available in schools. Total 19 items were constructed to collect the information with a view to achieve the objectives.

3.8.2 Interview schedule on the opinion of teacher
Forty items are in the schedule to the quality related information from the teacher in the following areas-
- Teaching Learning process
- Study material and their availability.
- Ongoing evaluation process.
- Remedial teaching
- Repetition
- Productive and creative work
- Physical education including games and sports.
- Cumulative Record card and progress Report
- Teachers’ opinion and suggestion.

3.8.3 Schedule on Socio economic background of the student
This schedule is comprises of 30 items. It has been prepared for collection of information in connection with status of income, educational background and occupation of the households and other demographic information like religion, caste, mother tongue, family size and ownership of amount of agricultural land.

3.8.4 Checklist regarding causes of dropout
Many research studies on causes of drop out conducted earlier were studied. The causes were categorised and listed. Then again some parents, social workers, headmasters, teachers and also school inspectors were interviewed and analysed the causes and prepared the final checklist. The checklist was divided in two parts. The works or occupations for which children are dropping out were listed. 17 areas were identified.13 other causes of dropout were enlisted in the second part of the schedule.
3.8.5 Achievement Level Test

The test was constructed by Dr. Kutubuddin Halder, Department of Education, Calcutta University, the supervisor of the present study under the guidance of late Dr. S. Chakrabarty, Department of Education, Calcutta University in the year 2001. That test has been scanned to learn how far it is appropriate to administer in respect of present syllabus and also tried out and found it is absolutely applicable in the present syllabus as it was prepared beyond textbooks to evaluate the competencies. So it is used in the present study.

Since one of the objectives of the present study is to compare the achievement level of class IV students before and after implementation of SSA Programme and the test was prepared to evaluate achievement level of the core competencies of class IV level which were beyond textbooks, so that test has been used in the present study.

That test was prepared at that time through scanning the syllabus, trying out the each individual item. The purpose of that test was maximisation of individual differences, discrimination of individuals, level and amount of learning of the individuals and group.

Indian Statistical Institute (ISI), Kolkata prepared achievement level test for class IV and applied it on large sample. Items of that test were also taken into consideration at the time of preparation of this test.

Item analysis was done keeping in view that there must be individual differences and also to maintain some sorts of reliability and validity, avoiding too much so called easy items or difficult items.

The test was framed in three parts based on three subjects namely Bengali, Mathematics and Environmental Studies. Full marks of each subject were 50. The total marks of the entire test were 150.

The first part Bengali comprised of six items to evaluate comprehension (10), language awareness (6) picture comprehension (10), handwriting (8), spelling (6) and
dictation (10). The comprehension competency measured by ability to comprehend simple paragraph in Bengali. Observation, language, consistency and imagination for picture comprehension ability were given to evaluate the ‘power of description’ in the test. Ability of writing alphabet in correct shape, gap between letters within the words, neatness, completion of letters for assessing handwriting and correctness, speed, punctuation (comma and full stop), completion and neatness for evaluation of dictation ability were taken into consideration. Scoring guidelines were 2 (two) marks for right answer, 1(one) mark for partially right answer, 0 (zero) mark for wrong answer.

Second part of the test of 50 marks consisted 11 items of Mathematics to measure the abilities like arithmetical concept from pictures (3), concept of large and small numbers (3), addition (6), subtraction (6), multiplication (6), division (6) (30 marks in total) and application of addition (5), subtraction (5), multiplication (5) and division (5) (20 marks in total). Part marking method was followed for each step of all items.

Last part of the test of 50 marks in Environmental Studies comprised of 25 items on history, geography and general science. Each item carries 2 (two) marks. The items were selected to evaluate the following components like concept of living and nonliving object from picture (16 marks), democracy and social awareness (10 marks), free from dogmas or orthodoxy (2 marks), scientific and general awareness (6 marks), cognition of social friends (6 marks), hill, mountain and island (2 marks), state, country and subcontinent (2 marks) Items were fill in the blanks, multiple choice and rearrangement type.

