CHAPTER 5

RESEARCH METHODOLOGY
5.1 What is Research?

Research is a logical and systematic approach to find new and important information on a selected topic. The terms research investigation of finding propose solutions to technological, scientific and social problems through aim and systematic analysis. It is a find for knowledge, that is, a finding of invisible facts. Here knowledge means information about stuff. The required information might be composed from different origin like past experience, books, journals, nature, internet, observation, use of technology etc. A research can guide to recent contributions to the past knowledge. Only through research is it possible to make advancement in a field. Research is truly advancement and determines the social and political development, economic, of a nation. The outcomes of scientific research very often force a change in the philosophical view of difficulties which expand far beyond the limited domain of science itself.

In our research we concentrate on analytical study of difficulties in object oriented programming and how to study/solve these difficulties using E-learning. Many people are doing research on education system for giving trouble free enhancive solution of learning. Many people contribute their knowledge systematically to solve technical and social problems in education. Our propose research follows all proper steps and method to produce enhancive and better outcomes of research. Propose research is the studies of effectiveness in E-Learning to analyze difficulties in object oriented Programming. In every research area domain is important aspect to find new things. We select Dhule district for research area and our research is experimental base approach to follows all steps of experimental base investigation. Research is not only finding or invent some new things, it is enhancive approach to give new vision and method for students, learners who are faced difficulties to understand object oriented programming concept and that can be understand using the effectiveness of E-learning.

5.2 Motivation behind Research

Research is kind’s life vehicle help to achieve distance of enhancive life. We already said that many users cannot understand the object oriented concepts easily. The main focus of our study is to analysis of object oriented concepts and understanding problem. For that, we first introduced with object oriented concept briefly in easy understandable format. We collect data for our research in systematic
manner object oriented and E-learning. After that we can take survey of colleges and taking some test on object oriented programming concepts. We can take total 500 samples from 20 colleges for analysis purpose and divided these samples in two parts, 50% samples take in rural and take 50% samples in urban area. From after survey, we can know about problem of students and teachers. For that, we cannot blame only students; teachers also cannot understand these concepts properly. Traditional teaching methods are responsible for problem facing student and teachers of understanding difficulties in object oriented programming. We can take survey to teach this concept by E-learning i.e. virtual classes can be arranges. On that basis of E-learning learn the concepts to students, the effect of this type of teaching are beneficial to students and teachers point of view. We compared all traditional technique to teach object oriented concepts. Taking reviews on all papers related our topic and getting or find to solutions on them. We also searches on E-learning can be useful for distance education learners. They can learn easily with the use of these techniques to follow. Our research trying to finding solution to understand object oriented concepts to students easily by E-learning.

a. **Advancement and great life:**

The inspiration behind every research in progressive and outstanding life. Advance comes about if the space of lack of awareness is included by learning and insight. Research gives advance approach in learning process of object oriented programming. In every research exceptional outcome is important to implement this strategy in our life. Learning and diplomacy drive the humankind to carry on with a discuss great life.

b. **Development of imaginative state of mind:**

Every research explores the hidden idea in mind. Each person in the world has different thinking power but it has needed to implement this idea with systematic manner. Our presence research is imagination of our min and we explore it using systematic analytical study. Analytical study is logical investigation of real life things. One of the reasons of research is to advance investigative attitude. Logical mentality is one that asks for what reason and in what way and responses are
discovered. This ‘Know-why’ and ‘know-how’ constitution support capacity and such educated abilities are the amazing holdings of social order.

c. Inventiveness of new things:

One of the major reasons of research is help to imagination and enhancement. New items, new methodology, new techniques, new utilization is the technique through which the planet goes alert. An energetic planet is not possible without originality presented sometimes in each ramble. Research does not skip the existing work it only enhance strategy and method to improve more exceptional solution of problem. The definition of research indicates Re-search means we” search again and again”. Our presence research invent new logical approach to solve the educational problem of disabled student using enhance technology.

d. Testing theory and making probabilities:

The aim of research is to investigate some new enhance method. The effective outcomes of each research is depends on its testing mechanism and outcome of result are probably. That information originates from testing speculations and creating new hypotheses. Demonstrated theories come to be hypotheses.

e. Forecast and control:

Applied examination has an unbelievable say in assumption and control-in practically all ramble of human attempt. Forecast is hopping into what’s to come and the speculations constitute the launch pillow. Control searches for digression between real event and anticipated occurrence. Simultaneously, the probabilities get rethink and redefined. Our presence research methodology indicates some forecast results that are useful to disabled student in their educational life but it is control under the supervision of expertise.

f. Purposive Enhancement:
In each research purpose is important aspect and purposeless research is non-directional research it has not bounded in particular criteria and also outcome of this research is not useful to any enhancement. In presence research purpose is finite and enhancive to developing rural India. This research reduces the cost and effort in education system and also develop new theme of education.

g. Trouble solving:

The aim of each research is to find new things, but without any problems we cannot find any things. Every research is beginning from problem. What is an issue? Issue is need or failure of something. Learning want, ability lack, benefit failure, and so on exist. In what manner can these be understood? Research into the powers that reason need and measures to hold them from creating lack is needed. Along these lines, problem resolve is an unbelievable motivation behind research.

