CHAPTER III

RESEARCH DESIGN

AND

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Schools across the country are utilizing digital ICT tools such as smart boards, LCD screens, audio-visual videos, digital recordings of older lectures and soon to teach children difficult as well as easy concepts. The role of a teacher has always been to impart knowledge to students and they have now become facilitators using digital tools. Most of the school heads concur that these technologies will never replace the physical presence of a teacher; instead it will complement the entire teaching process and achieves desired results through well-planned learning methods.

3.1 Introduction

Research methodology follows either the Positivistic approach also called Quantitative research which is scientific in nature or Interpretative approach referred to as Qualitative research.

Ahlstrom et al (2013) defined Research Design as ‘a plan, structure and strategy of an investigation so conceived as to obtain answers to research questions or problems. It contains the complete scheme of research – writing the hypotheses, giving their operational implications and analyzing the data’. There is a very slight difference between research methodology and research design. Research design provides framework to seek answers to research questions; research method details the techniques to be utilized at the different stages of the research. Keeping this in view, the researcher prepared a work plan which included the research design and methodology.

In this chapter, the researcher has presented the details of this present study: The research method used to test the research questions, sampling tools, procedure of data collection and the analysis of data along with the technique(s) used are detailed in this chapter. The study attempts to find an answer the research question and test the hypothesis made by the researcher. The methods used in the study are discussed in detail by the researcher and the usage of the objective of developing a framework for enhancing the impact of ICT in effective teaching-learning process.
3.1.1 Types of Research Methods

Research method is broadly of 2 types: Qualitative Research Method and Quantitative Research Method.

Qualitative research method is based on words, feelings, emotions, sounds and other non-numerical unquantifiable elements.

Quantitative research method describes, infers and resolves problems using numerical data as well as drawing inferences from the data collected.

Table 3.1: Qualities of Quantitative Research (Source: www.openedu.in)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>ITEM</th>
<th>QUANTITATIVE RESEARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Type of Knowledge.</td>
<td>Objective</td>
</tr>
<tr>
<td>2.</td>
<td>Aim.</td>
<td>Generalisable and testing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Independent and Dependant variables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre and post measurement of change.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replication.</td>
</tr>
</tbody>
</table>

Research Methods are:

(i) **Descriptive** (Qualitative or Quantitative): It has detailed description of specific situation(s) using interviews, observations, document reviews and numerical details. It has low effectiveness.

(ii) **Correlation / Regression Analysis** (Quantitative): It explores the mathematical measure of the average relationship between two or more variables. Low effectiveness is a quality of this method as it shows the estimation of unknown values of a variable as compared to the known values.

(iii) **Experimental**: It assigns individual participants randomly for comparison between a
control and treatment group. In Quasi-Experimental Method, there is random assignment of groups instead of individuals. It has high effectiveness.

(iv) **Meta-Analysis**: Synthesis of results from multiple studies to determine the average impact. The effectiveness of this method is the highest amongst all.

**Image 3.1: Types of Research Methodologies (Source: uconn.edu)**

### 3.1.2 Educational Research Methods

The methodology of the study to be conducted includes the participants, instruments and the procedures used to collect the data. There are generally 3 types of educational research used:

1. **Description**: Survey, Historical, Content Analysis, Qualitative.
2. **Association**: Correlation, Casual-Comparative.
3. **Intervention**: Experimental, Quasi-experimental, Action Research.

The process which is followed and is replicable includes the following steps:

a. Identify a problem.

b. Clarify the problem.
3.1.3 Selection of Research Design
The selection of the correct methodology of the study is a daunting task for any researcher and the main factors include the Research Question, Ethics, Budget and Time. For the design, the statistics must be quantified; generalizations and compromises should be minimized while at the same time the researcher has to be realistic. The researcher needs to recognize and evaluate the flaws of the design used, else results may be falsified.

3.2 Statement of the Problem
The problem for the present research study is entitled — “To study the impact of Information and Communication Technology (ICT) as a subject in Std. X (Tenth) students of Maharashtra State Board [S.S.C.] schools in Mumbai”.

3.2.1 (a) Major Research Question
What is the impact on students of Std. X (Tenth) when ICT is taught as a separate subject?

3.2.1 (b) Sub-Research Questions
1. What is the most effective method of evaluating ICT?
2. Whether students of Std. X (Tenth) should be taught ICT as an integrated subject?
3. Whether ICT is an effective learning tool?
4. What is the need of proper ICT teacher training?

3.3 Aim, Need and Purpose of the Study
ICT has revolutionized each and every nook and corner and all the spheres of human life all over the world. The impact as well as the usage of ICT can be seen by
a layman also and thus, ICT has been employed for faster and quicker services. The reason and main aim of selecting the topic is to find out the impact of ICT as a subject for the State Board students of Std. X (Tenth) in the schools in Mumbai. The process of collecting details, information and / or ideas is also discussed. Representation of the thesis is also part of the chapter which has helped to coordinate, organize and consolidate the details received.

