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## Effectiveness of ICT in Teaching and Learning in Secondary School with respect to School Teachers in Pune District Area, using Evolutionary Algorithm Based Technique

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### **Abstract:**

*The study investigated effectiveness of Information and Communication Technology (ICT) in teaching and learning in Secondary schools in Pune district area of Maharashtra State. A sample size of 236 School Teachers was used for the study. Simple random sampling technique was used to compose the sample. To measure the effectiveness, researcher used three research questions were answered. Questionnaire method used for data collection, it was objectively used to investigate the utilization of ICT tools, how ICT tools are used to evaluate teaching learning process and the constraint to effective utilization of ICT tools by Teachers. The study attempts to fit a classification, recursive partitioning and regression trees i.e. CART method also chi-square test is used. "The decision tree method is a powerful and popular predictive machine learning technique that is used for both classification and regression" [1]. This method known as Classification and Regression Tree (CART) [2]. Also, researcher use a Chi-Square statically analysis was done to find the difference between area wise data from the schools. The R Software implementation is carried out for this study, this implementation of the CART algorithm is called RPART (Recursive Partitioning And Regression Trees). "Here researcher use R software coding to compute and process classification and regression trees." [3] It was found that ICT tools were not fully utilized in the school. Based on the findings, it was recommended among others that the government of Maharashtra should embark on a massive computer literacy training programme state wide particularly for the teachers at all level of education.*

**Keywords:** Information Communication Technology (ICT), Effectiveness, Information Technology (IT), Computer, Internet and Multimedia.

### **1. Introduction:**

Information Communication Technology (ICT) is to align with the global best practices, with this ICT occupied a central stage in the senior secondary school curriculum in order to presents the total experiences to which all teachers must exposed and through which the content and performance

objectives of the subject must be achieved for teachers. Also, the teaching and learning materials of any subject when provide, it enhances the effective teaching and learning. Thus, these could be possibly released if all the teachers can effectively integrate ICT into the classroom. As stated by Olelewe and Amaka (2011), a good teacher can use various teaching and learning technologies like computer, internet and multimedia resources, which are increasingly being used in support of the teaching and learning process in presenting new challenges and opportunities for teachers and students to translate information into relevant knowledge that a student can understand, keep it and pass on to others under a favorable school environment.

India is using Information and Communication Technologies (ICT) to leapfrog economic development in key sectors: health, education, infrastructure, finance, agriculture, manufacturing, and governance. ICT is being used to deliver critical goods and services to hundreds of millions of Indian citizens. While many sectors have already seen huge improvements through innovative use of ICT, such as infrastructure and communications, the education sector has struggled to optimize the potential of ICT for improving teaching and learning. ICT holds an important promise for education especially in rural areas, if it is optimized and tailored to local needs.

Today, the implementation of new technologies (ICT) has challenged the traditional method and process of teaching and learning and have also change the way of education is managed to a more flexible, user friendly and simplified form. The United Nation Education Scientific and Cultural Organizations (UNESCO, 2004) focuses that ICT has turned from being a technology of communication and information alone, but to a curriculum creation and delivery system for educator and learners.

According to Obanya (2002), ICT has to do with utilization of process, the methods and the product of electronic communication related technologies and other related resources in todays knowledge driven society, for enhancing the productivity, the spread and efficiency of set programme activities feared towards the achievement of clearly defined goals. In the world, ICT and IT (Information Technology) are often used synonymously. However, the key difference is that IT is a subset of ICT which covers all forms of communication including telephone, mobiles etc while information technology (IT) refers to an entire industry that uses computers, networking, software and all other equipment to manage information.

According to United Nation Educational Scientific and Cultural Organization (UNESCO, 2005), ICT is defined as the combination of all the computers, telecommunication and media technologies. They also used these electronic technologies for accessing, processing, gathering, manipulating and presenting or communicating information in education system.

Edozie et al. (2010) stated that Information and Communication Technologies (ICTs) self-

responsibilities enhances the abilities of people to use ICT to improve their life skills and strengthen their capabilities. Such responsibilities could be facilitated awareness and motivation for ICTs. With this regards of their view, Umunadi (2011) added that the role of information and communication technologies in teaching and learning is rapidly becoming one of the most important widely discussed issues in secondary school in Nigeria. In another view, Openion of Obanya (2009) expressed that secondary school in Nigeria must strive to meet common 21<sup>st</sup> century challenges of providing student with an education that is viewed by the general society as relevant and valuable, and that teaching and learning must be driven by ICTs for effectiveness.