In addition to the above mentioned tools data were collected from another source -

3.8.6 Students’ admission and attendance register (class I to IV from 2007-08 to 2013)

The researcher collected each name of the student who was enrolled in class I in the academic sessions 2007-08 from the admission and attendance register of the schools. The repetition and drop out of the student in the entire period were availed from those registers. Attendance registers were also used to get information regarding regularity of the student. Cohort studies were also done from the information availed from those registers.
3.9 Collection of data

The comprehensive primary data of internal efficiency of the schools, physical facilities available in schools and also quality related data were collected from the headmasters, teachers, students and guardians. Subsequently those were supplemented by secondary data from the reports published by Government and non-Government agencies and the observation of investigator himself. The achievement test of the students of class IV was administered in December 2011 i.e. at the end of academic session with the help of teachers and Sikhsabandhus of SSA. The test was for 2 hours duration. The test was administered in a fare-free atmosphere which was created by the investigator and the teachers. The investigator also visited students’ home and met their parents for the collection of data regarding income, education and occupation of the students’ families through socio-economic background schedule. The primary data regarding physical facilities available in schools, internal efficiency and scholastic achievement of the students which were collected by Halder, K. from April to December 1998 were also taken for the Pre SSA period.

The investigators visited home and meet the sample parents and students and collected information and data using prepared schedule and checklist. The information collected has been cross-verified.

3.10 Statistical Treatment

For quantitative analysis of data, ratio percentage, mean, standard deviation, t-test, z-test and $\chi^2$ test were applied and qualitative analysis was done on the basis of informal discussion with the assistant teachers and headmasters of the schools while collecting data. In West Bengal, West Bengal Board of Primary Education introduced five grades in the evaluation system at the primary level. These are A Grade (from 81 to 100 marks), B Grade (from 66 to 80 marks), C Grade (from 51 to 65 marks), D Grade (from 36 to 50 marks) and E Grade (from 0 to 35 marks). In the present study, A, B and C Grades are considered as very good, good and average result for Class IV standard and D Grade is considered as Class III standard. E grade has further been divided into three Grades: E Grade (from 21 to 35 marks) and F Grade (from 1 to 20 marks).
marks) which are considered as Class II and Class I standard respectively, and G Grade (get 0 mark only) to analyze the achievement of the student more accurately. In this study rate of drop out, stagnation and completion were calculated using ‘True Cohort Method’ which is more accurate method in comparison to ‘Apparent Cohort Method’ or ‘Reconstructed Cohort Method’.

In this case, enrolment in class I in a given year is considered. Student flow charts are constructed for subsequent seven years showing drop outs and repeaters. This time series data are also used to calculate the indicators of internal efficiency of the schools.

The indicators of internal efficiency are calculated as follows –

(i) **Input Output Ratio**

\[
\text{Input/output (in percentage)} = \frac{\text{No of graduates} \times 4}{\text{Total Student years invested}}
\]

(ii) **Input per graduate**

\[
\text{Input per graduate} = \frac{\text{Total Student years invested}}{\text{No of graduates}}
\]

Wastage of Years (in percentage)

\[
= \frac{\text{Average time taken by the students} - 4}{\text{Average time taken by the students}}
\]

(iii) **Wastage ratio**

\[
\text{Wastage ratio} = \frac{\text{Actual Input output ratio}}{\text{Ideal Input output ratio}} \quad \text{(Ideally it should be 1.00)}
\]
(iv) Proportion of wastage on acccents of drop outs and repeaters

Wastage on account of the repeaters

\[
\text{Wastage on account of repeaters} = \frac{\text{Students' years wasted due to repeaters}}{\text{Total Students' years wasted}} \times 100
\]

Wastage on account of drop out

\[
\text{Wastage on account of drop out} = \frac{\text{Students' years wasted due to repeaters}}{\text{Total Students' years wasted}} \times 100
\]

(v) Average Duration of stay (Graduates, Drop outs and entire Cohort)

The next indicator of efficiency is the ‘average duration of stay ‘in the system, which can be computed separately for the graduates, drop out and also for entire cohort as a whole.