3.4 Significance of the Study
In writing the ‘significance of the study’ the researcher states the value or importance of the study undertaken, the results are itemized and the justification of the reason of the study. The researcher explains the rationale, timeless and or relevance of the study in the existing conditions as well as possible solutions to the existing problems or solutions. It also discusses the implications along with the possible causes and effects as well as the remedial measures to solve the problems. A few good points may be continued or even improved and would be useful for future references by other researchers (http://thesisnotes.com).

This study will help to contribute to the improvement of education using ICT and technological based tools in all the schools but also in those of different boards nationally. The researcher hopes that this research will encourage the teachers to adopt a student centric approach and be more tech savvy while teaching ICT as well as other school subjects. The government agencies should adopt either a practical evaluation system in examining ICT as a subject or develop a curriculum for other school subjects to be integrated with ICT so that the students can learn all subjects using the benefit of ICT tools.

The outcomes of the study by the researcher include -
Students: The results will provide students an awareness / insight of not to misuse networking sites. It will help them to enhance their creativity as well as logical thinking along with their using ICT tools. At the end they would be happy to note that learning ICT practically is more beneficial to them as ICT as a subject is the need of the hour for them to become future global citizens.

Teachers: The given data in the study will guide the teachers to become tech savvy
and continuously upgrade themselves with in-service training modules. They need to find a more practical evaluation system for the testing of ICT if taught as a subject. Parents: Like teachers, the parents will try to raise awareness as well as formulate preventive measures amongst their children regarding the misuse of different networking as well as social media sites. The findings will also help them to learn from the actions of their children and contribute to their holistic development.

3.5 Objectives of the Research

This gives a glimpse of the objectives of the research undertaken. The primary objective / aim to be achieved is to find out the impact of ICT as a subject for the State Board students of Std. X (Tenth) in the schools in Mumbai. For this the researcher has taken desirable outcomes of intended actions through the mode of education using ICT tools. The objectives are concentrated to get more and more information on previous situation of use of ICT in education and the present situation. All this has led the researcher to find out the changes and the root of changes in the research.

The researcher has decided to take the following objectives:

1. To study the opinion of students of Std. X (Tenth) regarding the learning of ICT as a subject.
2. To study the opinion of teachers of teaching ICT as a subject to the students of Std. X (Tenth).
3. To investigate the effectiveness of ICT as a subject for the students of Std. X (Tenth).
4. To study the status of requirement of ICT as a separate subject.
5. To study the status of ICT as integrated in all other school subjects.

3.6 Hypothesis

A hypothesis is an informed guess or inference with a reasonable chance of being right, formulated and tentatively adopted to explain observed facts or conditions and to guide further investigation (Carter V. Good). The guesses a scientist makes are the hypotheses which either solves the problem or guide him in further investigation (Werkmeiger). Cohen and Nagel state that we cannot take a single step forward in
any enquiry without a Hypothesis.
The objectives are based on the ‘need’ of the researcher; these are then used to frame the hypothesis of the research / study. The hypotheses are tentative solutions framed by the researcher and may or may not be correct. The gaps and limitations give the researcher a strong reason to believe that the variables are quantifiable. The analysis of the hypotheses will give an accurate result to the researcher for the study undertaken.
The hypothesis has allowed the researcher to use a valid and reliable tool for testing.
H01. To evaluate an effective evaluation system for teaching-learning in ICT.
H02. To search for an effective teaching process to help facilitate learning of ICT.
H03. To check whether the learning of ICT encourages the misuse of networking sites.
H04. To determine whether ICT is an effective tool for learning.

3.7 Limitations of the Research
From the literature survey conducted, the researcher found a gap in the process of teaching of ICT as a subject especially for the students of Std. X (Tenth) who appear for their Board Exams. The Boards across the country (S.S.C, I.C.S.E, C.B.S.E, I.G.C.S.E and I.B.) need to understand this gap which is affecting the students’ stress levels for teaching a subject which needs to be practically handled / taught.
The study is limited by the researcher to the state board schools – S.S.C. Board schools in Mumbai. But, in Mumbai’s West Zone, the K-P West Ward schools only were considered.
For the present study only the regular / normal school children were considered; there are exceptional children (Low / High IQ) as well as children with disabilities (Learning and / or Physical) who need to be taught with the help of ICT / Computers as a subject have not been considered for this study.

3.8 Research Methodology
The process used to collect information and data for the purpose of research is called Research Methodology. In this study the researcher has used a Survey Questionnaire to satisfy the objects of the study.

3.8.1 Tools of Research
There are several techniques available for collecting data for the user studies such as questionnaire method, personal interview and observation. For this study a survey sample questionnaire was decided by the researcher for the data collection. Around 16 state board schools in Mumbai’s West Zone K-P West Ward schools were selected and 1075 responses [17 staff and 1058 students] received.