h. Schematic assessment:

Result of each research is depends on schematic assessment of research processor. After problem definition of every research schematic evaluation is important to evaluate step by step methods of research. In our presence research we build schematic methodology to find appropriate result of research.

i. Influence analysis:

Research is attempted to assess the effect of certain measures or change presented on important variables. Influence studies are functional for social, business, monetary and different ranges of decision making. In our presence research we will conduct survey, exam, and implementation of enhancive method and analysis of result.

j. Methodological enhancement:
Another reason for research is to improve research procedure itself. It is important to improve the procedural method of research to better outcomes. Now days in Indian rural education system traditional approaches are use but this approaches are not feasible. For that reason we implement cloud based strategy to improve methodology of research and achieve better outcomes of research.

5.3 Research objective

While your trouble formulation served to explain the goal of our research, the objectives provide an accurate illustration of the particular activity you will take in order to reach this aim within time frame. As with the problem formulation, the overall objective should be framed in a single sentence. In all scenario of research conclude that the objective define goal of our research without aim we cannot reach to destination. Research objective is basic and first stage of every research and it provide finite boundary to our research. In our presence research scenario first we conclude the objective of my research to explore our research method and gain accurate finite result of the research.

The objective of our presence research is to study of effectiveness in E-Learning to analyze difficulties in object oriented Programming. We select dhule district to make good research to better study of difficulties in object oriented programming and effectiveness of E-learning. Aim of our research is to study the all aspect and current situation of education area of object oriented programming concepts in dhule district students. Dhule is our home town and I also faced many problems in our educational life and also facing problem to teach the students. In our presence research scenario we can not only study the rural and urban education but also find difficulties in learning and understanding process of object oriented programming concepts. Our research is combination of computer science, network and study through E-learning. We merge and define the interrelationship of this three subject. Because our research learning Object oriented programming concepts and E-learning mechanism and give the solution using computer based technology. Learning OOP is the major hurdle in education system or learners and we need to computer based education system and tools for enhance solution. In this research we mention and study the problem definition of education to analyze difficulties to understand
object oriented principles and effectiveness of E-learning. Following are the objective of our research to explore and give innovative direction to our research.

1] To study on object oriented programming concepts

   First important objective of our present research is to study on overall object oriented programming principles. From the basic point of view to study briefly each concept one by one. Our research must be done the programming concepts are analyzed effectively.

2] To study and analyze difficulties in object oriented programming

   The teachers faced number of problems, teaching Object Oriented programming to college students. The concepts like classes, constructor calling, polymorphism and other object oriented concepts are finding difficult to understand the students. The students that has background of procedural programming having face little problem to move towards object oriented programming directly. The students taking his own time to understand object oriented concepts. The basic task of our research is to study and analysis the arduousness or difficulties in object oriented programming. Various concepts in object oriented programming that must be tough to learners that could be analyzed and study effectively in our research.

3] To study of understanding problems of object oriented programming to students, teachers

   Our third objective is to study of what understanding problems of object oriented programming (OOP) to students and teachers. In current scenario we have to check what problem arises to students, teachers about object oriented programming concepts. The first two objectives analyze the object oriented programming principles and from these two objectives what problem faced students, teachers or any other learners. In the third object we mention or study the given problems occurs to students.

4] Our research can take total 500 samples from 20 colleges for analysis purpose and divided these samples in two parts, 50% samples take in rural and take 50% samples in urban area
Fourth important objective of our present research is to study traditional education system in rural education. Education is important aspect of every person life, and education give smart finishing to knowledge and behaviour of the student. Our research can take total 500 samples from 20 colleges for analysis purpose and divided these samples in two parts, 50% samples take in rural and take 50% samples in urban area In beginning of our research we study and observe the quantity of colleges in dhule district and also we study which facility are provided to colleges in dhule district.

- To make survey of colleges in dhule district and divide in two parts rural and urban
- We can take total 500 samples from 20 colleges for analysis purpose
- To find out learning methods and types of traditional learning system
- To check past result of student and select second and third grade student
- We can take test on object oriented programming in traditional method.
- To make list of teaching and training method
- To find tool of learning method
- To make list of infrastructure detail of colleges in rural and urban area
- To conclude disadvantages of traditional learning
- To observe and explore impact of traditional education

5] To study and analyze effectiveness of E-learning in teaching methods

The main objective of our research is to implement E-learning approach for student with learning OOP concepts. Our research says that why E-learning effectiveness in teaching methods. E-learning must be superior than traditional teaching method. We need to enhance this E-learning methodology. For fulfil this drawbacks we define some new strategy that provide cost effective , remote storage and anywhere, anytime access facility to student. Following are the sub objective related to computer based E-learning.

- To design computer based E-learning architecture for rural education
- To make analytical study result and benefits of computer based learning for students that facing difficulties in OOP concepts.
6] To need of E-learning to solve the given problem facing by institutions, teachers and students

This is the last and valuable objective of our research to need of E-learning. In our research we said that need of E-learning to solve the given problem facing by institutions, teachers and students. What problems facing students that mentions in above objectives. The E-learning methods or strategies to learn the object oriented programming concepts are effectively utilize. With the use of new E-learning methods to teach are used by teachers and free from the burden of difficulties to understand and teaching these concepts.

