Use of Information & Communication Technology in Secondary Schools

Research Report

Study Commissioned by NITI Ayog (Erstwhile Planning Commission),
Government of India, New Delhi

Conducted by:

Education Quality Foundation of India, New Delhi

Use of Information & Communication Technology in Secondary Schools

Research Report

Study Commissioned by NITI Ayog (Erstwhile Planning Commission),
Government of India, New Delhi

Conducted by:

Education Quality Foundation of India, New Delhi

Advisory Body

- Dr. Anjlee Prakash, Chairperson, Learning Links Foundation
- Prof. S.K. Yadav, Former Head, DTE, NCERT, New Delhi
- Prof Louis Vernal, Formerly, Dean (Education), Goa University

Project Team

- Mrs. Meera Balachandran – Principal Investigator
- Field facilitators
- Statisticians

Education Quality Foundation of India

1209, Padma Tower – 1,

5 Rajendra Place,

New Delhi - 110008

India


EQFI
enabling excellence

Contents

Foreword

Dr. AnjleePrakash
Chairperson
Learning Links Foundation
New Delhi

Education occupies a strategic position in the development priorities of our country. The focus of India's education policy has been on providing equitable access to quality education in order to equip learners with appropriate knowledge, skills and attitudes, to be committed and responsible citizens.

The National Policy on Education 1986 (modified in 1992), emphasized the need to employ educational technology to improve the quality of education. This led to two major centrally sponsored schemes, namely, Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS). In 2005, the NCERT released the National Curriculum Framework for School Education recommending the inclusion of ICT across the curriculum. Another centrally sponsored scheme – ICT@School, was launched in 2004 to provide opportunities to secondary school students to build their ICT skills and was further revised on 9th January 2010.

The Ministry of Human Resource Development has been extremely supportive in providing the resources for implementing ICT in improving the quality of classroom transaction. Given the level of investment and the importance of ICT in a knowledge society, NITI Ayog instituted a research study to find out the access and usage of ICT by teachers and students in rural and urban schools in six states. This report presents the findings of the study answering questions on factors affecting ICT access and usage in education and aims to provide recommendations for understanding the effectiveness of ICT investments.

I am thankful to Planning Commission for commissioning the study. I hope the findings of this research study will provide valuable insights to policy planners, teachers, and teacher educators. I congratulate Mrs. Meera Balachandran and other team members for completing this study.

Date: 15th May, 2015

Preface

Mrs. Meera Balachandran
Director
Education Quality Foundation of India (EQFI)
New Delhi

Information and Communication Technology (ICT) is increasingly at the helm of the education process today. From primary schools to higher education, classrooms are being transformed in new, exciting and creative ways to burgeon a world of teaching and learning. ICT breaks down the barriers of traditional knowledge, and offers a platform to develop knowledge and life skills.

The Education Quality Foundation of India (EQFI) sets quality standards in schools and helps them achieve better levels of quality in terms of infrastructure, teaching methods and content. EQFI engages in continuous research to understand the vibrant and ever changing education ecosystem. This study was conducted to determine the availability, access and usage of ICT by students, teachers and principals of schools.

This research study was designed and led by the EQFI team and conducted in collaboration with the NITI Ayog. We are indebted to officials, colleagues and several others who extended unqualified help and support from time to time during the course of study.

As the Director of EQFI, I am pleased to present this report, which offers some very useful insights into the ICT infrastructure of schools, access to computers and peripherals in schools and usage of ICT by teachers and students alike.

I deeply thank the NITI Ayog for their foresight in promoting ICT for education and for funding this research study. At EQFI, we are equally thankful to Dr. Anjlee Prakash and Dr. S.K. Yadav for their guidance and suggestions. It is a great pleasure and honour at EQFI to work together with the NITI Ayog for this research. We sincerely hope that the study will be found useful for policy makers, teachers, students, administrators and researchers in understanding the importance and effectiveness of ICT investments in the education field.

Date: 15th May, 2015

Acknowledgements

We would like to convey our gratitude to NITI Ayog for funding the research project and the following dignitaries for their support and participation in completing this project:

Dr. C. Chandra Mohan, Former Senior Advisor (SE & Sports), NITI Ayog, New Delhi.

Dr. T.S Sridhar, IAS, Former Secretary, School Education Department, Government of Tamil Nadu

Mr. M Sivasankar. IAS, Secretary, General Education Department, Government of Kerala

Dr. P Mani, Director and State Project Director (RMSA), Directorate of School Education, Government of Tamil Nadu

Tmt. V Rajarajeswari, Joint Director (Personnel), Directorate of School Education, Government of Tamil Nadu

Mr. R Parthsarathy, State Project Director, SSA, Government of Puducherry.

Mr. K Anvar Sadath, Former Executive Director, IT@School Project, Government of Kerala.

Professor SarojYadav, Dean (Academic), NCERT, New Delhi.

Prof. Vimala Veeraraghavan, Emeritus Professor, Psychology, SOSS, IGNOU, New Delhi.

Dr. Veera Gupta, Former Secretary CBSE, New Delhi.

Ms. Suman Bhatia, Consultant and Former Reader SCERT, New Delhi.

Dr. Jessy Abraham, Associate Professor, Department of Teachers & Non-Formal Education -Institute of Advanced Studies –Jamia Millia Islamia, New Delhi.

Mr. ShubhamRao, System Analytics, KPMG, Gurgaon.

Ms.DiptiArora,Market Analyst, Statkrafts Markets Pvt. Ltd., New Delhi.

Ms. Noopur Midha, MsNupur Sachdeva and MrAjit Kumar, Learning Links Foundation, New Delhi.

Mr. Gaurav Kumar,Visualiser, Learning Links Foundation, New Delhi.

List of tables

List of figures

List of abbreviations

AMC	Annual Maintenance Contract
BOOT	Build Own Operate Transfer
CDs	Compact Discs
CG	Central Government
CIET	Central Institute of Education Technology
CLASS	Computer Literacy and Studies in School
D/SE&L	Department of School Education and Literacy
ET	Educational Technology
GeSCI	Global e-Schools and Communities Initiatives
GOI	Government of India
ICT	Information and Communication Technology
JNV	Jawahar Navodaya Vidyalaya
KV	Kendriya Vidyalaya
MHRD	Ministry of Human Resource Development
NCERT	National Council for Education and Research
NCF	National Curriculum Framework
NITI Ayog	National Institution for Transforming India Ayog
PPP	Public Private Partnership
PTA	Parent Teacher Association
RIES	Regional Institute of Education
SCERT	State Council of Educational Research and Training
SCR	Student Computer Ratio
SG	State Government
SIET	State Institute of Education Technology
ToR	Terms of Reference
UTs	Union Territories

Executive summary

The vision of Government of India for a *"Faster, More Inclusive and Sustainable Growth"*, with focus on 4E's – Expansion, Equity, Excellence and Employability, has brought in more focus on Information and Communication Technology (ICT) playing a pivotal role in enhancing the outreach and improving the quality of education. Various schemes and measures have been formulated to utilize the potential of smart technologies. The National Policy on Education, as modified in 1992, also stressed upon employing educational technology to improve quality of education.

The ICT@School scheme launched in 2004, aims at catalyzing the process of infusion of Information and Communication Technology in schools to enhance productivity, efficiencies and an equitable access to education to all. This study has worked to deepen the understanding that, with appropriate infrastructure support in schools, ICT can provide important tools and resources to help improve teaching practices and student learning outcomes.

The study was conducted between August 2011 and May 2012 to deepen the understanding of access and usage of ICT by teachers and students in rural and urban schools in the states of Gujarat, Delhi, Kerala, Maharashtra, Tamil Nadu and Puducherry. The study was designed to address the following objectives:

1. To study the actual access and usage of ICT by teachers and students in secondary schools.
2. To compare the ICT usage by teachers and students in rural and urban areas.
3. To study the factors affecting ICT access and usage by teachers and students.
4. To provide suggestions and recommendations regarding optimal usage of ICT by teachers and students.

To get a fair representation from each of the states, two districts from every state were selected - one being the capital district and the other being a district that was located farther from the state capital in order to have rural representation.

The school list was prepared based on certain criteria like educational level, minimum student strength of 200, classes up till 12th standard, number of teachers not less than 6, student teacher ratio of 45:1. Co-educational schools were also included in the study. The schools samples included State Government schools, KendriyaVidyalaya, NavodayaVidyalaya and private schools located both in rural and urban areas.

Sampling

A sample of **110** schools was selected across the states by adopting the lottery method.

The sample also included **542** teachers, **713** students and **55** principals drawn from rural and urban schools located in different districts of the six states.

Methodology

Both quantitative and qualitative methods were used for conducting the study. Data collection methods included questionnaires for principals, teachers and students and focus group discussion with students. Case studies and field notes were also used for qualitative analysis. All data gathered during the study was analyzed using descriptive statistical method.

Key findings

1. Infrastructure

- Computers were available in 80% of the schools including Kendriya Vidyalayas, Jawahar Navodaya Vidyalayas, Government and Government aided and Private schools in Delhi, Kerala, Gujarat, Maharashtra, Tamil Nadu and Puducherry state.
- With the exception of Kendriya Vidyalayas (KVs), all private schools had better technology infrastructure than the government schools. There was a sense of ownership for infrastructure in the private schools, which was often lacked in the government schools.
- In Gujarat15 out of 18 schools and all the schools in Kerala had more than 20 computers. In Delhi, 6 government schools were surveyed and 2 schools had less than 10 computers. In Maharashtra, all the 4 State Government schools in rural and urban areas had less than 10 computers. All Central Government schools (KVs/NVs), except one in Delhi had more than 20 computers. In Puducherry, all four government schools in urban region had 10 or less computers.
- Almost 48% teachers reported that the infrastructure was sufficient for teaching ICT as a subject. About 22% teachers stated that ICT was sufficient for teaching and learning other subjects. However, the 28% said that infrastructure was insufficient for integrating ICT in teaching-learning other subjects. 24% teachers said that the ICT infrastructure often remained unutilized.

- The student-computer ratio (SCR) varied from 35:1 to 60:1 in rural schools though the situation was significantly different in JNVs (15:1). The SCR also varied significantly in urban schools, 25:1 to 50:1 for private schools and 35:1 to 150:1 in government and government aided schools. Kendriya Vidyalayas had an SCR range of 14:1 to 24:1. Maximum number of schools had student-computer ratio between 76-100 and 101-150 students per computer. Overall, the availability of ICT peripherals was found to be low in most of the rural schools.
- In rural schools the number of usable computers ranged from 10-35 per school whereas in urban schools the range was from 15-40 computers
- Around 80% of students reported that internet access was strictly reserved for staff members or for supervised groups of students. 11 schools in Gujarat and 10 schools in Kerala had internet connectivity in more than 20 computers. Kerala had better connectivity in government schools over private schools. In Tamil Nadu with a majority of rural State Government schools only had 5 to 10 computers with internet connection. In Maharashtra, all rural and majority of urban schools surveyed had ten or less internet connected computers. Most State Government schools in Delhi had only one to five computers with internet connection.
- About 70% schools had one scanner and about 50% had one projector. More than one printer was available in about 25% schools. The most common gadget available was the printer. However, its use by students, barring the students of JNVs was limited.
- Private schools, KVs and government aided schools were better equipped to provide e-learning experiences to their students as compared to government schools. More than 90% of the schools outsourced the e-learning material. 10% of teachers reported that they prepared their own educational CDs. The most commonly available e-materials were for Mathematics and Science.
- Kerala had the highest number of schools using teacher-created digital lessons attributed to the integrated teacher training. Gujarat also took the lead, with many schools using educational CDs. Subject wise analysis revealed a relatively high proportion of teachers using subject specific software to teach Science and Social science followed by Mathematics, but was seldom used for language learning.

- As many as 70% of the KendriyaVidyalayas had their own website. Nearly 40% of all teachers, about 50% from urban and 30% from rural schools, stated that their school had a website. 50% of students did not know whether their school had a website.
- Only 4% rural schools and 20% urban schools had made provision for technical support and regular maintenance of their hardware, mostly in private schools and JNVs.
- Around 80% of urban school and more than 54% of the rural sampled schools of this study reported that they had regular supply of electricity. The problem of irregular electricity supply was observed more in the rural schools than the urban schools.
- About 95% of schools did not place computers in the library. The situation was more or less same in rural and urban schools and also in government, government aided, private and KVS with little variations.

2. Access to computers and peripherals

- On an average, 40% teachers in school had access to computers. In rural schools, 30% teachers had access to computers. Teachers also reported that household responsibilities prevent them from using computer at home though more than half of teachers had computer at home.
- Principals and teachers reported that only 25-45% students in all rural schools had access to computers and other peripherals in schools. On the other hand, in urban schools 25 to 100% had access.
- Access to computers at home was still low in rural areas (20%) and for students of government schools (20%)but 60% of private school students had access to computer at home. In Gujarat, 75% students had computer at home. In Kerala and Maharashtra, 72% and 68% had computer at home. In Tamil Nadu and Puducherry, 35% and 28% students respectively had computer at home. In Tamil Nadu and Puducherry, 27% and 28% students respectively had internet facility at home.
- Almost 53% of students did not have a computer at home due to the high cost. 34% students used cyber cafe and 6% were not comfortable using technology.

3. Usage of ICT

- Printers were found to be most commonly used for educational purpose in schools. 75% teachers never used a scanner or a digital projector. Only 10-15% teachers considered themselves highly proficient in using technology. Teacher skills in ICT in using computer for presentations, internet surfing, e-mail and word processing were low in rural schools and in government

schools. In KVS, more than 90% teachers were proficient in using computers.

- ICT was more frequently used for teaching Science and Mathematics whereas it was used limited for teaching Social sciences, English and Music, around 10% in a week. The minimum use of ICT i.e. less than twice a month was reported by teachers for teaching Art. Schools did not have a clear policy mandate on the use of ICTs for subject related curricular work, and teachers lacked appropriate training on technology integration with other subjects.
- Students' perception on their ICT skills as 'good' was found in equal percentage of students from rural and urban areas (40%). However, in urban areas, students' perception on their skills as 'very good' was more in urban areas (12%) than rural (6%). The reason for rural students' somewhat low skills can be attributed to the lesser availability of infrastructure in schools and at home.
- Almost 40% of students stated that they learnt about computers on their own and 33% learnt from their teachers. Students used computers to work with word-processing, presentation and other applications. As a subject, ICT was accorded of much less importance than other conventional subjects. In most cases, each student got approximately 30–40 minutes (1 period in the timetable) on a computer per week.
- The study found that 95% of schools used computers for general office use, 60% used the technology for maintaining students' records and 80% used computers for accounts work. The number of computers devoted to this work is usually one or two.
- Students lacked proficiency in the English language, which acted as barrier in collecting and understanding information from the internet. It is also observed that merely providing devices and connectivity does not automatically translate to efficient usage of ICT in schools unless backed by appropriate resources, strategies and sustainable models.

4. Recommendations

Following recommendations emerged out of the findings of the study:

- The government can direct its focus on providing quality hardware like computers, printers, projectors etc., and ensure availability of updated software and seamless internet connectivity. At the same time, it should make provision for regular upgrading and maintenance of facilities. Specific funds should be earmarked for these activities and disbursed at regular intervals, specifically for rural areas.
- Schools should provide access to computers with internet connectivity for the students even beyond school hours to address the needs of such students who do not have personal computer at home.

- The computer lab should not be the exclusive domain of the computer teacher. Encouragement and involvement of subject teachers in the use of ICT in classrooms should be promoted to ensure better subject teaching and learning outcomes. Teachers need to be empowered and motivated to use ICT for curriculum transaction. Such trainings and professional development programs need to be organized on a continuous basis.
- Schools can set up a mobile computer that can be wheeled from room to room. A multimedia resource room with a projector, computer and Smart Board should be set up in schools for students' and teachers' use. A few computers can be placed in the library and staff room for students and teachers to facilitate preparation of assignments, question papers, worksheets, result sheets and so on.
- For efficient school administration, schools should utilize the benefits presented by ICT.
- To summarize, it is clear that ICT has the potential to positively influence teaching and learning. Therefore, it is essential on the part of the teachers and students to maximize the possibilities offered by ICT. Schools should make optimum use of the benefits of ICT for improving the overall quality of school education.


EQFI
enabling excellence

1. Introduction

Education is one of the main keys to economic development and improvements in human welfare. As global economic competition grows sharper, education becomes an important source of competitive advantage, closely linked to economic growth. In addition, education appears to be one of the key determinants of lifetime earnings. It is also linked to a whole batch of indicators of human development. As the pace of technological change quickens and the workforce in many countries grows older, education will continue to offer a way to improve and update the skills and capabilities of the older workforce and the young people joining it. Thus improving the quality of education is a critical issue, particularly at the time of educational expansion.

The Information Communication Technologies (ICTs) can enhance the quality of education in several ways which included, increase in learner motivation and engagement, facilitating the acquisition of basic skills and by enhancing training of teachers (Haddad &Jurich, 2002).

The Information and Communication Technology (ICT) has permeated in every walk of life, impacting the way people work, play and live. ICT has improved community life, and has provided opportunities to youth in solving complex problems, creating and sharingof new ideas as well as resources with colleagues and business partners, enabling them to participate in the global economy.

While ICT has impacted contemporary business and social practices globally, most educational systems around the world still engage in traditional teaching-learning practices that require learners to work individually, recall facts or perform isolated activities. Thus, ICT would play a pivotal role in reforming education and preparing students for the 21st century challenges, impacting the way learners access knowledge, research, communicate and collaborate with others.

This was also further given importance in the National curriculum framework 2005 (NCF 2005) .The NCF has suggested the effective use of ICT in classrooms for problem solving and critical thinking skills amongst the 21st century learners.

According to UNESCO (2002), ICT may be regarded as a combination of 'informatics technology' with other related technologies, specifically communication technology, which has become a global phenomenon of great importance and concern in all aspects of human endeavor, spanning across the gamut of activities from education; governance; business; labour; market; economics; productivity; trade; agriculture; domestic and international commerce to many more. Various types of ICT products and channels are available, and have been used for enhancement in delivery and learning outcomes in education. These include teleconferencing; internet; email; audio conferencing; television lessons; radio broadcasts; interactive radio counselling; interactive voice response system; audio cassettes and CD ROMs (Sharma, 2003; Sanyal, 2001; Bhattacharya and Sharma, 2007). The influences of these ICT products are more visible at the school level.

A great deal of research has proven the benefits of ICT to the quality of education (Yusuf, 2005; Al-Ansari, 2006). ICT has the potential to innovate, accelerate, enrich and deepen skills. For example, self-learning, problem solving, information seeking and analysis and critical thinking as well as the ability to communicate, collaborate and learn (Yuen et al, 2003). It also helps to enhance teacher training (Plomp et al, 2007) and motivate and engage students and teachers. It can also help relate school experience to work practices and create economic viability for tomorrow's workers (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005). Use of ICT also develops higher order thinking skills (HOTS), such as collaborating across time and place and solving complex real world problems (Bottino, 2003; Bhattacharya and Sharma, 2007; Mason, 2000; Lim and Hang, 2003; Alexander, 1999; Jonassen, 1999).

ICTs are also transformational tools which, when used appropriately, can promote the shift from teacher-centred to a learner/ learning-centred environment (Bransford, 1999). It has the potential to function as a facilitator of active learning as well serve as a tool for curriculum differentiation, providing opportunities for adapting the learning content and tasks to the needs and capabilities of individual pupils by providing tailored feedback (Mooji, 1999; Smeets & Mooji, 2001).

"It is a well-accepted fact that the effective usage of ICTs in the classroom is correlated to positive academic outcomes, including higher test scores, better attitudes towards schools, and better understanding of abstract concepts". (National Policy on ICT in School Education http://www.smartschoolonline.in/National-Policy-on-ICT-in-School-Education).

GeSci states that "only 13% of the 1.2 million schools (in India) have computers – unevenly distributed and almost predictably are not linked to any educational outcomes or economic opportunities for the students" (www.gesci.org/india).

A.W Bates (1999) states when teaching with technology, learning outcomes can be determined in terms of content, skills and values. While content is the "what" of teaching and can be learnt in a variety of ways, students need to develop skills. These, he states might include: how to find, analyze, organize and interpret appropriate information on a particular subject/ topic; how to solve problems; how to analyze concrete contexts and derive general principles; how to apply abstract principles to concrete contexts; how to argue cogently and how to think critically within the parameters of a particular academic discipline.

The teaching of effective skills such as values, according to Bates, is very subtle. Students need to be taught values of scholarship – inquiry, open mindedness, reflection, integrity and evidence based thinking and learn how to apply these to their study. (Poole&Bates,1999). Giving the role of teacher its due place, Bates states that good teaching may overcome a poor choice of technology but technology will never save bad teaching. A combination of the two is needed to deliver desired outcomes.

International Society for Technology in Education recommends grouping digital age learning outcomes under following heads where technology is an enabler to enhance: Creativity & innovation; Communication & collaboration; Research & information fluency and Critical thinking, Problem Solving and Decision Making (http://www.iste.org/Libraries/PDFs/NETS-S_Standards.sflb.ashx)

The question that needs to be answered is "what kinds of learning can different media best facilitate and under what conditions?" (Wilbur Schramm,1977). Ask not what technology can do for you, ask what you can do with technology, is perhaps the new age mantra.

A vital contribution of ICT in the field of education is easy access to learning materials/ content. With the help of ICT, students can now browse through e-books, sample examination paper, previous year's paper etc. and collaborate with resource persons; mentors; experts; researchers; professionals and peers worldwide. The use of ICT can improve performance, teaching-learning, administration, and develop relevant skills in the disadvantaged communities (Bottino, 2003 and Sharma, 2003) too.

Since ICTs provide both students and teachers with many opportunities in adapting to learning and teaching according to individual needs, there is an urgency to respond to this technical innovation. Shri Kofi Anan, former United Nations Secretary General, indicates that in order to attain the goal of Universal Primary Education by the year 2015, we must ensure that ICTs unlock the doors of education systems. This indication forms the basis the potential and promise that ICTs hold for education in the future. ICT can also be used integrated in teaching-learning process with a way of teaching scholastic subjects.

Information Technology did not exist for subject teaching in most schools that formed part of this study.According to National Council of Teachers Mathematics, (2000), "technology is essential in teaching and learning Mathematics; it influences the Mathematics that is taught and enhances students' learning. Teachers' attitudes play an important role in using technology in teaching and learning Mathematics". (p. 24)

While it is important to have teachers with positive attitudes towards teaching Math differently, many may not be aware of types of technology available for teaching this subject as elucidated in literature.