3.8.2 Survey Technique
The term 'survey' means to collect information. A sampling of individual units from a population in the field of applied statistics of human research is a Survey. It is associated with data collection techniques (questionnaire construction), methodology (Questionnaires (personal, mail or telephone), interviews, observations, document reviews / non-response follow-ups), methods for improving numbers and accuracy to responses. (Wikipedia, September 2016)

A single survey may focus on opinions, behaviours, preferences or factual information. Survey is scientific as well as professional method which ends in data analysis. Thus it is used in qualitative as well as quantitative studies.

It follows two purposes:
(i) describing aspects or characteristics of population;
(ii) testing the hypotheses about nature of relationship in the population.

The researcher had found this method most suitable as it helped to gain data from a large group (students and teachers of state S.S.C. Board schools); it also helped the researcher to identify a specific location (K-P West Ward in Mumbai in this case) to collect data. It also helped the researcher to explain the trend (ICT as an effective tool in education and to be taught practically not as a theory subject) in the research through a self-administered survey.
3.8.3 Merits of Survey Technique
1. A survey can be conducted faster (from different sections of society) and cheaper as well as cost effective than any other method of primary data collection like observation and experimentation.
2. Primary data gathered from survey is easy and quicker to analyse.
3. A survey can be conducted anytime and anywhere – no geographical limits exist.
4. It can be collected from a large group of people – versatility as an asset.
5. It is a reliable method of inquiry as it has standardized format of questions.
6. Cross-sectional surveys are about personal opinions, events as well as behaviour and are designed to assess. Hence they are not stagnant.

3.8.4 Demerits of Survey Technique
1. Unwillingness and / or inability of respondents to provide information.
2. Human bias makes respondents give inaccurate information.
3. It is difficult to formulate questions with proper wording which will elicit a similar response from the respondents due to difficulty in understanding the meaning of the question. This will not help to decode the information properly.
4. The survey is a single instrument for collecting the data and is inflexible.
5. Survey results may not be valid as results obtained allow the researcher to more comprehensively examine the topic studied.
6. Cross-sectional surveys may cause anxiety and even lead to depression.

Though social networking sites are beneficial, very few respondents are willing to disclose personal information leading to negative relationship.

3.9 Data Collection
Data is information in a raw or unorganised form which represents conditions, ideas or
objects. It is limitless as well as available everywhere in the universe. Data is information or knowledge in a set of values of qualitative and quantitative variables which can be measured, collected, reported, analysed as well as visualised (Wikipedia). In computing, data is information which has been translated or converted into digital binary form (www.techterms.com).

Data can be:
1. Qualitative Data – in descriptive form.
2. Quantitative Data – in numerical form.
   a. It can be Continuous – it can take any value within a particular range.
   b. It can be Discrete – it can take only certain values.

There are two types of data which is collected:
1. **Primary Data**: This data is obtained at places of origin or all data which have been gathered or are in the process of being gathered. For the purpose of this study the researcher made a structured questionnaire and administered it to the selected respondents.
2. **Secondary Data**: This data is that which have been collected previously and reported by some individual other than the present researcher. This also includes publications which have reported for primary data.

For the purpose of this study, the researcher referred to the information relevant to the subject selected for the research in the form of books, journals, periodicals, articles and reports from electronic databases and World Wide Web. The online resources available were also studied and referred.

The instruments that are employed to gather new facts or to explore new fields are called tools. It is vitally important to select suitable tools or instruments. The tools are classified as:
1. Inquiry Forms – Questionnaire, Schedule, Check List, Rating Scale, Score Card and Opinionnaire or Attitude Scale.
2. Observation.
3. Interview.
4. Sociometry.
5. Psychological Tests – Achievement Tests, Aptitude Tests, Intelligence tests, Interest
Inventory, Personality Measures.

Data can be collected in many ways. The six most common methods are: Tests, Questionnaires, Interviews, Focus Groups, Observation and Secondary or existing Primary data. With these methods of data collection, the researchers can measure the degree of skills (Tests); fill out self reports (Questionnaires); converse / talk in person (Interviews); discuss issues with multiple participants (Focus Groups); examine behavior(s) in a natural or structured environment (Observation); use previously collected data which is already available for solving a problem (Secondary Data). Sometimes the researchers may use inter-method mixing of two or more methods of data collection to study the problem or intra-method mixing by using only one method to creatively complete the data collection.

In this study, the researcher had personally distributed the Questionnaires to around 16 schools after obtaining the requisite permissions as a method of quantitative data collection to obtain the primary data from the participants (respondents). They were collected back the same day (Students) and / or the next day (Teachers).

3.9.1 Questionnaire

A questionnaire is a self-report data collection instrument that each research participant has to fill as a part of a research study. The researchers attempt to measure different kinds of characteristics by using questionnaires. Questionnaires are frequently used in quantitative and social research which is a valuable method of collecting a wide range of information from a large number of respondents.

A survey questionnaire is used as the main primary data collection instrument. The modes of data collection (giving initial letter of introduction, method of administration and medium of delivery) vary in the manner in which the questionnaire is delivered and the respondents answer with different effects of accuracy and quality of data given. Surveys can be conducted for collecting data in any setting using paper and pencil (personal), electronic media (on computer via mail) or the telephone. But whatever the mode of administration, there are many potential influences to the respondent which may affect the quality of data. Once a questionnaire is despatched, a follow-up is required by the researcher to ensure its return, but there is an inability to control
whether the respondent has completed it by self; also there is no guarantee for anonymity.