- To find computer based assistive tools for student
- To measure impact of E-learning on student
- To conduct examination using computer based tools
- To compare the grade of student in traditional learning approach and computer based E-learning approach.

5.4 Research methodology

Research methods are the different method, schemes and algorithms used in research. All the research methods implement by a researcher during a research study are termed as research methods. They are essentially developed scheme, scientific and value-neutral. They contain theoretical procedures, experimental studies of research attributes, numerical plan, statistical approaches, etc. Research methods support to collect samples, data and find finite outcomes to a problem. Particularly, scientific research methods call for explanations based on composed factors, computation and survey and not on reasoning alone. They obtain only those explanations which can be confirmed by experiments.

Research methodology is a systematic way to resolve a trouble. It is a science of investigate how research is to be carried out. Essentially, the process by which researchers proceed about their work of describing, explaining and forecast phenomena are called research methodology. It is also describe as the preparation of methods by which knowledge is acquired. The goal of research methodology is to give systematic work plan of research. It may be provide science and step by step process of research help to support researcher to successfully reach their research
goal. It is compulsory for researcher to understand research techniques but also important to know methodology of research. Every researchers not only needed to understand concept like, how to explore individual tests, how to formulate the mean, the mode, the median or the standard deviation, how to implement particular research techniques, but they also required to understand which of these methods or techniques, are relevant and which are not, and what would they mean and show and why. Researchers also required understanding the expectation underlying different methods and they required to know the rules by which they can decide that certain techniques and procedures will be appropriate to certain problems and others will not.

The area of research methodology is large than research methods. Thus, when we talk of research methodology we not only discuss about research method but also identify logic and reason behind this method we deploy in our current research scenario and explain why we are using a especially method or technique and why we are not using others so that research outcomes are capable of being assess either by the researcher himself or by others. In present research we use analytical study method to implement cloud based learning approach in rural education. Analytical study identifies and quantifies groups, test hypothesis, identify causes and compare more than one group of data.

5.5 Types Of Research

The types of research conclude that researcher can investigate what types of result or outcome of research it’s depend on research types. Researcher use following techniques to evaluate their research by systematic way and reach to their destination to achieve specified result

(i) **Descriptive vs. Analytical**

Descriptive research contains surveys and fact-finding inspection of different kinds. The major beginning of descriptive research is description of the state of incident as it exists at present. This method will be making survey base research of different kinds of research area. The methods of research implement in descriptive research are survey methods of all kinds, including comparative and inter relational methods. In analytical research, on the other hand, the researcher has to utilize facts or information previously present, and examine these to make a fault finding evaluation of the material.
(ii) **Applied vs. Fundamental:**

Research can either be action research or basic research; it also called as pure research. The aim of applied research is to finding an appropriate solution for a current problem interfacing a people or an industrial and educational organization, whereas basic research is mainly concerned with generalizations and with the correct formulation of a theory. These types of research will be give critical problem solution.

Fundamental research describe some basic phenomenon of nature and pure mathematics are basic example of fundamental research that describe basic things behind research and introduce basic type of attribute that explore some large innovation Similarly, research studies, related people behaviour carried on with a view to make generalisations about human behaviour, are also one of the examples of fundamental research, but research goal at certain result facing a concrete social or business trouble is an example of applied research.

**Quantitative vs. Qualitative**

Quantitative research can be find quantity related this research based on the measurement of quantity or amount, this research are use to count quantity of something. It is applicable to fact that can be expressed in terms of quantity. Qualitative research, on the other hand, is concerned with qualitative fact, this type of research maintain a quality of research and it investigate qualitative approach in. qualitative research goal at detect the underlying motivation and desires, using in depth interviews for the purpose.

iv) **Conceptual vs. Empirical**

Conceptual research is abstract techniques of research and it implemented to explore abstract idea and theory of something. Conceptual research method can be used for moderating existing concept or theory on the basis of previous. This research method can be use philosophers to explore new ideas but this ideas are based on previous methods on the other hand, empirical research depends on experience or inspection alone, often without due regard for system and theory. Empirical research is data-based research, coming up with conclusions which are able of being confirmed by observation or experiment. It is also known as experimental type of research. In such a research it is important to get at reality firsthand, at their origin, and actively to go about doing particular things to encourage the production of desired information.
V) Some Other Types of Research

All other types of research are imbalance of one or more of the above stated research, based on either the use of research, or the time needed to fulfill research, on the environment in which research is done. Form the point of view of time; we can think have research either as one-time research or longitudinal research. In the former case the research is confined to a single time-period, whereas in the latter case the research is carried on over several time-periods.

