CHAPTER - 3

RESEARCH METHODOLOGY

3.1 Introduction
3.2 Research Plan and Research Design
3.3 Research Hypotheses
3.4 Research Area
3.5 Population and Sampling for the Study
3.6 Sources of Data Collection
3.7 Pilot Survey
3.8 Designing of Questionnaire
3.9 Data Collection Procedures
3.10 Process of Data Analysis and Statistical Tests Used
3.11 Summary
In the previous chapter the literature reviewed for the study has been presented in detail. This chapter provides a detailed insight into the research methodology used for the research study.

3.1 Introduction:
Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically (Kothari, 2006 pp.8). Research methodology involves the systematic procedures by which the researcher starts from the initial identification of the problem to its final conclusions. The role of the methodology is to carry on the research work in a scientific and valid manner. The method of research provides the tools and techniques by which the research problem is resolved. The methodology consists of procedures and techniques for conducting a study (Singh, 2006). The research process for this study could be divided into three parts.

- Research plan carried out as per research design
- Testing of Hypotheses
- Conclusions and Suggestions / Recommendations

This inquiry involves identification of the variables from literature, observation of student’s activities, questionnaires to give relevant data for study. Qualitative and quantitative approaches together form a methodology (Creswell, 2009).

3.2 Research Plan and Research Design:
3.2.1 Research Plan:
The research plan on which the study was carried over has been presented here. The research plan was drafted as under:

a) Identification of problem area
b) Setting of Objectives
c) Reviewing and examining of relevant literature
d) Collection of information from school authorities regarding social characteristics of school.
e) Finalization of Sample size,
f) Preparatory work for designing the questionnaire, drawing up the draft questionnaire, its pilot testing, analysis of the sample and finalization of the questionnaire done in consultation with experts.

g) Collection of primary data through documentation, suitable questionnaires and data entry.

h) Analysis of primary data carried out with the help of statistical tools to draw findings, testing of hypotheses, interpretations and conclusions.

i) Presentation of certain suggestions / recommendations on the basis of findings and conclusions.

3.2.2 Research Design:  
Design of the study is an essential part of a research project. It has been noted that an appropriate research design saves against the collection of irrelevant data for an exploratory study like this. Exploratory research seeks to obtain familiarity with a behavioural phenomenon to accomplish new insights into it; frequently with a view to formulating a more precise research problem (Dwivedi, 1997).

As per views of various experts and authors, analytical research, uses facts or information already available, and analyze them to make a critical evaluation of the material. Thus, on the basis of the above, the researcher has used the tools which were appropriate for the study. Considering the complexity of school setting and its diverse types of users, to answer the research questions, a multipronged approach (more than two data collection techniques (Creswell, 2009) has been used. This study involved identification of variables through review of literature, expert’s opinion and data from questionnaire.

The researcher had read through the literature and reviewed important concepts namely learning environment, social, spatial characteristics of school building and student behaviour and student’s academic performance. Review also focused on studies indentifying relation and association between the study variables. Earlier studies provided an understanding of the various concepts related to the study. It assisted to firm the
objectives and hypothesis for the study. It facilitated the researcher to select the necessary research tools for this study.

The various researches done earlier helped the researcher to understand the relationship/significant association of the condition of the school building, building components and student’s academic performance and student behaviour.

Figure: 3.1 Variables for Study

(Source: Author --background image, BaLA-BUILDING AS LEARNING AID pp. 43)

The review of literature helped the researcher to delineate her study in the following aspect:

- Selection of classroom as unit of analysis along with corridor, amenities to find out association and relationship between social spatial characteristics of primary school and student behaviour, learning.
- Selection of primary schools for the study; especially Standard VII students and Teachers as end users.
This is the first study that has been done on primary school. The study explores the association and relationship between social, spatial characteristics of primary school and student behaviour, learning.

**Tools Used for the Study:**
This qualitative and quantitative -- mixed research study has been done with following tools:--

- School information to be collected from school authorities.
- Documentation of classroom under study by the researcher.
- Questionnaire for students.
- Questionnaire for Teachers, Informal discussions with school Principals.
- Direct observation of student activities.
- Photo documentation of space (wherever permitted).

Observation of the behaviour of individuals and groups is important for studying the aspects of human life and it is a basic method of research in behavioural sciences. Direct observation is a relatively unstructured observation involving several methods and techniques. Direct observation is primarily a quantitative technique in which the observer is explicitly counting the frequency and/or intensity of specific behaviors or events or mapping the social composition and action of a particular scene. Direct observation is about observable behavior and is typically associated with research objectives that require some sort of ordinal data or purely factual description like how often, how many, how intensely, who was there, and the like.