Keeping in mind the nature and objectives of the study, the following tools were developed by the researcher:
1. Questionnaire for the Std. X (Tenth) students.

2. Questionnaire for the teacher(s) teaching ICT to the Std. X (Tenth) students.

3.9.2 Questionnaire Construction

Questionnaire construction refers to design of a questionnaire to gather statistically useful information about a given topic. When properly constructed and responsibly administered, questionnaires can provide valuable data about any given subject (Wikipedia, September 2016). A researcher needs to pay attention when constructing of the data collection instrument (in this case a Questionnaire) which will be used to collect the data for the research.

The survey questionnaire made up of high visual content or complex alternatives or semi-structured interview can be administered in a variety of ways – by post, by mail, by telephone, by face-to-face interview and many more. The main problem of self administered surveys is lack of control over the response.

The factors affecting the structure and construction of a survey questionnaire are (Source: Synodinos, Nicolaos: Integrating Manufacturing Systems; 2002):
(i) Objectives of the study.
(ii) The target group and its geographical distribution of the sample.
(iii) Type of questions as per method of administration.
(iv) Proper use of available resources to complete the questionnaire.
(v) Cost considerations should not exceed or overshadow the quality of response.
(vi) In multi-national studies, appropriate and reasonable factors should be used to affect culture.

The researcher constructed the questionnaire in the form of statements and sub-statements. The sub-statements had responses on the Likert Scale. The researcher
studied the results on a two-point, three-point and five-point scale to complete accurate findings which had a neutral choice also. The questionnaire was constructed keeping the respondents (students and teachers) and the level of computer literacy and ICT applications in mind. There are a total of 05 statements in the questionnaire and each is divided into sub-statements (10 each) to let the respondents’ knowledge of the topic in detail as well as give their answers based on the available options. The language of the questionnaire is English to understand the level of awareness in ICT.

The base for constructing the questionnaire was taken from earlier researches, and developed it for the teachers as well as the students for the present study. The researcher made efforts to include the most relevant items of each component of ICT so that the objective of the study could be achieved. The questionnaire has been designed by the researcher to be straight and simple to understand the details of applications of ICT and the issues suffered by the students of Std. X (Ten) wherein ICT has to be learnt theoretically. Close ended as well as one (1) open ended questions have been included with care. Unambiguous, annoying, negative and double-barrelled questions were avoided and utmost care was taken by the researcher for this. The researcher has behaved in a polite and courteous manner as the respondents have done a favour in completing the questionnaire. The researcher has ensured the respondents especially teachers that their correct answers / responses would be used for research only and kept confidential.

3.9.3 Questionnaire Structure

A. For ICT Teachers: Personal / Background information regarding the ICT teacher – name, qualifications, name of the school and location were included in Part I in the questionnaire. The information about ICT tools in school, its usage in the school as well as its use personally is included in Part II and III; Part IV and V includes the ICT usage and obstacles in the teaching-learning process; Part V also includes the only open-ended question in the entire questionnaire about ‘how ICT should be taught and evaluated’.

Table 3.2: Structure of Questionnaire for ICT Teachers
A copy of the questionnaire for ICT teachers teaching Std. X can be referred to in Appendix (i).

B. For Std. X Students: Personal / Background information regarding the Std. X student – name, name of the school and location were included in Part I in the questionnaire. The information about ICT tools in the school, its usage in school as well as personally is included in Part II and III; Part IV includes the ICT usage and obstacles in the teaching-learning process; Part IV also includes the only open-ended question in the entire questionnaire about ‘how ICT should be taught and evaluated’.

Table 3.3: Structure of Questionnaire for Students of Std. X (Tenth)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>PART No.</th>
<th>COMPONENT</th>
<th>No. OF ITEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I</td>
<td>Background (Personal) Information</td>
<td>15</td>
</tr>
<tr>
<td>2.</td>
<td>II</td>
<td>Personal ICT Usage</td>
<td>04</td>
</tr>
<tr>
<td>3.</td>
<td>III</td>
<td>ICT Usage in Teaching</td>
<td>03</td>
</tr>
<tr>
<td>4.</td>
<td>IV</td>
<td>Opinion on ICT Usage in Teaching Process</td>
<td>05</td>
</tr>
<tr>
<td>5.</td>
<td>V</td>
<td>Obstacles in using ICT in Teaching-Learning Process</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>30</td>
</tr>
</tbody>
</table>
3.9.4 Questionnaire Distribution

The questionnaire development is in two formats – Close ended: Yes / No type for seeking information from a large audience and Open ended: used in Interviews.

In this study, the researcher has used:

a) Close ended questions: Yes / No type for each factor identified.

b) Contingency questions: Multiple questions wherein different types of Likert’s scale are involved.

