INTRODUCTION

Research methodology may be defined as academia’s established regulatory framework for the collection and evaluation of existing knowledge and for validating new knowledge. How effective any investigation turns out to be, depends upon the methodology followed. The plan of research study is very important for the conduct of any research work. Without an intelligent planning, the difficulties to be encountered during the process of research work cannot be anticipated and solved. Planning improves the possibility of better performance. Methodology in fact, is an idea of the whole work or the blueprint of the study.

For the sake of convenience, the material and methods adopted in the course of investigation of this study have been summarized below.

RESEARCH DESIGN

Keeping in mind the objectives and nature of this study, descriptive research method has been adopted. The research design used for the present research has been further described in the following sections:-

3.1 – SAMPLING DESIGN
3.2 – OPERATIONAL DESIGN
3.3 – STATISTICAL DESIGN

3.1 SAMPLING DESIGN

Sampling design deals with the method of selecting sample, which is the element to be studied for the given study.

3.1.1 Locale of Study

Agra District was selected purposively as the locale of the present study.
3.1.2 Selection and Size of Sample

Since Agra District is divided into rural and slum areas. For the present study the list of AWCs in rural and slum was obtained from Chief Development Office of Agra. The list showed that there are 2041 AWCs running in rural area and 477 AWCs in urban areas of Agra. The present study was conducted on 40 AWC and 150 ICDS beneficiary & 150 ICDS non beneficiary women of the selected area.

3.1.3 Selection of the Sample

Figure 3.1 Sample selection from block of rural area

GP – GRAM PANCHAYAT,  AWC – ANGANWADI CENTRE,  B – BENEFICIARY,
NB – NON-BENEFICIARY
3.1.3.1 Selection of blocks: The rural area of Agra is divided into 16 blocks, out of these; **four blocks were randomly selected randomly** by lottery method. The four blocks selected were Etmadpur, Saina, Shamshabad and Khandouli. (Refer figure – 3.1)

3.1.3.2 Selection of wards: According to Sabhasabad of Agra there are ninety wards, from these ninety wards **four wards were selected randomly** by lottery method. The selected wards were Eidgah, Lawyers Colony, Belanganj and Raja-Ki-Mandi. (Refer figure – 3.2)
3.1.4 Selection of AWCs and AWWs

3.1.4.1 Selection of AWCs in rural Agra: According to Nagar Palika records, in rural areas each block has its own Gram Panchayat. The blocks Etmadpur, Saina, Shamshab and Khandouli are having 38, 39, 55 and 38 Gram Panchayats respectively. Thus, the selected blocks had 170 Gram Panchayats. Five Gram Panchayats were selected randomly one each from each of the selected blocks. Thereafter, one AWC was selected randomly from each selected Gram Panchayat. (In Gram Panchayats where there were more than one AWC, selection of the AWC was done by lottery method). Thus for the study, in stage 2, a total 20 AWCs of rural areas of Agra were selected. The AWW operating in the selected AW was the AWW respondent (sample element) for the present study. (Refer figure – 3.1)

3.1.4.2 Selection of AWCs in slums of Agra: In the slum areas each ward has its own Mohallas. Eidgah, Lawyers Colony, Belanganj and Raja-Ki-Mandi wards were selected which had 13, 21, 9 and 18 Mohallas respectively. There were total 61 Mohallas in the four selected wards. From these 61 Mohallas, five Mohallas were selected randomly, one from each of the selected wards. Finally one AWC was selected randomly from each of the selected Mohallas. (In Mohallas where there were more than one AWCs, selection of the AWC was done by lottery method) Thus, for the present study in stage 2 a total 20 AWCs of slum areas were selected. The AWW operating in the selected AW was the AWW respondent (sample element) for the present study. (Refer figure – 3.2)

3.1.5 Selection of Beneficiary and Non Beneficiary Women

3.1.5.1 Selection of Beneficiary Women: As stated earlier one AWC was selected randomly from the Gram Panchayats in rural areas. Thereafter fifteen beneficiary women were selected randomly from each of the five selected AWCs where they were registered in the rural areas. Thus a total of 75
beneficiary women were selected randomly from the five selected AWCs of rural areas.