"…many teachers lack the knowledge of how to properly incorporate technology in the classroom (Doering, Huffman, & Hughes, 2003). Research on technology integration in mathematics education has examined the effectiveness of spreadsheets and dynamic geometry software on achievement (Isikal&Askar, 2005), computers and 2D geometric learning (Olkun, Altun, & Smith, 2005) and dynamic geometry sketches (Sinclair, 2004).

The findings of the studies support computers in mathematics teaching and learning, Isikal and Askar (2005) investigated the effect of spreadsheet and dynamic geometry software on mathematics achievement and mathematics self-efficacy. The results indicated that using technology effectively as a learning tool improves students' mathematics achievement. Olkun et al. (2005) found that students who did not have computers at home initially had lower geometry scores. Therefore, Olkun (2005) suggests that in schools, it seems more effective to integrate mathematical content and technology in a manner that enables students to do playful mathematical discoveries". (Lin Cheng-Yao, 2008, pg. 135-142).

The schools provide children with an opportunity to learn science literacy, but arguably have not been successful in creating adequate interest in applications of science due to the nature of rote learning that is perpetuated through a didactic approach in the classrooms underscored by a formal examination system. This is not the story in Indian schools – it is endemic to many school systems across the world.

"Krajcik (2001) supports the conclusion that students at the elementary, middle and high school levels do not develop an understanding of science that is useful for their everyday lives. Other studies have suggested that students do not see how science applies to everyday life (Linn &Hsi, 2000), and that there is very little integration of science within everyday thinking among students (Cobern, Gibson, & Underwood, 1999). Research has shown that even students with the most grade success in Science do not necessarily grasp fundamental concepts about nature and science (Cobern, et al., 1999). Not surprisingly, then, Science is said to be poorly

taught in schools (Eisenhart, Finkel, & Marion, 1996). Several aspects of traditional school science teaching may be responsible for this."(Kubicek, J.,2005)

Science teaching and learning is quite dramatically transformed through the inquiry approach where learners can explore, question, understand, build and experiment with variables in an environment to construct their understanding. Kubrick argues further that science inquiry using technology is not a lofty claim. He also accords importance to the teacher's role in guiding students to use technology for learning science "few would argue that the learning environment created by the science teacher plays a role in shaping students' perceptions of the way science is practiced and how new knowledge is created."

The science of languages are best learnt by seeing, hearing, experiencing, expressing, comprehending things around learners. Technology is a wonderful tool that can immerse students learning a particular language through a multi-sensory approach. Language is situated in real experiences and best learnt through expression in various forms. With technology, teachers can provide frequent opportunities for students to express their ideas and experiences. Through reading others' writings they learn to comprehend. Doing one without the other may suppress essential language skills. Language skills can be developed across curricular subjects as long as students are being able to express, comprehend and communicate.

Computers and technology are still perceived as a threat and insecurity for many teachers everywhere in the world despite the latest advances applicable to language teaching such as specialized websites, blogs, wikipedia, language teaching methodology and journals. Many teachers still lack interest, strong will to learn and a challenging attitude towards teaching through computer. Most times, the reasons are the lack of time for out-of-school training in combination with the natural difficulty in incorporating new working schemata within their own classrooms. As a consequence, computers should no longer be a little more than a way to typewrite (as they are sometimes today), send messages and, when lucky, to browse out for information on the net (Johnson & Eisenberg, 2006). Therefore, one major concern that is commonly shown by both teachers and education boards is how to motivate and instruct teachers to integrate computers and ICT into their language classes.(Laborda, J. G., &Royo, T. M. (2007)

Factors such as these have evinced an interest in the use of ICT to deliver education and training. Computers began to appear in school and university classrooms in the more advanced countries in the early 1980s. Broadband connections in schools and universities became commonplace in western economies in the second half of the 1990s. In developing countries, however, the play out of ICT usage has been more limited. This is not necessarily a negative phenomenon, it is a natural outcome of economics and affordability and on the positive side it allows countries such as India to learn from the experience of the other countries. Once learnt, the lessons must quickly be integrated into indigenous systems, and rolled out.

In the early years of ICT usage, particularly in the education sector, policy makers, educators and other stakeholders saw the use of ICTs in the classroom mainly as a way to impart computer literacy. Most now see a broader role for it i.e. delivering varied paradigms in learning at lower cost and with higher quality than traditional methods of teaching. In addition, schools and universities increasingly use ICTs, as do other large organizations, to reduce the costs and improve the efficiency of administration.

There are three main rationales for promoting ICT in schools, namely economic, social and pedagogical. These, of course, are not mutually exclusive. The first two derive directly from the proliferation of ICT in the modern world. The pedagogical rationale for promoting ICT in schools is concerned with the use of ICT in teaching and learning. It provides teachers with a range of new tools to complement traditional pedagogies. Most importantly, teachers gain the potential to develop new teaching methods. ICT provides exciting and relevant learning opportunities to students who are growing up in a culture of all-pervasive technology.

1.1. ICT in Schools – a Historical Context

The National Policy on Education 1986, as modified in 1992, emphasized the need to employ educational technology to improve the quality of education. The policy statement led to two major centrally sponsored schemes, namely, Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS).

The CLASS project was initially introduced as a pilot with the introduction of BBC micro-computers. A total of 12,000 such computers were received and distributed by the State Governments to secondary and senior secondary schools. The project was subsequently adopted as a centrally sponsored scheme during the 8th Plan (1993–98). An annual maintenance grant was given as assistance for purchasing and maintaining BBC micros for new schools.

National Task Force on Information Technology and Software Development (IT Task Force) constituted by the Prime Minister in July, 1998 made specific recommendations on the introduction of IT in the education sector, including schools. Some of the relevant recommendations are mentioned below:

- Vidyarthi Computer Scheme, Shikshak Computer Scheme and School Computer Scheme to enable students, teachers or schools respectively, desirous of buying computers to do so under attractive financial packages. These schemes were supported by a suite of initiatives such as lowering the cost of PCs; easy installment for bank loans; computer donations by IT companies and other business houses; bulk donations of computers by NRI organizations; large-volume bargain price imports; multi-lateral funding etc. It was also proposed that internet and computers were to be made accessible to schools, polytechnics, colleges and public hospitals in the country by the year 2003.

- The concept of Smart schools where the emphasis was not only on information technology in schools, but also on the use of skills and values that would be important in the next millennium, should be started on a pilot demonstrative basis in each state.
- The report recommended provision of computer systems to all educational institutions up to higher secondary/ secondary schools by suitable investments (about 1–3%) of the total budget during the next five years.
- National Informatics Centre was identified as the nodal agency for finalizing the contract hardware supply.Due to limited use and supply of software, coverage was confined to senior secondary schools,and students of class XI and XII had to undergo a computer course module.

  In 2000, the government media house launched GyanDarshan with three completely digital and round-the-clock TV channels dedicated to education. The IGNOU, Ministry of Human Resource Development and PrasarBharati teamed up to provide educational programs to support primary, secondary, higher secondary, technical and vocational education.

  In November, 2001, GyanVani, a radio channel on education was launched through different FM stations in the country with 40 broadcast stations (GOI Ministry of HRD Press Release, October 21, 2003). These stations operated in several cities across India, broadcasting programs in Hindi, English and regional languages through various government agencies, NGOs and multi-lateral organizations. Each station covered an entire city and the adjoining rural areas.

  National Curriculum Framework for School Education (2000) recommended formulation of plans for integration of computers into the curriculum and creation of a framework for enhancing learning opportunities using ICTs across the curriculum. It was also recognized that success of implementation of ICTs depends on the provision of professional development opportunities for teachers. The implementation of these guiding principles differs in levels of investment, connectivity and curriculum provisions for ICT integration by the state. The variations are quite pronounced.

  In 2002, the Indian government launched a project called VidyaVahini to provide IT and IT-enabled education in 60,000 schools in India over three years (India has about 1.1 million schools) as part of Rs 6,000 crore (USD 1.2 billion) project. Beginning with a pilot covering 150 schools, the government proposed to equip each school with a computer lab with internet, intranet and a television to facilitate video-conferencing, web-broadcasting and e-learning. (Kumar, A., October 9, 2002).

- Edusat was India's first dedicated education satellite launched in September, 2004 at a cost of USD 20 million. With footprints covering the entire country, Edusat makes it possible to receive 'Direct to Home' quality broadcasts of educational programs using any television set with a low-cost receiver.
- NCERT brought out the National Curriculum Framework (2005) recommending inclusion of ICT across the curriculum. It was also realized that its success depended on the professional development of teachers.
- Centrally Sponsored Scheme of Information and Communication Technology (ICT) in Schools -the ICT in Schools Scheme was launched in December, 2004 to provide opportunities to secondary stage students to enable them to build their capacity in ICT skills and make them learn through computer-aided process. The scheme is a major catalyst to bridge the digital divide amongst students of various socio-economic and other geographical barriers. It also provides support to states and Union Territories to establish computer labs on a sustainable basis. It also aims to set up Smart schools among the KendriyaVidyalayas and NavodayaVidyalayas, which are pace-setting institutions of Government of India to act as "Technology Demonstrators" and to lead in propagating ICT skills amongst students of neighborhood schools.

  Over the years, the centrally sponsored schemes, ET and CLASS have been suitably modified, keeping in view the past experiences, feedback received and changing needs of schools to form a new scheme — Information and Communication Technology in Schools (ICTS). The scheme was revised in July, 2010 and its essential components are as follows:

  a) Partnership with State Governments and Union Territory Administrations for providing computer-aided education to Secondary and Higher Secondary Government and Government-aided schools.
  b) Establishment of Smart schools, with an intention to become the technology demonstrator schools.
  c) Teacher-related interventions, such as provision for engagement of an exclusive teacher, capacity enhancement of all teachers in ICT and a scheme for national ICT award as a means of motivation.
  d) Development of e-content, mainly through Central Institute of Education Technologies (CIET), six State Institutes of Education Technologies (SIETs) and five Regional Institutes of Education (RIEs) also through outsourcing.
  e) Broadband connectivity in all secondary schools (2006)

The Government of India, Ministry of HRD, Department of Secondary Higher Education issued an order for the constitution of an Integration Action Plan to implement broadband connectivity in all secondary schools (order dated May 20, 2006, GOI, HRD, Dept. of Secondary and Higher Education;website: www.mhrd.gov.in)

1.2. ICT in School Education - National Policy

The Department of School Education & Literacy (D/SE&L), Ministry of Human Resource Development (MHRD), Government of India along with Global e-Schools and Communities Initiative (GeSCI) initiated a consultative process to formulate the 'National Policy on ICT in School Education' to address the needs and challenges of teaching and learning in the 21st century using modern technology tools. The MHRD initiated the policy formulation process on 'Building a National policy on ICT in School Education', and achieved another milestone.

A committee was constituted to draft the policy on the usage of ICT in School Education. A draft policy has been prepared, and aims at using ICT for preparing youth to compete globally and participate creatively in the establishment, sustenance and growth of a knowledge society. The draft policy was approved last year by the Central Advisory Board of Education.

1.3. ICT @ Schools, 2004 – Government of India

The centrally sponsored scheme – Information and Communication Technology @ Schools, 2004 was launched to provide opportunities to secondary school students to build their ICT skills. The scheme is a major catalyst to bridge the digital divide amongst students from different socio-economic and geographical backgrounds. The scheme supported the establishment of computer labs. This scheme was further revised on 9th January, 2010 to include the following aspects:

- Expansion with emphasis on quality and equity - there was a need to further expand the outreach of the scheme to cover educationally backward blocks and areas with concentration of SC, ST, minority and weaker sections. Along with it, government needed to ensure dependable power supply connectivity.
- Demonstration effect- Smart schools were to be set up at district level to serve as demonstration models for neighboring schools.
- Teacher engagement and better in-service and pre-service training - a trained technology coordinator or ICT teacher was required for each school and pre-service as well as in-service training of all teachers in effective use of ICT in teaching and learning process.

- Development of e-content - there is a need to develop and use appropriate e-content to enhance comprehension levels of children in different subjects.
- Monitoring and management a strong monitoring mechanism needs to be instituted at all levels to ensure optimal delivery of set targets.
- Community involvement - the scheme envisages that the School Management Committee, Parents Teachers Association and local bodies would be involved in the management of the program.

The scheme established partnership with the State Governments and Union Territories to benefit secondary school students in government and government-aided schools.

Components of the revised scheme:

Content

- States will initiate the process of launching/ creating courses in different areas of ICT.
- States will make provision for the availability of a wide range of teaching-learning materials that will create ICT enabled classrooms.
- Teachers will be actively involved in selection and evaluation of digital content and resources. Both teachers and students will also be encouraged to develop their own digital resources.
- A School Management Information System (School MIS) with repository of tools, digital content and resources, professional development and continuing education platforms, counseling and guidance and other student support services should be available.

Accessibility

- The special needs students will have access to content in an appropriate format.
- The scheme will try to incorporate information in regional languages, wherever possible.

Capacity building: teachers

- Capacity building of in-service teachers will be done by the Regional Institutes of Education of the NCERT, State Councils of Educational Research and Training (SCERTs). Refresher trainings will be conducted every year.
- All pre-service teacher education programs will have a compulsory ICT component.

Capacity building: school heads

All school heads will undergo appropriate orientation in ICT and ICT-enabled education training programs, especially related to school management and school safety.

Capacity building: State/ District Education Department personnel

States/ Districts Education Department personnel at all levels will be oriented to integrate ICT into their work.

ICT infrastructure

- There would be provision of at least one printer; scanner; projector; digital camera; audio recorder and other devices available at each school.
- Each school will have at least one computer laboratory with at least ten network computer access points. The student-computer ratio at any time of use should not exceed 2:1.
- Internet connectivity to be provided in the library, teachers' common room and the school head's office.
- A wide variety of software applications and tools going well beyond an office suite, such as graphics and animation, desktop publishing, web, designing, databases, and programming will be available.
- Regular and regulated supply of electricity, where needed, will be ensured.
- An ICT lab attendant/ technical assistant with appropriate qualifications will be appointed to manage the ICT/ multimedia resource lab.

States are given the option of using the Build Own Operate and Transfer (BOOT) model, where private sector is given the responsibility of providing and maintaining the infrastructure and training teachers to use ICT.

1.4. ICT in education: Public-Private Partnerships

There are numerous Public-Private Partnership (PPP) programs in which State Governments partnered with large private sector organizations and multinational corporations to reach large number of beneficiaries. Some of these PPP include:

- HEADSTART in Madhya Pradesh (2003) with provider of Linux technologies, Red Hat India.
- Project Shiksha (2004) with Microsoft in West Bengal, Karnataka, Andaman and Nicobar Islands, Lakshadweep and Tamil Nadu.

- The Intel Teach Program (February, 2000) to train classroom teachers in over 35 cities nationwide to use technology to improve teaching and learning.
- SmartClass program bringing digital content bringing digital learning in the classroom available throughout the country through education organizations like Educomp.
- Shiksha India (December, 2001), a non-profit organization set up by the Confederation of Indian Industry (CII), has created a teachers portal using open source tools and technologies.
- Community Learning Centres (CLC) (2003) was set up by the AzimPremji Foundation in rural Karnataka. A CLC generally has 6–8 computers in a Government Higher Primary School used by children of that school during school hours for learning curriculum through interactive games and exercises. They are used by the community before or after school hours and during holidays. So far, about 90 CLCs have been set up.

1.5. ICT is an integral part of modern life

It gives us almost instant access to facts, materials and services that could not have been thought of a few years ago. ICT brings to all in education the 3 'Rs' – Raising levels of achievement for all, Reducing exclusion and Reducing the workload on teaching staff. Recognizing its potential and the benefits that can accrue from it, those responsible for policy making have rolled out many kinds of policy frameworks to be adopted by state education authorities where ICT forms the basis of implementation since mid-80s.

Government of India has announced 2010-2020 as the decade of innovation. Foundation of the skills leading to innovation is laid at school level. Though computers came to Indian classrooms in the year 1984-85, the level of adoption of modern technology in the teaching and learning process has been limited and uneven. In the Indian context, ICT also helps education to move away from centralized approach to a multi-centric participation in content generation and dissemination process (NCF, 2005).

The Department of School Education & Literacy, Ministry of Human Resource Development (MHRD), Government of India is tasked with the overall responsibility of guiding the implementation of ICT. It provides funding to the Central Institute of Education Technology (CIET) and State Institute of Education Technology (SIET) on a 75:25 basis. North Eastern states will reserve funding from the Central Government on a 90:10 basis. The grant of Rs 6.4 lakh (non-recurring) and Rs 2.7 lakh (recurring) per school is given under the scheme.

States are encouraged to implement the program through Public-Private Partnership where the supplier provides infrastructure and maintenance services for a fixed duration contract period. MHRD, along with the Global e-Schools and Communities Initiative (GeSCI), has initiated a consultative process to formulate the 'National Policy on ICT in School Education' to address the needs and challenges of teaching and learning in the 21st century using modern technology tools. The policy formulation process on 'Building a National Policy on ICT in School Education' is yet another milestone.

Even though there has been considerable achievement in recent years in developing the ICT infrastructure in schools, more needs to be done. The infrastructural development so far has needed significant levels of investment by the State Governments and individual schools and institutions. Given the level of investment of both time and finance, as described in this report, the need for a thorough study of the access and utilization of ICT in schools was clear.

This report presents the findings of a study on the utilization of ICT on teaching and learning in secondary schools in six states of India. The study set out to ascertain the extent to which ICT is used in both urban and rural schools and more importantly, assess the impact ICT has on teaching and learning. The views of principals and teachers about their ICT skills and their opinions about the impact and future role of ICT in education were sought during the study.

The pivotal role of ICT in the development of the knowledge economy is widely recognized. As described earlier, there has been substantial investment in ICT in education over the past decade. Given the level of investment, and the importance of ICT in a modern knowledge society, it is important to study up to which extent students are able to access and their learning, and skills are enhanced. Besides this, the research finding of the study as detailed earlier had mixed results. There is need to have more researches for generalization of the findings therefore this research has been undertaken to find out the answers to the following questions:

1. What is the technology infrastructure available in school – computers and internet connectivity? How does the school maintain and update the technology infrastructure?
2. How do teachers and students use ICT?
3. Do teachers perceive it as a value addition or just another activity that needs to be done and finished with? Do they feel empowered through technology?
4. Are they learning computers only as a stand-alone subject? Or are they using it as a learning tool?
5. Students who have computer and internet access at home, do they have an edge over their peers?

6. Is technology becoming a part and parcel of school administration and management? What are the technology needs of the school, teachers and students?
7. What are the enablers and barriers to technology integration in a school in the Indian education setting? What are the limitations to using technology in education?

In order to answer the above questions the following objectives were formulated for the study:

1.6. Objectives of the study:

The study was under taken with the following objectives

a. To study the actual access and usage of ICT by teachers and students in secondary schools.
b. To compare the ICT usage by teachers and students in rural and urban areas.
c. To study the factors affecting ICT access and usage by teachers and students.
d. To provide suggestions and recommendations regarding optimal usage of ICT by teachers and students

2. Research Design

This research study has been undertaken to make a systematic analysis of the issues related to the accessibility and use of ICT in secondary schools with a view to understand the factors affecting the adoption of ICT for teaching practices and enhancement of the quality of learning outcomes. The present study is a combination of the quantitative and the qualitative analysis using survey design methodology.

This chapter presents the research design that includes methodology for conducting the study including sampling, tools, procedure for data collection and data analysis.

2.1. Methodology

The research study utilized both quantitative and qualitative data collection tools, but is more rooted in a qualitative framework which recognizes the importance of locating the study within socio-economic perspectives (more focus on rural-urban). However, qualitative approach was applied with quantifiable evidences to create valid findings. To collect the data for the study, systematic samples of respondents – principals, teachers and students were surveyed in six states. Interviews were conducted with students and teachers for in-depth understanding of their perceptions and attitudes on ICT usage.

The first step towards conducting the research study was preparation of the research design, which was framed with literature review and inputs from strategic meetings held with the policy makers, academicians and experts.

Based on this, an outline of the study was drawn along with two research methods – qualitative and quantitative. The key processes taken up for the study were - designing the study, formulating research questions, analyzing the data collected, interpreting and reporting the results with recommendations.

2.2. Sampling

The study was conducted in six states approved in the Terms of Reference, namely Gujarat, Delhi, Kerala, Maharashtra, Tamil Nadu and Puducherry. The study included different types of schools, including State Governments, KendriyaVidyalaya and private schools located in rural and urban areas to study different level of usages and integration of ICT in schools. To carry on with the said targeted groups, school management authorities were approached for seeking

relevant permission for the study in recommended schools. The details of states and districts are given explained in Table 2.1:

2.2.1. Identification of districts

a. District selection criteria

The six states/ UTs chosen for the study were included in Terms of Reference (ToR). These were geographically diverse, and embodied different levels of development. While Maharashtra, Gujarat and Tamil Nadu are the larger states, Kerala, Delhi and Puducherry are relatively smaller states/ UTs. To get a fair representation from each of the selected states, two districts in every state were selected - one being the capital district and the other being a district that was located farther from the state capital. This was done to have rural representation Random sampling adopting lottery method was followed to select the number of schools included in the survey. The following table gives a list of districts from the different states:

Table 2.1| Details of districts selected from sampled state

S.No.	States	District 1	District 2
1.	Delhi	North	West
2.	Gujarat	Ahmadabad	Valsad
3.	Kerala	Thiruvananthapuram	Kannur
4.	Maharashtra	Mumbai suburban	Nagpur
5.	Puducherry	Puducherry	Karaikal
6.	Tamil Nadu	Chennai	Coimbatore

2.2.2. School selection criteria

From each state, 20 schools were to be selected representing both the districts. However the data obtained from each state varies in terms of school as given in table 2.3. These schools were a mix of State Government, Central Government and Private schools. The schools were selected by the State Government based on the criteria detailed out in the table 2.2. In order to cover all socio-economic groups in the survey, schools with some understanding of ICT were selected so as to get a holistic perspective of the issues. A list of schools of State Government, KVS, NVs and private schools from urban and rural areas was prepared from each district, based on the following criteria:

Table 2.2| School selection criteria

Criteria	Indicators
• Educational Level	Till 12th standard
• Co-educational school	
• No. of students	At least 200
• No. of teachers	At least six
• Student – teacher ratio	Approximately 45:1
• Student fee	Affluent, Affordable, free
• Minority section enrolment	Desirable
• Backward caste enrolment	Desirable

2.2.3. Sampled Schools

Efforts were made to select equal numbers of schools from rural and urban areas to ensure uniform representation. For selection of schools, State Governments utilized the national average statistics for state government schools, central government schools and private schools in rural and urban areas, which formed the specific criteria for selection of schools.