Average duration of stay of Graduates

\[
\text{Average duration of stay of Graduates} = \frac{\text{Total time in years taken by the graduates}}{\text{Total no.of primary graduates}}
\]

Average duration of Drop Outs

\[
\text{Average duration of Drop Outs} = \frac{\text{Total time in years taken by the drop out student}}{\text{Total no.of drop out student}}
\]

Average duration of entire Cohort

\[
\text{Average duration of entire Cohort} = \frac{\text{Total time in years taken by the entire Cohort}}{\text{Total no.of entire Cohort}}
\]

(vi) Cohort Survival and Drop out Rates

Cohort Survival rates

\[
\text{Cohort Survival rates} = \frac{\text{No.of survived student}}{\text{Total no. students}} \times 100
\]
Cohort Dropout rates = \( \frac{\text{No. of drop out students}}{\text{Total no. of students}} \times 100 \)

Completion Rate

Completion rates = \( \frac{\text{No of students completing class IV}}{\text{Initial Enrolment in class I 4 years back}} \times 100 \)

For quantitative analysis of data, ratio percentage, mean, standard deviation, t-test, z-test and \( \chi^2 \) test were applied as recommended by standard books of statistics e.g. the book of A.M. Goon, M.K. Gupta and N.G. Das.

1. Mean = \( \bar{x} = \frac{1}{N} \sum f_i x_i \)

\[ \text{S.D} = \sqrt{\frac{1}{N} \sum_{i=1}^{k} f_i x_i^2 - \bar{x}^2} \]

Where, \( x \) is the variable,

\( k \) is the number of classes or groups in which the variable is classified,

\( x_i \) is the midpoint of the \( i^{th} \) group

\( f_i \) is the frequency of the \( i^{th} \) group, and

\( N = \sum_{i=1}^{k} f_i \) = total number of observations.

2. To compare the means of two populations or groups (say \( \mu_1 \) and \( \mu_2 \)) the t-static was used. Let \( N_1 \) and \( N_2 \) be the sample sizes drawn from the two groups and \( \bar{x}_1 \) and \( \bar{x}_2 \) the sample means. The sample variances are defined as

\[ S_1^2 = \frac{\sum_{i=1}^{n_1} f_1 x_i^2 - N_2 \bar{x}_1^2}{N_1 - 1} \]

and \( S_2^2 = \frac{\sum_{i=2}^{n_1} f_1 x_i^2 - N_2 \bar{x}_1^2}{N_1 - 1} \)

Then the t-statistic is defined as

\[ t = \frac{\bar{x}_1 - \bar{x}_2}{s \sqrt{\frac{1}{N_1} + \frac{1}{N_2}}} \]

Where \( s^2 = \frac{(N_1 - 1)s_1^2 + (N_1 - 1)s_2^2}{N_1 + N_2 - 2} \)

To test \( H_0 : \mu_1 = \mu_2 \) against \( H_1 : \mu_1 > \mu_2 \)
We reject $H_0$ at the 0.05 level of significance if

$$t > t_{n-1, 0.05}[H_1 : \mu_1 \neq \mu_2] = t_{n-1, 0.025}.$$

3. In comparison of the proportions of some characteristics under different situations (phase, gender, community, district) the z-test was used which is as follows:

Let $p_1$ and $p_2$ be the population proportions of different situations and $P_1$ and $P_2$ the sample proportions based on $N_1$ and $N_2$ observations respectively.

To test $H_0 : P_1 = P_2$ against $H_1 : P_1 \neq P_2$

The statistic was used:

$$Z = \frac{p_1 - p_2}{\sqrt{p(1-p)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Where, $p =$ proportion in combined sample for sufficiently large $N_1$ and $N_2$. $Z$ is distributed as a standard normal variable $N(0, 1)$.

$H_0$ is then rejected at the 5% level of significance if $|z| > 1.96(Z_{0.025})$

To test $H_0 : P_1 = P_2$ against $H_1 : P_1 > P_2$ we rejected $H_0$ at the 5% level of significance if $z > 1.64$.

4. The $\chi^2$ statistic was used to compare between different groups (promoted, stagnant and dropout) in relation to the socio-economic background of the students.

Using a two way classification with $K$ and $1$ classes the formula was:

$$\chi^2 = \sum \left[\frac{(f_0 - f_e) - 0.5}{f_e}\right]^2$$

Where, $f_0 =$ observed frequency in a given cell

$f_e =$ expected frequency in a given cell

= product of the marginal frequencies divided by the total number of observations

We rejected the hypothesis of no difference between the groups at the 5% level of significance if $\chi^2 > \chi^2(k - 1)(1 - 1), 0.05$

3.11 Conclusion

This chapter is designed to find out the objectives of the study e.g. to find out and to compare the rate of repetition, completion, the internal efficiency of school and the achievement level of class IV students at primary level before and after implementation of SSA Programme.