As per United Nation Educational Scientific and Cultural Organization (UNESCO, 2005), ICT is defined as the combination of all the computers, telecommunication and media technologies. In education system, ICT is electronic technology used for accessing, processing, gathering, manipulating and presenting or communicating information.

According to Maharashtra Digital School Survey Finding Report (2020), Maharashtra State has prioritized the integration of technology in teaching practice as a key area for helping to raise learning outcomes for students across the state. In order to guide their investments, the state is interested in identifying the most effective tools and approaches for various types of learning environments within the state that can be scaled up.

This paper focuses on Information and Communication Technology (ICT) is defined as electronic media, devices and application used in the classroom to and effective teaching and learning processes. All such materials, media and devices provided by ICT which appeal to all the senses and feeling and learning constitute teaching and learning materials. The materials help teachers communicate effectively to the students so that learning is facilitated. The development of ICT into the school's system will have effect upon the technological revolution expected in business and economic environment and the global society.

#### **Statement of Problem:**

The problem of the study stated as: Does ICT enhance effectiveness by secondary school teachers in teaching and learning? This is the problem to be investigated by this study.

#### **Purpose of the study:**

The main purpose of this study is to examine information and communication technology effectively used in secondary school teachers in Pune District area of Maharashtra State.

Specifically, the aim of the study is to:

- Investigate the extent of utilization of ICT tools by Teachers in secondary schools in Pune district area of Maharashtra State.
- Examine the use of ICT tools in evaluating teaching and learning process by Teachers of



secondary schools in Pune district area of Maharashtra State.

- Describe the constraints of effective utilization of ICT by Teachers in Pune district area of Maharashtra State.

### Research Questions:

- To What extent are ICT tools used and utilized by school Teachers of secondary schools in Pune district area of Maharashtra State?
- How are ICT tools use in evaluating teaching and learning process by school Teachers of secondary schools in Pune district area of Maharashtra State?
- What are the constraints to effective utilization of ICT by school Teachers of secondary schools in Pune district area of Maharashtra State?

### 2. Methodology:

Researcher used a descriptive survey to carry out the study. This is because it has beneficial for permitting description of conditions as they exist in their natural setting. This survey research is a kind of research which involves the assessment of all school related public opinion using questionnaire. So, this study specifies to obtain information from teachers on the use of effectiveness of ICT in teaching and learning. This research work was carried out in Pune District of Maharashtra state. Researcher physically visited each selected school, distribute the questionnaire and after giving some duration collect the data for analysis. The population of the study consisted of different regions secondary schools' teachers of fifty-nine (59) selected secondary schools of Pune District, Maharashtra State. The sample size of study was two hundred thirty-six (236) teachers of the schools' respondents. For the sample selection, researcher adopt a Simple random sampling technique for this study. Researcher use the questionnaire, this was considered necessary for the collection of data for the study because it has the characteristic of being used to ascertain facts, opinions, beliefs, attitudes and practices of the respondents. The respondents' responses in the questionnaire items were used to analyze the research questions.

After collecting the data from the respondents, researcher specify the code to the answer as per each question ask to respondent like Yes, No, Agree, Disagree, Satisfied etc. Researcher use the Microsoft Excel to store the raw data. This data prepared and coded as per the statistical method using questionnaire. For this analysis researcher used Microsoft Excel, R and R Studio 4.2.1 software as a tool and through this tool researcher get the summary of data and describe the data in tabular and tree structured format using evolutionary algorithms like decision and classification tree, regression and classification methods, recursive partitioning i.e. CART method etc.

The study attempts to fit a classification, recursive partitioning and regression trees i.e. CART method. "The decision tree method is a powerful and popular predictive machine learning

technique that is used for both classification and regression" [1]. This method known as Classification and Regression Tree (CART)[2].Also, researcher use a Chi-Square statically analysis was done to find the difference between area wise data from the schools.

The R implementation is carried out for this study, this implementation of the CART algorithm is called RPART (Recursive Partitioning and Regression Trees). "Here researcher use R software coding to compute and process classification and regression trees."