Similarly, the selection of beneficiary women in slums was done from the AWCs that had been selected randomly from the Mohallas. That is to say, fifteen beneficiary women registered in each of the selected five AWCs of the selected Mohallas were randomly selected from slum areas. Thus a total of 75 beneficiary women were selected randomly from the five selected AWCs of slum areas.

3.1.5.2 Selection of Non Beneficiary Women: In rural areas a list of ICDS non beneficiary women of the selected Gram Panchayats was prepared by door to door visit. Thus five lists, one each from the selected Gram Panchayats was prepared. Fifteen non beneficiary women were selected randomly from the lists thus prepared (15*5). Thus a total of 75 non beneficiary women were selected randomly from the five selected Gram Panchayats.

Again, a list of ICDS non beneficiary women of the selected Mahallas was prepared by door to door visit. Thus five lists, one each for the selected Mahallas was prepared. Fifteen non beneficiary women were selected randomly from the lists thus prepared (15*5). Thus a total of 75 non beneficiary women were selected randomly from the five selected mahallas.

In this way 300 respondent out of which 150 were ICDS beneficiaries (75 each from rural and slum areas) and 150 were Non ICDS beneficiaries (75 each from rural and slum areas) were the selected as units of information for the present study.

3.1.6 Criteria for Selection of Sample Elements

The criteria for selection of the respondents /elements for the present study were following:-
Beneficiary women:
1. Selected women were availing facilities of Anganwadi Centre.
2. The selected women were residents of the selected slum or rural area.
3. The age of the selected women was between 15-45 years.
4. Only married women having at least one child were selected.
5. The selected women were either pregnant or lactating. Many of the selected women had children below six year of age.

Non beneficiary women:
1. Selected women were not availing the facilities of ICDS Anganwadi centre.
2. The selected women were residents of the selected slum or rural area.
3. The age of the selected women was between 15-45 years.
4. Only married women having at least one child were selected.
5. The selected women were either pregnant or lactating. Many of the selected women had children below six year of age.

3.1.7 Steps for selection of the sample
The women fulfilling the above mentioned criteria were selected in following steps:-

- In the selected rural and slum areas a list of beneficiary women from the AWC was obtained.
- The list of non beneficiary women was prepared by door to door visit of the selected rural and slum area.
- From the two lists of beneficiaries and non beneficiaries, the elements of the sample were selected randomly. Thus in the present study about 64.1% women from the area were the part of the present study.
Table 3.1 Showing the selected number of elements in rural and slum areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Sl No</th>
<th>Particular</th>
<th>Total Number</th>
<th>Selected elements</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>18</td>
<td>15</td>
<td>83.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>21</td>
<td>15</td>
<td>71.4</td>
</tr>
<tr>
<td>AWCs of Slum Areas</td>
<td>2</td>
<td>Beneficiaries</td>
<td>20</td>
<td>15</td>
<td>75.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>27</td>
<td>15</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>15</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>23</td>
<td>15</td>
<td>65.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>17</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>28</td>
<td>15</td>
<td>68.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>22</td>
<td>15</td>
<td>68.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>31</td>
<td>15</td>
<td>48.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>33</td>
<td>15</td>
<td>45.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>17</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td>AWCs of Rural Areas</td>
<td>2</td>
<td>Beneficiaries</td>
<td>38</td>
<td>15</td>
<td>88.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>16</td>
<td>15</td>
<td>93.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>27</td>
<td>15</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>17</td>
<td>15</td>
<td>88.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>35</td>
<td>15</td>
<td>42.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>18</td>
<td>15</td>
<td>83.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficiaries</td>
<td>29</td>
<td>15</td>
<td>51.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non beneficiaries</td>
<td>15</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>468</td>
<td>300</td>
<td>64.1</td>
</tr>
</tbody>
</table>

3.2 OPERATIONAL DESIGN

Operational design includes the techniques by which the work is carried out. Preparation of the tools for the research was an important step because the data selected to study the knowledge and practices of the respondents were based on the efficiency of the tools.
To assess the status of Anganwadi workers a self constructed tool was used in the present study.