From each district, 9 rural and 11 urban schools were supposed to be selected, out of which 12 schools were government and 8 private. Since some states did not cooperate, the number of schools varied from each other. The table below presents the number of schools management wise, district wise and location wise, selected from the six states/ UTs - Puducherry, Delhi, Gujarat, Kerala, Tamil Nadu and Maharashtra.

Table 2.3 l Total number of schools from each state/ Union Territory

State	Number of schools
Puducherry	12
Delhi	09
Gujarat	20
Kerala	20
Tamil Nadu	17
Maharashtra	32
Total	110

* There was no JawaharNavodayaVidyalaya in Tamil Nadu - this was replaced by a rural Tamil Nadu government school.

KendriyaVidyalaya (KV) Schools were selected from both districts in all the states with an from Gujarat. Since Valsad district of Gujarat does not have a Grade XII KV school, the two KV schools selected in Gujarat were from Ahmedabad.

^ In the private school sector, schools were selected from the Central Academic Boards, namely, Central Board of Secondary Education/ Indian Certificate of Secondary Education or State Academic Boards.

*Though the schools selected were 110 but after data cleaning variations in the number of schools existed under different areas of the study.

2.3. Respondent Profile

Respondents include Principals, Teachers and Students

Respondents were selected from diff types fo schools representing state govt, govt aided, KVS, NVS, private across the rural and urban segments.

Table 2.4 | Respondent selection criteria per school

Respondent	Number
Total no. of respondents in a school	15
Principal / Management	1
Secondary School Teachers	6 - 2 Science, 1 Math, 2 Language arts (English and Regional language), 1 Social science
Students	Grade IX to XII: 8 (2 students from each grade)

This study surveyed a total of 110 schools selected by the state govt. From these schools in actual 542 teachers, 55 principals and 713 students were selected for the study.The profile of teachers and students who were the main stakeholders in the implementation of ICT in school education are shown through various pie-charts.

2.3.1. Profile of teachers

The data was collected from 542 teacher from 110 schools, 60% of them were from urban and 40% from schools in rural areas.

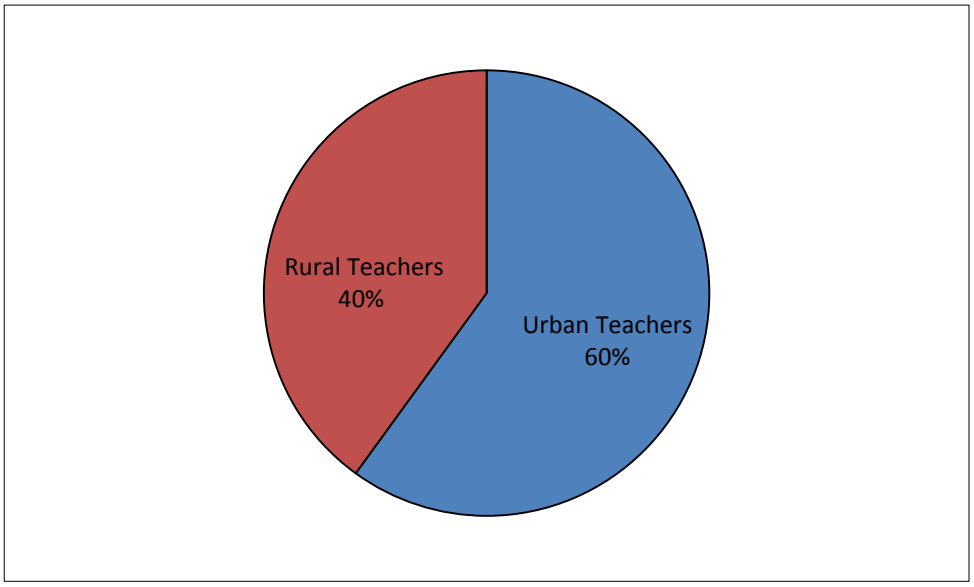

Fig. 2.1(a) |Location wise distribution of teachers

The biggest portion of the respondent teachers were State Government schools and smallest from JawaharNavodayaVidyalyas (JNV), therefore the data of JNVs was merged in most of the cases with the rural schools . This is also shown in Figure 2.1b, where maximum numbers of schools were of State Government (38%) whereas as only 5% representing JNVs. Figure 2.1b also represents that government aided and private schools were in equal number.

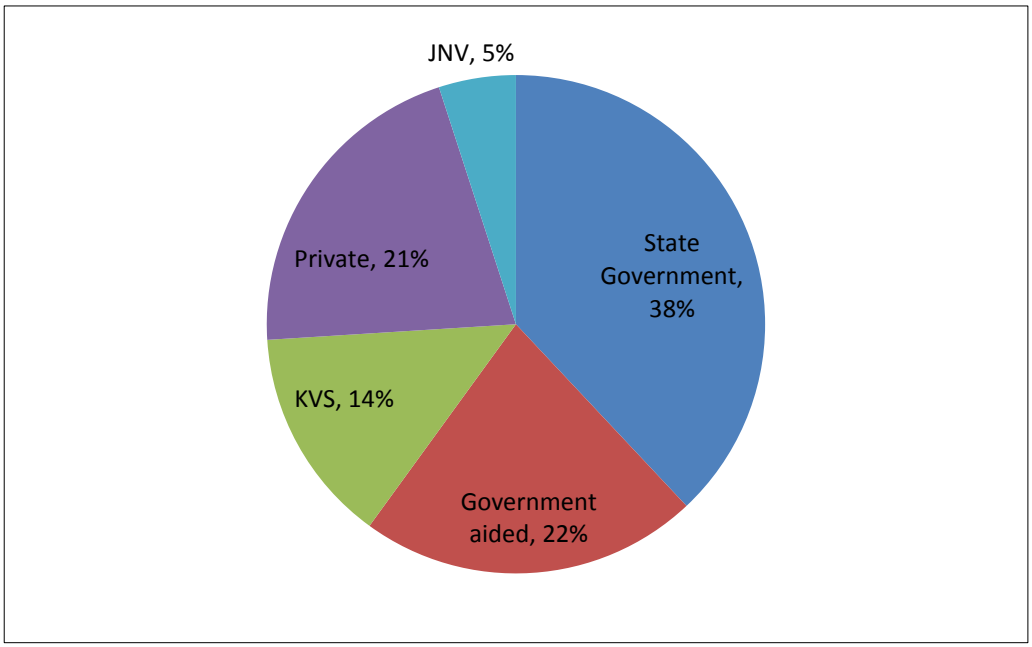

Fig. 2.1(b) | Percentage of teachers by type of schools

Languages, Mathematics and Science teachers were almost in equal proportion, and together made a larger group than those teaching Social Science, Computer Science and Commerce as shown in Fig. 2.1(c)

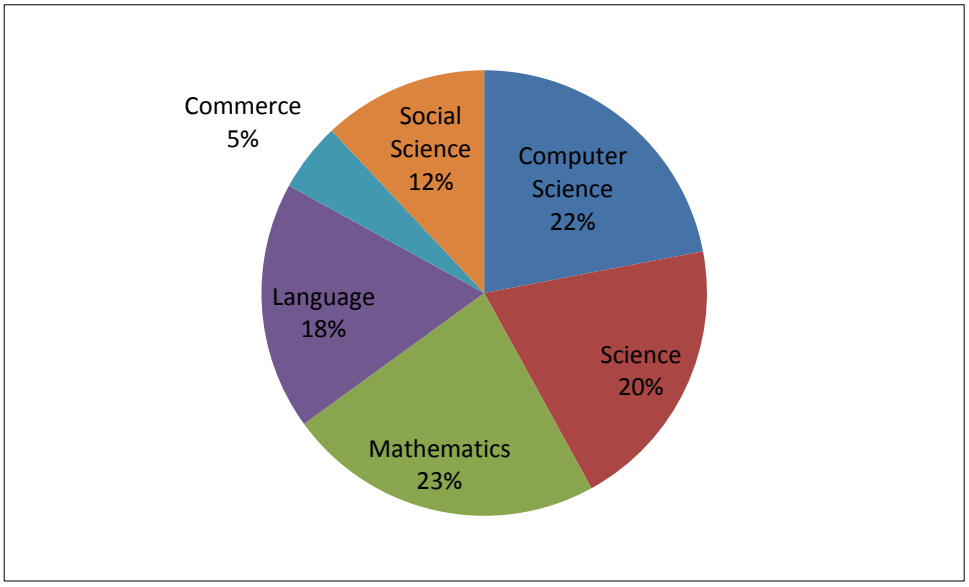

Fig. 2.1(c) | Percentage of teachers by subject teaching

2.3.2. Student Profile

Out of 713 students, 58% of the student respondents were from urban and 42% were from rural schools.

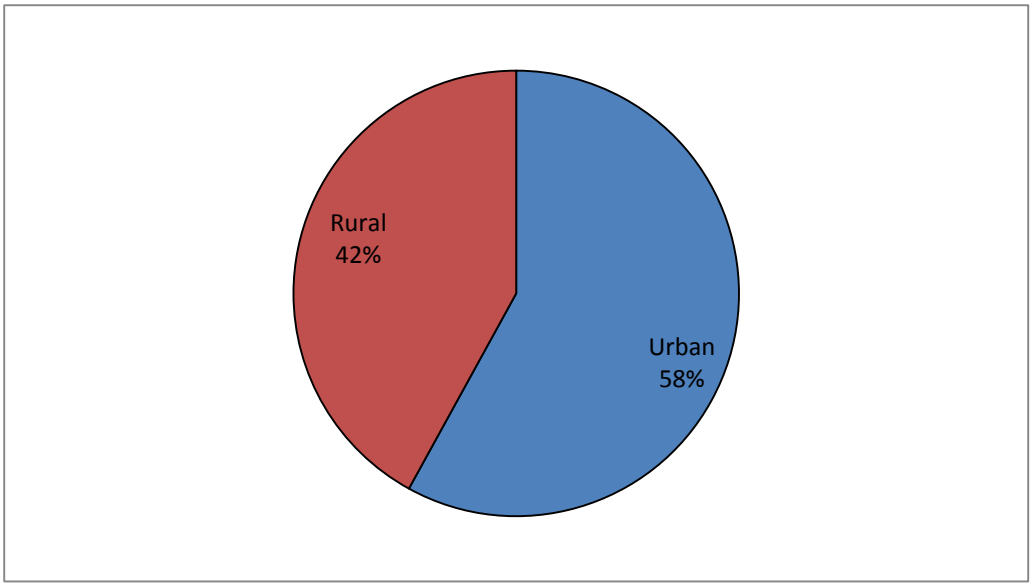

Fig. 2.2(a) | Students by location

All the students were from classes 9th to 12th. More students from classes 9th and 11th were covered as students from classes 10 and 12 were busy preparing for their board examination.

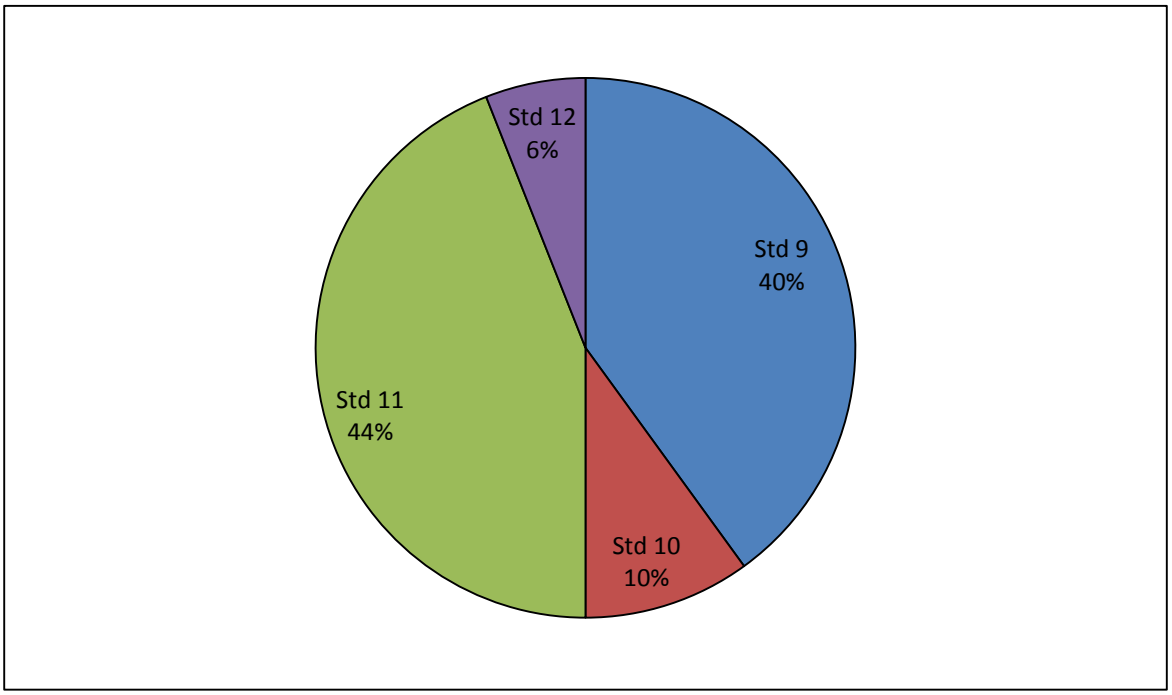

Fig. 2.2(b) | Percentage of students by class

Therefore the number of students selected for the sample of the study was 40% from class IX, 10% from class X, 44% from class XI and only 6% from class XII.

2.3.3. Parental Background (education & occupation) of students

The educational profile of the parents* of the studentsshows that about half of the parent population from urban areas and a quarter from the rural areas were graduates. However, one-third of the parent population in rural areas had not completed their school education and 4% were not educated, as shown in figure 2.3 (a).

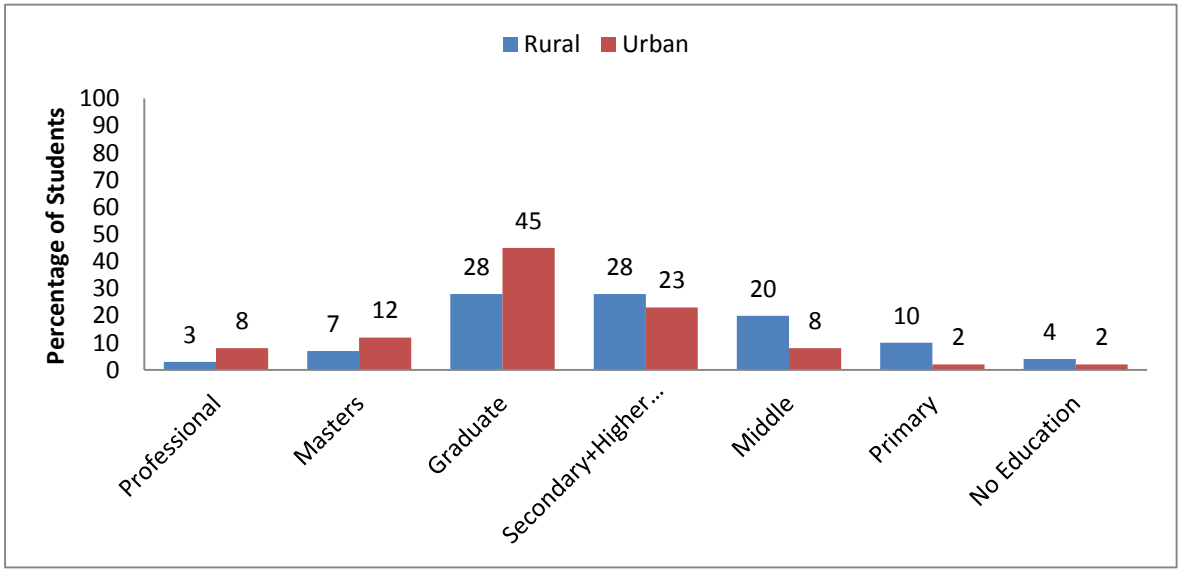

Fig. 2.3(a) | Percentage of students as per their parents'educational qualification

This difference in educational level of parents in rural and urban schools is also reflected in their occupation, as given in figure 2.3 (b). More rural than urban parents were manual workers. The service class constitutes maximum number both in rural and urban area; it includes varied professions, like military personnel; teachers; government services; engineers and doctors. An equal number of parents were into business from both urban and rural areas.

*Parents: Most of the respondents provided information about fathers education and very negligible about mother's education.

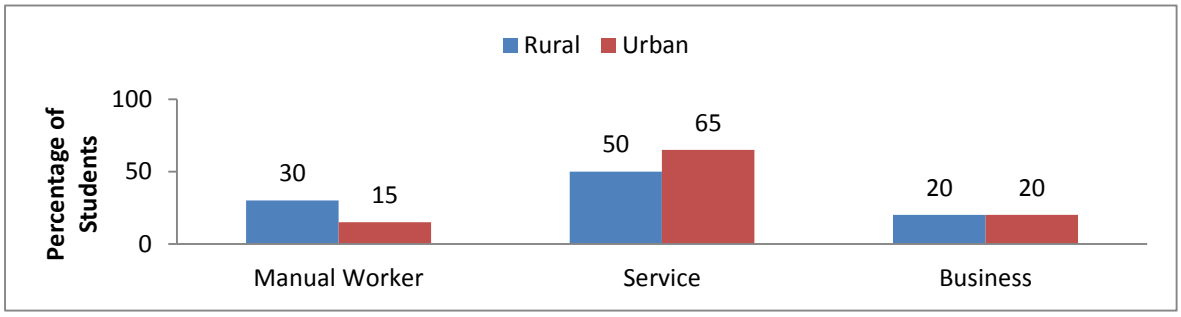

Fig. 2.3(b) | Percentage of students as per their parents' occupation

2.4. Tools used:

The first set of research tools was developed in October and November, 2011. These research tools were field tested in four schools in Delhi, Thiruvananthapuram and Chennai. In each school, an in-depth interview was conducted with the principal. The responses from the sample interviews were used to finalize the questions for the survey.

Teachers and students were interviewed using close-ended multiple choice questionnaires to collect quantitative data. They were also administered open-ended questionnaires as qualitative tools through which the respondents were asked to elaborate their experiences with ICT deployment & usage in their schools in the form of anecdotes or case studies.

The following tools were used:

2.4.1. Student Questionnaire

The student questionnaire for students covers major areas like students's perspective of ICT, ,infrastructure in school, knowledge of ICT, creative use of ICT its benefits and challenges. Each area includes several questions. The student questionnaire also consists of the profile of the students.

2.4.2. Teacher Questionnaire

The teacher questionnaire consists of questions related to 13 broad themes. It also includes categorization of school by management, their educational qualification, classes and subjects taught by them, infrastructure available etc. The tool also includes questions related to the use of technology including creative use and procedure followed by them, their knowledge and competency level. Each theme has many questions to collect deeper understanding and use of ICT from the teachers.

2.4.3. Principal Questionnaire

This questionnaire consists of 46 questions. These questions are related to the profile of the school, availability of infrastructure, use of ICT by teachers in different subject areas and students. Pilot testing of the questionnaires provided crucial input for restructuring the questionnaire, particularly the length and language used in questions.

2.4.4. Case Study

For validating the data, case studies of schools were conducted where ICT have been used successfully.

2.4.5. Field Notes

During data collection, the field investigators noted important observations and points in their diaries.

2.5. Process of Data Collection

For collecting the data of students, teachers and principals, a team of 24 Research Facilitators (RF) was trained on all facets of the program for handling data collection. Since this research was designed to target different geographical locations, orienting the Research Facilitators (RF) on conducting the study on ground was a key factor.

The orientation for the Research Facilitators was conducted in two phases. Phase I was primarily a video conference with all the state based Research Facilitators to share their thoughts and views on research tools that were sent to them before the discussions. The feedback was incorporated in the final questionnaire.

Phase II of the Research Facilitators orientation took place on site in face to face mode. The Research Lead Team visited all the locations and accompanied Research Facilitators for data collection to a few schools so as to keep in touch with the ground realities. Since the emphasis was on gathering quality responses also from respondents. The Research Facilitators were grouped together in small numbers of two to three at a time and were explained the scope and purpose of the study at length as well as the context of the questionnaire.

Structured interviews, based on the questionnaire, were conducted with the principals of schools.

Teachers and students questionnaires included close-ended multiple choice questions as well as administered open-ended questionnaires through which the respondents were asked to elaborate their experience with ICT deployment and use in their schools in the form of anecdotes or stories. Focus group discussions were also held with the students based on the questionnaire.

Questions regarding change are often difficult to answer in objective formats. Experiences are personal to each individual and even if an overall experience of an intervention is negative, a discussion or narrative can draw positive inferences which sometimes become a reason enough to pursue the intervention in some modified form. The stories of who did what, when and why and the reasons for the event's importance (Dart 1999a, 1999b) are critical in understanding an intervention particularly when subject-base is as varied as in this study.

The following steps were followed for the process of data collection:

Research Facilitators prepared a schedule of school visits. In each school, they accessed school technology infrastructure and used class schedules to attend technology-oriented classes to understand use of technology in classrooms. In addition to collecting filled in questionnaires, Research Facilitators sought, collected and documented anecdotal instances and views of the respondents.

In all schools, Research Facilitators conducted face-to-face interview with the principal based on a semi-structured questionnaire. In many schools, principals' interview was also recorded using technology and was later transcribed by the Research Facilitators. Teams responsible for data collection had to follow the schools' academic and holiday calendar. Since the calendars of different states did not match, the team had to work on six separate data collection schedules.

Technology was not used for data collection though it was used for collating and tabulating the data.

2.6. Data Analysis

All data gathered was cleaned before being analyzed. Descriptive Statistical method was used for data analysis. The results were presented in percentages and counts in all tables and charts. The data were also triangulated collected through questionnaire, focused group discussions, case studies and field notes.

To conclude, it can be stated that this chapter has mentioned the roadmap for conducting the study.

3. ResultsandDiscussion

This chapter focuses on the analysis of data, its interpretation and results related to availability of Information and Communication Technology, infrastructure of ICT in schools of Delhi, Kerala, Gujarat, Maharashtra, Tamil Nadu and Puducherry. The infrastructure of ICT included availability of computers; adequacy of ICT infrastructure; internet connections; ICT peripherals; school website and maintenance of technical support. This chapter also discusses the use of ICT by students, teachers and principals in schools of all the six states. Four case studies of schools where ICT has been used successfully are also given in this chapter.