- Field-setting research or laboratory research
- Exploratory or Formalized research.
- Conclusion oriented research
- Historical research
- Decision-oriented research

5.6 Significance of Research

Indian education is heart of country and development and growth of every country is depends on education ratio of country. Importance of every research is depends on outcome and utilization of this research. In present research we conclude those aspects that are useful to student with learning Object oriented programming and education system in India. In current scenario of education government fully focused on education system and declare large economical budgets for enhancing rural/Urban education. Our research area limited to Dhule district and government affiliated colleges in Dhule district. But problem is that the proper trainer are not available to give computer knowledge to rural/Urban student and student with difficulties are faced many problem in their educational life. Learning difficulties of OOP concepts to students/teachers are most essential issue in current scenario in education. For solving this hurdle in rural/Urban education we need to implement modern computer base approach to enhance education for normal as well as student with learning difficulties. Following are significance of our present research.

- Present research enhance traditional method of education
- Improve the infrastructure and learning environment
- Explore new technology for student with learning difficulties.
- Improve quality of rural/Urban education
• Cost effective technology it has not required large investment
• Solve drawbacks of e-learning.
• Provide any where any time access technology to access educational content

a. Binary Number System

Binary means two. The 0 and 1 are two basic binary numbers. In number system binary uses only two digits 0 and 1. All the numbers is binary number system are sequence of 0s and 1s.

Ex: - 0, 1, 0010, 1111, 0010 0111

In above examples binary number consist of any number of digits but all digits are either 0 or 1.

The binary numbers are important, because in computers the data is represented in the form of binary numbers. Computer is digital electronic machine consisting of transistors. These transistors are switching devices which have only two states, either ON or OFF. ON represents 1 while OFF represents 0.

Following numbers represents binary number as

225=>0010 0010 0101

b. Radix

Radix is number which indicates the base of specific number system. This number represents total symbols of the system and weightage or power of each digit. The radix for decimal number system ‘10’ because total symbol are ten from 0 to 9. Radix for other number system.

<table>
<thead>
<tr>
<th>Number system</th>
<th>Radix</th>
<th>Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Decimal Number System</td>
<td>10</td>
<td>0,1,……8,9</td>
</tr>
<tr>
<td>2.Binary Number System</td>
<td>2</td>
<td>0 and 1</td>
</tr>
<tr>
<td>3.Octal Number System</td>
<td>8</td>
<td>0,1,….7</td>
</tr>
<tr>
<td>4.Hexadecimal Number System</td>
<td>16</td>
<td>0,1,…..9,A,B,…F</td>
</tr>
</tbody>
</table>
c. Decimal Number System

The number system used by general users in daily life is decimal number system. This number system has a base of 10. ie-there are ten basic numbers:0,1,2,3,4,5,6,7,8,9. All others numbers are combination of these ten basic numbers. Following are some example of decimal numbers…..1,3,15,565,12347,11056 etc.

The decimal numbers cannot be represented directly into the computer system. We need to convert these numbers into binary numbers. Following table shows binary number for decimal number.

<table>
<thead>
<tr>
<th>Decimal Number</th>
<th>Binary Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>1001</td>
</tr>
<tr>
<td>10</td>
<td>1010</td>
</tr>
</tbody>
</table>

Table-4: Decimal to Binary number conversion

d. Octal Number System:

The octal number system has been base of eight. That is, there are basic numbers 0, 1, 2, 3, 4, 5, 6, 7. All other numbers are combination of these numbers.

Ex:-0, 5,7,10,2136 etc.

The octal numbers are important because it is easy to represents the octal number in binary form. For each digit of octal number we can write three bit binary number.
<table>
<thead>
<tr>
<th>Octal number</th>
<th>Binary Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>000</td>
</tr>
<tr>
<td>1</td>
<td>001</td>
</tr>
<tr>
<td>2</td>
<td>010</td>
</tr>
<tr>
<td>3</td>
<td>011</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>10</td>
<td>001 000</td>
</tr>
</tbody>
</table>

Table-5: Octal to binary number conversion

e. Hexadecimal Number System:

Hexadecimal number system has a base of sixteen. That is, there are sixteen basic numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. All other numbers are combination of these basic numbers. Following table shows equivalent decimal and binary number for hexadecimal numbers…..

<table>
<thead>
<tr>
<th>Hexadecimal</th>
<th>Decimal</th>
<th>Binary</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0000</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0001</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0010</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0011</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0100</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>0101</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>0110</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0111</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>1001</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>1010</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>1011</td>
</tr>
<tr>
<td>C</td>
<td>12</td>
<td>1100</td>
</tr>
<tr>
<td>D</td>
<td>13</td>
<td>1101</td>
</tr>
</tbody>
</table>
The hexadecimal number system are extensively used in microprocessor work. It is easy to represent hexadecimal number in binary form. For each digit of hexadecimal number we can write a four bit binary number.

9AF => 1001 1010 1111

Therefore, \((9AF)_{16} = (1001 1010 1111)_2\)

**f. Conversion Techniques**

The number of one number system can be converted to another number system. The conversions of number system as ……

**g. Binary To Decimal Conversion**

To convert a binary numbers into decimal number follow the given procedure

Step 1: Write the given binary number

Step 2: Write the binary weightage below each number

<table>
<thead>
<tr>
<th>Decimal point</th>
</tr>
</thead>
<tbody>
<tr>
<td>2^7</td>
</tr>
<tr>
<td>128</td>
</tr>
</tbody>
</table>

Table-7: Binary To Decimal Conversion

Step 3: Cancel the weightage, which is placed below zero because any number multiplied zero is

Zero.