Observation process involves many aspects like selection, recoding and encoding of recorded data which in turn describes actual phenomenon into behaviour pattern. As per Social scientist Dwivedi, direct observation enables researcher to record and study behaviour as it occurs. So direct observation was done during school hour especially during recess and break time between two lectures. It assisted in listing activities and spaces associated with them. Observation of users was definitely important for the study to know how students use the space during structured and non structured time in
classroom. The field observation noting form was used to record the students’ activities chosen for in the interval. Questionnaire design is an important and tedious task for any research study. Questionnaire is the most suitable method of data collection for this study because it does inquire the presence of the variables from the user’s (i.e. students and teachers) point of view. Questionnaire was designed for student and teachers separately considering their age group. The questionnaire for teachers include questions using 5 Likert scale measurement which are strongly disagree, disagree, can’t say, agree and strongly agree. Also to encourage response to study some space was allotted after all questions. The questionnaire for students was drafted with YES/NO option only. This study was conducted in the time span allotted by the school.

Interview with principals as a representative of the management definitely helped in getting perspective on the study. The questionnaire design is mainly based on reference from researcher’s observations, Total Learning Environment Assessment (TLEA), Henry Sanoff’s Building Assessment Method and CAPE (Commonwealth Assessment of Physical Environment) and also focuses on student behaviour questions. The discussions conducted informally as per the convenience of school authorities touched may issues like school culture, school discipline, social & cultural activities, changing responses of students etc. Each school is different in its own way with school building and maintenance. The interactions with principals helped the researcher to indentify the issues from the managements’ perspective. Photo documentation of activities and school spaces supported the above data collected where ever possible. Collected Data have been converted into systematic information required for statistical analysis to identify the spatial characteristics which influence student behaviour and academic performance in primary schools. The following table no. 3.1 explains the research design used for the study.

<table>
<thead>
<tr>
<th>Research Design</th>
<th>Research Methodology</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Research</td>
<td>Field study</td>
<td>It is concerned with school buildings, classrooms and opinions obtained.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It involves the identification and</td>
</tr>
</tbody>
</table>

Table No. 3.1: Research Design and Research Methodology
<table>
<thead>
<tr>
<th>Nature of the Study</th>
<th>Qualitative and Quantitative Study</th>
<th>Focuses on qualitative and quantitative methods based on scientific approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Collection Approach</td>
<td>I) Primary Data</td>
<td>Documentation of Classroom, Questionnaire Method, Interview Method, Formal and Informal Discussion</td>
</tr>
<tr>
<td></td>
<td>ii) Secondary Data</td>
<td>Data from School Authorities, Review of Literature.</td>
</tr>
<tr>
<td>Interview Type</td>
<td>Interview &amp; Formal and Informal discussions</td>
<td>Discussion with principal / school administration - Verbal questioning for gaining relevant information related to research study</td>
</tr>
<tr>
<td>Data collection</td>
<td>Observation &amp; Questionnaire Design</td>
<td>School Data Sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Observation Noting Sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Questionnaire I: Teachers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Questionnaire II: Students</td>
</tr>
<tr>
<td>Population &amp; Sampling</td>
<td>Population size</td>
<td>As per the Pune Shikshan Mandal – Education Department of Pune Municipal Corporation approved school list for year 2013-14. Schools were selected by simple random sampling (Dwivedi 1997, Krishnamurthy 1978) and who gave permission to carry out the study.</td>
</tr>
<tr>
<td></td>
<td>Sample Size</td>
<td>31 Schools</td>
</tr>
<tr>
<td></td>
<td></td>
<td>31 Classrooms i.e. VII Std. classroom from each school (Actual Observation and Physical Verification)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>343 Teachers (for questionnaire I)</td>
</tr>
</tbody>
</table>
3.3 Research Hypotheses:
Considering the statement of problem, the research premise and the objectives of the study, the research hypotheses have been formulated as:

1. \( H_0: \) There is no association and relationship between spatial characteristics of primary school and student behaviour.
   \( H_1: \) There is an association and relationship between spatial characteristics of primary school and student behaviour.

2. \( H_0: \) There is no association and relationship between spatial characteristics of primary school and Learning.
   \( H_1: \) There is an association and relationship between spatial characteristics of primary school and Learning.

3. \( H_0: \) There is no association and relationship between social characteristics of primary school and student behaviour.
   \( H_1: \) There is an association and relationship between social characteristics of primary school and student behaviour.

4. \( H_0: \) There is no association and relationship between social characteristics of primary school and Learning.
   \( H_1: \) There is an association and relationship between social characteristics of primary school and Learning.

(Source: Primary Source)
3.4 Research Area:
Pune is the eighth largest developing metro city in India which is referred to as a cultural and educational capital of India. Pune is an educational hub ranging from primary schools to many universities and with the largest number of higher educational campuses and is referred to as Oxford of the East. Pune is a pioneer in women’s education with first school for women started way back in 1870 by Mahatma Jyotiba Phule. Current growth trends in Pune and the government policy for schools after the year 2000 saw a growing number of new school establishments in Pune. Public schools (locally known as municipality schools) are run by the Pune Municipal Corporation and the private schools are run by educational trusts or Sansthas or Societies. The schools are usually affiliated to the State Board of Education (SSC). Other than SSC there are schools with National Board of Education (CBSE) and ICSE running in city. The study was carried out only in Pune municipal area i.e. within the administrative limits of Pune Municipal Corporation. This study involves schools across Pune municipal area which would be representatives for the study. The researcher has chosen this area for study since the researcher is a resident of the city. The figure no. 3.2 and 3.3 displays the research area chosen for the study.