3.1. Infrastructure

The access of ICT in any school depends on the adequacy and the quality of available infrastructure. This section presents ICT infrastructural issues as reported by schools. Issues of ICT maintenance and technical support were also examined in addition to the access of computer and internet by teachers and students in schools. The number and location of computers in schools was also examined as a major factor for understanding access. All the data together provided insight into the issues that rose as a result of availability and access to infrastructure, and how these could be addressed. Specific probe areas where ICT facilities are used most often by teachers and students provides an understanding of usage patterns in schools. Specific reference is also made to the dedicated computer room and to ICT specialist and general classrooms. Finally, the chapter looks at the availability of ICT peripherals in schools, and it concludes by providing observations through case studies.

3.1.1. Availability and access of computers in school

Computers were available in 99schools including government, KendriyaVidyalayas, Government-aided and Private schools in the state of Delhi, Kerala, Gujarat, Maharashtra, Tamil Nadu and Puducherry. The results of the study reveal that the meaning of the terms “technology” and “ICT” isprimarily understood by respondents to denote computer, the internet and computer peripheral products (printer, modem etc.). This was true for teachers as well as students. This may be the reason that computer is the most popular device in terms of technology infrastructure. Only a handful of schools have installed interactive classroom technologies with digital content, hence penetration of ICT was low and mostly restricted to urban schools. The following figure indicates the range of technology available in schools.

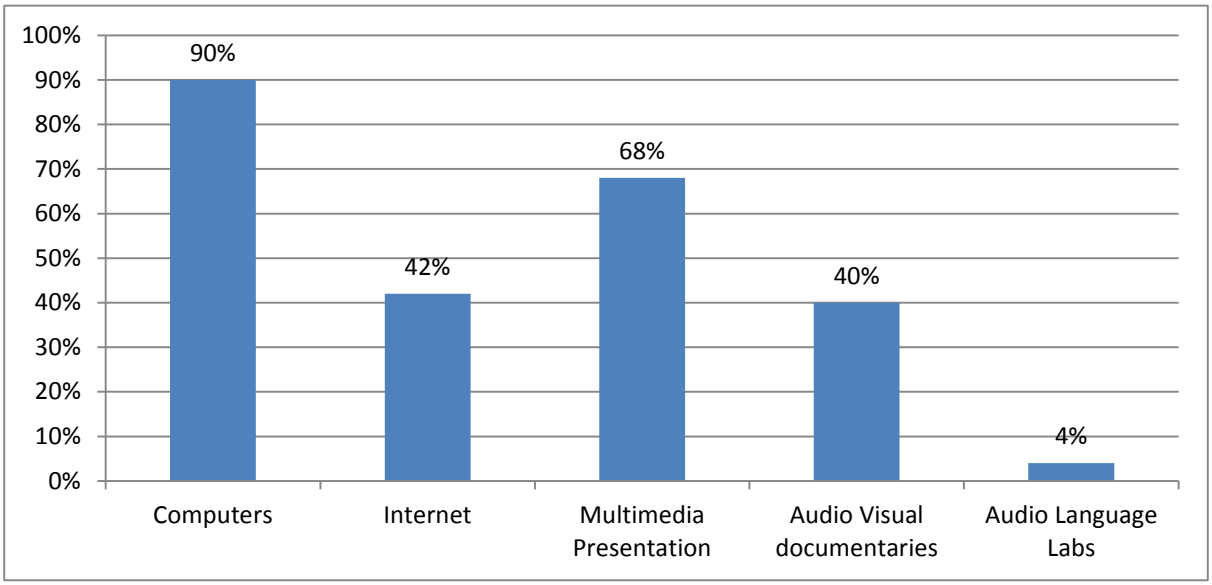

Fig. 3.1 | Range of technology infrastructure in schools

All the states putting together,90% schools were having computers and 68% were having multimedia presentation. Around 40% were having internet connection, and audio-visual documentaries. Audio-language lab was found only in 4% of the schools.

By and large, all the private schools had better technology infrastructure than the government schools as shown in Table 3.1. There was a sense of ownership for infrastructure in the private schools, which was often missing in the government schools. While private schools were seen to be having better technology infrastructure, there appeared to be complacence in upgrading the hardware once installed.

3.1.2. State wise availability of computers in schools

The table below presents the number of computer in schools in the state of Delhi, Gujarat, Puducherry, Tamil Nadu, Maharashtra and Kerala.

Table 3.1 | Details of no. of computers in selected schools in the states

	No. of Comps	Puducherry	Gujarat	Tamil Nadu	Kerala	Delhi	Maharashtra	Total
CG	1-5	-	-	-	-	1	-	1
	6-10	-			-	-	-	0
	11-15	-	-	-	-	-	-	0
	16-20	-			-	-	-	0

	No. of Comps	Puducherry	Gujarat	Tamil Nadu	Kerala	Delhi	Maharashtra	Total
	Above 20	1	3	4	5	1	5	19
SG	1-5	-		-	-	1	2	3
	6-10	4		-		1	2	7
	11-15	-		2	1	2	-	5
	16-20	2	1	1	-	-	-	4
	Above 20	3	8	8	6	2	3	30
Private	1-5	-	-	-	-	-	-	0
	6-10	-	-	-	-	-	1	1
	11-15	-	-	-	-	1	2	3
	16-20	1	-	-	-		-	1
	Above 20	1	7	1	7	-	9	25
Total		12	19	16	19	9	24	**99**

Though the number of schools from Puducherry, Delhi, Gujarat, Kerala, Tamil Nadu, and Maharashtra were 12, 9, 20, 20, 17, 32 respectively, which reduced to 12, 9, 19, 19, 16 and 24 post refining the data.

1. The State Government schools in Gujarat and Kerala were well equipped followed by Tamil Nadu. A total of 18 out of 19 schools surveyed in both Gujarat and in Kerala have more than 20 computers.

2. Tamil Nadu schools (SG) also boast of good infrastructure with 8 out of the 11State Government schools having more than 20 computers.

3. In Delhi, 10 State Government schools were surveyed and it was found that 2 schools had less than 10 computers.

4. In Maharashtra, 4 State Government schools surveyed in rural and urban areas had less than 10 computers.

5. It was found that Central Government schools (KVs/ NVs) were well equipped with computers. All Central Government schools surveyed, except one in Delhi, had more than 20 computers. In Puducherry, 4 state government schools had less than 10 computers.

Some schools surveyed had old and extremely outdated computers that did not function, and some had computers still lying in unopened boxes.

A case study of one such private school DAV, Khera Khurd, Delhi is given below:

Case study 1: Enhancing Access and Addressing Inequities

DAV School, KheraKhurd, is managed by a private trust in the rural outskirts of Delhi. The school caters to the low and middle income groups in the rural North-West district of the national capital region. The school has 15 computers installed in a computer lab. To encourage teachers to integrate ICT in their teaching practice, one computer (with internet connection) has been installed on each floor of the school building.

This is basically rural area so most students do not have access to the information technology outside their school. To enable access and to foster learning with technology skills effectively, the school mandates each class to be divided into two groups - one which uses the lab while the other undergoes a theory session in the classroom. This allows the students more space to learn and enables teachers to manage the class better.

Technology is integrated in the curriculum and pedagogies of the schools. The school also has an audio lab. It has two full-time technicians to train and help students create audio programs as part of the lessons. Students also create audio programmes on various social and environmental issues, and these are broadcast for others in the school.

The school has its own website and blog. Each teacher is required to check announcements made via the blog, and has to update the blog. There is a social networking section on the blog which is accessible to the students. The school lab remains open for teachers', students'and parents' use. The principal is very innovative and, leads the ICT transformation in the school with the support of her teachers. Garnering support of parents has helped them to break away from traditional myths about computer access (exposure to unsuitable content being one such myth) and bring about the technology revolution in the school

3.1.3. Adequacy of ICT infrastructure

The following table describes the perspective of teachers on adequacy of ICT infrastructure.

Table3.2 | Teachers' perspective on ICT infrastructure

Sl.No.	Teacher response	% of teacher response	
		ICT as a subject	ICT for Other subjects
1.	Sufficient	48	22
2.	Deficient	28	60

3.	Often remain unutilized	24	18

It is observed that 48% of the teachers found that that sufficient infrastructure was available in the school for teaching ICT as a Subject. Whereas only 22% teachers said that ICT was sufficient for teaching other subjects. At the same time 24% teachers reported that ICT infrastructure remained unutilized even while teaching ICT as a subject, similarly 18% teachers responded about non utilization of ICT infrastructure for teaching other subjects.

Putting together both sufficient and unutilized infrastructure indicated that 72% teachers responded the availability of ICT infra in schools for teaching ICT as a subject and 40% for teaching other subject areas. Only 28% teachers said the ICT infra for teaching ICT as a subject was deficient. At the same time 60% of the teachers found that the availability of ICT infra for teaching other subject areas deficient. This also indicates that the availability of ICT was more for ICT as subject than for other subject areas.

The perspective of the teachers about the infrastructure is graphically given in Fig 3.2

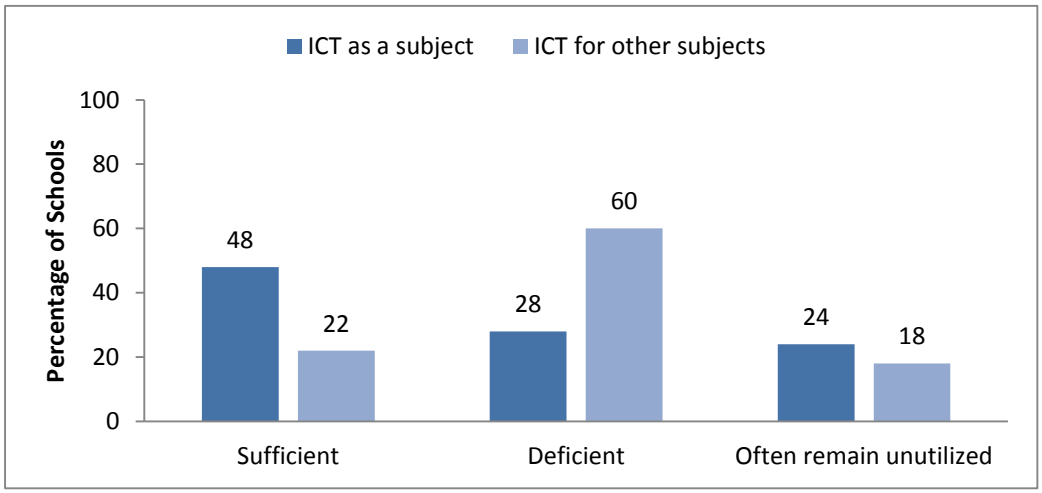

Fig. 3.2 | Infrastructure – teachers' perspective

All the above issues have collectively slowed down the integration of technology in secondary schools that were part of this study. The focus of meeting the challenges needs to shift to quickly resolving the access and integration issue and building new technology-enabled learning environments in schools.

The adequacy of ICT infrastructure in rural, urban, KVs, government, government aided and private schools is shown in Fig No.3.3.

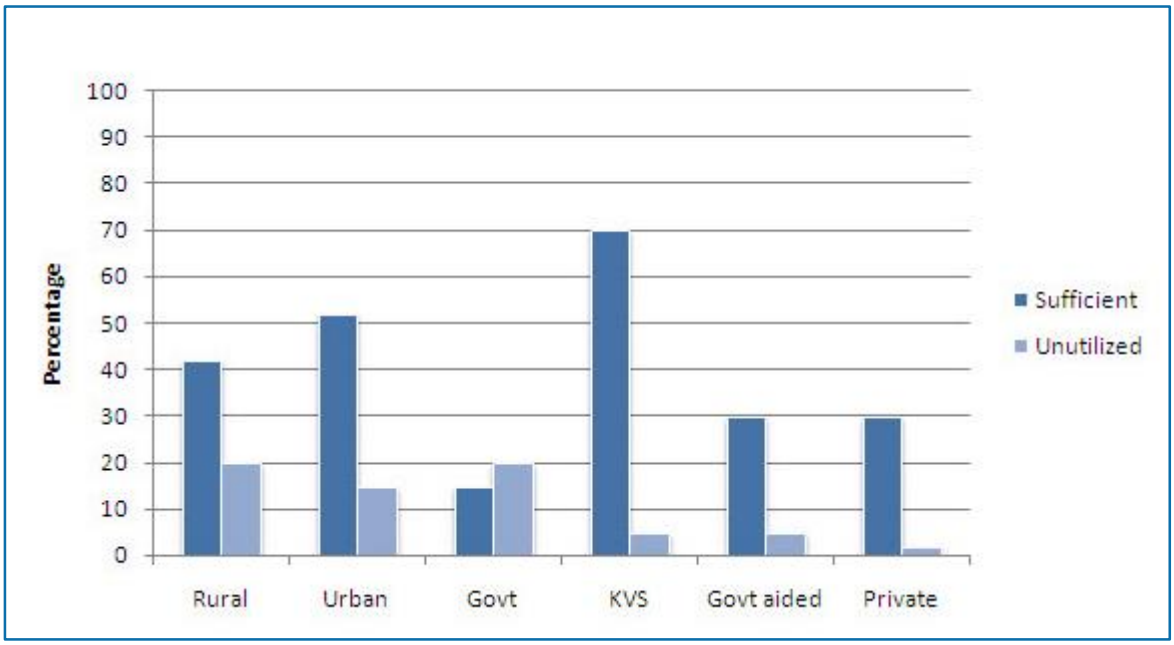

Fig. 3.3 | Adequacy of ICT infrastructure in schools

About 70% of the KVS teachers felt that ICT infrastructure was sufficient in their schools for teaching and learning IT as a subject. However, it was inadequate for integrating ICT in teaching-learning with other subjects. More than 50% teachers belonging to schools urban area said that ICT was sufficient in their schools, but it was found unutilized in 20% of the government schools. In rural schools 50% of the available infrastructure is unutilized.

The study also revealed that the level of penetration of ICT infrastructure is better in the urban schools as compared to the rural schools.The Principals of the rural schools who had access to the basic ICT infrastructure, such as computers, TV and radio expressed grave concerns about the quality of hardware. Some schools still had computers, which were provided years ago, are these lying unopened in their original cases. The justification provided was lack of trained teachers/ technical staff to handle and take responsibility of the ICT infrastructure.

In schools where ICT facilities were inadequate and unutilized (which is the case in majority of the government schools, both in rural and urban areas), it took a long time for the non-functional hardware to become functional. It adversely affected the access to ICT by teachers and students. This impacted the interest levels of both teachers and students. It is widely known and understood that while most teachers become adept in using computers and content after training they still look for technical support to sort out hardware problems. Thus it has been recommended that with relevent and adequate hardware support, teachers have the time and mental energy to concentrate on skill development for their subjects using the technology.

3.1.4. Student-computer ratio in schools

The student-computer ratio (SCR) is a good indicator of adequate computer availability. It is quite high in most of the schools studied for this report. Lower the SCR, better the availability of computers. The detail of student-computer ratio in schools is given in the table 3.3 :

Table 3.3 | Student computer ratio in school

Sl.No.	Student-computer ratio	Types of school
1.	35:1 – 60:1	Rural
2.	25:1 – 50:1	Urban
3.	35:1 – 150:1	Government & Government Aided
5.	14:1 – 24:1	Kendriya Vidyalaya

From the above table, it appears that student-computer ratio (SCR) varies from 35:1 to 60:1 in rural schools. The SCR also varied significantly in urban schools i.e- 25:1 to 50:1 for private schools and 35:1 to 150:1 in government and government aided schools. However, the situation was much better in Kendriya Vidyalayas which have an SCR range of 14:1 to 24:1.

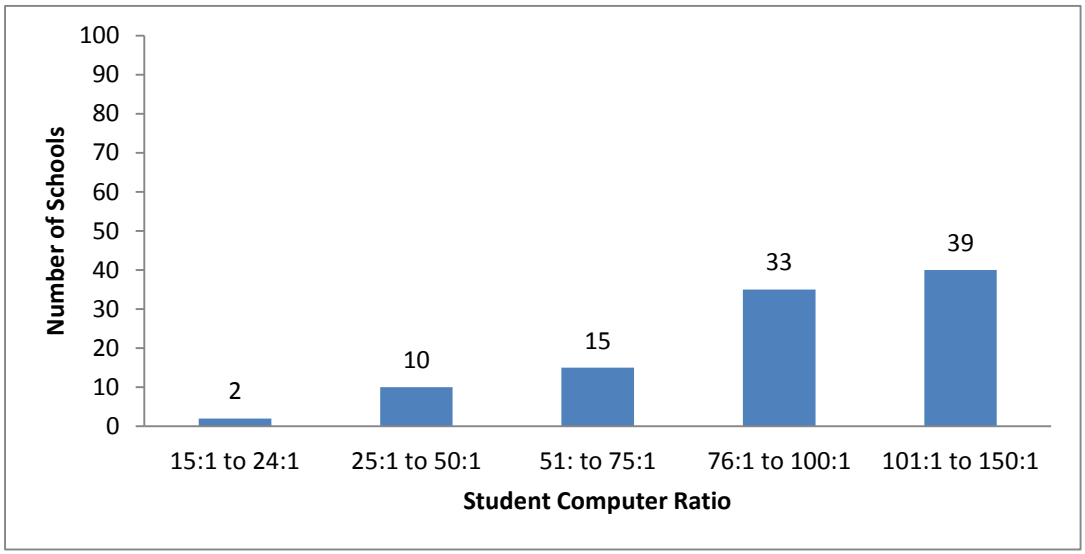

Fig. 3.4 | Student-computer ratio (SCR) in schools

Though the data was collected from 110 schools, however after cleaning, data was found only in 99 schools.

The fig.3.4 clearly reveals that, only two schools had student-computer ratio between 15 to 24 students per computer, 10 schools between 25 to 50 students per computer and 15 schools between 51 to 75 students per computer. A majority

schools had student-computer ratio between 76 to 100(33 schools) and 101 to 150(39 schools) students per computer.

There was a lot of variation in the number of usable computers in each of the schools studied. It varied greatly in rural and urban schools and in different types of schools as well. It is observed that in rural schools, the number of usable computers ranged from 10 to 35 computers per school. In urban schools, the range was from 15-40 computers, which is far less from the optimum quantity – generally taken as 5:1 to 10:1 that is required for effective learning by each student of the school.

3.1.5. Internet connection in schools

The detail of internet connections in schools of all the states is given in Fig 3.5

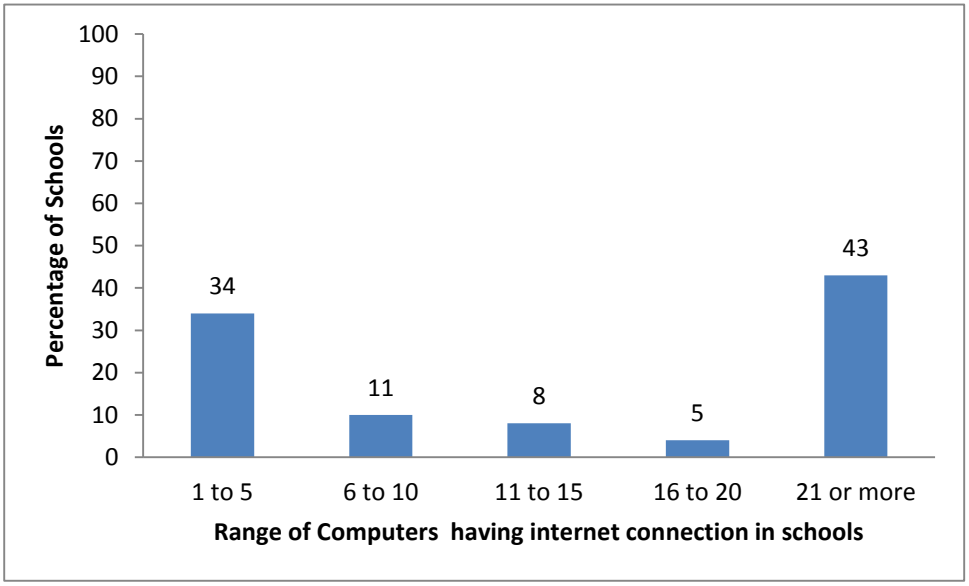

Fig. 3.5 Internet connection in schools

A total of 99Schools have either broadband or dial up internet connection. However the teachers reported that (i) internet connection was limited to 1 to 5 computers in 34 schools, (ii) internet connection is given to 6 to 10 computers in 10 schools, (iii)in 8 schools internet connection was given in 11-15 computers. (iv) 4 schools reported to have Internet on 16-20 computers and 43 schools reported to be having Internet facility on more than 20 computers. All schools surveyed had 10 or less internet connected computers. Most State Government schools in Delhi have only 1 to 5 internet connected computers. 80% of students reported that “internet access is strictly reserved for staff members or for supervised groups of students.” However, when this matter was discussed with the teachers it was observed that internet acts as a very valuable teaching resource. Details of number of internet connection in all six states/UTs are given below:

Table 3.4 l Details of number of internet connected computers in selected schools in the states

	No. of connected comps	Puducherry	Gujarat	Tamil Nadu	Kerala	Delhi	Maharashtra	Total
CG	1-5	-	-	-	1	1	2	4
	6-10	-	-	-	-	-	-	-
	11-15	-	-	-	-	-	1	1
	16-20	-	-	-	-	-	-	-
	Above 20	1	3	4	4	1	3	16
SG	1-5	-	2	8	1	6	5	22
	6-10	6	-	1	-	-	1	8
	11-15	-	3	2	1	-	-	6
	16-20	2	1	-	-	-	-	3
	Above 20	1	3	-	5	-	1	10
Private	1-5	-	2	-	6	-		8
	6-10	-	-	-	-	1	1	2
	11-15	-	-	-	-	-	1	1
	16-20	1	-	-	-	-	-	1
	Above 20	1	5	1	1	-	9	17
Total		12	19	16	19	9	24	99

While conducting the state wise survey, it was found that Gujarat and Kerala are the front runners on internet connectivity, with 11 and 10 schools respectively having more than 20 computers with internet connectivity. Kerala also has better connectivity in government schools over private schools. As the data shows, Tamil Nadu is having less internet connection in computers i.e.(majority of rural State Government schools only have5 to 10computers with internet connection). In Maharashtra, 7 schools were found having internet connectivity on 1-5 computers and 2 schools had internet connectivity on 6-10 computers. The private schools were found to be better connected than the government schools in Maharashtra.

3.1.6. ICT peripherals

The Schools were also asked about availability of other ICT tools & peripherals like Smart Boards, Projection Systems, Printers and Scanners in the school for teaching &learning.