The questionnaire was designed to capture opinions and inputs which were quantified by the researcher.

Considering the factors which make an ideal questionnaire, the researcher constructed a structured questionnaire with close ended questions and administered it to a select group of respondents (teachers and students of a few of the selected state board schools of the K-P West ward of Mumbai) to check the level of use of ICT applications and the reason for need of change of teaching ICT practically not theoretically.

3.9.5 Likert’s Scale

The Likert’s scale invented by Rensis Likert is a psychometric scale in research that employs questionnaire and uses scaling responses (rating scale) in a survey research (Source: Wikipedia).

- A scale is a collective response to a set of items ranging from 2 – 10 called Summative Scales.
• The ‘Bipolar’ Likert Scale measures the positive or negative response.
• The ‘Symmetry’ scale contains a level of agreement or disagreement with a Nil (0) or Neutral value (when respondent is unsure) to balance the responses.
• In the ‘Even Point’ scale, the neutral option is removed wherein the respondent is forced to make a choice.

The Likert’s Scale is effective when:
1. **Accuracy**: Questions when phrased correctly without causing confusion increase their effectiveness.
2. **Careful use of Adjectives**: When concepts in the survey are clearly explained and the response option has easily understandable descriptive words then there will be no confusion in giving the correct response.
3. **Unipolar (5 point) or Bipolar (7 point) Responses**: Depending on the question(s) asked, the scale can be used for a perfect response. Scales with odd numbers have a midpoint.
4. **Ask**: Generally respondents will tend to agree rather than disagree; hence, statements should not be ambiguous.
5. **Labelled and Continuous**: Numbered scales may not give a proper response if the respondents are unable to identify the positive or negative end. Also, the response options should be equally spaced.
6. **Inclusive and Logical**: The scale should span an entire range of responses and add a skip logic question for improvement suggestions.

The Likert Scale was used for this study as it is the most widely used scale for ICT studies (Gupta et al, 2008). The researcher has tried to use different Likert scales for different questions in the survey questionnaire to get a varied yet accurate response for what the respondents actually feel about a particular topic. Also, to balance the responses, the Symmetry scale was used so that the respondent could remain neutral and not be forced to answer a particular question.

### 3.9.6 Merits of Likert’s Scale

The Likert’s Scale is simple to use and easy to carry out statistical and percentage
analysis for interpreting the data. A large number of statements about the research is collected. The main advantage is that several items can be combined to get multiple results.

3.9.7 Demerits of Likert’s Scale
The different combinations of several scale items may mislead the researcher as the overall result is the same.

3.10 Sampling Technique
Sampling is the process of drawing a sample from a larger group (population). Since the sample is smaller in size than the population, it can save time and money for the researcher. A researcher then makes statements (generalization) about the population based on the sample data collected.

The researcher found the survey sampling method most convenient in this study and decided on it as the respondents [staff and students] were easily available and accessible. This exploratory method despite a few unknown qualities of errors is extremely useful. It was the only option under the circumstances due to the unavailability of previous records and / or registers on computer requirements and needs of the students of Std. X (Tenth). Data of impact of ICT of the respondents has been represented as bar graph and pie diagram and the basic as well as core skills are represented in the table in percentage. The questions have been ranked in a two or three or a five point using the Likert's scale and the result is represented as percentage.

3.10.1 Justification of Sampling Technique
There are two kinds of sampling techniques used:
1. A random (probable) sampling technique which gives a representative sample resembling the population in all characteristics. A random sample is the perfect representative of the population except that it is smaller. Thus it is most frequently used in the non-experimental survey research method in the form of questionnaires and / or interviews to gain information about the characteristics of the population
2. A non-random sampling (non-probable) technique gives rise to biased samples which are systematically different from the population in certain characteristics. The researcher has undertaken a convenient random sampling technique for the purpose of the study which was relevant to this research topic as well as easily available.

3.10.2 Sample Size
A sample is the representative of a population, the results of which can be extended to the population if the sampling is done correctly (Heckmaan, 1979). A sample size is a count of individual samples or observations in a statistical setting (survey) and distributed to individuals. Surveying the entire target population would be impossible, expensive and time consuming, hence by surveying a sample population the researcher can make inferences and cover insights of the target population.

The respondents of the survey sample were 17 teachers [staff members] teaching the subject ICT in the selected 16 schools of the K-P West Ward in Mumbai and 1058 students of Std. X (Tenth) in those schools which the questionnaires were given by the researcher. Thus, the researcher received a total of 1075 valid responses.

3.10.3 Limitations of Sample Size
If the sample size is too small, there will be few responses. The results would then be inaccurate and not represent the target population. If the sample size is too large, there will be many responses. The analysis would be a drain on the researcher's time and budget especially when incentives have to be offered to surveyors.