3.2.1 Tools used

A structured schedule that comprised of eight sections as stated under, was formulated to elicit the information from of the respondents.

1. Demographic characteristics of the sample
2. Exiting status of AWCs (ES)
3. Services provided by AWCs (SP)
4. Assessment of health services availed by non beneficiary (AHSANB)
5. Assessment of Nutritional knowledge (ANK)
6. Assessment of Utilization of maternal services (AUMS)
7. Assessment of Immunization services (AIS)
8. Assessment of Breast feeding knowledge (ABFK)

3.2.2 Preparation of the Schedule

The steps followed in the preparation of the schedule are further discussed.

3.2.2.1 Planning of the Schedule

Initially available literature, journals, researcher articles, books, relevant websites, existing tools and other means of information pertaining to the subject were consulted and reviewed with an endeavor to get an insight of the problem. The various areas related to objective of study like exiting status of AWCs and services provided by AWCs, assessment of nutritional knowledge, utilization of maternal services, immunization services, breast feeding knowledge of ICDS beneficiaries and non beneficiaries' women were identified. The review, consultations and interactions with target sample gave a deep understanding and acquaintance with the ground reality of the problem. The schedule was then planned in line with the objectives of the
The schedule was prepared keeping in mind the instructions and basic rules of schedule construction. After the first draft, the schedule was sent to seven experts for inviting their critical evaluation. The valuable suggestions obtained from them helped in making the schedule more appropriate. Some statements were reframed, added or deleted as per the suggestions received. Expert opinion was again taken before finalizing the tool. The schedule contained questions for collecting information under the various heads. The number of items in each section and the nature of the schedule are given in Table 3.2

Table 3.2 Details of the prepared schedule

<table>
<thead>
<tr>
<th>S No</th>
<th>Section of schedule</th>
<th>No of Item</th>
<th>Nature of schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demographic Characteristics of Sample (DCS)</td>
<td>10</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>2</td>
<td>Existing status of AWCs (ES)</td>
<td>12</td>
<td>Observation Schedule</td>
</tr>
<tr>
<td></td>
<td>(a) Equipments available</td>
<td>5</td>
<td>Observation Schedule</td>
</tr>
<tr>
<td></td>
<td>(b) Activities of AWCs</td>
<td>6</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td></td>
<td>(c) Infrastructure &amp; resources</td>
<td>3</td>
<td>Observation Schedule</td>
</tr>
<tr>
<td></td>
<td>(d) Training of AWWs</td>
<td>16</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>3</td>
<td>Services provided by Anganwadi Centre (SP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non formal education service in AWCs</td>
<td>9</td>
<td>Observation and Interview schedule</td>
</tr>
<tr>
<td></td>
<td>Assessment of Supplementary Nutrition service</td>
<td>5</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td></td>
<td>Assessment of health services</td>
<td>16</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>4</td>
<td>Health Services Availed by Non Beneficiaries (HAS)</td>
<td>9</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>5</td>
<td>Assessment of Nutritional Knowledge (ANK)</td>
<td>25</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>6</td>
<td>Assessment of Utilization of Maternal Services (AUMS)</td>
<td>9</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>7</td>
<td>Assessment of Immunization Services (AIS)</td>
<td>9</td>
<td>Interview Schedule</td>
</tr>
<tr>
<td>8</td>
<td>Assessment of Knowledge Regarding Breast Feeding (AKRBF)</td>
<td>20</td>
<td>Interview Schedule</td>
</tr>
</tbody>
</table>
3.2.2.2 Pilot study

To find out the appropriateness of the prepared schedules pilot study was done. For pilot study, the prepared schedule was administered on sixty persons who had the sample characteristics but were not a part of the sample. In the present study out of the total 340 samples (150 beneficiaries and 150 non beneficiaries and 40 AWC) in rural and slum areas, four rural and four slum AWCs were selected for pilot study, it was administered on eight AWWs from the selected AWCs.