**Figure No. 3.2: Pune City- Research Area**

(Source: www.mapsofindia.com)
3.5 Population and Sample for the Study:

3.5.1 Population:

A research population is also known as a well defined collection of individuals or objects known to have similar characteristics. A population is any group that is the subject of research interest. It is often not practical or possible to study an entire population, it is necessary to make general findings based on a study of only a subset of the population. Such subsets are called samples (Goddard & Melville, 2006). However due to the large size of the population it is difficult to test and obtain detailed data from every individual of the population. If each and every individual of that population is to be tested, then it will become time consuming and expensive. Hence appropriate sampling should be done which will represent the appropriate population.

Sometimes researchers have prior information regarding certain characteristics of the population's composition, and they want the selection of sample items to reflect this. In stratified random sampling, researchers use simple random sampling within each group (or stratum), ensuring that appropriate numbers are selected from each group so that the overall sample reflects each group in the known proportions. Looking at the estimated
future growth of Pune city population, the number of schools is also increasing to cope
with the demand in future. Many schools have got the sanction up to secondary or higher
secondary level and each year they are adding one more standard to their school. This is
the reason, why Pune city has schools with different standards.

Primary schools are categorized as per their management type. Primary schools are of
three types like municipal schools, aided and non aided schools which have been selected
for data collection. School selection has been done on basis of the approved list obtained
from the Education Department, Pune Municipal Corporation. The school list was
obtained from Pune Shikshan Mandal office for the study year. Management wise
division of schools was available in the same list. Permission was obtained from PMC
authorities for conducting the research. Non aided school authorities were approached
explained about the research study and permissions were obtained. Schools which
allowed conducting of survey, allotted a particular time from their timetable to collect
student’s questionnaire. The researcher approached the respective class teachers and
briefed them about the questionnaire whenever required.

The researcher has used the target population in the form of schools and the population
size was obtained through the list from Pune Municipal Corporation’s Pune Shikshan
Mandal. The table no. 3.2 shows the total number of schools as per the list obtained from
PMC’s Pune Shikshan Mandal.

<table>
<thead>
<tr>
<th>Schools Type</th>
<th>No. of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMC schools</td>
<td>282</td>
</tr>
<tr>
<td>Other schools</td>
<td>337</td>
</tr>
<tr>
<td>Total</td>
<td>619</td>
</tr>
</tbody>
</table>

(Source: PMC Shikshan Mandals Approved School List - Final school list for year
2013-14)
The above table gives the total number of schools run by the PMC and others. The list includes pre-primary, primary, secondary and higher secondary schools. The criteria used to choose the population for the research study was:

- Schools with SSC Curriculum
- Sanction as Primary School
- 1<sup>st</sup> to 7<sup>th</sup> Standard running in the same building

The target population of the research study i.e. schools satisfying the above mentioned criteria, is listed in table no. 3.3.

Table No. 3.3: Target Population of the Study

<table>
<thead>
<tr>
<th>Schools Type</th>
<th>No. of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMC schools</td>
<td>99</td>
</tr>
<tr>
<td>Other schools</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>219</td>
</tr>
</tbody>
</table>

(Source: PMC Shikshan Mandals Approved School List - Final school list for year 2013-14)

3.5.2 Sample:

Schools in Pune can be classified according to the type of management of school as PMC schools and other schools (Aided and Unaided). Each type of school has been identified as a strata and a Stratified Simple Random Sampling (Dwivedi, 1997) (Krishnamurthy, 1997) technique was adopted to ensure a representative sample for schools in the Pune Municipal Area.

The primary schools in Pune municipal area with different syllabus have pre primary to 2<sup>nd</sup> standard, pre primary to 4<sup>th</sup> standard, 2<sup>nd</sup> – 4<sup>th</sup>, 3<sup>rd</sup> – 10<sup>th</sup>, 1<sup>st</sup> – 4<sup>th</sup>, 1<sup>st</sup> - 7<sup>th</sup>, 1<sup>st</sup> - 6<sup>th</sup>, 5<sup>th</sup> - 10<sup>th</sup>, and 5<sup>th</sup> – 12<sup>th</sup> standards. Therefore, those schools having 1<sup>st</sup> - 7<sup>th</sup> standard primary schools (as per National Curriculum Framework 2005) are listed for the selection of sample size.
On the basis of the target population the selection of appropriate sample size has been made. Out of the total 219 target population 31 schools have been selected by using simple random sampling technique as given in table no. 3.4.