### Data Analysis:

As per research question specified above, researcher explain the data analysis, data presentation using the different computational tools and statistical methods specified earlier.

Here, researcher collect the data from Pune District different region on whether the teachers utilize the ICT tools for different school activity's purpose or not? i.e., to what extent ICT tools utilized by the teachers of a school? Following table shows the data received from the respondent.

Area -> Purpose	Baramati		Bhor		Daund		Indapur		Jejuri		Junner		Nira		Pune City		Saswad	
	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N
Tools Use Everyday	24	24	13	7	13	11	27	13	14	6	9	3	9	3	32	8	11	9
Maintain School Records	31	17	17	3	22	2	33	7	16	4	10	2	11	1	35	5	13	7
Software for typing	44	4	17	3	24	0	33	7	17	3	11	1	12	0	31	9	19	1
Excel to Prepare Result	48	0	17	3	22	2	31	9	16	4	11	1	11	1	30	0	20	0
PPT in teaching	44	4	17	3	24	0	33	7	17	3	11	1	12	0	31	9	19	1
Operate Printer	37	11	17	3	23	1	31	9	16	4	10	2	11	1	25	9	19	1
Internet & Search educational Material	48	0	17	3	24	0	35	5	17	3	11	1	12	0	30	0	20	0
Have email account?	44	4	20	0	24	0	40	0	20	0	12	0	12	0	31	9	19	1
Computer / Laptop in Teaching	46	2	20	0	21	3	30	10	19	1	12	0	11	1	30	0	20	0
Comfortable using computer	48	0	20	0	24	0	30	0	20	0	12	0	12	0	30	0	20	0

Table 1: Utilization of ICT tools by Teachers of a school.

Above table shows almost in all regions utilization of ICT tools by teachers specified in the questions. As per the data collected its percentage is near about 80-85% utilized these tools by the school teachers.

Here researcher find and present below the tree structured format summary of the Table 1 data and describe the data through classification and regression tree methodology (Recursive Partitioning Method)(CART), it is evolutionary algorithm method used with the objective of creating a model that predicts the value of target (or dependent variable) based on the values of several input (or independent variable), through this researcher find the RPART. Here researcher uses questionnaire for collecting data contains question number 38 to 47 for the opinion questions, so the Q30 to Q47 appear in tree structure. This processed data as follows:

n= 236 node), split, n, loss, yval, (yprob) \* denotes terminal node

- 1) root 236 188 Baramati (0.2 0.085 0.1 0.17 0.085 0.051 0.051 0.17 0.085)
- 2) Q45=1 222 178 Baramati (0.2 0.09 0.11 0.18 0.09 0.054 0.054 0.14 0.086)
- 4) Q46=0 17 7 Indapur (0.12 0 0.18 0.59 0.059 0 0.059 0 0) \*
- 5) Q46=1 205 163 Baramati (0.2 0.098 0.1 0.15 0.093 0.059 0.054 0.15 0.093)
- 10) Q39=0 44 27 Baramati (0.39 0.068 0.045 0.068 0.091 0.045 0.023 0.11 0.16)
- 20) Q40=0 8 5 Bhor (0 0.38 0 0.12 0.38 0.12 0 0 0) \*
- 21) Q40=1 36 19 Baramati (0.47 0 0.056 0.056 0.028 0.028 0.028 0.14 0.19) \*
- 11) Q39=1 161 134 Indapur(0.16 0.11 0.12 0.17 0.093 0.062 0.062 0.160.075)
- 22) Q43=1 148 123 Indapur(0.14 0.11 0.12 0.17 0.1 0.068 0.068 0.14 0.081)\*
- 23) Q43=0 13 7 Pune City (0.31 0 0.077 0.15 0 0 0 0.46 0) \*
- 3) Q45=0 14 5 Pune City (0.29 0 0 0 0 0 0 0.64 0.071) \*

Now here researcher represents the above R coding result data in tree structure and partitioning it with the help of CART method and specifies the defining features as:

Response Variable: Area Method: CART  
 Variables used for partitioning: Q38 to Q47  
 Number of Partition sets: 06