Step 4: Add the remaining numbers.

**Examples:**
1] Convert \((1001)_2\) into decimal number.

\[
\begin{align*}
\text{Step 1:} & \quad 1 \quad 0 \quad 0 \quad 1 \\
\text{Step 2:} & \quad 2^3 + 2^2 + 2^1 + 2^0 \\
\text{Step 3:} & \quad 8 + 0 + 0 + 1 \\
\text{Step 4:} & \quad 8 + 1 \\
\text{:} & \quad (9)_{10} \\
\therefore & \quad (1001)_2 = (9)_{10}
\end{align*}
\]

2] Convert \((110011)_2\) into decimal number.

\[
\begin{align*}
\text{Step 1:} & \quad 1 \quad 1 \quad 0 \quad 0 \quad 1 \quad 1 \\
\text{Step 2:} & \quad 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0 \\
\text{Step 3:} & \quad 32 + 16 + 0 + 0 + 2 + 1 \\
\text{Step 4:} & \quad 32 + 16 + 2 + 1 \\
\text{:} & \quad (51)_{10} \\
\therefore & \quad (110011)_2 = (51)_{10}
\end{align*}
\]

Fractional binary numbers:

Ex: 1] Convert \((10101.101)_2\) into decimal.

\[
\begin{align*}
\Rightarrow & \quad 1 \quad 0 \quad 1 \quad 0 \quad 1 \quad 1 \quad 0 \quad 1 \\
= & \quad 2^4 + 2^3 + 2^2 + 2^1 + 2^0 \cdot 2^{-1} + 2^{-2} + 2^{-3} \\
= & \quad 16 + 4 + 1 \cdot 0.5 + 0.125 \\
= & \quad (21.625)_{10}
\end{align*}
\]

h. Decimal To Binary Conversion

Dividing given number by two and taking only remainders do this. This method of dividing given number by two is known as “double-dabble method”. Let us
we see what is MSB & LSB. MSB represents “Most Significant Bit” that represents the first number in given number. LSB means “Least Significant Bit” which represents last number.

Examples:

1] Convert (35)\textsubscript{10} into binary number (Method-1).

\begin{align*}
\Rightarrow 35/2 \text{ remainder } 35-34 &= 1 \quad \text{LSB} \\
17/2 \text{ remainder } 17-16 &= 1 \\
8/2 \text{ remainder } 8-8 &= 0 \\
4/2 \text{ remainder } 4-4 &= 0 \\
2/2 \text{ remainder } 2-2 &= 0 \\
\end{align*}

MSB

2] Convert (88)\textsubscript{10} into a binary number (Method-2).

\begin{align*}
\text{LSB} \\
0 &\quad 88-88 \\
0 &\quad 44-44 \\
0 &\quad 22-22 \\
1 &\quad 11-10 \\
1 &\quad 5-4 \\
0 &\quad 2-2 \\
1 &\quad \\
\end{align*}

MSB

\Rightarrow (88)\textsubscript{10} = (1011000)\textsubscript{2}

i. Octal To Binary Conversion

The conversion between octal to binary can be done by replacing every octal digit by its 3 bit equivalent binary.

Ex:- Convert (736)\textsubscript{8} into binary number.

\Rightarrow (736)\textsubscript{8} = (111 011 110)
j. **Binary To Octal Conversion**

Binary numbers can be transforming into similar octal numbers by making gathering of these initial bits from LSB and transform towards MSB for number part integer. Then replacing each three bits by its octal representation. For fractional part gathering initial from the binary point by three bits.

Ex:- Convert \((1001110)_2\) into octal number.

\[
\Rightarrow (1001110)_2 = (001 001 110)_2 = (116)_2
\]

k. **Hexadecimal To Decimal Conversion**

The decimal equivalent of hexadecimal number equals the sum of all hexadecimal digits multiplied by their weight. In hexadecimal number system the weight of each position of digit is power of 16.

Ex: - Convert \((3A.2F)_{16}\) into decimal number.

\[
\Rightarrow (3A.2F)_{16} = 3*16^1 + 10*16^0 + 2*16^{-1} + 15*16^{-2} \\
= 48 + 10 + 2/16 + 15/16^2 \\
= (58.1836)_{10}
\]

l. **Hexadecimal To Binary Conversion:**

By replacing each hex digit to its similar four bit binary number that way the hexadecimal number should be converted.

Ex: - Convert \((2F9A)_{16}\) into binary number.

\[
(2F9A)_{16} = (0010 1111 1001 1010)_2
\]

m. **Binary To Hexadecimal Conversion:**

- Ex: - \((1111 0001 . 1001 1001)_2\)

\[
1 \quad F \quad 1 \quad 9 \quad 9
\]

\[
= (1F1.99)_{16}
\]
n. BCD Numbers System

BCD numbers are binary coded decimal numbers. In BCD, each decimal digit is represented by its equivalent four bit binary number. For example, \((23)_{10}\) is represented by \((0010 0011)\), rather than \((10111)_{2}\). Here BCD numbers require the more number of bits to code a decimal number. But it is very useful and convenient to write BCD numbers.