**Table No. 3.4: Sample Size**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools Surveyed (14.15% of 219 schools)</td>
<td>31</td>
</tr>
<tr>
<td>Classrooms Studied (One 7th standard classroom from each school)</td>
<td>31</td>
</tr>
<tr>
<td>Students Questionnaire (Collected from all the 31 schools)</td>
<td>1083</td>
</tr>
<tr>
<td>Teachers Questionnaire (Collected from all the 31 schools)</td>
<td>343</td>
</tr>
</tbody>
</table>

(Source: Primary Source)

The schools have been chosen using random sampling technique since all the schools did not permit the researcher to conduct the study. Hence only those 31 schools which permitted the researcher to conduct the study have been chosen. The schools chosen for the study cover different parts of the city and are not concentrated in any particular area.

There are different stakeholders in education i.e. the school management, teachers, students, parents and the government. This study is related to the social and spatial characteristics with regard to primary schools. The study also covers the student behaviour and learning. Hence the researcher has conducted an opinion survey to view the perception of the teachers and the students who use the classroom more.

**3.6 Sources of Data Collection:**

For this research study the data and information is collected through primary source and secondary source. The details of these sources and process are explained below:

**3.6.1 Primary Source:**

The primary data has been collected through Questionnaire method, Interview Method and Observation Method which are briefly mentioned below.

1) **Questionnaire Method:** The formal instrument in the form of questionnaire was developed. The information will be collected through the ‘Questionnaire’ method. Hard
copies of questionnaires were circulated to the concerned respondents and the data was collected.

2) **Interview Method:** In this method interviews were scheduled with the respondents and questions were asked orally and information related to the questionnaire was collected. This method was used for those respondents who are not ready to fill the questionnaire by themselves. Formal & informal discussions with respondents and experts in the subject have helped the researcher to analyse, interpret & to arrive at conclusions.

3) **Observation Method:** In this method the researcher has observed the activities of the students and the spatial characteristics of the classroom and collected different points & things which are useful for interpreting the data.

Using the above mentioned three methods the primary data has been collected in four groups as:

- **Spatial Data:** This data gives the information regarding the spatial characteristics of the classroom. The spatial data consists of the classroom and corridor measurements which were physically obtained by the researcher by taking actual measurements. Also the views of the students and teachers regarding the spatial aspect of the classroom have been collected using the questionnaire collected from the students and teachers.

- **Social Data:** This data is related to the social aspects of the school like the students’ strength and student teacher ratio which was obtained directly from the school management. This data provides an insight into the social characteristics of the students who study in the school. Also the views of the students and teachers regarding the social aspect, has been collected using the questionnaire collected from the students and teachers.
• **Behavioural Data:** The students’ behaviour has been observed using a noting sheet through the activities in the classroom and corridor during structured and non-structured hours and during the recess time. Also the views of the students and teachers regarding the behavioural aspect of the students’, have been collected using the questionnaire collected from the students and teachers.

• **Learning Data:** The continuous evaluation record as per the RTE ACT 2009 norms done by the teachers in grade or percentile has provided the data regarding the learning of the students. The data was based on the academic performance of the students in the particular year of study. The data was provided by the respective class teachers.

3.6.2 **Secondary Source:**

The Sources of secondary information was collected from printed and electronic annual reports, Acts, Rules and Regulations prescribed by the government, working papers, journals, books, magazines and research work and it consist of

1. The data about different related research work and opinion of researcher’s about their work

2. The data related to legal provisions, rules and regulations and norms issued by the government.

3. Data collected from books and journals published on Architecture, Behavioural Science, Management, Education, Law, Commerce, Economics, Published reports and articles, Weekly Magazines and Websites related to the research study.

3.7 **Pilot Survey:**

After reviewing relevant literatures and research studies regarding this topic, preliminary questionnaires were prepared and a pilot study was conducted. A pilot study execution was very much essential in order to check the responses of users especially students. School authorities were approached by researcher, who explained the research initiative and survey format to them. Pilot study was conducted in five schools. It included 30 teachers of schools in the study area i.e. Pune city. Five students from seventh standard
from each of the school chosen for the pilot study was randomly selected were asked to fill the questionnaire. Observation of student’s activities were done during recess time.

The pilot study formed the platform for this research. From the findings of the pilot study the researcher developed an understanding regarding user’s perception, which also helped the researcher to refine the study variables and methodology. After analysis of the responses of both the questionnaires, student’s questionnaire was modified considering time required for filling the same and the questions were reframed to close ended format as yes / no.

Based on the findings of this pilot study the researcher decided to use Likert type scale for Teacher’s questionnaire. Teacher’s questionnaire was also refined with open ended question at the end. Both questionnaires were translated into Marathi, the local language for ease of respondents. The researcher has also observed different problems faced by users as Unhygienic conditions of the toilet, Improper Parking Facility, less play area, improper maintenance of furniture etc.