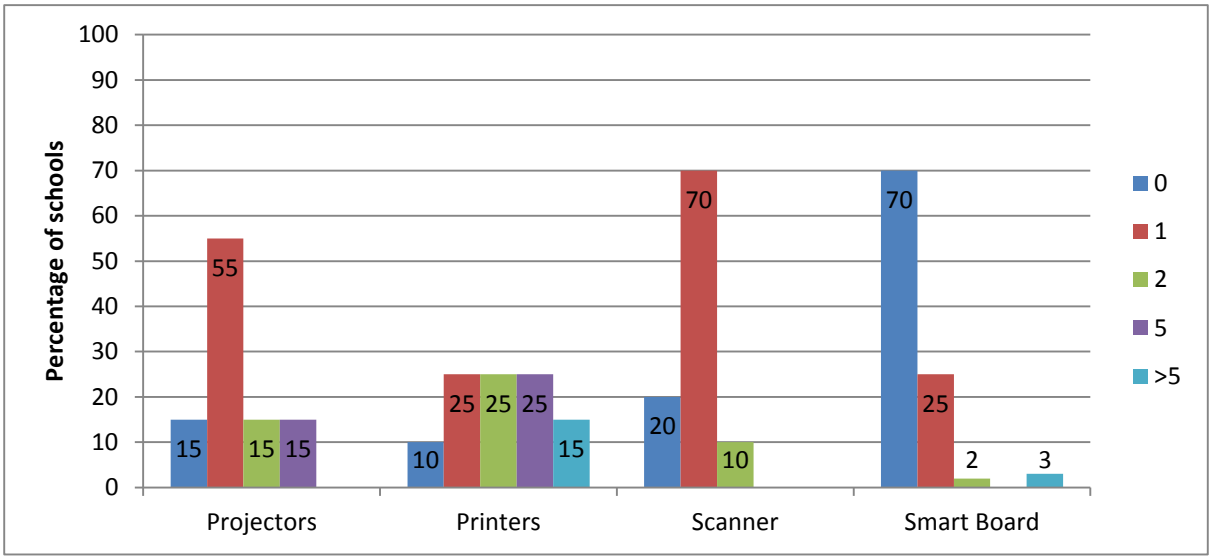

Fig. 3.6 | Availability of peripherals

The School Heads and Teachers when asked about other ICT peripherals (Fig 3.6), their responses are that 70% schools were having one scanner, whereas 10% were having 2 scanners and 20% schools reported not having any scanner in their school. It was reported that 55% schools were having one Projector, 15% schools have 2 Projectors and 15% schools were having 5 Projectors and 20% did not have Projector. Smart boards were not available in 70% of schools. More than one printer was available in about 25% schools. The range of peripherals available in schools was highly dispersed and no standard pattern emerged from the data to distinguish rural from urban schools though overall availability was found to be low in most of the rural schools. The availability is definitely better in some private schools (not all), especially in urban areas and Kendriya Vidyalayas (KVs). However, Smart boards were not found in all the Kendriya Vidyalayas. The most common gadget available was the printer. However, its use by students, barring the students of KVs was limited.

Availability of e-educational material, subject software and school website

The e-Educational materials consist of generic knowledge enhancing material whereas subject softwares are related to specific subject areas.

The availability of softwares and school websites has been shown in the Graphs in Figure 3.7(a) locaiotn wise and as in Figure 3.7(b) type of schools

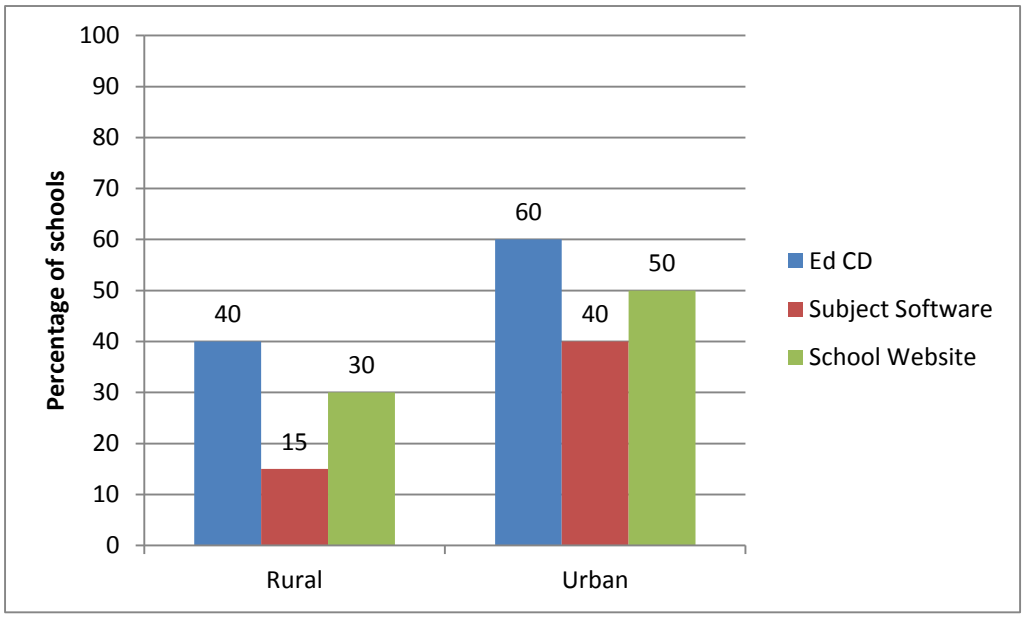

Fig. 3.7 (a)| Availability of e-educational material, subject software and school website

It appears from the above graph that all the three educational softwares are available more in urban area school than that in rural areas. The availability of subject software is minimal as compared to the availability of Educational CD(Ed-CD) and School website.

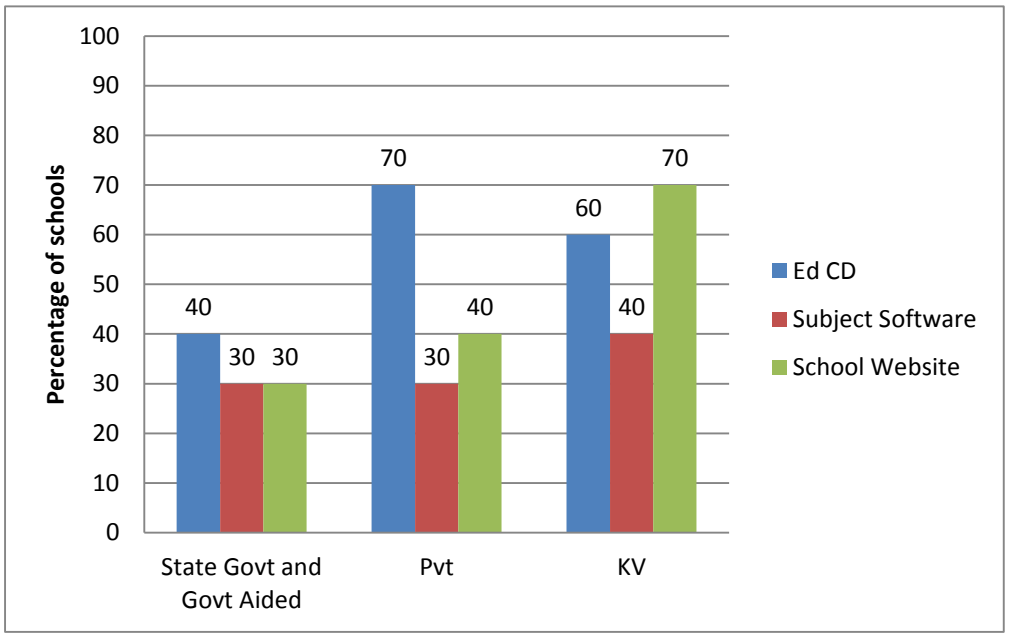

Fig. 3.7(b)| Availability of e-educational material, subject software and school website

The Fig 3.7(b), shows that school website was available in 70% KVs, 30% in State Govt. Schools and 40% in private schools.

KVs take the lead regarding Web Site and Private schools have more educational CDs.

In general, it was found that limited areas of the school curriculum were supported by e-material and software. Rural schools were at a disadvantage in comparison to the urban schools, presumably due to non-availability of materials in rural areas. Private schools and KV were in a better position to provide e-learning experience to their students as compared to government schools. While more than 90% of the schools outsource the e-learning material, 10% of teachers reported that they prepared their own educational CDs. Most commonly available e-materials were for Math and Science. From the field notes it was observed that software were available for only particular curricular areas (math and science). The most popular software was for the English language. The study data however, mentioned that the software was not regularly used. It is also interesting to note that a small number of responses mentioned about the lack of software available in schools despite grants being provided for purchasing equipment, peripherals and software. Rural schools whether government or private were facing disadvantage in terms of availability of e-material or software.

Kerala has the highest number of schools using teacher-created digital lessons, which can be attributed to the integrated teacher training as part of the IT@School project.

Gujarat also takes the lead with many schools using educational CDs. Subject wise data analysis revealed a relatively high proportion of teachers using subject specific software to teach Science and Social science followed by Math, but was seldom used for language learning.

It is clear that many teachers were unaware of the range of e-material and software already available to them in their school.

3.1.7. School Websites

Schools with their own website consider it as an important means of informing the public&parents about their school and for promoting the work done in their respective schools. Some websites contain information on initiatives and projects that the school has undertaken, whereas a few have examples of work done by students.An average of 40% of all teachers, about 50% from urban and 30% from rural schools stated that their school had a website. 70% of the KVs have their own website.

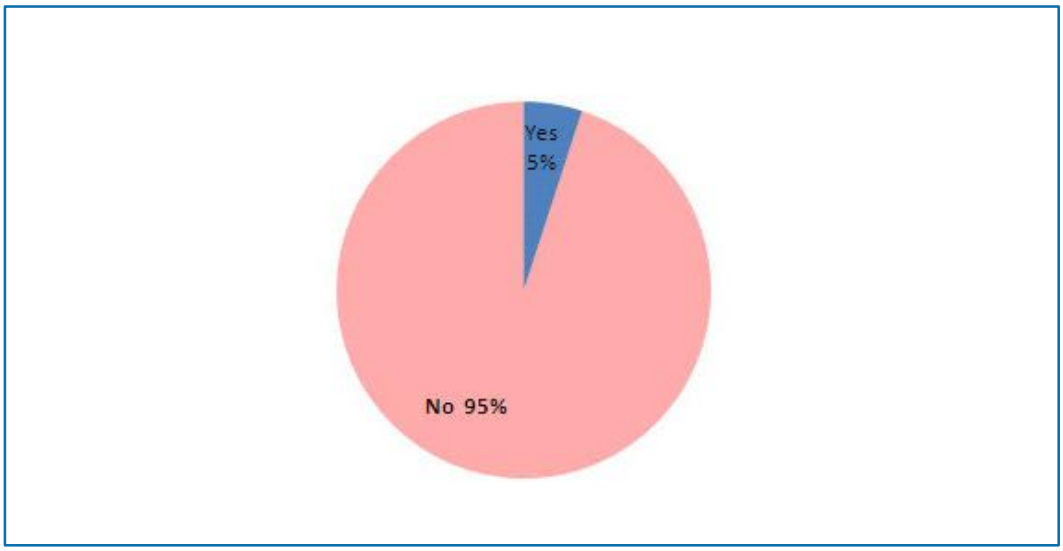

Fig. 3.8 | Percentage of student work uploaded on school website

Of the schools having the Website, only 5% reported that their site contained a reference to, or details of project work or other work done by students. Fifty percent of students did not know whether their school had a website.

3.1.8. ICT Maintenance and Technical Support

The study reveals that both quality &availability of infrastructure was an issue in the schools, especially in the government schools in rural areas. Benefits of ICTs are leveraged not only by mere presence of technology in the schools, but by maintaining quality and providing access.. The study highlights that out of the schools that have technology, 69% of the government schools had technology that is old and outdated. Most of the computers were more than 8 years old. Putting together the obsolete technology, the student to computer ratio reduces the effective access of computers by students

The Technology becomes obsolete very fast and the computers in many schools were found to be very slow (with very less RAM). In the regime of low student-computer ratio (SCR), this obsolescence of technology reduces the effective access to students as just a miniscule of the computer time available. For example, when a computer is shared by 3-5 students, its obsolescence makes it extremely slow and the effective and useful availability per student becomes abysmally low. Once provided, neither the technology equipment were upgraded regularly nor any new equipment procured fresh.

The problems associated with the lack of technical support and maintenance was commented upon strongly in the study responses from principals and teachers. These respondents' comments provided an insight into the complexities faced by some schools regarding this issue.

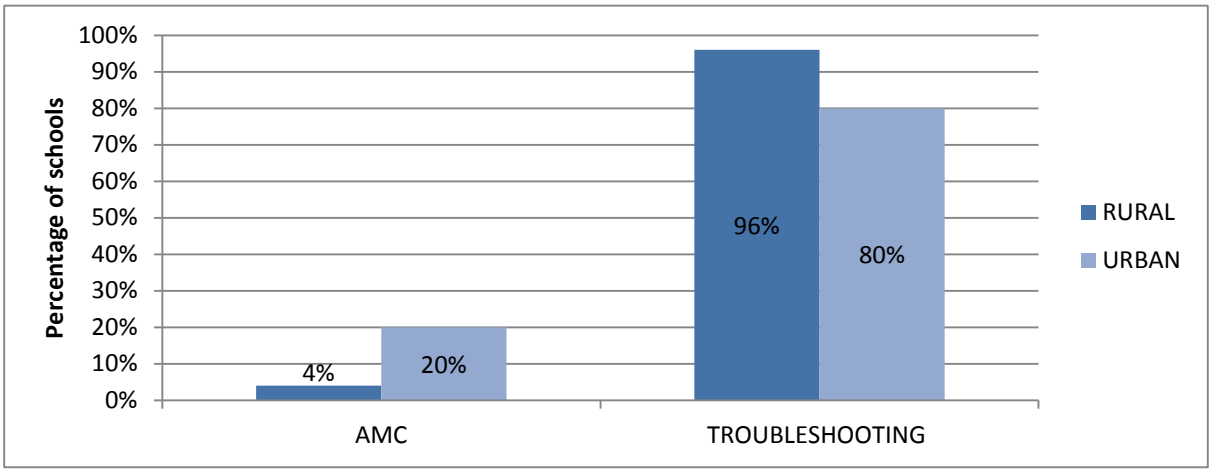

Fig. 3.9 | ICT maintenance and technical support

Teachers commented:

"The problem is the maintenance of the computers. Sometimes the computers were less [due to the fact that some are not working]; and when one goes to the computer room, one will find some of them are not working. There are 20 computers and maybe five are not working and 15 of them are working."

"Most of the IT equipment in the school are old, and constantly giving trouble. We have no technical expertise amongst the staff so maintenance is a problem. Teachers are discouraged and frustrated and the use of ICT becomes a negative experience for both students and teachers".

Many schools reported that the maintenance, upgradation and technical support of their ICT equipment was a cause of great strain and consumed significant amount of their budget which is either allocated from a government fund they receive for ICT or out of PTA fund. Only 4% rural school and 20% urban schools had made provision for AMC and regular maintenance of their hardware (mostly private schools and), by having an annual contract with external agency, while other schools were only troubleshooting in both rural and urban areas. In schools where such a facility is not available (majority of the government schools, both in rural and urban areas), it takes a long time for the non-functional hardware to become functional. Schools with no hardware maintenance system stated that this acted as a significant impediment to the development of ICT in their school. In general, schools do not have the expertise within their current staffing to maintain their ICT systems.

3.1.9. Availability of Power Supply

Uninterrupted power supply to computers and other peripherals affect use of ICT by teachers and students significantly. The availability of electricity and other support for ICT hardware is given in the Fig 3.10

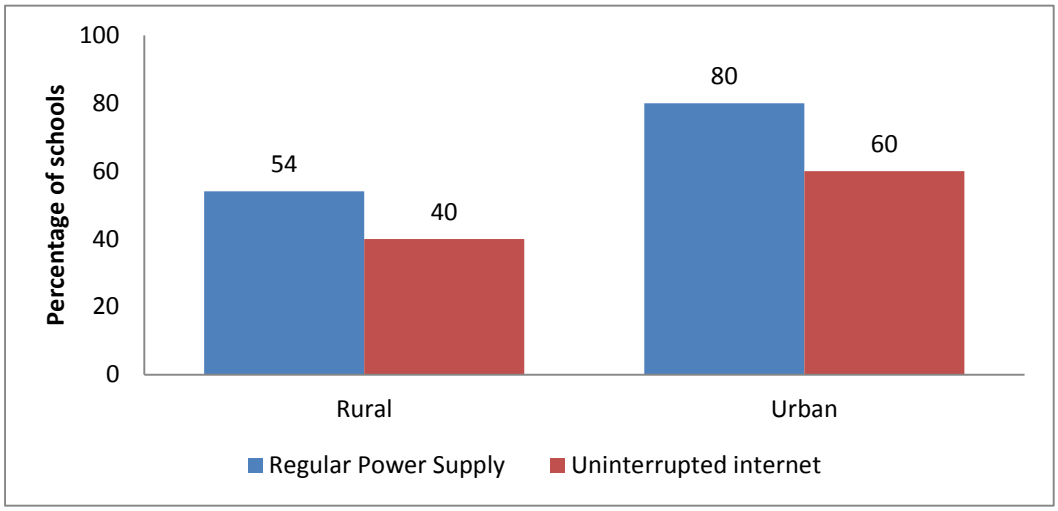

Fig. 3.10| Power supply and internet in schools

Almost 80% of urban and around 54% of the rural sampled schools of this study reported that they had regular supply of electricity. The problem of irregular electricity supply was observed more in the rural schools than the urban schools. However, wherever there was a problem with electricity, schools reported that they had installed a UPS this providing power for 1-2 hours. The problem was becoming more acute when there was power cut for longer duration. Availability of internet was also an issue, especially in rural schools and the schools which had generally dial-up network. The non-availability of computers and other peripherals, for whatever reason, impacts the interest levels of both teachers and students.

3.1.10. Installation of computers in schools

In planning the use of ICT in schools, the location of computers is also important. Computers are needed in all the places where learning is taking place, for example, classroom, staffroom, library and laboratories. The placement of computers in the schools is present below in graphical form:

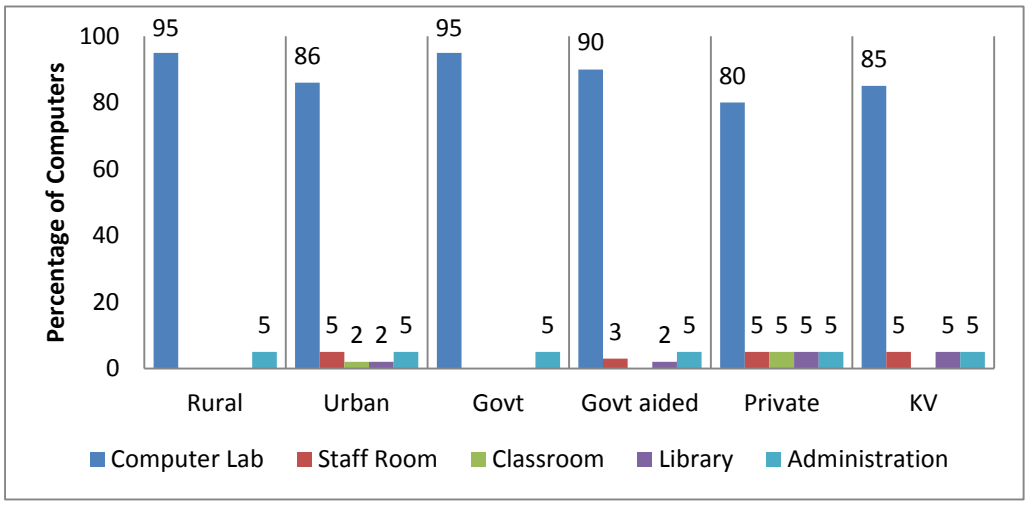

Fig. 3.11 | Location of computers in school

Most of the schools prefer to have a dedicated computer lab or room where all the computers are located, as shown in the above figure. About 95% of schools did not place computers in the library. The situation was more or less same in urban schools and also in government aided, private and KVS with little variations. Use of Computers by students, therefore, is more a function of access to a computer room than actual access to computers per se.

The computer room was generally used for teaching computer skills to full class groups and one computer was usually shared by 2-4 students or sometimes even more. In Most of the rural and government schools maximum computers were kept in the computer room for efficient management of the computers in schools. Private schools and KVs provided computers in staffrooms, library and even in classrooms. One Kendriya Vidyalaya in Delhi had made provision of one e-learning classroom in each grade.

In the sampled schools, 50% of principals felt that the main advantage of having a computer room was that it provided a more conducive environment for learning ICT than the classroom.

When computers are placed in computer labs, where usage time is scheduled according to the school time-table, these can only fulfil the requirements of IT as a subject (that is part of the curriculum), not for other subject related teaching.

About 96% of the students articulated that technology should be placed in the classroom. 94% of the teachers felt that it is vital for both teachers and students to be regularly exposed to the use of technology and therefore, technology should become part of the classroom itself. Teachers articulated that taking the students to the computer lab posed administrative and operational issues.

Almost 79% of teachers opined that at least one computer in the staff room should be provided. Some private schools and KendriyaVidyalayas where dedicated computer facilities were available for teachers' use in staff room reported that it encouraged the teachers to engage with the technology and that it also led to improvements in the quality of the resources used in teaching. The teachers also wanted a lab/ resource centre available for their research and preparatory work. There can be nothing better than a positive outlook – teachers in this study seemed aware of the possibilities available for technology access and came forward to express the need for it in their arena.

Locating computers in classrooms provides greater access to technology and learning opportunities for students. Studies corroborating teachers' views reported that from a teaching and learning viewpoint, the advantages of having computers in classrooms were threefold:

1. Convenience and flexibility of access.
2. Ease of supervision, control and assistance to students.
3. Facilitates individual attention and focus on children with special needs.

It is also important to note that only 50% of schools had networked computers in their computer labs. A significant number of labs also had a number of stand-alone computers.

3.1.11. Time table

Seventy five percent of the schools quantified the time for which computer rooms were used. In general a class in the computer room was of 35-40 minutes duration. The occupancy of the computer room ranged from 30% to almost 90%, of the given school time, with the average being slightly more than 60%.