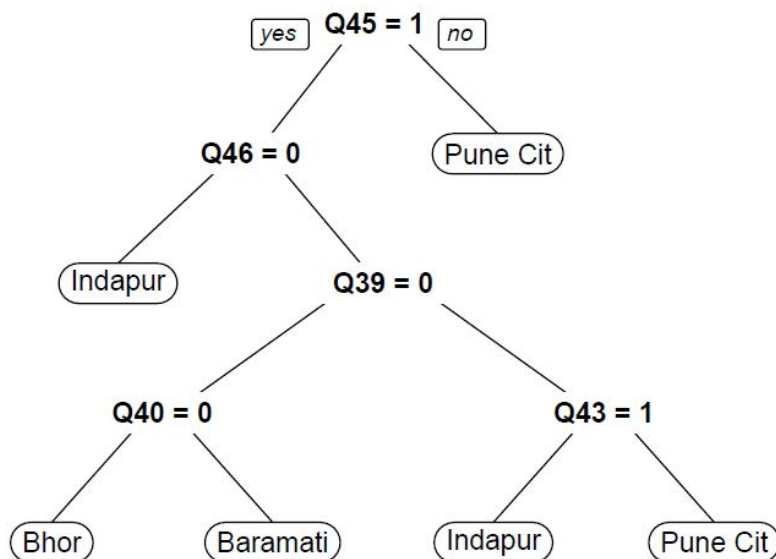
Terminal Leaf Node	No. of Responses (n values)	Label	Defining features
3:	14	Pune City	Q45 = 0
23:	13	Pune City	Q43 = 0 Q39 = 1 Q46 = 1 Q45 = 1
22:	148	Indapur	Q43 = 1 Q39 = 1 Q46 = 1 Q45 = 1
21:	36	Baramati	Q40 = 1 Q39 = 0 Q46 = 1 Q45 = 1
20:	8	Bhor	Q40 = 0 Q39 = 0 Q46 = 1 Q45 = 1

4: 17 Indapur Q46 = 0

**Variable Importance:**

Q40	Q45	Q46	Q39	Q43	Q41	Q42	Q38	Q44
22	21	20	14	10	4	4	3	3

Above data shows that in Baramati school teachers uses ICT for software for typing documents, also uses their email account, uses computer / laptop in teaching but not used to maintain school records. In Indapur, maximum teachers use ICT for maintain school records, operate printers, use email account and use computer / laptop in teaching. In Bhore, teachers not use ICT for maintain school records, also not used software for typing documents but they use an email account and uses computer / laptops in teaching. From the above data we get the tree as:



**Fig: TT1: Teachers Data tree 1**

Here researcher collected the data about whether the school evaluate teaching and learning process and promote to the teachers to use the ICT in teaching and learning in different ways. Following table shows the collected data. Here following table shows that to what extent teachers are confident in the ICT related skills? Responses we get in the form of a lot skill knows and used, sometimes i.e., partially used, a little time used and none i.e., not at all about use such skills in it. Means here researcher evaluate the ICT skills up to what extent teachers confident to use it.

Skills used by Teachers	Response →	A lot (4)	Partially (3)	A little (2)	Not At All (1)
	Edit documents, multimedia, online links & images, online questionnaire, organize files and folders.		59	86	52



Create database, use spreadsheet and plot graphs	71	73	55	37
Create a presentation with animations, video, audio	63	67	44	63
Use emails to communicate others, create and maintain blogs, websites.	82	54	30	70
Participate in social network	41	59	54	82
Install software, download & upload resources from website or learning platforms for students to use	54	86	48	49
Teach students how to behave safely and ethically online	96	63	53	26
Prepare materials to use with an interactive whiteboard	35	53	55	93

**Table 2: Evaluation of ICT by Teacher at their teaching & learning**

Above table shows that, ICT skills like edit document, use of skills to prepare spreadsheet, presentations, use of mail, installation skills and download, upload skill and also get some resources from websites or learning platforms for students done by 60% to 70% teachers. Also, a lot of teachers give knowledge to students about safely and ethically behavior when they work online. Less number of teachers use the interactive whiteboard for prepare the material.

Researcher find, processed and represented the above evaluation based data in tree structure using classification and regression tree and some statistical methods. This tree structure describe and indicated that the teachers skill related to ICT, means teacher is confident about the implementation of different ICT work at its own. The skills are:

- Edit and create documents, databases, spreadsheets and presentations with features, organize files and folders.
- Use email to communicate others i.e., administration, students, parents etc., create and maintain blogs, websites and online activities.
- Install different software, download & upload resources from the website or learning platforms for students to use and teach the work safely and ethically online.