3.8 Designing of Noting Sheet & Questionnaire:
Before formulating the research questions, various sources of materials regarding the subject were examined. Also based on the pilot study and the objectives and research questions, appropriate questionnaires were developed. With inputs from the review of literature, i.e. from the Indian School Code and the UNICEF Child Friendly School Manual, the researcher has identified the following parameters for the research study and grouped them as per the requirements of the study as can be seen in table no. 3.5.
<table>
<thead>
<tr>
<th>SPATIAL GROUP</th>
<th>CODE</th>
<th>NO.</th>
<th>CHARACTERISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom Essentials</td>
<td>A</td>
<td>1</td>
<td>Age of building</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Area of classroom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Classroom dimensions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Classroom proportion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>Classroom height</td>
</tr>
<tr>
<td>Classroom fittings</td>
<td>B</td>
<td>6</td>
<td>Minimum clear distance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>Base of the chalk board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>Chalkboard location</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>Chalkboard size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>Children’s chalk board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>Storage--cupboard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>Pin board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13</td>
<td>Desirable fittings</td>
</tr>
<tr>
<td>Environmental Condition</td>
<td>C</td>
<td>14</td>
<td>Fan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>Light</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16</td>
<td>Window area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17</td>
<td>Noise</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18</td>
<td>Door width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>19</td>
<td>Two doors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21</td>
<td>Colour</td>
</tr>
<tr>
<td>Corridor ,amenities</td>
<td>D</td>
<td>20</td>
<td>Corridor/Verandah</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23</td>
<td>Garden</td>
</tr>
<tr>
<td>SOCIAL GROUP</td>
<td>E</td>
<td>24</td>
<td>Type</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25</td>
<td>School size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26</td>
<td>Student teacher ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27</td>
<td>Attendance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28</td>
<td>Midday meal</td>
</tr>
<tr>
<td>Social Interaction</td>
<td>F</td>
<td>Maintenance</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>1. Friendship</td>
<td>G</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>ii. Sense of Community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iii. Frequency of Knowing each other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv. Cooperation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>v. Exploration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vi. Visual connectivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vii. Sense of belonging</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LEARNING GROUP H Learning  

(Source: Primary Source)

3.8.1 Designing of Noting Sheet:
A noting sheet was designed by the researcher to record the physical measurements of the classroom under study. The spatial parameters studied using the noting sheet included the parameters grouped under code A, B, C D and E as mentioned in table no. 3.5. The behavioural observations of the students was recorded in a separate sheet where the researcher recorded the behaviour of the students grouped under code G as mentioned in table no. 3.5, during their breaks i.e. recess time and also before and after school hours within the school premises. A specimen of the noting sheet is attached in Appendix IIIA and III B.

3.8.2 Designing of Questionnaire:
In order to study the perception of the students and the teachers regarding the classroom under study and also to support the research hypothesis the researcher prepared a questionnaire for Students and Teachers. The questionnaires were numbered as I and II as given below:

Questionnaire I: For Students
Questionnaire II: For Teachers

Questionnaire I was prepared to collect the opinions of the seventh standard students of the school. The questionnaire was formulated keeping in mind the objectives of research
mainly to know about student behaviour of primary school and their opinion about classroom and transitional space that they use often. The questionnaire consisted of open ended and close ended questions. The open ended questions at the end gives a picture about idea of school any additional opinion regarding their school. The questions support the grouping of parameters done as explained in table no. 3.5. A specimen of the questionnaire for students, in English and Marathi language, is attached in Appendix IA and IB.

**Questionnaire II** was prepared to collect the opinions of the Teachers of the school. The use of questionnaire allowed the validation of data collected from observations. The questionnaire was prepared keeping in mind the objectives of the research mainly to know about student behaviour, learning of primary school student and their opinion about classroom and transitional space that they use often. The questionnaire consists of open ended and close ended questions. Two open ended questions at the end gives an opinion about their school and their views regarding school design. The questions support the grouping of parameters done as explained in table no. 3.5. A specimen of the questionnaire for teachers, in English and Marathi language, is attached in Appendix IIA and IIB.

**3.9 Data Collection Procedures:**
The study is based on the social, spatial characteristics and student behaviour and learning. The spatial characteristics and student behaviour were recorded using a noting sheet and an opinion survey was conducted using a questionnaire to support the study. The social characteristics were collected through formal and informal discussions with the principals and management of the school. The schools on the list were randomly chosen and contacted and those schools which did not allow behaviour noting or questionnaire survey were discarded and again another school was chosen randomly. The schools which permitted for behaviour noting and questionnaire were studied. The researcher faced the problem of getting permission from the school authorities to study the school. The difficulty in getting permission from the schools was explained to PMC education department and the PMC education department informed all principals about
the research and it was also said that their cooperation was expected. Site visit was arranged as per school’s permission and time specified by the school. A visit of each area was conducted, and subsequently the Spatial Characteristics Noting Sheet was completed by the researcher for each school. For this research study the data has been collected in four groups.

1. **School information and academic performance data:** After obtaining the necessary permission, school information was collected from school office records and academic performance record were collected from the respected class teachers.

2. **Documentation of classroom under study by researcher:** The researcher physically measured and collected the information on the classroom understudy and it was recorded in the noting sheet.

3. **Direct observation of student activities:** The field observation to record the students’ activities for each space was done in a separate sheet. Observation was carried out for ten minutes, in three timings i.e. 10-15 minutes before school timing, during recess and after school timings.