3.11 Percentage Analysis
A percentage frequency distribution or analysis is a display of data that specifies the percentage of observations for each data point or group of data points. It is useful for expressing the relative frequency of survey responses. Percentage frequency distributions can be displayed as tables or bar graphs or pie charts. The researcher has used percentage analysis to read and interpret the data; it has proved helpful in
carrying out comparative analysis of the findings from the responses and coming to a conclusion. The researcher has used percentage analysis on the available demographic details of the gender of both the respondents (students and teachers), type of schools and mediums of schools surveyed.

3.11.1 Merits of Percentage Analysis
Percentage analysis of the collected data appears adequate and helps to draw a detailed conclusion of the data analysed.

3.11.2 Demerits of Percentage Analysis
There may be a scope of bias in the interpretation and ambiguity in the data collected.

3.12 Procedure of Data Collection, Analysis and Justification
A research is a systematic investigation that aims to generate knowledge about a particular topic of study and reflects the study objectives. Thus, research tools are used to find, collect, analyse and interpret the data. The researcher needs to make a decision about using qualitative or quantitative data for monitoring and evaluation. A choice needs to be made between using a questionnaire and conducting a focus group discussion to collect the data. Quantitative research explores specific and clearly defined questions and hence used to gather data in surveys through questionnaires such that it is numerical. As compared to it Qualitative data is non-numerical covering images, texts and a person’s spoken or written word. Hence it is gathered using semi-structured or unstructured individual interviews or observation.
For this study, the major study is on the ‘impact of ICT’; hence, the researcher has opted for quantitative data collection using a survey questionnaire and the results were tabulated and analysed statistically in the form of percentage frequency distribution or analysis. Also the analysis and the results are presented is collective analysis of the data received from the respondents.

3.13 Profile of Area Surveyed
The city of Mumbai, Maharashtra, India is located in the western coast facing the Arabian Sea (18.96° North and 72.82° East) and is the biggest metropolitan city in population size and the economy it generates; thus it is the financial nerve of the country. It is the capital of the state of Maharashtra and was previously made up of 07 small islands which have got connected with natural and manmade reclamations. It has 03 major geo-locations: Mumbai City District, Greater Mumbai and Western and Eastern suburbs which have been divided into administrative divisions or wards by the Mumbai Municipal Corporation or Brihanmumbai Municipal Corporation (B.M.C.). The B.M.C is the oldest corporation in India started in 1872 under the Bombay Municipal Corporation Act 1888. The Mumbai Island City plus Mumbai Suburban District (Greater Mumbai) are now governed by Municipal Corporation of Greater Mumbai (M.C.G.M.) headed by a Municipal Commissioner and the area extends from Colaba in the South to Mulund, Mankhurd and Dahisar in the North. It is responsible for civic infrastructure and administration, so the M.C.G.M has divided the city into 6 zones each consisting of 3 to 5 wards which are named alphabetically. There are a total of 24 wards each headed by an Assistant Municipal Commissioner with 27 Corporators or Councillors under him / her in a ward office. (Source: [www.mcgm.gov.in](http://www.mcgm.gov.in)).

![Image 3.2: Map of Mumbai.](image-url)
### Table 3.4: Zones and Wards in Mumbai

<table>
<thead>
<tr>
<th>AREA</th>
<th>ZONE</th>
<th>ADMINISTRATIVE WARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>Zone 2</td>
<td>Ward F (North), Ward F (South), Ward G (North), Ward G (South).</td>
</tr>
<tr>
<td>West</td>
<td>Zone 3</td>
<td>Ward H (East), Ward H (West), Ward K (East), Ward K (West), Ward P (East), Ward P (West).</td>
</tr>
<tr>
<td>North</td>
<td>Zone 4</td>
<td>Ward R (North), Ward R (South), Ward R (Central).</td>
</tr>
<tr>
<td>East</td>
<td>Zone 5</td>
<td>Ward L, Ward M (East), Ward M (West).</td>
</tr>
<tr>
<td>East</td>
<td>Zone 6</td>
<td>Ward N, Ward S, Ward T.</td>
</tr>
</tbody>
</table>

![Image 3.3: Map of Wards of Mumbai, Maharashtra, India.](image)

The basic demographic indicator of the study area is K-P Ward in West Zone 3 of Mumbai, Maharashtra. A survey was conducted to assess the survey area and to predict the possible risks and challenges while the actual data collection would be done by the researcher. The data collected would form the base for building the details of the study. The data collected was cross-
sectional questionnaire based approach as it captures the experiences, opinions and beliefs of the respondents accurately (Yin, 2013).

3.13.1 Profile of Study Area
The K-P West ward in Mumbai contains 139 educational institutions (schools and colleges) from Santa Cruz West (Milan Subway) to Goregaon West which has 57 Aided institutions including 05 B.M.C. schools and 04 Night schools + Junior colleges and 82 Unaided (Government Recognized Private) institutions. From these, there are 83 State Board S.S.C. schools, 26 Other Board affiliated schools (I.C.S.E, C.B.S.E, I.G.C.S.E and I.B), 24 Junior Colleges and 06 Degree Colleges.
The distribution of the 139 institutions medium wise is: 93 English Medium, 20 Marathi Medium, 11Urdu Medium, 08 Hindi Medium and 07 Gujarati Medium.
A survey sample was decided by the researcher for around 16 state board S.S.C. schools in the K-P West ward in Mumbai with completed survey forms received from 1075 respondents [17 teachers and 1058 students].