Researcher find the tree structure with coding and classification as:

n= 236 node), split, n, loss, yval, (yprob) \* denotes terminal node

1) root 236 188 Baramati (0.2 0.085 0.1 0.17 0.085 0.051 0.051 0.17 0.085)

2) Q62.01=1,2,3 137 105 Baramati (0.23 0.12 0.073 0.2 0.12 0.073 0.058 0 0.12)



- 4) Q62.01=3 65 41 Baramati (0.37 0.046 0.11 0.2 0.015 0.031 0.046 0 0.18)  
 8) Q62.14=1 28 10 Baramati (0.64 0 0.036 0.071 0 0 0 0 0.25) \*  
 9) Q62.14=2,3,4 37 26 Indapur (0.16 0.081 0.16 0.3 0.027 0.054 0.081 0 0.14)  
 18) Q62.10=3 10 4 Baramati (0.6 0 0.3 0 0 0 0 0 0.1) \*  
 19) Q62.10=2,4 27 16 Indapur (0 0.11 0.11 0.41 0.037 0.074 0.11 0 0.15)  
 38) Q62.07=1,3,4 15 6 Indapur (0 0.067 0.2 0.6 0.067 0 0.067 0 0) \*  
 39) Q62.07=2 12 8 Saswad (0 0.17 0 0.17 0 0.17 0 0.33) \*  
 5) Q62.01=1,2 72 57 Jejuri (0.11 0.19 0.042 0.19 0.21 0.11 0.069 0 0.069)  
 10) Q62.02=1,3,4 54 39 Jejuri (0.15 0.22 0.056 0.11 0.28 0.11 0.056 0 0.019)  
 20) Q62.18=1 16 11 Baramati (0.31 0 0.19 0.12 0.12 0.062 0.12 0 0.062) \*  
 21) Q62.18=2,4 38 25 Jejuri (0.079 0.32 0 0.11 0.34 0.13 0.026 0 0) \*  
 11) Q62.02=2 18 10 Indapur (0 0.11 0 0.44 0 0.11 0.11 0 0.22) \*  
 3) Q62.01=4 99 59 Pune City (0.16 0.03 0.14 0.13 0.04 0.02 0.04 0.4 0.03)  
 6) Q62.08=4 55 42 Daund (0.11 0.055 0.24 0.2 0.073 0.036 0.073 0.2 0.018)  
 12) Q62.13=1,2 23 15 Daund (0 0.13 0.35 0.35 0.087 0 0.087 0 0) \*  
 13) Q62.13=3,4 32 21 Pune City (0.19 0 0.16 0.094 0.062 0.062 0.062 0.34 0.031) \*  
 7) Q62.08=2,3 44 15 Pune City (0.23 0 0.023 0.045 0 0 0 0.66 0.045) \*

After get the earlier format data, researcher represents the result in tree structure and partitioning it with the help of CART method and specifies the defining features as:

Response Variable: Area                      Method: CART  
 Variables used for partitioning:            Q62.01 to Q62.20 (rpart)  
 Number of Partition sets:                    10