BCD numbers are very useful when decimal information is transferred into or out of digital system. The circuits of pocket calculators, can process BCD numbers because you enter decimal numbers through keyboard and see decimal answers on LED or liquid crystal display. Digital clocks, digital voltmeter works with BCD numbers. Following table shows BCD equivalent for decimal numbers…

o. ASCII Code

The data consist of numbers, characters and other symbols. This data we need to feed to the computer and also get require out of a computer. For this we need to use some alphanumeric code. The Computer industry have set up a standard code known as American Standard Code for Information Interchange (ASCII). This code is useful for input/output devices such as keyboards, printers, video display etc.

The ASCII code is a seven bit code whose format is,

\[
X_6 \ X_5 \ X_4 \ X_3 \ X_2 \ X_1 \ X_0
\]

Where each \(X\) is a 0 or 1. For example A is coded as 1000001.

The word RAMA in ASCII form is written as,

\[
\begin{array}{cccc}
R & A & M & A \\
\downarrow & \downarrow & \downarrow & \downarrow \\
1010010 & 1000001 & 1001101 & 1000001
\end{array}
\]
5.7 Research Process

Define Research Problem

Review Concept and Theories

Review Previous Research Finding

Assessment of Student

Find Learning Difficulties

Collect Rural Student Data

Collect Urban Student Data

Analysis of Data

Implement Computer based Technology

Result and Conclusion

Fig-39: Process diagram of propose research
Before we start our research it is important to draw process flow chart, it gives pictorial representation of process flow of research methodology. It seems exact to present a brief overview of the research process. Research process consists of series of sequential activity or steps necessary to effectively carry out research and the desired sequencing of these steps. Flow chart represents initialization of research to appropriate outcome of research.

The chart indicates that the research process consists of a many different activities, but such activities overlap continuously rather than following a strictly direct sequence. One should remember that the different steps include in a research process are not mutually exclusive; nor they are discreet and distinct. They do not necessarily shadow each other in any certain order and the researcher has to be always expecting at each step in the research process the need of the subsequent steps. Following flow diagram describe detailed flow of research methodology help to achieve appropriate outcomes of research.

However, the following steps to supply guidelines to the research process

(1) Research problem finding
(2) Literature survey extensively
(3) Student assessment
(4) Find learning and understanding difficulties OOP
(5) Collect Rural/Urban student data
(6) Analysis of data
(7) Implementation of computer based E-learning technology
(8) Result and conclusion.

This all steps of procedure chart help to achieve successive outcomes of research.

5.7.1 Formulating the research problem

According to process flow of research methodology first steps of our present research is to formulating research problem. Every research is start from problem definition and solution of that problem using systematic methodology is outcome or
result of research. Our present research is start from educational/Learning problem of Object Oriented Programming in Dhule district. Now days Dhule is backward district in Maharashtra state due to poor economy, lack of income sources, lack of Programming education quality, lack of employment in this situation there are need to improve economy.

Quality of Computer programming education in rural area are very poor due to lack of infrastructure, lack of teacher, lack of ICT, lack of sufficient resources and due to this reason scholar student in village are not gain proper knowledge and guidance for enhance their knowledge and lifestyle and also this student leave the colleges and goes to employment. Another major problem in rural education is learning difficulties these difficulties affect on student ability to learning. Here same condition in urban area but some facility are available to students to learn concepts by E-learning but also lack of poor understanding of OOP principles by teachers and students cannot understand properly. When we observe and fill such bad situation in rural area we decided to find solution for that problem. The formulation of a general topic into a particular research problem, thus, represents the initial step in a systematic and scientific query. Essentially two steps are include in formulating the research problem, viz., comprehension the problem thoroughly, and reword the same into meaningful terms from an analytical point of view. The best way of comprehension the problem is to discuss it with one’s own associate or with those having some expertise in the matter. What deliberation are include in its possible solutions.

After we reconstruct the trouble into analytical terms i.e., to place the problem in as particular terms as possible. This task of prepare research problem is a pace of considerable significance in the complete research process. The problem to be explored must be defined directly for that will support perceptive applicable data from irrelevant ones. In fact, formulation of the research problem often follows a step by step structural design of research where various formulations are organize, each and every formulation more special and unique than the preceding one, each one explore in more analytical terms and concept, and each more practical in terms of the visible information and resources.

5.7.2 Extensive literature survey

After the formulation of problem we clearly understood what is goal of our research. Once the research problem is formulated, a brief summary of research it
should be written down. It is important to writing thesis for Ph.D. At this stage we should undertake extensive literature survey concern with research problem. Literature review will be give existing research work and their result for supporting presence research. The first place to go for abstracting and indexing journals and bibliographies. Academic journals, existing thesis, synopsis, government reports, books, conference proceedings etc., the present research is combination of

**Fig-40: source of extensive literature survey**

Object oriented programming, education and computer based technology. We prepare all kind of books and existing research to find related data and existing solution. The study of literature review support to show existing research strategy and what will be drawbacks of that research. Internet is best source for preparing literature of review and finding appropriate information about research topic. Our topic is based on OOP and E-learning is also internet based tools. The existing studies, if any, which are similar to the study in hand, should be carefully studied. A good library in our university will be facilitates a great help to me at this stage.