Table 3.5: Overall Details of Schoolwise Survey

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>SCHOOL</th>
<th>AREA</th>
<th>STATUS</th>
<th>MEDIUM</th>
<th>TOTAL STUDENTS</th>
<th>TOTAL TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>St. Xavier's High School</td>
<td>Vile Parle</td>
<td>Govt. Aided</td>
<td>English</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Oriental Public School</td>
<td>Oshiwara</td>
<td>Govt. Private</td>
<td>English</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Shree Ram Welfare Society's High School</td>
<td>Andheri</td>
<td>Govt. Private</td>
<td>English</td>
<td>99</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Vivek Vidyalaya</td>
<td>Goregaon</td>
<td>Govt. Aided</td>
<td>English</td>
<td>142</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>School Name</td>
<td>Location</td>
<td>Type</td>
<td>Language</td>
<td>10th/12th Average</td>
<td>11th Grade Scholarships</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------</td>
<td>--------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Diamond Jubilee Fidai School (Smt. K.J. Fidai D.J.H.S)</td>
<td>Andheri</td>
<td>Govt. Private</td>
<td>English</td>
<td>62</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>C.W.C. High School</td>
<td>Versova</td>
<td>Govt. English</td>
<td>English</td>
<td>98</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Vidyanidhi V.P. English High School</td>
<td>Juhu</td>
<td>Govt. Private</td>
<td>English</td>
<td>99</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>S.E.S's Malti Jayant Dalal High School</td>
<td>Juhu Road, Santa Cruz</td>
<td>Govt. Aided</td>
<td>English</td>
<td>42</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Farooq High School (Girls)</td>
<td>Jogeshwar i</td>
<td>Govt. Private</td>
<td>Urdu</td>
<td>80</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Farooq Umar BhoySattar High School for Boys</td>
<td>Jogeshwar i</td>
<td>Govt. Private</td>
<td>Urdu [IT in Eng.]</td>
<td>106</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Tata Compd. Mun. Urdu School</td>
<td>Irla, Vile Parle, BMC</td>
<td>Urdu</td>
<td>Urdu</td>
<td>44</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Andheri Mun. Sec. School</td>
<td>Andheri</td>
<td>Govt. Aided</td>
<td>Marathi</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Vidyanidhi High School</td>
<td>Juhu</td>
<td>Govt. Aided</td>
<td>Marathi</td>
<td>47</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Sir B. J. Girls' School</td>
<td>Goregaon</td>
<td>Govt. Aided</td>
<td>Gujarati</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>I. B. Patel High School</td>
<td>Goregaon</td>
<td>Govt. Aided</td>
<td>Gujarati</td>
<td>36</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>Andheri Mun. Sec. School</td>
<td>Andheri</td>
<td>BMC</td>
<td>Hindi</td>
<td>23</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 3.6: Details of Participating Schools in Survey

<table>
<thead>
<tr>
<th>Name</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andheri Mun. Sec School [Mar] Tata compound Andheri(W)</td>
<td>50</td>
<td>4.7</td>
<td>4.7</td>
<td>4.7</td>
</tr>
<tr>
<td>Andheri Mun. Sec School [Hin]</td>
<td>24</td>
<td>2.3</td>
<td>2.3</td>
<td>7.0</td>
</tr>
<tr>
<td>CWC High School</td>
<td>100</td>
<td>9.3</td>
<td>9.3</td>
<td>16.3</td>
</tr>
<tr>
<td>Farooq High School (For girls)</td>
<td>82</td>
<td>7.6</td>
<td>7.6</td>
<td>23.9</td>
</tr>
<tr>
<td>Farooq Sattar Umarbhoy High School For Boys</td>
<td>107</td>
<td>10.0</td>
<td>10.0</td>
<td>33.9</td>
</tr>
<tr>
<td>I. B. Patel Vidyalaya</td>
<td>37</td>
<td>3.4</td>
<td>3.4</td>
<td>37.3</td>
</tr>
<tr>
<td>Oriental Public School</td>
<td>16</td>
<td>1.5</td>
<td>1.5</td>
<td>38.8</td>
</tr>
<tr>
<td>School Name</td>
<td>Total</td>
<td>5.9</td>
<td>9.2</td>
<td>9.3</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Smt. K.J.F.D.J. High School</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shree Ram Welfare Society's High School</td>
<td>99</td>
<td>9.2</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>Sir B.J. Girl's School</td>
<td>19</td>
<td>1.8</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>St. Xavier's High School Vile Parle (W)</td>
<td>100</td>
<td>9.3</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>Tata compound Mun. [Urdu] New Sec School</td>
<td>45</td>
<td>4.2</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>V.P Vidyanidhi High school [Eng]</td>
<td>100</td>
<td>9.3</td>
<td>9.3</td>
<td></td>
</tr>
<tr>
<td>Vidyanidhi High School [Mar]</td>
<td>48</td>
<td>4.5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>M. J. D. High School</td>
<td>43</td>
<td>4.0</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>VivekVidyalaya</td>
<td>142</td>
<td>13.0</td>
<td>13.0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1075</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.3: Details of participating School in Survey