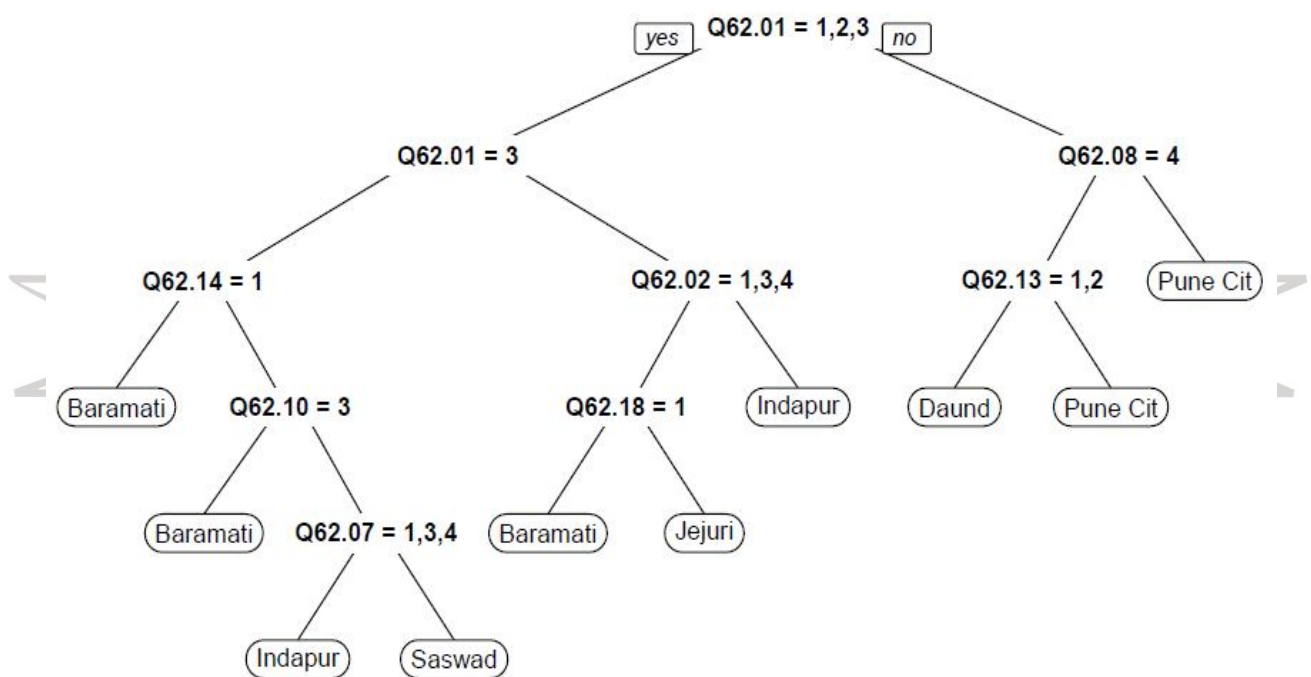
Terminal Leaf Node	No. of Responses (n values)	Label	Defining features
7:	44	Pune City	Q62.08 = 2, 3 Q62.01 = 4
13:	32	Pune City	Q62.13 = 3, 4 Q62.08 = 4 Q62.01 = 4
12:	23	Daund	Q62.13 = 1, 2 Q62.08 = 4 Q62.01 = 4
11:	18	Indapur	Q62.02 = 2 Q62.01 = 1, 2
21:	38	Jejuri	Q62.18 = 2, 4 Q62.02 = 1, 3, 4 Q62.01 = 1, 2
20:	16	Baramati	Q62.18 = 1 Q62.02 = 1, 3, 4 Q62.01 = 1, 2

39:	12	Saswad	Q62.07 = 2 Q62.10 = 2, 4 Q62.14 = 2, 3, 4 Q62.01 = 3
38:	15	Indapur	Q62.07 = 1, 3, 4 Q62.10 = 2, 4 Q62.14 = 2, 3, 4 Q62.01 = 3
18:	10	Baramati	Q62.10 = 3 Q62.14 = 2, 3, 4 Q62.01 = 3
8:	28	Baramati	Q62.14 = 1 Q62.01 = 3

**Variable Importance:**

Q62.14	Q62.11	Q62.1	Q62.15	Q62.10	Q62.07	Q62.16
10	10	9	8	7	6	5
Q62.13	Q62.20	Q62.12	Q62.08	Q62.02	Q62.17	Q62.18
5	5	5	5	4	3	3
Q62.09	Q62.03	Q62.04	Q62.06	Q62.19	Q62.05	
3	3	2	2	2	2	

After analyze the above data, pune city and daund teachers confident and Baramati region teachers little confident about the skill of editing different purpose documents. Email and online skills somewhat aware in Indapur, Jejuri, Saswad and Baramati region teachers but not confident about creating and maintaining blogs and websites. This data represented in tree format as:



**Fig. TT2: - Teachers Data Tree 2**

As the third research question, what are the constraints to effective utilization of ICT by school teachers? Here researcher collected the data and specify the different constraints occurred during the ICT implementation in the school. Below table shows that different types of an obstacles give the major effect of implementing the ICT in teaching and learning.