4. **Discussions with Principals and Questionnaire for teachers:** With due permission, the questionnaire was circulated among the teachers and collected as per the convenience of the teachers and formal and informal discussions were conducted with the principals.

5. **Questionnaire for Students:** The research study is related to primary schools. The researcher spoke to the students and distributed questionnaires after which filled questionnaires were collected. Informal question and answer session with student respondents was helpful in understanding their activities and views about schools in general.
3.10 Process of Data Analysis and Statistical Tests Used:

3.10.1 Process of Data Analysis:
The spatial data was collected by actually measuring the classroom and transitional space and the social data was collected using a questionnaire and students’ behaviour was observed and noted in a separate sheet. Data collected from schools was noted on a noting sheet and on the same day observation noting was done. School data was received in various forms. This data was segregated as per parameters, checked and coded. For coding of data the following steps have been used by the researcher. Before using statistical tools one important part was the coding of data. When the researcher received the data in various forms, the data had to be recorded in central data sheets as per the groups and then all entries had to be checked. Then the statistical data was processed. Hence coding is an important part of the analyzing activity. For coding of data the following steps have been used by the researcher.

- Firstly the all 31 schools were coded from A to Z, AA, AB, AC, AD, and AE. Classroom studied in detail were given the same code followed throughout the analysis. List of coding of schools is attached in Appendix IV.
- Coding of data was done with the help of Microsoft excel sheet for social characteristics – numerical, availability and spatial data – actual measurement and availability of facilities.
- Coding of data was done with the help of Microsoft excel sheet for Questionnaire I & II. The students questionnaire has been coded as 1 = Yes and 2 = No. Answers of Open ended questions have been compiled school wise and analyzed. The teachers questionnaire had five options to express their opinion and it has been coded as 1 = Strongly Disagree, 2 = Disagree, 3 = Cannot Say, 4 = Agree and 5 = Strongly Agree. Answers of Open ended questions were compiled school wise and analyzed.
- Numerical values were assigned for each and every field.
- Test Synchronization was done with Questionnaire I & II.
- Recording of the entire 1083 entries of student questionnaire and 343 teachers questionnaire in coded format was done in excel sheet.
• All coded data was imported to Statistical Package for Social Sciences (SPSS) Software and prepared for statistical data analysis.

Two questionnaires and noting sheet were coded by assigning numeric value to each and every field. Questions were grouped as per the parameter grouping as mentioned in table no. 3.5 above to analyze user’s opinion and further it was needed for inferential statistics. Then all statistical activities were processed.

After completing data collection process, the collected data was recorded in Microsoft excel in three separate data sheets prepared group wise. Answer to all questionnaires, coded in excel were exported to SPSS software package. Then various statistical tools and test for analysis were applied and reports were generated.

3.10.2 Statistical Methods / Tools used for data analysis:
As the research consists of large sample size, the data falls in the category of the normal distributions. After coding of data the analysis has been done by using various tests and statistical tools for data analysis. The following are the statistical tools used by the researcher.

• Auto CAD: - Draw Plans
• Microsoft Excel:- Data Storage Tool
• IBM SPSS: - For Data Analysis & Interpretation.
• Microsoft word: - Data Presentation.
• Statistical test :- Testing of hypotheses

The statistical tools used by the researcher are explained in detail here.

Auto CAD:
AutoCAD is a computer-aided design (CAD) program used AutoCAD is developed and marketed by Autodesk Inc. and was one of the initial CAD programs that could be executed on personal computers. AutoCAD is a 2-D and 3-D computer-aided drafting software application used in architecture, construction and manufacturing to assist in the
preparation of 2-D and 3-D design and drafting. Blue prints and other engineering plans.\(^1\). It is a tool which aid in drafting the floor plans, sections, elevations etc.

**Microsoft Excel: - Data Storage Tool:**
Excel is an electronic spreadsheet program that can be used for storing, organizing and manipulating data. When you look at the excel screen you see a rectangular table or grid of rows and columns. The horizontal rows are identified by numbers and the vertical columns with letters of the alphabet. For columns beyond 26, columns are identified by two or more letters. The intersection point between a column and a row is a small rectangular box known as a cell. A cell is the basic unit for storing data in the spreadsheet. Because an excel spreadsheet contains thousands of these cells, each is given a cell reference or address to identify it. The cell reference is a combination of the column letter and the row number (Microsoft). The types of data that a cell can hold include numbers, text or formulas. Just as in mathematics class, formulas are used for calculations usually involving data contained in other cells. Excel and other electronic spreadsheets include a number of built in formulas used for common tasks known as functions.

**SPSS: - For Data Analysis & Interpretation:**
Statistical Package for the Social Sciences (SPSS) was religiously used for the statistical analysis. Coding of variables in a quantitative research is very critical for better interpretation of results. The questions and responses were coded and entered in the computer using Microsoft Excel Software. Required analysis was done with the aid of Statistical Package for Social Sciences. Certain statistical methods were applied on the data to get the results which were analyzed. After the excel sheet was completed with coding of data the researcher exported all the data to SPSS software package, checked all fields, scales and other parameters of data and then applied various tools i.e. mean and various tests to generate reports for the study.