The pilot study was done on total 60 units which consisted of 15 beneficiaries and 15 non beneficiaries from rural as well as same number from slum areas. After the pilot study the responses were judged and the required corrections were made. Thereafter the final schedule was formed.

3.2.2.3 Reliability and validity of the schedules

The reliability of the prepared schedule was calculated through test retest method. The obtained reliability and validity are given in the table 3.3.

Table 3.3 Showing the reliability and validity of the prepared schedule

<table>
<thead>
<tr>
<th>S No</th>
<th>Name of Schedule</th>
<th>Reliability</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Activities of AWCs</td>
<td>87.0</td>
<td>9.2</td>
</tr>
<tr>
<td>2</td>
<td>Training of AWWs</td>
<td>75.0</td>
<td>8.6</td>
</tr>
<tr>
<td>3</td>
<td>Non formal education service in AWCs</td>
<td>82.0</td>
<td>9.0</td>
</tr>
<tr>
<td>4</td>
<td>Assessment of supplementary nutrition service</td>
<td>78.0</td>
<td>8.7</td>
</tr>
<tr>
<td>5</td>
<td>Assessment of health services</td>
<td>84.0</td>
<td>9.0</td>
</tr>
<tr>
<td>6</td>
<td>Assessment of nutritional knowledge</td>
<td>86.0</td>
<td>9.2</td>
</tr>
<tr>
<td>7</td>
<td>Assessment of utilization of maternal services</td>
<td>73.0</td>
<td>8.5</td>
</tr>
<tr>
<td>8</td>
<td>Assessment of immunization services</td>
<td>76.0</td>
<td>8.4</td>
</tr>
<tr>
<td>9</td>
<td>Assessment of knowledge regarding breast feeding</td>
<td>92.0</td>
<td>9.5</td>
</tr>
</tbody>
</table>
3.2.3 Scoring pattern: This has been shown in table 3.3

Table 3.4 Scoring pattern of the prepared schedule

<table>
<thead>
<tr>
<th>S No.</th>
<th>Parameter Tested</th>
<th>Scoring Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Existing status of AWCs (ES)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Equipments available</td>
<td>A score of “1” was given for availability of the equipment and non availability of equipment was scored “0”</td>
</tr>
<tr>
<td></td>
<td>Activities of AWCs</td>
<td>A score of “1” was awarded for the conduct of the activity where as non conduct of the activity was scored “0”</td>
</tr>
<tr>
<td></td>
<td>Infrastructure &amp; resources</td>
<td>When the recourse was available in AWCs a score of “1” was awarded and “0” was given when the AWC was not seen to possess the items</td>
</tr>
<tr>
<td></td>
<td>Training of AWWs</td>
<td>A score of “1” was given where AWWs reported having obtained training, “0” was given when the reverse was true</td>
</tr>
<tr>
<td>2</td>
<td>Services provided by Anganwadi centre (SP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non formal education service in AWCs</td>
<td>Availability of the services was scored “1” where as non availability of the services was scored “0”</td>
</tr>
<tr>
<td></td>
<td>Assessment of Supplementary Nutrition service</td>
<td>Availability of the services was scored “1” where as non availability of the services was scored “0”</td>
</tr>
<tr>
<td></td>
<td>Assessment of health services</td>
<td>Availability of the services was scored “1” where as non availability of the services was scored “0”</td>
</tr>
<tr>
<td>3</td>
<td>Health Services Availed by Non Beneficiaries (HAS)</td>
<td>Score of “1” was awarded for availing the service where as “0” was awarded for not availing the service</td>
</tr>
<tr>
<td>4</td>
<td>Assessment of Nutritional Knowledge (ANK)</td>
<td>Correct answer was assigned 1 mark and the wrong answer was assigned 0 mark</td>
</tr>
<tr>
<td>5</td>
<td>Assessment of Utilization of Maternal Services (AUMS)</td>
<td>A score of “1” was given for availing these services whereas a score of “0” was awarded for not availing the services</td>
</tr>
<tr>
<td>6</td>
<td>Assessment of Immunization Services (AIS)</td>
<td>A score of “1” was given for availing these services whereas a score of “0” was awarded for not availing the services</td>
</tr>
<tr>
<td>7</td>
<td>Assessment of Knowledge Regarding Breast Feeding (AKRBF)</td>
<td>Correct answer was assigned 1 mark and the wrong answer was assigned 0 mark</td>
</tr>
</tbody>
</table>
3.2.4 Variables of the Research