Obstacles by	Response → A lot (4)	Partially (3)	A little (2)	Not At All (1)
Insufficient number of computers	109	39	63	25
Insufficient number of internets connected computers	85	73	74	4
Insufficient internet bandwidth or speed	46	62	117	11
Insufficient number of interactive whiteboards	33	55	131	17
Insufficient number of Laptops/ notebooks	61	68	51	56
School computers out of date / need to repair	67	90	59	20
Lack of adequate skills of teachers	89	96	43	8
Insufficient pedagogical support for teachers.	75	70	66	25
Lack of adequate content/material for teaching	88	73	59	16
Too difficult to integrate ICT use into the curriculum	85	63	80	7
Lack of Pedagogical model on how to use ICT for learning	64	65	100	7
School time and space organization	75	110	32	30
Most parent not in favor of the use of ICT at school	104	86	26	20
Most teachers not in favor of the use of ICT at school	92	79	45	20
No or unclear benefit to use ICT for teaching	65	101	40	30

**Table 3: Obstacles to using ICT in teaching and learning.**

Through above table response says that a lot of obstacles occurred at the time of teaching and learning to the teachers, they are:

- Insufficient number of computers, internet connection.
- Most of parent and teacher not in favor of the use of ICT at school, also its difficult to



integrate ICT use into the curriculum, ICT is not benefited for teaching etc.

- Partially obstacles occurred by lack of adequate skills of teachers, school time and space for organization and no benefit to the school by sing ICT for teaching.
- A little obstacle occurred by insufficient internet bandwidth or speed, interactive whiteboards and lack of pedagogical model on how to use ICT for learning.

Above analysis of teachers obstacles represented in the tree structure using R coding and data tree occurred as:

n= 236 node), split, n, loss, yval, (yprob) \* denotes terminal node

- 1) root 236 188 Baramati (0.2 0.085 0.1 0.17 0.085 0.051 0.051 0.17 0.085)
- 2) Q60.02=1,3,4 163 128 Baramati (0.21 0.12 0.11 0.17 0.1 0.055 0.055 0.055 0.11)
- 4) Q60.14=4 14 4 Indapur (0 0 0.14 0.71 0.071 0 0.071 0 0) \*
- 5) Q60.14=1,2,3 149 114 Baramati (0.23 0.13 0.11 0.12 0.11 0.06 0.054 0.06 0.12)
- 10) Q60.08=1,4 64 37 Baramati (0.42 0.062 0.047 0.031 0.094 0.047 0.016 0.14 0.14)
- 20) Q60.04=1,2,4 33 12 Baramati (0.64 0 0.061 0 0.03 0.03 0.03 0 0.21) \*
- 21) Q60.04=3 31 22 Pune City (0.19 0.13 0.032 0.065 0.16 0.065 0 0.29 0.065)
- 42) Q60.01=1 13 8 Jejuri (0 0.31 0 0.15 0.38 0.15 0 0 0) \*
- 43) Q60.01=3 18 9 Pune City (0.33 0 0.056 0 0 0 0 0.5 0.11) \*
- 11) Q60.08=2,3 85 69 Bhor (0.094 0.19 0.15 0.19 0.12 0.071 0.082 0 0.11)
- 22) Q60.17=1,3 49 37 Bhor (0 0.24 0.2 0.24 0.2 0.041 0.061 0 0)
- 44) Q60.20=1,2 28 17 Bhor (0 0.39 0.11 0.18 0.25 0.071 0 0 0) \*
- 45) Q60.20=3 21 14 Daund (0 0.048 0.33 0.33 0.14 0 0.14 0 0) \*
- 23) Q60.17=2 36 27 Saswad (0.22 0.11 0.083 0.11 0 0.11 0.11 0 0.25)
- 46) Q60.20=1,3 12 4 Baramati (0.67 0 0.25 0 0 0 0 0 0.083) \*
- 47) Q60.20=2 24 16 Saswad (0 0.17 0 0.17 0 0.17 0.17 0 0.33) \*
- 3) Q60.02=2 73 42 Pune City (0.18 0 0.082 0.16 0.041 0.041 0.041 0.42 0.027)
- 6) Q60.11=2 8 0 Indapur (0 0 0 1 0 0 0 0 0) \*
- 7) Q60.11=1,3,4 65 34 Pune City (0.2 0 0.092 0.062 0.046 0.046 0.046 0.48 0.031) \*

Here researcher represents the above R coding result data in tree structure and partitioning it with the help of CART method and specifies the defining features as:

Response Variable: Area                      Method: CART  
 Variables used for partitioning:            Q60.01 to Q60.21 (rpart)  
 Number of Partition sets:                    10

Terminal Leaf Node	No. of Responses (n values)	Label	Defining features
7:	65	Pune City	Q60.11 = 1, 3, 4 Q60.02 = 2

6:	8	Indapur	Q60.11 = 2 Q60.02 = 2
47:	24	Saswad	Q60.20 = 2 Q60.17 = 2 Q60.08 = 2, 3 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
46:	12	Baramati	Q60.20 = 1, 3 Q60.17 = 2 Q60.08 = 2, 3 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
45:	21	Daund	Q60.20 = 3 Q60.17 = 1, 3 Q60.08 = 2, 3 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
44:	28	Bhor	Q60.20 = 1, 2 Q60.17 = 1, 3 Q60.08 = 2, 3 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
43:	18	Pune City	Q60.01 = 3 Q60.04 = 3 Q60.08 = 1, 4 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
42:	13	Jejuri	Q60.01 = 1 Q60.04 = 3 Q60.08 = 1, 4 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
20:	33	Baramati	Q60.04 = 1, 2, 4 Q60.08 = 1, 4 Q60.14 = 1, 2, 3 Q60.02 = 1, 3, 4
4:	14	Indapur	Q60.14 = 4 Q60.02 = 1, 3, 4

**Variable Importance:**

Q60.20	Q60.01	Q60.14	Q60.02	Q60.11	Q60.04	Q60.12
10	9	9	8	8	7	7
Q60.03	Q60.08	Q60.18	Q60.17	Q60.09	Q60.05	Q60.07
5	4	4	4	4	3	3
Q60.13	Q60.06	Q60.21	Q60.16	Q60.15	Q60.10	
3	3	3	2	2	2	

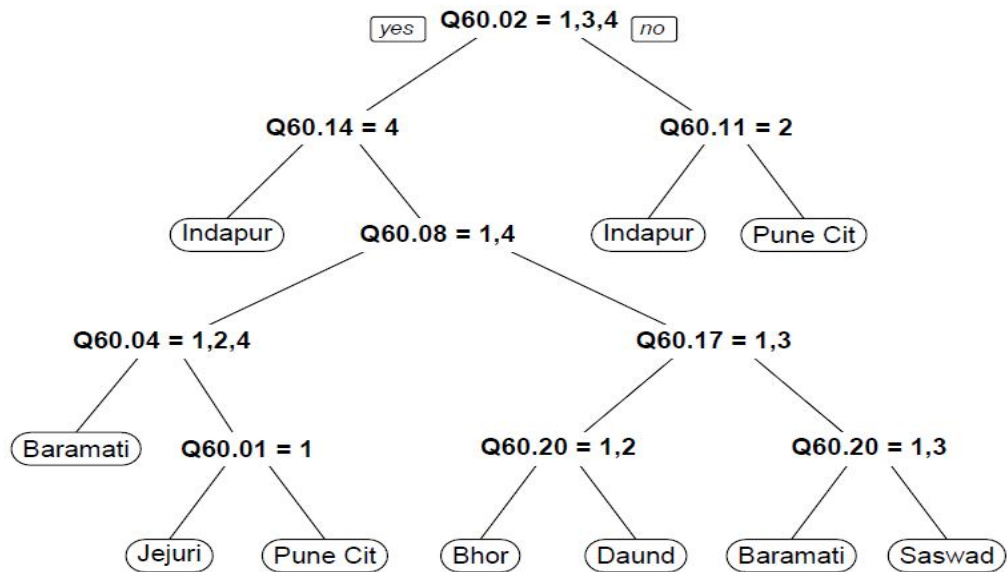
Above response state that, above mentioned obstacles occurred in teaching and learning in different school area in the district at teachers point of view.

It describes as:

- Pune city and Indapur schools have an obstacle of lack of adequate contents/material for teaching.

- In Baramati, Saswad, Daund and Bhore schools have an obstacle of no benefit to use of ICT for teaching.
- In Jejuri, Pune city have an obstacle of insufficient of computers, also in baramati have an obstacle of insufficient number of interactive white board. School space and storage have an obstacle in Indapur schools.

This data represented in tree structure as follows.



**Fig.TT3: – Teachers Data Tree 3**

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