Table 3.7: Number of participant respondents (Student and Teachers)

<table>
<thead>
<tr>
<th>Valid Respondents</th>
<th>1075</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing Respondents</td>
<td>0</td>
</tr>
<tr>
<td>Percentage</td>
<td>100%</td>
</tr>
</tbody>
</table>

3.14 Research Ethics and Confidentiality of Data

For general public, the word ‘ethics’ means the rules of conduct which helps them to distinguish the right from wrong / acceptable from unacceptable behaviour; a system of moral principles; a branch of Philosophy dealing with values related to human conduct. In research on any subject, ethics refers to ‘standards of conduct’. Also, since the research involves coordination and cooperation amongst the participants / respondents, ethical standards promotes values which are essential for collaborative work. Research Ethics include Honesty, Objectivity, Integrity, Confidentiality, Responsible Publication, Non-Discrimination, Safety, Animal Care, Legality, Competence and
Social Responsibility. Research Misconducts are Fabrication of data, Falsification / Manipulation of research materials and Plagiarism of ideas and results. It does not include honest human errors or difference of opinions (www.ethicsguidebook.ac.uk)

Confidentiality refers to the researcher's agreement to handle, store and share data to ensure that the data obtained from and about the research participants is not divulged. They have shared the data for research purposes only and the information needs to be protected outside the research setting (www.researchintegrity.com)

The researcher tabulated the answers obtained from the respondents and analysed them statistically. The analysis and the results presented by the research scholar is a collective analysis of the data received from the respondents (Teachers and Students) and does not refer to any specific school or any individual's response to a particular question.

Similarly the observation and learning gained by the research scholar through the review of already existing literature on ICT, its impact, digitization and the role of teachers has been acknowledged to the original author of the article or book or the website is mentioned. The researcher has not taken any credit for the work which is not done by the research scholar.

The researcher visited the schools with the tool (questionnaire) required for the data collection. The Principal / Head of each school was contacted to seek permission to collect the data and explained the purpose of the present study. A copy of the Permission Letter for questionnaire for the ICT teachers and Std. X (Tenth) students can be referred to in Appendix (iii). Of the selected schools a sample was made of the 16 schools which agreed to be part of the study.

Before administering the questionnaire to the selected ICT teacher(s) a rapport was established, explaining the motive of the study and the need to provide proper and reliable information for all the items in the questionnaire. The sample / students of each of these schools were explained the purpose and usefulness of the study which excited the respondent students and motivated them to fill the complete information as best as they could. To ensure that the students returned the completed questionnaire, the researcher administered them personally in a familiar environment (classroom with their teacher) to the selected sample. All the instructions were given in
a simple language so that the students did not face any difficulty while answering the questionnaire. Since the questionnaire was in English, the other medium students were also given an explanation in the medium of study and in case of any difficulty the teacher was requested to translate the same.

The data thus collected was recorded for further analysis by using frequencies and percentages. Confidentiality has been maintained during the writing of the details in the thesis and relevant industry has been acknowledged in the thesis to the original writer or the author of the article. No credit has been taken for the work which is not originally done by the researcher.

3.15 Synopsis / Conclusion
Progressive movement is the ‘Law of the Universe’. Life presses on & onward in its incessant march. Life is progress. Progress is the unfolding of the design of Providence. The world works out its great purpose & moves towards a definite goal. This chapter will help other researchers to understand the subject of information and communication technology as well as get information. This chapter has also highlighted the latest or earlier trends on the subject.

This study explored the problems and solutions reported by 17 teachers and 1058 students from S.S.C. Board Schools in the K-P West Ward in Mumbai. Both groups (total respondents = 1075) indicated in the survey questionnaires their problems with: accessibility of websites; course/learning systems; accessibility of digital audio and video; inflexible time limits; PowerPoint/data projection during lectures; course materials in PDF, and lack of needed adaptive technologies. Students also mentioned technical difficulties of using e-learning and connecting to websites, problems downloading and opening files, web pages that would not load, video clips taking too long to download, poor use of ICT tools by professors and their own lack of knowledge working with advanced tools. Sixty-seven percent of students indicated that at least a few problems remained unresolved. The different roles and perspectives of the two participant groups influence their views and the researcher has made recommendations addressing the identified common learning problems. Despite all of these, there is no denial that ICT has changed the social, economic and
knowledge dimensions of people all over the world. Voogt and Pelgrum (2005) supported the idea that curriculum needs to be reformed for students to develop competencies that will help them to survive in the 21st century. Thus, what is an important learning ICT tool today, might be outdated a few years later; teachers need to keep their minds open and move along with the technological changes the world is currently experiencing.