The variables identified for the present study were:

**Independent Variables:**
- ICDS beneficiary status
- ICDS non beneficiary status

**Dependent Variables:**
- Nutritional knowledge
- Knowledge of Breast feeding
- Immunization status
- Utilization of maternal services
- Quality of services with respect to preschool education, supplementary nutrition

3.2.5 Collection of Data

After finalizing the schedules, the data was collected from selected AWWs as well as beneficiary and non beneficiary women. The respondents were collected and were ensured that their response would be kept confidential. The information was recorded in the schedules.

The information which was collected through the interview schedule was supported by observation method adopted by the investigator. The prepared schedules were filled by the researcher herself.

3.2.6 Processing and Analysis of Data

The data was collected; classified and total obtained scores were analyzed for interpretation.
Figure 3.4  Methodology at a glance

**RESEARCH DESIGN**

**Descriptive research Method**

**SAMPLE**

**AWCs – Rural, Slum**

Women (Age Group: 15-45)

Beneficiaries
- Rural (75)
- Slum (75)

Non beneficiaries
- Rural (75)
- Slum (75)

**Tool Used:**
- Existing Status of AWCs (ES)
- Services Provided by AWCs (SP)
- Assessment of nutritional Knowledge (ANK)
- Assessment of utilization of Maternal Services (AUMS)
- Assessment of Immunization Services (AIS)
- Assessment of Knowledge regarding breast feeding

**Variables**

**Independent**
- ICDS Beneficiary Status
- ICDS Non Beneficiary Status

**Dependent**
- Knowledge of Breast feeding
- Nutritional Knowledge
- Immunization Status
- Utilization of maternal services
- ICDS Services
  - Pre school
  - Supplementary nutrition

**Identification of Need of AWWs**

**Training Program**
1. Need of ANC
2. Nutritional needs of Infants
3. Preparation of low cost weaning food
4. Craft activities

**Conduct of the Study**

Establishing Rapport
Collection of data

**Analysis of Data**
- Frequency and percentage
- Mean Score and Standard Deviation
- Student t test
- Correlation
3.2.8 Organizing a one Day Training Camp for AWWs to Enhance Their Knowledge and Skills

An interaction with the AWWs helped the researcher to identify broad areas in which the need for training was identified to help AWWs perform their duties better. One day Training camp was organized for 31 AWWs as target group out of which 26 AWWs attended the program. On the basis of the need the objective of the training program were decided.

The investigator thereafter fixed up date, time and venue of the program with the AWWs. Experts were identified and contacted to obtain their consent for delivering their expert lectures on the pre scheduled dates. In addition arrangements for refreshment were also made. (Tea was served twice and lunch was also served). On the day of the program it was ensured that the lecture hall had public address system and LCD projector. Arrangement was also made in the Foods lab where the AWWs were to be taught some weaning food recipes.