### 1.7.3 Assessment

Third phase of our research is Assessment of student in rural and urban area. Assessment is based on multiple criteria to find grading/percentage of student and
assessment help to find learning and understanding difficulties in student. After the completion of literature of review phase it clarifies and gives existing problems and solution regarding current research. In existing research describe multiple types of object oriented programming concepts difficulties in rural/urban education. In present research we identify and conclude some other type of learning difficulties and can be solved using E-learning.

For finding such kinds of learning and understanding difficulties we need to organize pattern of student assessment. In assessment process conduct multiple test for identifying student have learning and understanding difficulties. Firstly the test would be conducted on paper basis without study to student using E-learning method. In present research have not only search learning difficulties of student but also find computer based technology to enhance learning system i.e.-E-learning system.

In assessment phase of research methodology we can determine existing grade of student to identifying particular type of difficulties. Assessment process are conduct following phases infrastructure assessment, teacher assessment and student assessment.

---

**Fig- 41: Types of assessment**
5.7.4 Infrastructure assessment

Infrastructure of college is assessing using number of criteria. Including list of tables that indicating college facilities and available tools and other tables that indicating unavailable facilities. Infrastructure base assessment are use to assess the all kind of colleges environment tools that are participated in education process. This assessment process is helpful to examine college infrastructure background. We use some existing method and research approach to find environment hurdle in education. This assessment include following terms use to find infrastructure aspect in rural/urban education.

- To maintain survey table of colleges in Dhule district
- Maintain table that indicate college facility as per student quantity
- Maintain list of tools that are useful in learning process
- Maintain table that indicate tools for E-learning facility
- Analysis of extra facility for student
- Display chart that indicate student academic growth ratio

5.7.5 Student Assessment

Student is basic entity of education and assessment of student is important know the student development ratio. In our research methodology we design different kinds of test to examine student difficulties. We build schedule and visit to government/private colleges in Dhule district. According to existing research we study the type of learning difficulties to OOP and we need to apply some traditional learning method to assess the difficulties in OOP to student. Student assessment process includes multiple method of traditional learning. Following method is apply to student assessment.

- To conduct seminar and simple teaching method apply for student
- Maintain table that contain assessment schedule
- To conduct reading, writing, oral test for finding ability of student
- Build chart of teaching methods and tools
- Measure comprehension of student
- Compare and maintain assessment table for indicating grade of student in each test
5.7.6 Assessment of teacher

Teacher is an important part of the education system and all aspects of the learning process are dependent on the teacher. In research methodology, it is important to assess the teacher's methodology of teaching. Teacher assessment helps to design a table of traditional methodologies of learning. In our research, our aim is to improve the education system in rural/urban areas and design an architectural pattern for students with learning and understanding difficulties of Object Oriented Programming. In traditional learning, teachers use an old approach for teaching; it is not feasible or effective for students with learning difficulties. This assessment conducts all minor aspects of trainers and measures the impact of this method of learning on student academic activity and also measures the impact of this method on students with learning. In the teacher assessment phase, we design the following approach to determine the teacher's skill and academic activity it has performed.

- Build a table of teaching and training methods
- Firstly study on student difficulties and improvise different E-learning methods to teach students easily.
- Maintain activities table containing academic activity schedule
- Compare different methods of E-learning using ICT lab
- Assess special teaching approach for students with learning difficulties
- Design teacher evaluation techniques

5.7.7 Searching learning and understanding difficulties

Learning difficulties are a major challenge in education and affect student learning ability and behavior. The fourth important phase in research methodology helps to understand learning difficulties in students. There are multiple criteria used to find learning difficulties in rural/urban areas. We collect the data of 20 colleges in Dhule district having 500 samples, which is 50% in rural areas and 50% in urban areas, for finding difficulties in learning and understanding. There are two important phases conducted to identify learning difficulties. One is the determination of infrastructural hurdle and the determination of network base hurdle. We use previous techniques to find learning difficulties in the phase of literature review. We study different kinds of methods that help to find learning difficulties. Many researchers conclude different methods to
finding learning difficulties. We use different criteria to find learning difficulties and measure different learning difficulties. Following key and techniques are use to find learning difficulties.

- **For infrastructure base difficulties**
  - Suggestion of expertise
  - Measure the impact of poor infrastructure on student learning process
  - Examine lack of learning tools
  - Examine E-learning techniques and required tools availability
  - Observation of available resources and facility are helpful for student learning process
  - Use existing techniques and method for finding infrastructural difficulties.
  - Measure quantity of colleges as per quantity of taluka

5.7.8 Collect rural student data:

![Fig-42: collection of Rural student data](image_url)
Collection of rural student data includes assessment report and particular type difficulties category. This phase help to describe details characteristics and analysis of data, it also classify subtype of difficulties of OOP. This phase integrates data of literature review and assessment test, it includes all tables and chart containing. This phase bound all structural data concern with infrastructural learning difficulties and also maintains step by step assessment results of student with learning difficulties of OOP. In present research our objective is to find learning difficulties of OOP in rural education and enhance it using E-learning based learning approach. This rural student data collection is used to assess which type of infrastructural issues is found in rural education.