In schools where the timetabled occupancy was low it was reported this was to allow teachers to use the computer room and its facilities as and when needed arose. Secondly teachers also mentioned practical difficulties involved in taking a group of students to the computer. It was reported that taking students to the computer room was made discouraging. For example, moving children from classrooms to a computer room for a 40 minute class means that the effective class time available for use is only 30 minutes; by the time children walk to the lab, settle for work, good 10-15 minutes are lost. Thus meaningful engagement cannot be expected in this short time span.

During an interview, a teacher concurred that time was a problem and stated, *"I wouldn't say that learners have enough time because there is only one room as the computer lab and we have an enrolment of 1300 students. There is a six-day cycle in this school, and each learner has one opportunity to use the computer laboratory every six days."*

Furthermore, a few ICT coordinators spoke of problems that tended to arise when there was unplanned and unsupervised use of the school's computer room by the teachers (for example technical problems, breakage, and tampering with systems). For subject teachers to make greater use of computer rooms, school management would need to ensure that a simple and accessible system exists for booking the room. It is also important that rules for the computer room are established and that these are regularly brought to the attention of all teachers and students who use the room.

3.2. Access to computers and peripherals

Access to computer and its peripherals plays an important role for using ICT in schools. The proportion of teachers and students having access to computer facilities is discussed below:

3.2.1. Access by teachers

In any school, where use of ICT is encouraged, teachers need to use the computer or internet to prepare for lessons and manage their classes. They can create instructional material, access model lesson plans, research based practices and can keep record of students. All teachers should have access to computers and other peripherals.

However, the ground reality in schools studied in this report was different. As mentioned earlier, only 5% urban schools have computers in staff rooms – that too only in private schools and Kendriya Vidyalayas. On an average, 40% teachers in any school can access computers whereas 25% teachers could access computers in rural areas. Teachers reported that household responsibilities prevent them from using computer at home though more than half of teachers had computers at home.

3.2.2. Access by students

The proportion of students who had access to ICT in schools is presented in the following figure:

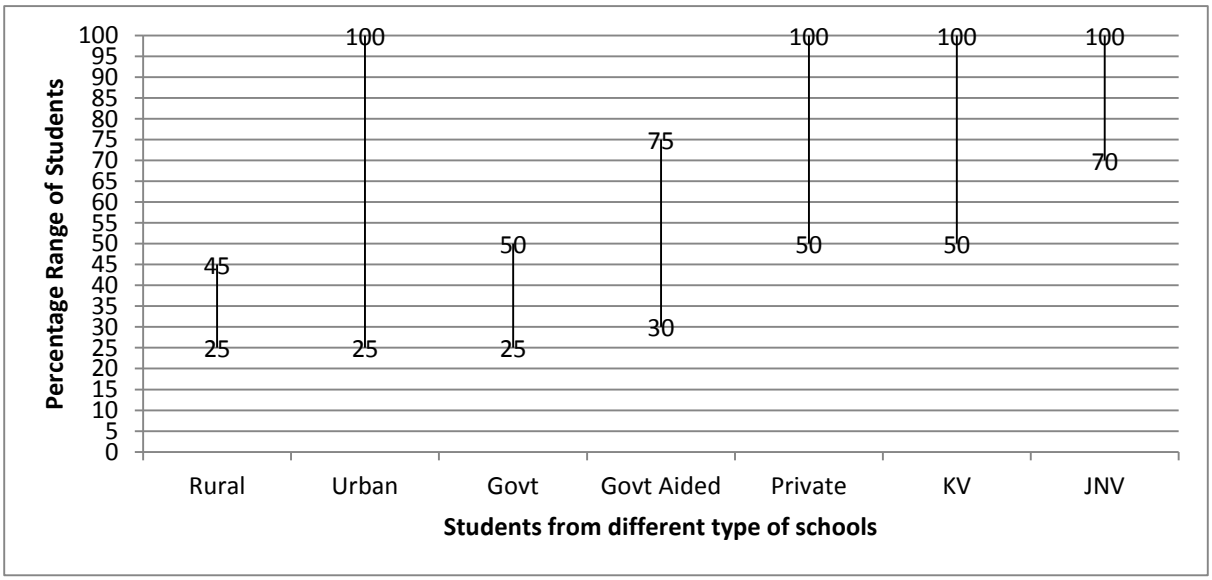

Fig. 3.12 | Proportion of students who have access to ICT in schools

The Principals and teachers reported that students' access to ICT in schools was 25-45% in rural schools where as in urban schools it was reported 25 to 100%, in urban schools, which was due to better access conditions in private schools, and Kendriya Vidyalayas. The variation in ICT access by students was far more in urban areas as compared to rural areas.

Government school children had less access to computers and peripherals .A large number of students in schools face constraints with regard to contact opportunities and this aspect of promoting ICT in schools was very challenging, thereby highlighting the infrastructure problems referred to earlier in the report. Therefore there is a need for more computers for the use of students.

Students were also asked about the access to computers in school as well as at home. Rural students were found at disadvantageous state both in school as well as at home. 20% students had access to computersat home in rural areas and similar percentage of student inGovernment schools, where as in private schools60% students had access to computers at home. A number of students, who did not have computers at home, tried to access technology at other places, such as a cyber café, a friend's or relative's house.

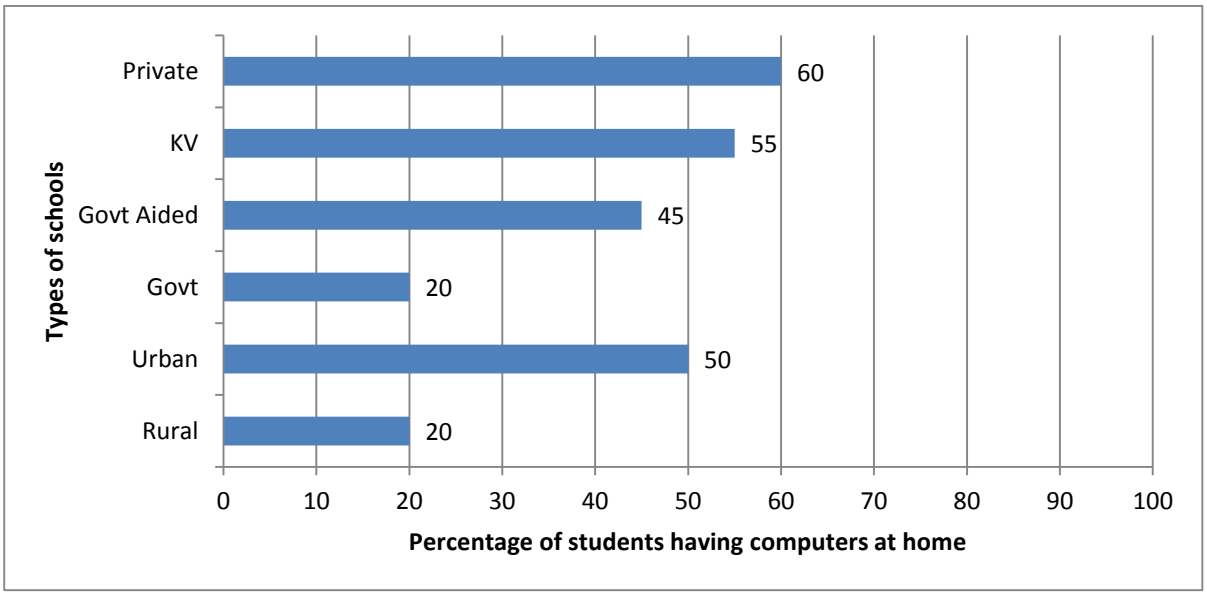

Fig. 3.13 | Proportion of students having access to computers at home

The study further inquired into reasons for not having a computer at home. Quite a large number of students (53%) did not have a computer at home because the high cost – affordability is an issue in the target audience studied in this report. 34% students used cyber cafe and small number i.e. 7% were not found comfortable using technologyand 6 % reported that their parents were not supportive. This issue thus needs to be dealt with as part of a socio-economic milieu that is a reality in many parts of India. Schools and ICT program makers need to respect that by providing equitable access in schools so these students are not excluded from mainstream agenda of 21st century learning and skills.

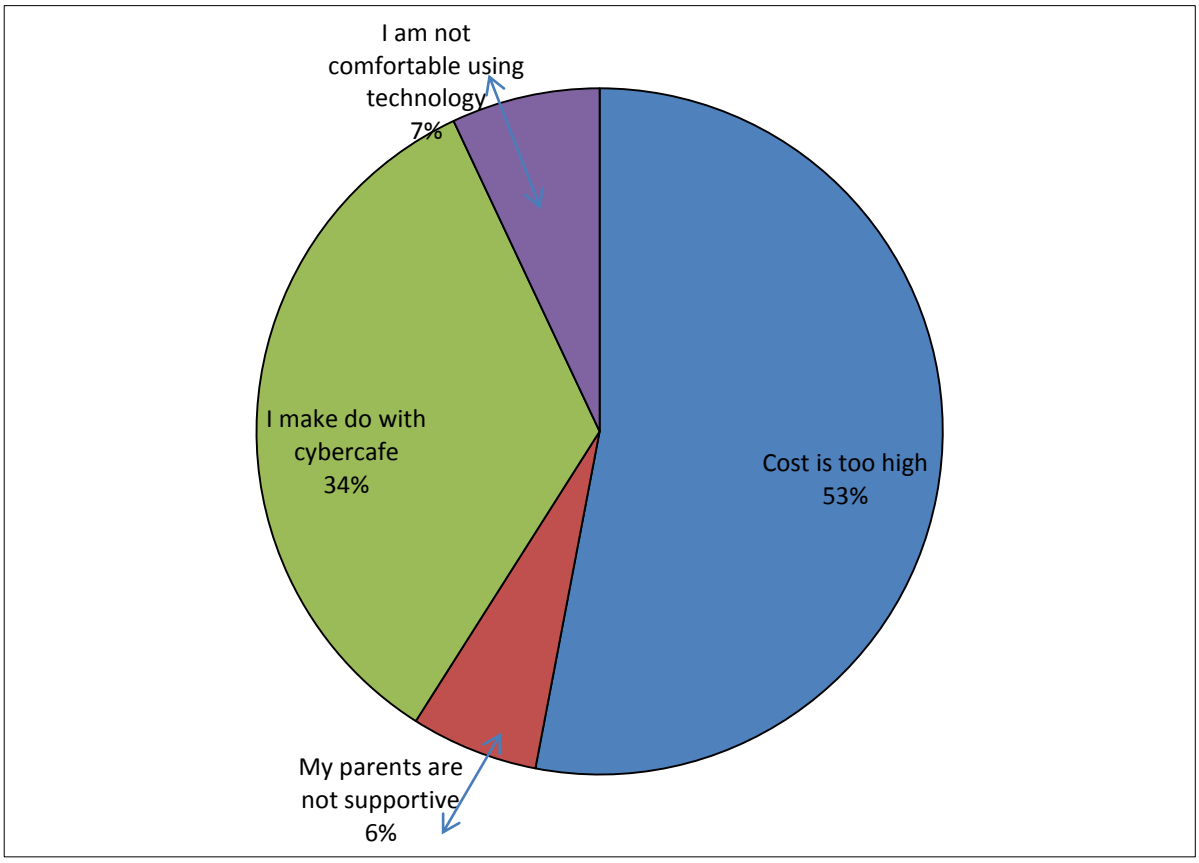

Fig. 3.14 | Reasons for not having a computer at home

3.2.3. Availability of manpower for ICT

Existence of infrastructure, being a prerequisite for accessing ICT, its efficient use is contingent upon the availability of trained and motivated manpower. It is believed that teachers hold the key to successful use of technology or ICT integration in schools. Investments in ICT cannot be deemed effective unless teachers learn how to use and integrate ICT into their teaching. Hence, from manpower standpoint, the barriers to ICT integration in schools were non-availability of ICT coordinators, lack of computer skills among teachers, low confidence, knowledge and skills to use the computer as a teaching tool and negative attitude towards the use of computers as a teaching tool.

About Seventy five percentage of the study schools have an appropriately trained ICT teachers/coordinator to take care of ICT infrastructure and teaching of ICT skills to the students.

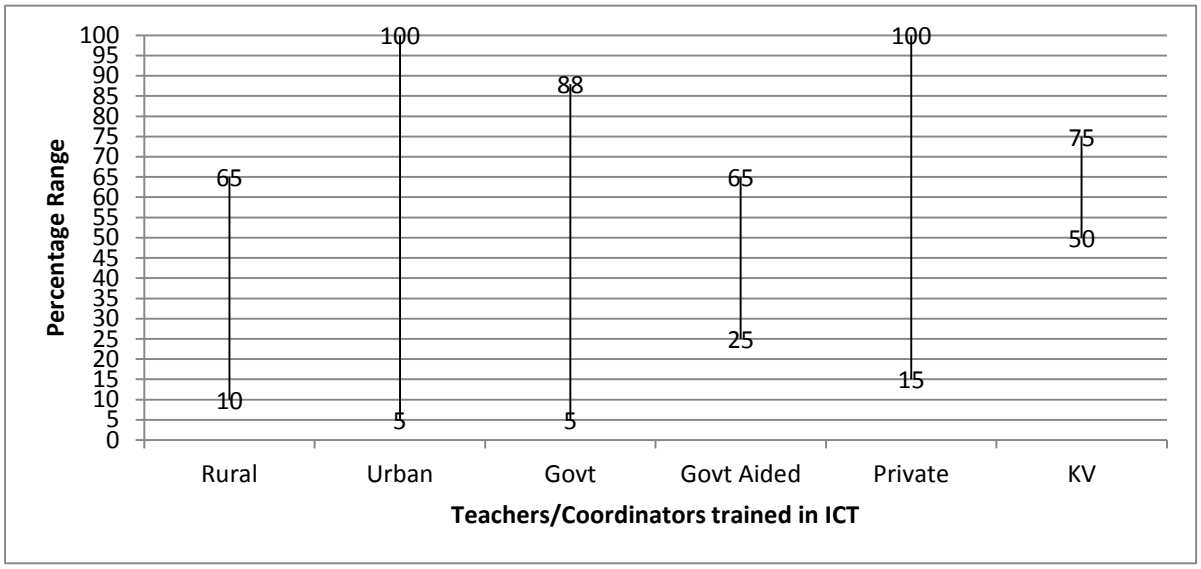

Fig. 3.15 | Proportion of teachers/coordinators trained in ICT

Teachers/coordinators trained in ICT vary from 10% to 65% in rural schools and 5% to 100% in urban schools. In govt. school this range was 5%-88% where as in government aided the range was between 25to 65 %,within the type of schools also there was large variation in the proportion of trained teachers. Although a large proportion of trained teachers had been reported by many schools, the principals felt that their competencies in use of ICT was just average.

It is essential that every teacher is trained in ICT skills and understanding of ways in which it can be integrated in teaching learning of their subjects.

3.2.4. Public Private Partnership for improving access and usage of ICT

Public private partnership (PPP) involve the public and private sectors working together to achieve important educational, social and economic objectives. PPPs can be defined narrowly to include only formal arrangements such as sophisticated infrastructural initiatives or they can be defined more broadly to cover all manner of partnership between the public and private sector.

In order to provide ICT support, the private partner builds, owns and operates the infrastructure facilities and the government uses these facilities for teaching-learning purposes, in lieu of which the private partner is paid a fee over the period of the contract or sometimes it is a philanthropic activity. This helps in overcoming the infrastructure and skilled manpower shortage. There are large number of cases throughout the country of PPP and Initiatives in which state governments have partnered with large private sector organizations and multinational corporations to help bring computer enabled education to the masses.

Schools felt that the private sector can provide support services with greater efficiency as compared to government sector because of specialization. Also, greater accountability of private staff leads to improvement of efficiency.

3.3. Usage of ICT

This section deals with usage of ICT for various activities in school and its contribution to teaching and learning in secondary schools. It examines how students and teachers were familiar with the relevant technology and its applications by looking at their ICT qualifications and skills. The section then reviews the use of ICT in education settings and its use in assessment, drawing on information collated from different category of schools.

3.3.1. Use of ICT peripherals

The range of peripherals used and the extent of their use are shown in following figure:

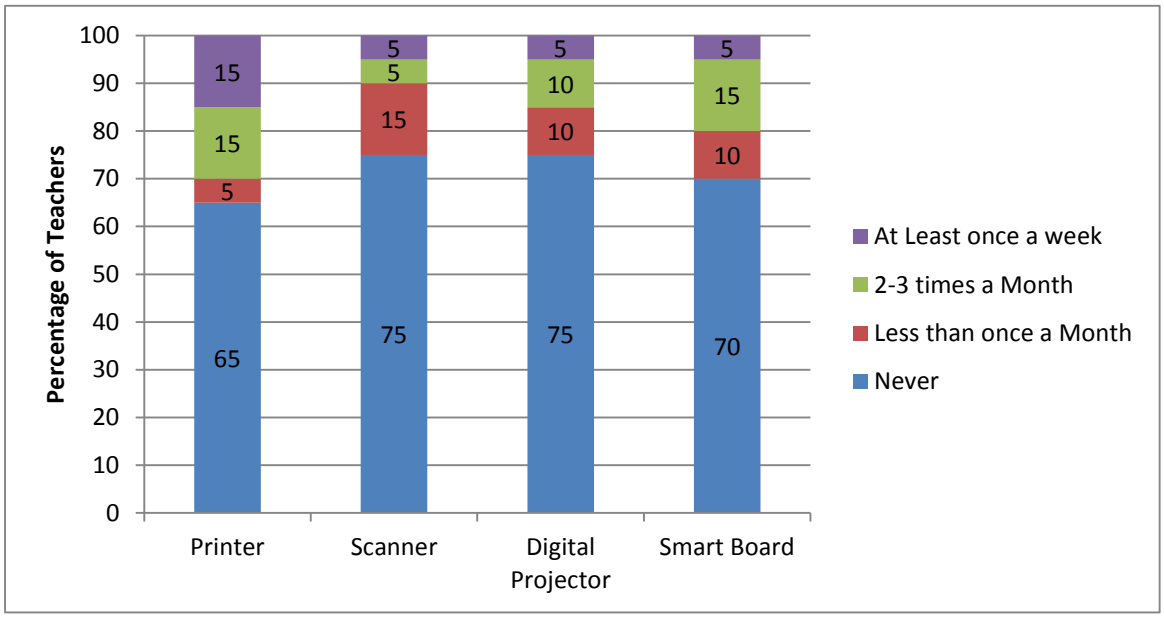

Fig. 3.16| Average percentage of use of ICT peripherals in schools where available

Printers were found to be the most frequently used ICT peripherals for educational purpose in schools. However 65% teachers never used printer,5% of the teachers reported making use of a printer less than once a month or and 15% at least two or three times per month. Only 5% teachers reported using scanner at least once a week,75% never used both scanner and projector. The next most frequently used peripheral is Smart Board which was used at least 2-3 times a month by 15% of the teachers though the availability of such boards is limited to only 30% of the surveyed schools. In generally it is observed that 5% teachers reported using scanner, digital projector and smart board at least once a week.

Analyzing data by subject area revealed that a relatively high proportion of teachers of English and Science used ICT peripherals in comparison with teachers of Mathematics and Social science. However, in absolute terms, the use of peripherals is still very low. For example, 80% of teachers from rural schools and 50% of urban teachers reported never having used a printer in their teaching process. 65% of the study schools reported availability of more than one printer. Teachers viewed the projector as a tool that could significantly enhance the teaching and learning process. Many described how the projector could "bring the subject matter to life" through, for example, multimedia presentations (i.e. presentations that include a combination of effects, such as animation, music, and text). It was also described as being a "visually effective tool," particularly from the students' viewpoint because of the larger screen it facilitated better interaction. Finally, a majority of teachers interviewed mentioned that using the projector will also allow them more time to engage with students as opposed to having to spend time writing or drawing on the blackboard.

3.3.2. Teachers' ICT skills

Teachers were asked to state their perceived level of proficiency in a number of important ICT skills areas. An analysis of the responses (presented in the graph) to this question showed that the majority of teachers did not consider themselves proficient in a wide range of ICT skills and applications.

Most teachers in the sampled schools were of view that bringing technology to the classroom was crucial as it provides a better world view on subject matter. Experts in technology believe that ICT skills come with practice and it is important for students and teachers to access technology on a regular basis. The figure 3.17 shows teacher specific skills related to the use of ICT applications, while figure 3.18 shows variations in applications of teachers for the use of ICT applications in different categories of schools.

Though only 10%-16% teachers considered themselves under "satisfactory" to highly satisfactory' or in terms of skills, competency, preparedness and comfort in the use of ICT,1%-3% of teachers considered themselves 'below average' in terms of knowledge and competency in ICT. More than 75% of teachers' self-perception about knowledge and competency indicated an average level. This shows an overwhelming number of teachers rated themselves as "average" on skills, competency, preparedness and comfort.