\(^1\) Ref.: (www.study.com)
**Microsoft word - Data Presentation:**
Word processors have a variety of uses and applications within the business world, home, and education. Business, within the business world, Microsoft word is extremely useful tool. In Microsoft word, word processors on their computers, word processing in the home tends to be educational or business related, dealing with assignments or work being completed at home. However, many of these home publishing processes have been taken over by desktop publishing programs.

Finally all the collected data through open ended questions from questionnaires and SPSS were consolidated and processed through Microsoft word. The data was divided into chapters and all relevant information related to the specific chapter was recorded with the help of word processor and also advance functions like font selection, margin selection was done through Microsoft word. Tables and graphs are visual representations. They are used in the study to organize information to show patterns and relationships between different variables related with retailers and consumers. Different graphs and charts like scatter plots have been used for better presentation of the data.

**Statistical Tests:**
The researcher has used different statistical tools like the Measures of Central Tendency, Correlation, Mann Whitney Test, Z test, Chi square test, Scatter diagram, Test of Reliability and the Test of Validity.

**Measures of Central Tendency:**
Measures of central tendency (or statistical averages) tell us the point about which items have a tendency to cluster. Such a measure is considered as the most representative figure for the entire mass of data. Measure of central tendency is also known as statistical average (C.R., 2006). Mean, median and mode are the most popular averages. Mean, also known as arithmetic average, is the most common measure of central tendency and may be defined as the value which is obtained by dividing the total of the values of various given items in a series by the total number of items. Mean is the simplest measurement of central tendency and is a widely used measure. Its chief use consists in summarizing the
essential features of a series and in enabling data to be compared. It is amenable to algebraic treatment and is used in further statistical calculations. It is a relatively stable measure of central tendency. But it suffers from some limitations viz., it is unduly affected by extreme items; it may not coincide with the actual value of an item in a series, and it may lead to wrong impressions, particularly when the item values are not given with the average. However, mean is better than other averages, especially in economic and social studies where direct quantitative measurements are possible.

**Correlation:**
For expressing the degree of relationship quantitatively between two sets of measures of variables usually the help of an index that is known as coefficient of correlation is taken. It is a kind of ratio which expresses the extent to which changes in one variable are accompanied with changes in the other variable. It involves no units and varies from -1 (indicating perfect negative correlation) to +1 (indicating perfect positive correlation). In case the coefficient of correlation is zero; it indicates zero correlation between two sets of measures (Singh, 2006). In computing coefficient of correlation with the help of this method ranks are i.e. positions of merits of these individuals in the possession of certain characteristics. Charles Spearman’s coefficient of correlation (or rank correlation) is the technique of determining the degree of correlation between two variables in case of ordinal data where ranks are given to the different values of the variables. The coefficient of correlation is computed by this method as it considers only the ranks of the individuals in the characteristics A and B and is known as Rank correlation coefficient and is designated by Greek letter (Rho). Sometimes it is also known as Spearman's coefficient of correlation after the name of its inventor (Singh, 2006). The main objective of this coefficient is to determine the extent to which the two sets of ranking are similar or dissimilar. As Spearman’s rank correlation is a non-parametric technique for measuring relationship between paired observations of two variables.

**The Mann-Whitney Test**
The Mann Whitney U Test is designed to test the significance of difference between two populations, using random samples drawn from the same population. It is a non
parametric equivalent of the parametric ‘z’ test. It may be considered a useful alternative to the \( t \) test when the parametric assumptions cannot be met and when the observations are expressed in at least ordinal scale values. The basic computation is \( U_1 \) and in experiments using small samples, the significance of an observed \( U \) may be determined by the \( U \) critical values of The Mann–Whitney Tables (Best & Kahn, 2006). When the size of either of the groups is more than 20, the sampling distribution of \( U \) rapidly approaches the normal distribution, and the null hypothesis may be tested with reference to the ‘z’ critical values of the normal probability table.

**Chi-Square:**
Chi-square is an important non-parametric test and as such no rigid assumptions are necessary in respect of the type of population. We require only the degrees of freedom (implicitly of course the size of the sample) for using this test. As a non-parametric test, chi-square can be used (i) as a test of goodness of fit and (ii) as a test of independence (C.R., 2006).

As a test of independence, the test enables us to explain whether or not two attributes are associated. If the calculated value of chi-square is greater than its table value, our inference then would be that null hypothesis does not hold good which means the two attributes are associated and the association is not because of some chance factor but it exists in reality. It may, however, be stated here that chi-square is not a measure of the degree of relationship or the form of relationship between two attributes, but is simply a technique of judging the significance of such association or relationship between two attributes (C.R., 2006).