This rural student data collection contain environmental information of rural college like, college infrastructure, method of teaching, availability of resources, implementation of ICT, tools needed for E-learning and expense to implement E-learning. This approach is inverse processing of these all factors and after overall study of this factors we can find or give the appropriate solutions to better environment or better resources to E-learning techniques.

5.7.9 Collect Urban student data

Second phase of data collection is urban student data collection, it also include all rural base learning difficulties data collection.

![Fig 43: collection of Urban student data](image-url)
In current research methodology after the finding of learning difficulties of OOP we have need to collect all sample data and assessment report to judge and identify particular type of learning difficulties of OOP. After the extensive literature review process we collect large collection of data regarding existing research and also adopt traditional techniques that are useful in current research.

This phase of research methodology is very important to understand or learning difficulties of OOP concepts. In urban area there is difference present than rural area in all categories. In assessment phase we conduct various different tests that are help to find particular learning difficulties of OOP. In above figure indicates collection of different types of data and report and existing content it helps to identify particular learning difficulties in urban colleges. After the collection of both types of data we clearly understood which learning difficulties of OOP are occurs in rural/urban education and after the finding of learning difficulties can do analysis of data for integrating all aspects of problems. The completion of data collection are done 50% of research work and clearly describe method of finding learning difficulties and classification, after this stage of methodology our actual research will be start.

5.7.10 Analysis of data

Analysis is a procedure of investigation, wipe, modify, and modelling data with the objective of inventing use total information, recommend conclusions, and sufficing decision-making. Data analysis has many aspect and concept, enclosing various different techniques and methods under a multiple names, in various business, science, education and social science domains. After the data have been composed, the researcher revolves to the task of analysing them. The analysis of data required a number of closely related operations such as initiation of categories, the deployment of these categories to raw data through tabulation and then drawing statistical inferences, classification of difficulties, finding methods and required enhancive method. The cumbersome data should necessary be concentrated into a few manageable groups, report and tables for further analysis. Thus, we should identify the raw data into some purposeful and usable groups.
a. **Data requirements**

The data important as inputs to the analysis are identified based upon the need of those manage the analysis. The general type of entity upon which the data will be integrated is mention to as an exploratory unit such as quantity of difficulty occurs student. Specific variables regarding student with learning difficulties may be identify and acquire. Data may be numerical or categorical.

b. **Data collection**

Data is integrated from different sources of research methodology component. The requirement may be interface by analysts to keeper of the data, such as information technology resources within a College place in rural/urban area. The data may also be collected from different government and private colleges, and also collect data from assessment reports, data from method to finding learning and understanding difficulties etc. It may also be obtained through observation, downloads from online sources, or reading study literature of review and data collected from student.

c. **Data processing**

Data primary adopt must be processed or organized for analysis of research data. For instance, this may include arrange data into rows and columns in a table format for further analysis, data processing are is use to arrange collected data from previous phase into systematic tabular format and sort out it from different purpose.

d. **Data cleaning**

Data cleaning is the process to find and correcting the error of previous data collection. Once processed and organized, the data may be insufficient, contain duplicates, or contain mistake. The requirements for data cleaning will occur from problems in the way that data is collected and stored. Data cleaning is the process of avert and correcting these errors. In present research this phase will be very important to framing all collected data that are important to find solution and invent better outcome of research.

**5.7.11 Implement computer based structure module**

After the completion of all previous data collecting phases we implement new enhance method for student with learning difficulties of OOP. For fulfilment of present research outcomes we apply new enhancive method to improve educational
quality in rural/urban education. This phase include categorization different learning difficulties, implement assistive tools for problematic student, use existing method of E-learning for different student, reassess student grade, compare impact of previous traditional learning on student and E-learning. In this phase of research method we collect all analyse data from previous study and methods and arrange it to different table. In rural college government implement ICT lab and provide all required tools and resources. In the present research scenario we implement and design architecture of E-learning that provide separate tools and application for rural and urban student. Following keys are concern with conducting this phase.

- Make group of student have same type of learning difficulties
- Design E-learning architecture for rural/urban student
- Use existing assistive tools and method for rural/urban student
- Developed separate tools and method for each student
- Use all types of Resources and component of E-learning
- Design cost effective model of E-learning based and virtual classroom
- Design table that indicate benefits of E-learning based education for student, teachers, institution
- Students, teachers that have knowledgebase from learning
- Compare traditional learning impact and E-learning based impact on student
- E-learning structure derivation
- Display the table of reassessment table and improvement of student in learning.
- Describing chart that indicate characterise benefits and enhancive feature of E-learning
- Define feature for research.

5.7.12 Result and conclusion

Final conclusion is a destination and fulfilment of objective of research, it include all step by step result and investigation outcomes. Success of research is depends on conclusion of research and how we can cover all the aspect of our
research problem. In our present research we define the problem definition that can show purpose of research and methodology is the bridge between problem definition and conclusion. In computer science research result of research depends on methodology of research and sequence and method of research will be done what is effective outcome of research.