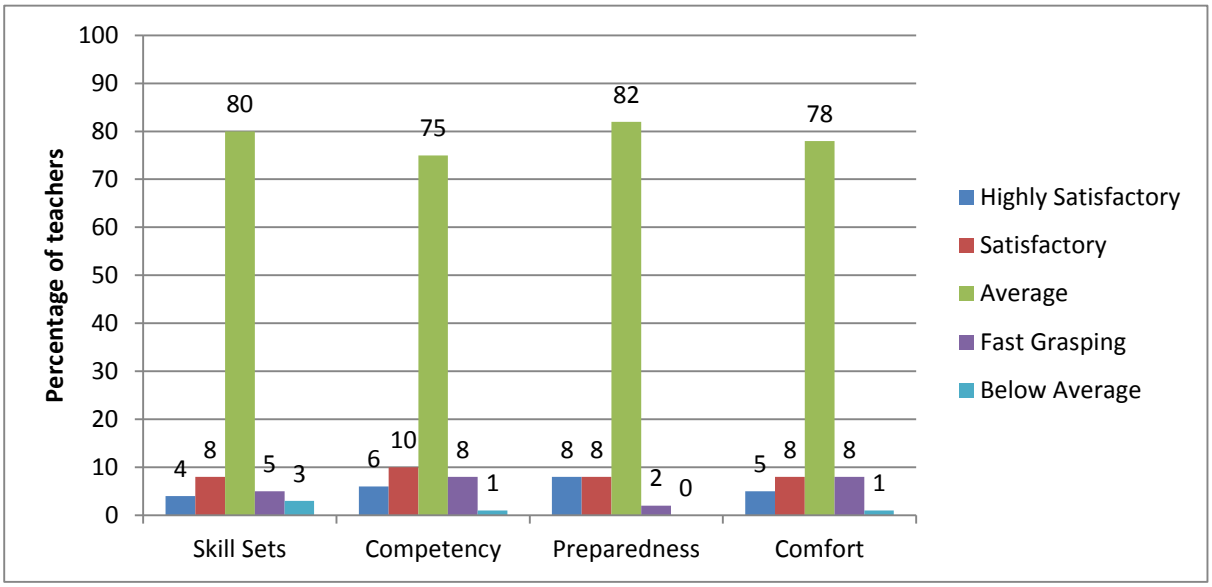

Fig. 3.17| Teachers' self-perception on knowledge and competency

Skills in ICT were in rural schools and in government school teachers. The proficiency of using computer for PowerPoint Presentation, internet surfing, email including word processing was low in rural and government schools. Only in KVs, more than 90% teachers had proficiency of using all the skills of computer as shown in the figure 3.18

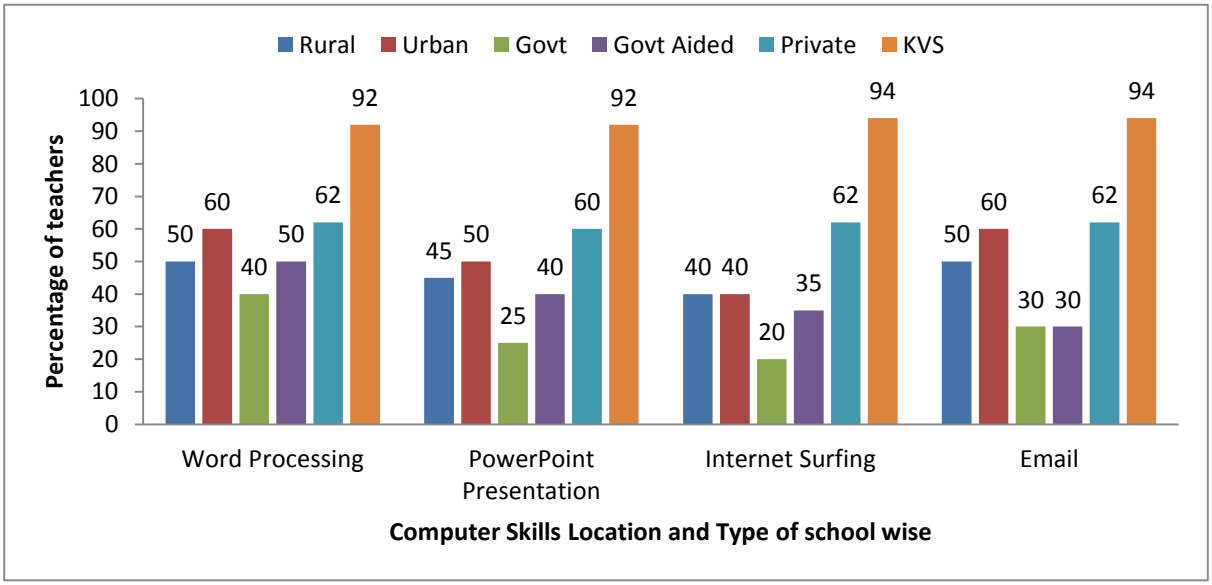

Fig. 3.18| Teachers' self assessment of their specific computer skills

Another important aspect of this finding is that it is based on the perception of the teachers and not based on their actual use either in the classroom or in the computer lab.

The analysis also shows that perception of teachers' competence is not enough to ensure the transfer of that competence into practice. Obviously other factors, such as the availability of resources, teacher motivation, and prevailing school culture, affect actual use of technology in teaching and learning. If ICT is to be effectively integrated in teaching and learning, it is clear that a holistic approach that embraces awareness-raising, professional development (pre-service, induction and in-service), planning, and infrastructure management, are required.

In light of the importance of ICT in promoting a wider range of teaching and learning methods, including inquiry-based approaches, the education departments should prioritize further use of ICT in teaching students of various aspects of the curriculum.

3.3.3. Teacher's views on ICT skills of Students

Most teachers admitted that students are better skilled, confident and comfortable while using technology whereas, the teachers themselves are often apprehensive about using the same technology in the class.

In total the students are the main beneficiaries of ICT programs in schools: Therefore it is essential to study the effectiveness of ICT in teaching learning process, it is essential to know about students' ICT skills and its impact on their academic learning. During the study, the individual students were interviewed and students' focused group discussions were conducted to learn about their ICT related skills, use of ICT in school and at home and their motivations as well as attitude towards same.

When teachers were asked about the computer skills of their students, 50% teachers said that urban private and KV students in senior classes had developed some competency in ICT related skills by using word-processing and internet. Rural students lag behind their urban peers fig3.18.Similarly, from teachers' point of view, ICT skills of government school students are not as good as those of private and Kendriya Vidyalaya students. Clearly, what teachers think of as "good" skills amongst students (perhaps when comparing these to their own skills).

The case study of a government school in Chennai, Tamil Nadu is a good example of how the school successfully organizing community outreach programs by allowing students and youth from neighborhood communities to use computer lab after school hours and on weekends.

Case study 2: Empowering Community through ICT

Most schools function as islands of learning, providing opportunities only to the few students enrolled in the school. Since the schools work for only half a day, the infrastructure is grossly underutilized,ButPathipagaChemmal K Ganapathy Government Higher Secondary School, located in Kodambakkam, Chennai is implementing an innovative program in the school, which not only empowers the teachers and students of their school with critical technology skills, but also opens up the school computer lab to the students/ youth from neighboring communities. This program is being implemented with the support of Government of Tamil Nadu and Learning Links Foundation.

Under the "Explore@My World Program", the school has been provided with state of art technologies. The teachers and students are encouraged to use technology judiciously to research, analyze, collaborate and communicate effectively. Teachers are encouraged to integrate technology judiciously into their teaching practices. Many students have been motivated to take up computer science in the higher classes despite having no access to technology at home. Today the teachers and students are at ease using web 2.0 tools and also exploring the emerging technologies for developing 21st century skills.

Besides catering to the needs of the students, the school has also extended the computer lab facilities to the children from the neighboring community post school hours at no cost. This initiative has provided access to the community children and youth who would otherwise be denied access elsewhere. The participants are empowered with digital literacy and entrepreneurial skills.

*Website:*http://www.learninglinksindia.org/program-overview.html

The Akshaya Project of Kerala addresses the issues of ICT access and basic technology skill in the community. The Project has been successful in bringing about massive transformation in the community and generated employment opportunities for children and youth.

Case study 3: Transforming Communities through ICT

Akshaya Project in Kerala has succeeded to a large extent in bridging the digital divide and addressing the issues of ICT access among the people of the state. Quality ICT dissemination and services delivery facilities - 'Akshaya centers' - are within a maximum of two kilometres for any household and networked effectively leveraging entrepreneurship and skill development. These centers are the grass-root level ICT centers at the Panchayat/ Municipal ward level bringing ICT to all segments of people. Since its inception, Akshaya centers have been a catalyst for academic, social and economic empowerment focusing on various facets like e-learning, e-transaction, e-governance, information and communication. The project has acted as a vehicle of improved quality of life, accessibility to information and transparency in governance and over all socio-economic growth of the community in the state.

The efforts of the project today have brought about massive changes in the community for ICT integration:

There is one computer literate person in every home in the state today.

3000 direct and double the amount of indirect employment opportunities have been generated.

By bringing ICT to all segments of people in the state, it is contributing

3.3.4. Use of ICT in teaching different subjects

Underlying the aim of integrating and improving the use of ICT by teachers and students is an assumption that teachers themselves are competent and confident in the use of ICT in terms of teaching and learning, and that they are able to use it for integration.

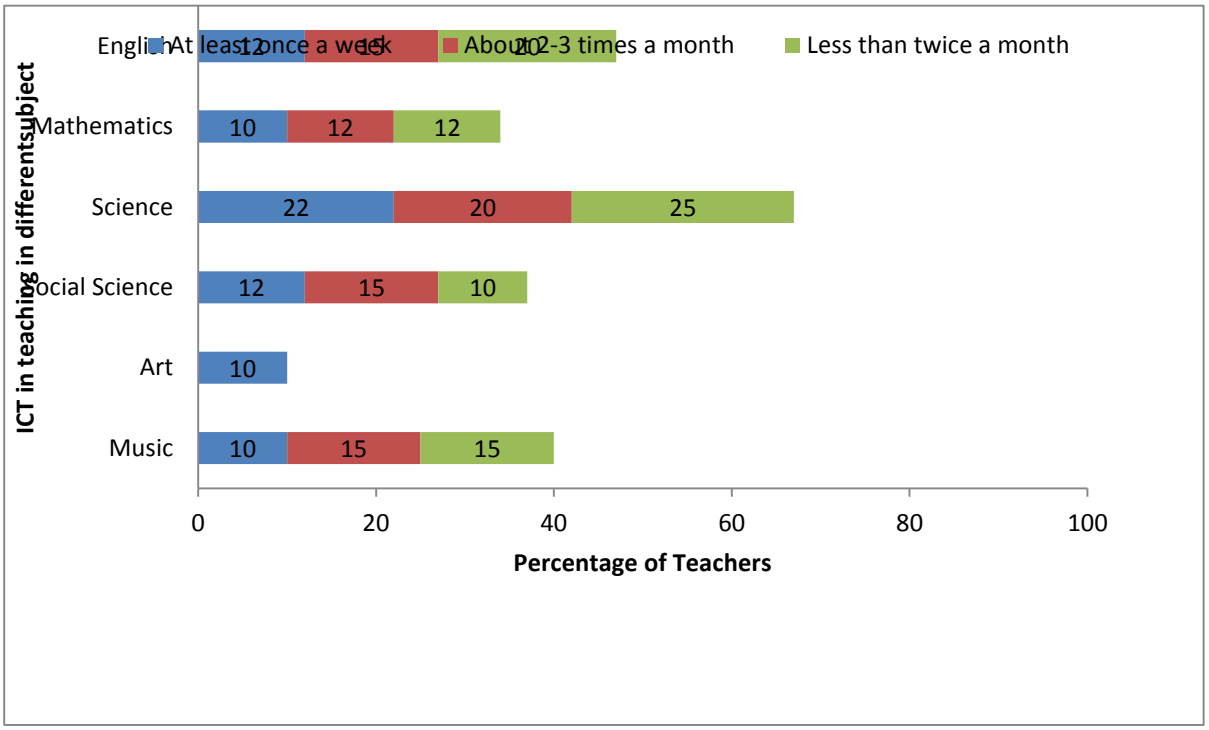

Fig 3.19| Frequency of ICT use for teaching curricular areas

The study found that not only does ICT predominates core curricular areas, such as English, Science and Mathematics, but even here ICT is used for Social science, music and arts though relatively less in number.

Figure 3.19 demonstrates that ICT was used most frequently to promote learning of science. However, only 22% of these teachers used ICT in teaching science at least once a week. At the same time, 20% and 25% reported using ICT about 2-3 times a month and less than twice a month respectively. For other subjects like Social sciences, Mathematics, English and music there was very limited usage, around 10% in a week and about 12-15%, about 2 to 3 times a month. The minimum use of ICT, i.e. less than twice a month was reported by teachers for teaching art.

It is clear from this examination that the use of ICT is somewhat limited in schools using it in more traditional subjects. The potential for using ICT to develop critical life skills, such as communication, problem-solving and independent thinking was not realized by school and teachers. Analysis of the implementation of the curriculum in recent years has also drawn attention to the deficit of provision in relation to the development of thinking skills. There is a great need, therefore, to promote the development of these skills through ICT with regard to the implementation of the curriculum. The information given by teachers related to Mathematics, Science and English are given below:

3.3.4.1. *Mathematics*

Most teachers interviewed for this research study had a positive attitude towards using technology for teaching Mathematics. A step in this direction was taken by the Central Board of Secondary Education that has mandated schools under its aegis to set up Math labs so that Math could be taught and understood practically. However good as the initiative was, its implementation floundered. In some schools, Math labs worked with very basic activities like paper folding, that teachers considered not worth their while. Many math teachers were of the view that introducing computers in the Math lab and using it as per the curriculum would make the lab far more useful and interesting.

3.3.4.2. *Science*

The results of this study revealed that one-third of the schools surveyed did not have Science labs so whatever little application is possible via these labs cannot be enforced thus leaving Science a subject to be taught in a classroom only via chalk and talk method. Such a didactic approach to teaching science can be detrimental to not only students but society as a whole as science is supposed to been lived every day.

Schools that did have labs lack in basic equipments and materials needed to perform experiments. These problems were endemic. These affected both government and private schools in rural and urban areas. Some science teachers were of the view that internet could have helped them show quality multimedia content - images, photographs and simulated experiments to enhance the science teaching and learning experiences. Thus, use of technology for science teaching is being viewed as a substitute for what schools did not have – while study of science must included both – vibrant visual representation as well as hands-on exposure.

About 67% teachers acknowledged that the use of technology helps in overcoming difficult topic in subject teaching. Teachers expressed the need for customized subject specific software to enhance learning particularly in vernacular languages.

3.3.4.3. *English*

In many of the schools selected for the study, English is not the first spoken language or the medium of instruction.

The language teachers felt that technology can enhance language teaching for grammar, pronunciation, nuances of language use and connecting literary themes with society. Setting up of audio/language lab or audio lessons of language will be effective to generate more interest in learning the language among students. More than 62% teachers established a link between teaching language with technology and improved learning.

The vernacular schools stated that technology can have an alienating effect due to lack of vernacular content available on the net. Customization in vernacular languages is an uphill task and only planned efforts would sustain. Other solutions for translation to ease access should also be explored. In this regard, a case of e-learning in a Delhi school has been cited below.

In this regard, a case of e-learning in a Delhi school has been detailed below which has made efficient deployment and usage of technology by providing the state of the art ICT tools and resources for teaching learning.

Case Study 4: E-learning School in Delhi

KendriyaVidyalaya, Janakpuri became a 'Smart' school in September, 2012. The school is well equipped with the funding received from the KendriyaVidyalayaSangathan and efficient deployment and usage of ICT resources by the principal and teachers. The school has almost 100 computers, wi-fi (Internet) access for teachers, making it one of the few government schools to have such state-of-art ICT facilities. There are three labs catering to primary, secondary and high school. The school also has 16 e-learning classrooms; each classroom has a computer and a Smart Board. The school also boasts of a fully digitized library.

The teachers are encouraged to use ICT for teaching-learning. There is a school blog (esheeksha.blogspot.in) where teachers post lesson plans, e-content, links, homework and assignments. All teachers maintain their lesson plans in the e-digital diary. The computer teachers have been empowered as mentor teachers and they further train other subject teachers in the school. Though teachers had initial resistance to using ICT, but now they find it useful and essential to teaching.

Students are encouraged to use technology for enhancing their learning. Students who do not have computers at home are allowed to use computers during free period or after school hours. The teachers felt that, students, especially at the primary level, really enjoy interactive sessions using ICT, it generates a lot of interest and enthusiasm. ICT enabled lessons are perceived to be more interesting than regular textbooks. It also helps students learn at their own time and pace, which is especially useful in KVs where students come from very different socio-economic backgrounds. The school also encourages parents to learn more about computers and they are explained security features of computer and usage of ICT tools during parent-teacher meeting. Students and teachers are also encouraged to participate in national level competitions where they create multimedia and other online projects. The labs are well maintained, the engineer visits the school twice every month for servicing and maintenance.

3.3.5. Frequency of professional use of ICT

There is a large variance in how frequently ICT is used to achieve different tasks by teachers. Around one-fifth of teachers use ICT on a weekly and/or daily basis to create materials for student use and to make presentations. However, 58% and 63% teachers never used ICT respectively for the above. The most frequently undertaken task using ICT is communicating with colleagues and for personal online professional development, which is done by half of the teachers on a weekly or daily basis as reported. Here as well, 50% teachers reported that they never used ICT for communicating with their colleagues. ICT is least used to communicate with students or parents (86% never used) and student assessment and record keeping (65% never used). 50% teachers also reported of never using online professional learning by them. However, rest 50% either used once a term, weekly or daily.

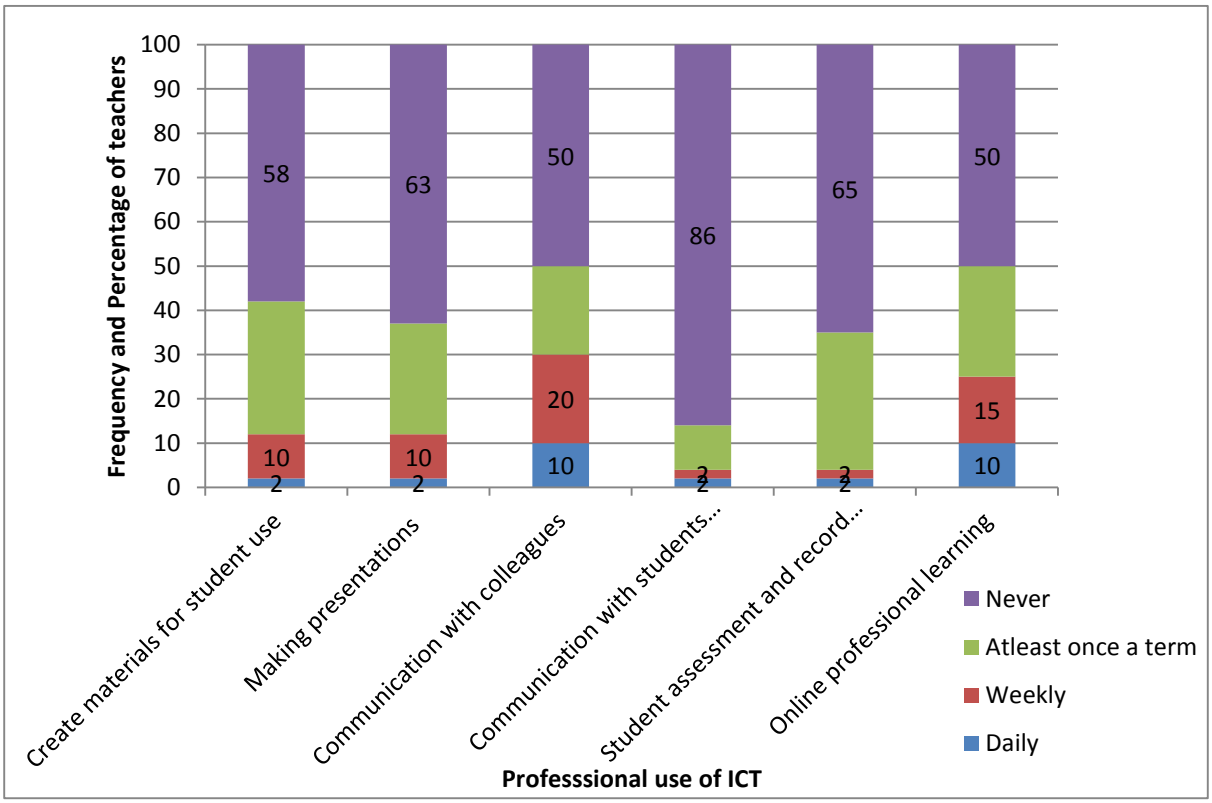

Fig. 3.20| Frequency of professional use of ICT

The reasons cited for low usage of technology by teachers were:

1. The infrastructure in schools is generally "busy" with classes for completing the computer application/ computer science syllabi.
2. The logistics involved in booking an audio visual (AV) room (for schools that have an audio-visual room – many don't) in advance, getting students to the AV room and back to classroom wastes precious class time.

3. There is no policy or mandate for teachers to conduct such classes – curriculum may be there but its implementation was found undefined.
4. The teachers have to invest considerable time to plan and prepare technology enabled lessons – this is usually on personal time and initiative.
5. Many teachers perceive students' higher knowledge of technology as a threat.

Some schools have tried to resolve the issue of limited access to technology during school hours by keeping school computer labs open after school hours. However, some respondents of such schools confess to serious logistical issues such as security concerns, extra duty hours for the computer lab in-charge, special time table for access, to name a few, as being the constraints in making this model a success. Besides, many government schools run two school shifts per day. Some rural schools made use of school premises for other social and educational purposes, like adult education or vocational training for which the labs are engaged.

3.3.6. Teachers attitudes and motivation towards ICT

Teachers hold the key to success of technology or ICT integration in schools. However, they do not change their practices easily. Re-culturing is required for any changes to occur and for this, opportunities must be provided for teachers to change – this could be achieved when teachers become conversant with educational teaching and learning theories related to use of technology, and when they experience the fruitfulness of new technological practices.

Because of the relationship between teachers' attitudes and motivation and their ICT competence and use, it is important to understand what comprises attitudes and motivation, and consider how they can be improved so that the relationship can be made stronger and teachers ICT skills and knowledge improve too.

In the study schools, teachers were asked to indicate the extent to which they agreed with four attitudinal statements relating to their use of ICT.

1. ICT provides valuable resources and tools to support student learning.
2. ICT provides students with efficient presentation and communication tools.
3. Student use of ICT has the capacity to strongly support student-centerd inquiry based learning, and
4. ICT has limited capacity to provide benefits in the classroom.

About 42% teachers were found strongly in agreement and 55% agreed that ICT provides valuable resources and tools to support student learning.(fig.3.21)

When asked, whether ICT provides students with efficient presentation and communication tools, 39% teachers were found strongly in agreement and 54% agreed with the statement.

Around 37% and 54% teachers strongly agreed and agreed respectively with the statement that 'Use of ICT motivates students to learn'. Only 25% disagreed that ICT does not have benefits in the classroom, whereas 75% either strongly agree or agree with the benefits of using ICT in classrooms.

The Figure 3.21 depicts the responses to the four aspects of attitudes and motivation.