In order to apply the chi-square test either as a test of goodness of fit or as a test to judge the significance of association between attributes, it is necessary that the observed as well as theoretical or expected frequencies must be grouped in the same way and the theoretical distribution must be adjusted to give the same total frequency as found in case of observed distribution.
Scatter Diagram:
Regression lines can be used as a way of visually depicting the relationship between the independent (x) and dependent (y) variables in the graph. A straight line depicts a linear trend in the data. In addition to visually depicting the trend in the data with a regression line, the equation of the regression line can be calculated. This equation can either be seen in a dialogue box and/or shown on a graph. How well this equation describes the data (the 'fit'), is expressed as a correlation coefficient, R² (R-squared). The closer R² is to 1.00, the better the fit. This too can be calculated and displayed in the graph.

Test of Reliability:
Reliability of measure indicates the extent to which it is without bias and hence ensures consistent measurement across time and across the various items in the instrument. Thus, reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the goodness of measure. SPSS has the reliability analysis procedure. This reliability procedure is executed on the data to assess its reliability.

Test of Reliability --- Student’s Questionnaire
Following tables shows the SPSS output of reliability analysis of student’s questionnaire.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valid</td>
<td>1082</td>
<td>99.9</td>
</tr>
<tr>
<td>Excluded</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>1083</td>
<td>100</td>
</tr>
</tbody>
</table>

a. List wise deletion based on all variables in the procedure.

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.544</td>
<td>30</td>
</tr>
</tbody>
</table>

2 Ref.: www.wikipedia.com
3 Ref.: https://www.ncsu.edu/labwrite/res/gt/gt-reg-home.html
The reliability of the questionnaire was analyzed using Cronbach’s Alpha, which is considered valid for determining the internal consistency of the questionnaire. Reliability analysis was carried out where the Cronbach’s alpha was tested. Ideally, the Cronbach’s alpha should be in between 0.5 and 1. In our case, it comes out to be above 0.54 (As per Table number 3.7). Therefore, the data is reliable.

**Test of Reliability --Teacher’s Questionnaire**

Following tables shows the SPSS output of reliability analysis of teacher’s questionnaire.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Valid</th>
<th>Excluded a</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>342</td>
<td>1</td>
<td>343</td>
</tr>
<tr>
<td>%</td>
<td>99.7</td>
<td>0.3</td>
<td>100</td>
</tr>
<tr>
<td>a. List wise deletion based on all variables in the procedure.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Source: Primary Data)

<table>
<thead>
<tr>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.876</td>
<td>30</td>
</tr>
</tbody>
</table>

(Source: Primary Data)

Reliability analysis is carried out where the Cronbach’s alpha was tested. Ideally, the Cronbach’s alpha should be in between 0.5 and 1. In our case, it comes out to be above 0.8 (As per Table number 3.9). Therefore, the data is highly reliable.

**Test of Validity:**

Bartlett’s test of sphericity is an indication of the strength of the relationship among the variables. This tests the null hypothesis that the correlation matrix is an identity matrix. An identity matrix is one in which all of the diagonal elements are 1 and all off diagonal elements are 0. In such a case the null hypothesis is rejected. Further, in this case the Bartlett’s test of sphericity testing for the significance of correlation coefficient matrix is significant as indicated by the p value corresponding to the chi-square statistic.
Test of Validity: Student’s Questionnaire

Table No. 3.10: KMO and Bartlett’s test – student

<table>
<thead>
<tr>
<th>Bartlett's Test of Sphericity</th>
<th>Approx. Chi-Square</th>
<th>1968.539</th>
</tr>
</thead>
<tbody>
<tr>
<td>Df</td>
<td>Sig.</td>
<td>.000</td>
</tr>
</tbody>
</table>

(Source: Primary Data)

The p value is 0.000, which is less than 0.05, the assumed level of significance, indicating the rejection of null hypothesis that the correlation matrix of the variables is insignificant. Hence we can say that the data is valid.

Test of Validity: Teacher’s Questionnaire

Table No. 3.11: KMO and Bartlett’s test – Teachers

<table>
<thead>
<tr>
<th>Bartlett's Test of Sphericity</th>
<th>Approx. Chi-Square</th>
<th>3676.231</th>
</tr>
</thead>
<tbody>
<tr>
<td>df</td>
<td>Sig.</td>
<td>.000</td>
</tr>
</tbody>
</table>

(Source: Primary Data)

The p value is 0.000, which is less than 0.05, the assumed level of significance, indicating the rejection of null hypothesis that the correlation matrix of the variables is insignificant. Hence we can say that the data is valid.

3.11 Summary:

In this chapter the methodology for exploring the association and relationship between social, spatial characteristics of primary school and student behaviour and learning has been presented. The methodology mainly included:--

- Identification of parameters and research area i.e. classrooms in study area.
- Designing of questionnaires for students and teachers of schools to collect their opinion regarding the parameters indentified for the research study.
• Compilation, segregation and organization of collected data and preparation of data sheets for statistical analysis.
• Statistical test used for exploring the relationship and the tests used for identifying the contributing spatial characteristics has been studied.