Support of eighteen student volunteers was also obtained for organization of training program for AWWs
Table 3.5 Showing the details of the training program for AWWs

<table>
<thead>
<tr>
<th>S No.</th>
<th>Time</th>
<th>Objective</th>
<th>Issues discussed/demonstrations</th>
<th>Expert</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.00 AM</td>
<td>Registration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>09.00 AM to 11.00 AM</td>
<td>Imparting education on &quot;Need of ANC&quot;</td>
<td>Care to be taken during pregnancy Importance of immunization of mother during pregnancy Dietary modification needed in pregnancy</td>
<td>Dr. Vinita Taneja Gynecologist</td>
</tr>
<tr>
<td>3</td>
<td>11.00 AM to 11.15 AM</td>
<td>-- Tea --</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>11.15 AM to 01.00 PM</td>
<td>Imparting education on &quot;Nutritional needs of Infants&quot;</td>
<td>Dietary needs of infants Importance of weaning food.</td>
<td>Prof. Gul Mathur</td>
</tr>
<tr>
<td>5</td>
<td>01.00 PM to 02.00 PM</td>
<td>-- Lunch --</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 6     | 02.00 PM to 04.00 PM | Demonstration of preparation of low cost weaning food recipes | • Poha Khichri  
• Sprouted Mung & Channa halwa  
• Suji Kheer with Gur | Researcher                |
| 7     | 04.15 PM to 06.00 PM | Introducing new Craft activities for AWWs     | a) Spray, block, thumb, thread, nib and vegetable painting  
b) Making models of fruits and vegetables with clay  
c) Paper machie work for making  
• Face masks  
• Wall clock  
• Puzzle games | Researcher                |
| 8     | 06.00 PM to 06.30 PM | -- Open session for feedback --               |                                                                    |                         |
3.3 STATISTICAL DESIGN

Statistical Techniques

In the present study following statistical techniques were used for analysis.

(a) Arithmetic Mean – The arithmetic mean is the sum of scores divided by the number of respondents.

\[
X = \frac{\sum x}{N}
\]

Where,

\[ X = \text{mean} \]
\[ \sum x = \text{Sum of Scores} \]
\[ N = \text{number of respondents} \]

(b) Percentage – Comparison where made on the basis of the percentage. The frequency of a particular cell was multiplied by 100 and divided by total number of responses in that particular category to which they belonged.

\[
P = \frac{n \times 100}{N}
\]

Where,

\[ P = \text{Percentage} \]
\[ n = \text{Obtained Score} \]
\[ N = \text{Total or Max Score} \]
(c) **Chi-square Test** – Chi-square test was used to judge the significance of the population variance and is calculated by using the following formula.

\[ \chi^2 = \sum \frac{(O - E)^2}{E} \]

Where,

- \( O \) = Observed Value
- \( E \) = Expected Value

Expected value is calculated by using:

\[ \frac{(\text{sum of rows}) \times (\text{sum of column})}{\text{total observation}} \]

\( df \) = degree of freedom is calculate by

\( (R-1) \times (C-1) \)

Where,

- \( R \) stands for total number of rows
- \( C \) stands for total number of columns

(d) **Standard deviation** – It is usually denoted by letter \( \sigma \) (small sigma) of Greek alphabet and is a measure of dispersion. Standard deviation is the square root mean of the square of given observation from their mean.

\[ \sigma = \sqrt{\frac{\sum d^2}{n}} \]

Where

- \( \sigma \) = standard deviation
- \( d \) = deviation from mean
- \( n \) = total number of observations
- \( \sum \) = Sum of total
(e) Student t Test

\[ t = \frac{x_1 - x_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \]

Where,

X1 = mean of 1st group
X2 = mean of 2nd group
S1 = Standard deviation of 1st group
S2 = Standard deviation of 2nd group
n1 = number of Sample of 1st group
n2 = number of Sample of 2nd group