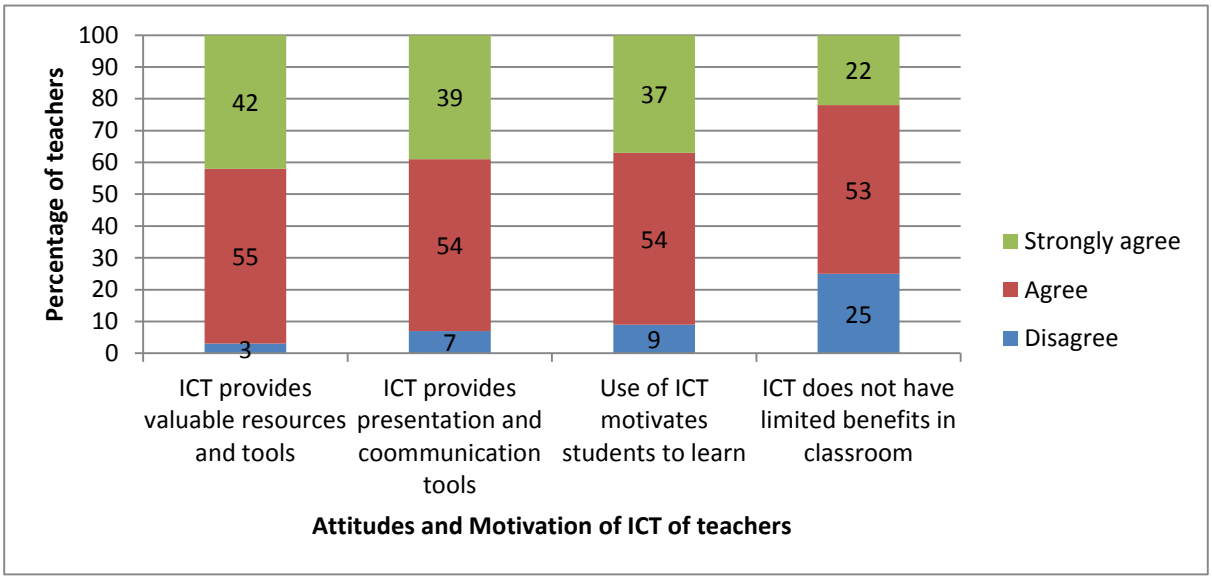

Fig. 3.21| Teachers' attitudes and motivation towards ICT

In other words, on the whole, teachers' attitudes and motivation were extremely positive, with the two most positive statements attracting less than 10% disagreement, as shown in the graph. However, the focused group discussions (FGDs) with students and the field notes. It was observed that the practices in schools were different and did not match with responses of teachers. Thus the schools were faced with a situation of a deepening gap between how teachers understand the use of ICT and its benefits and how they implemented it in school. It thus becomes imperative to closely look at the barriers of low integration and promotion of ICT in schools.

The use of ICT or technology implementation in teacher development is a process. Not all teachers embrace technology in the same manner. Teacher development sessions pertaining to ICT or technology usage and integration planning must aim for increased teacher self-efficacy, i.e. raising personal beliefs regarding the ability to learn or perform ICT related skills and classroom implementation strategies at varying levels.

The establishment of communities of practice could assist develop teacher self-efficacy. Adopting a multi-faceted socio-cultural approach that acknowledges school structures, classroom dynamics, teacher beliefs and student (learner) behaviors are important.

3.3.7. Use of ICT by students

3.3.7.1. *Access by students*

State wise analysis has also been done with regard to access to computers and internet at home. With reference to table 3.5, Gujarat, Maharashtra and Kerala are the forerunners both in access to computers and internet, while Puducherry and Tamil Nadu lag behind. Policies in these states need to focus on schemes that allow for cheaper and easier access to these technologies at home.

Table 3.5 I Percentage of students having access to computers and internet at home

State	Computer at Home (%)	Internet at Home (%)
Kerala	72	52
Maharashtra	68	58
Gujarat	75	58
Tamil Nadu	35	27
Puducherry	28	28
Delhi	63	48

In Gujarat, 75% students were having computers at home. Whereas, in Kerala and Maharashtra 72% and 68% respectively were having computer at home. Similarly, 58% students in Gujarat and Maharashtra were having internet connection also. In Tamil Nadu and Puducherry, 35% and 28% students respectively were having computer at home. In Tamil Nadu and Puducherry, 27% and 28% students respectively were having internet facility at home.

In urban areas, 68% students have access to computers and 56% have access to internet at home,but the students in rural households are at a disadvantage both at school as well as at home. Only 17% of students in rural areas have access to computers of which Internet is available to just 13%. The students from rural areas often use computers at other places, such as cyber café, a friend's house or a relative's house. The high cost of computers tends to be a bigger deterrent for not owning computers in rural areas as opposed to urban areas.

Table 3.6 l Student perception of competency by location

Student's Perceived competency (Mean)		Rural	Urban
Skills	CG	4.46	7.485
	SG	4.11	6.11
	Private	4.27	2.275
Competency	CG	4.43	1.465
	SG	4.44	4.895
	Private	4.64	5.66
Preparedness	CG	4.4	6.645
	SG	4.06	5.7
	Private	4.91	6.99
Comfort	CG	4.31	2.585
	SG	4.39	7.415
	Private	5.07	7.03

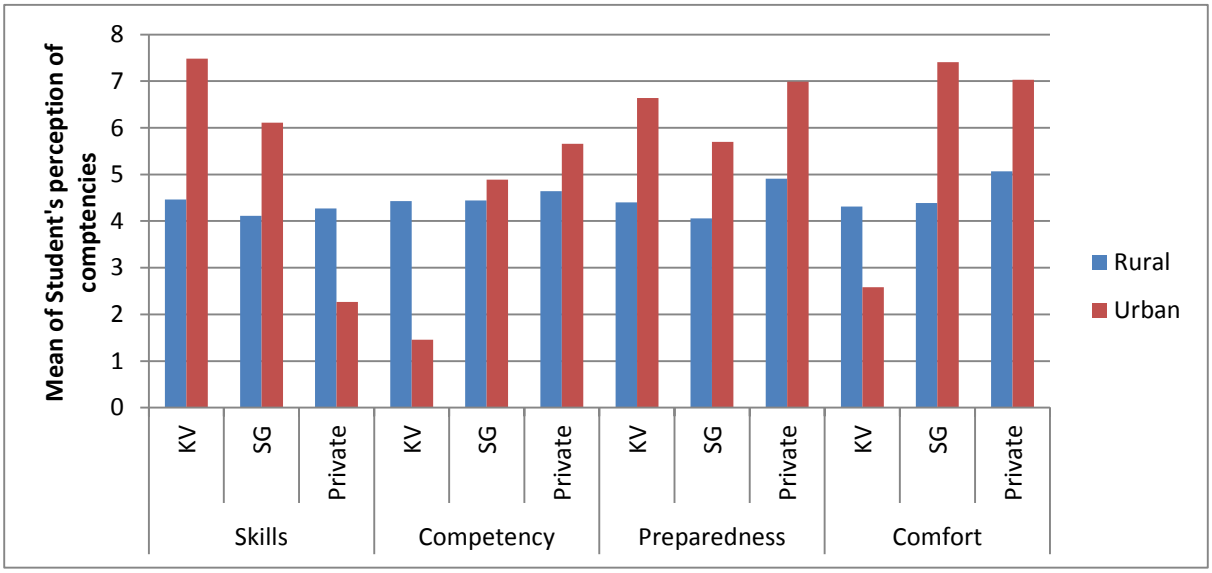

Fig. 3.22| Student's own perception on their ICT

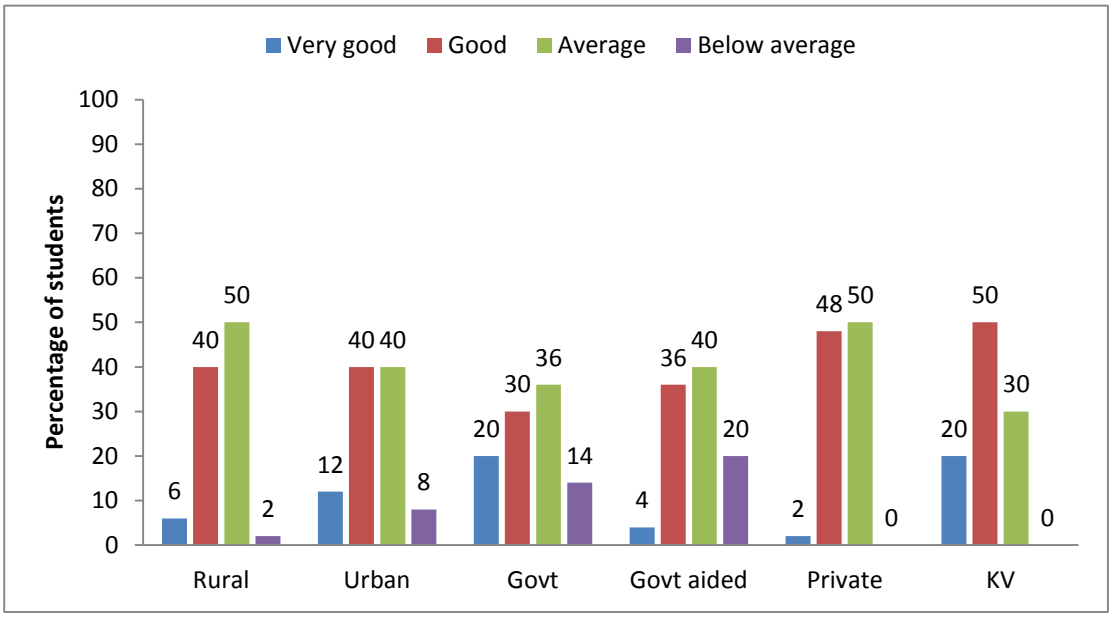

Fig. 3.23| Location and type of school wise Student's own perception on their ICT SKILLS

The students showed a modest view of their own skills. While analyzing the fig.3.23 it was found that students own perception about their ICT skills as 'good' was found in equal percentage of students (40%). However, in urban areas, students' own perception about their skills as 'very good' was more number of students in urban areas (12%) than rural (6%) areas. Nonetheless, their perceptions matched with their teachers' views. The reasons for rural students' somewhat low skills can be attributed to the lesser availability of infrastructure in schools and at home as well.

3.3.7.2. *Use of ICT by students*

In the survey process, the students were asked about their use of computers and other peripherals in schools. As shown in figure 3.24 a large proportion of students were using computers for not more than an hour in a week. Little above 50% of government school students were not using computers in school at all. Although the infrastructure is good in private schools, the extent of usage of computers is rather low (less than 26%). This may perhaps be due to lack of motivation and support from the school.

Relatively, lower usage of computers found by teachers and students in rural schools can be explained primarily by the limited access to Internet and computers, directly impacting the implementation of ICT in school programme.

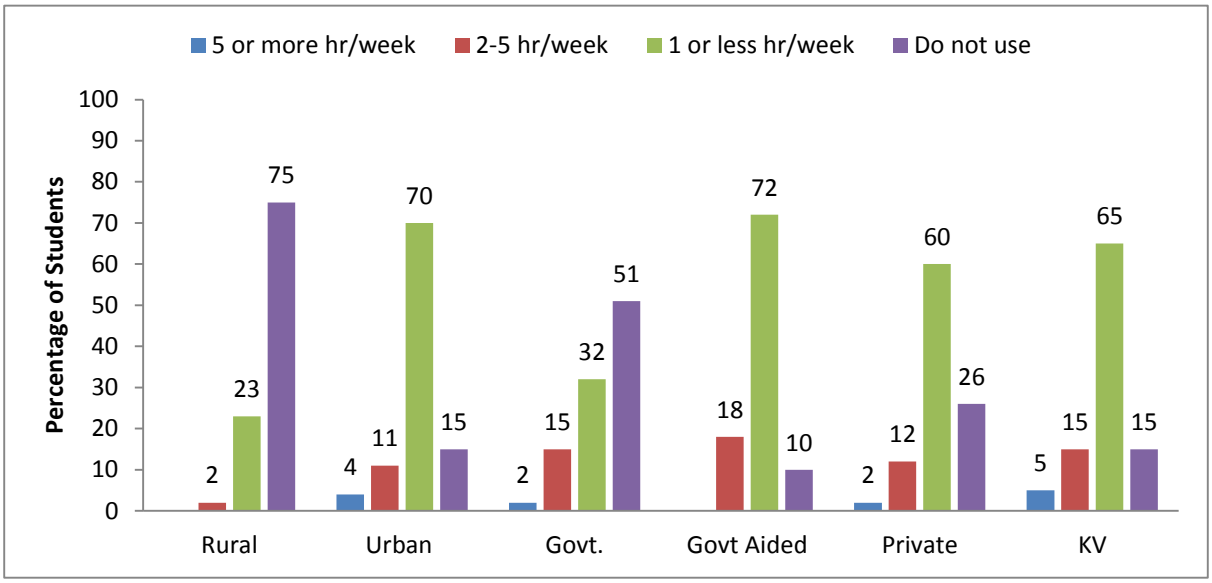

Fig. 3.24 I Use of ICT by students belonging to different types of schools

Though KV is better equipped in terms of infrastructure, the situation is not much satisfactory as only 5% students use computer for 5 or more hours per week and only little above 20% use 2-5 hours per week (Table3.7and fig 3.24). Use of computers for one hour or less per week is even less than that of government aided school. The picture of no use of computer is more or less same in rural areas as well as in KV.

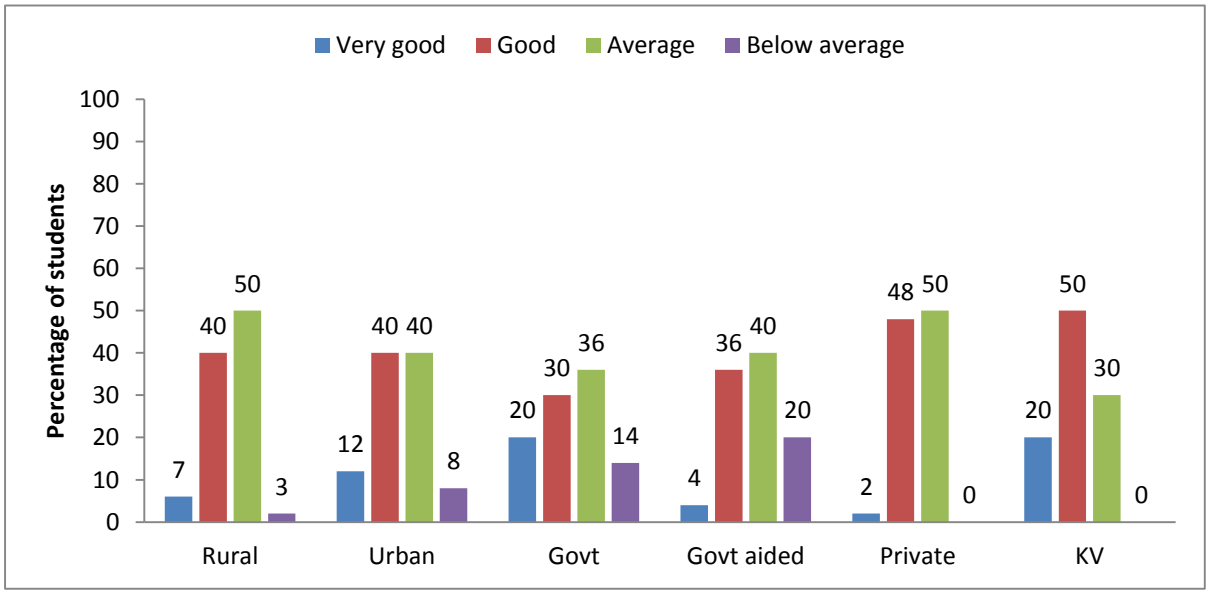

Fig. 3.25| Use of computers and peripherals by students LOCATION AND TYPE OF SCHOOL WISE

	5 or more hr/week	2-5 hr/week	1 or less hr/week	Do not use
Rural	0	2	23	75
Urban	4	11	70	15
Govt.	2	15	32	51
Govt Aided	0	18	72	10
Private	2	12	60	26
KV	5	15	65	15

Table no. 3.7

Majority of students stated that using a computer helped them with their school work. This was mainly through the use of internet for projects. Only 24% reported using home computer to help them with their homework.

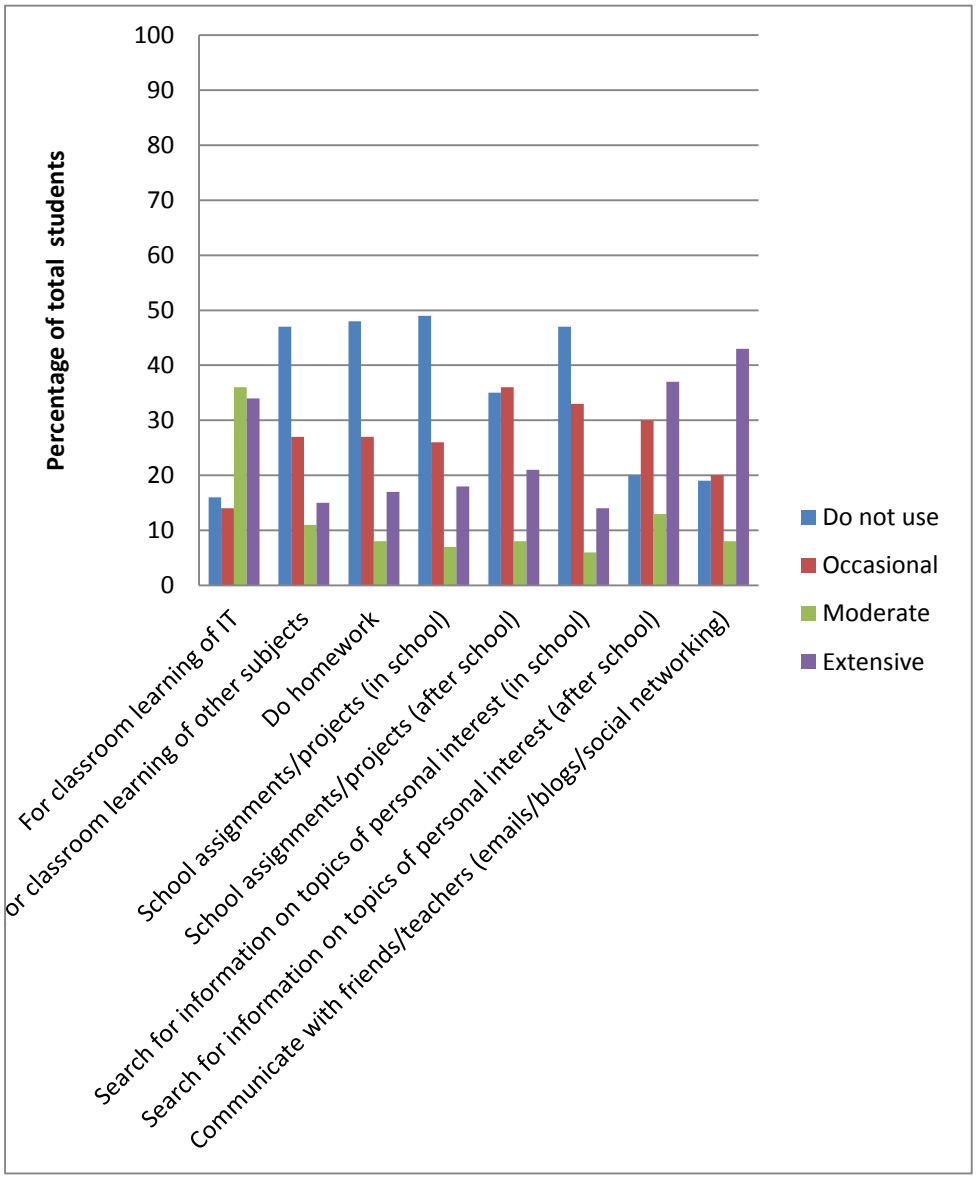

Fig. 3.26 | Purpose and frequency of technology use by students

Students were also specifically asked to state what kinds of tasks they used computers for in school and at home. The most frequent replies by 50% students were extensive use when it comes to communicating with friends via email, blogs and other social networks. Other tasks performed on the internet were information collection on the topic of personal interest (38%) from the internet nevertheless this is done after school hours. The high ratio of "Do not use" bars need be noted in figure above. Students lacked proficiency in the English language, which acted as a barrier in collecting and understanding information from the internet. Thus we see the making of a 'digital divide' here.

Interestingly, during focused group discussion, 40% of students surveyed stated that they learnt most about computers by teaching themselves (45% stating that they taught themselves how to use the internet), while 33% stated that they learnt most through their teachers. More students in schools with a high student-computer ratio stated that they were using computers to work with word-processing, presentation, and other applications. A small proportion also reported being able to create a multimedia presentation.

In school' parlance, ICT education means learning about the computer rather than learning *with* the computer. As a subject ICT is accorded much less importance than other more conventional subjects whilst time for using ICTs for learning other conventional subjects is not allocated at all. In most cases, each student gets approximately 30–40 minutes (1 period in the timetable) on the computer per week. Amongst schools where the study was conducted, respondents in at least 35% schools mentioned computers were shared between two or three students during such classes hence the hands-on time that a single student gets is even less, perhaps 15 minutes per week. This issue is more important in rural government schools because many students do not have any access to computers outside school.

The paper states that even though computer science is an optional subject offered in the senior secondary grades of XI and XII, schools do not have a single computer meant for academic use for secondary students. In a shocking revelation, students learn the basic concepts of computer operations and advanced concepts like programming, computer graphics through books and theoretical lessons! As a result, these students are not fully adept at the practical usage of the technology.

The high ratio of "Do not use" bars need be noted in the figure 3.24and table3.7. Also, significant is the extensive use when it comes to communicating with friends/ teachers via email, blogs and other social networks. If this is the "hook" for 21st century learning, schools should move faster than ever before in bringing technology to students where they learn – the classroom.

Issues: Schools do not have a clear policy mandate on using ICTs for subject related curricular work. As a result technology integration for subject learning is not planned by the schools. Principals observed that they and the teachers having lack of appropriate training on technology integration with other subjects. This also affects the decision making processes as well.

Other reasons cited for the low usage of technology by the teachers are:

1. The infrastructure in schools is generally "busy" with classes for completing the computer application/ computer science syllabi.
2. The logistics involved in booking an audio visual (AV) room (for schools that have an audio-visual room) in advance and getting students to the AV room and back to classroom wastes lots of precious class time.
3. There is no policy or mandate for teachers to conduct such classes .The curriculum may require it but implementation is undefined.
4. The teachers have to invest considerable time to plan and prepare for technology, which also involves edit lessons. This takes lots of personal time and initiative issues.
5. Many teachers perceive the students' higher knowledge of technology as a threat.

Some schools have tried to resolve the issue of limited access to technology during schools hours by keeping computer labs open after school hours. However, some respondents of such schools confess to serious logistical issues such as security concerns, extra duty hours for the computer lab in-charge, special time table for access to name a few, as being the constraints in making this model a success. Besides many government schools run two school shifts per day. Some rural schools make use of the school premises for other social and educational purposes, like adult education or vocational training for which the labs are engaged.

3.4. Impact of ICT on teaching and learning

Teachers were of the view that ICT enhances teaching and learning if the technology is used effectively. The benefits of ICT, as articulated by the teachers are as follows:

1. Using ICT means that information can be obtained almost instantly. The worldwide web, for example, contains a vast amount of easily accessible information. Such information can provide learners with different viewpoints and a wider understanding of issues.

2. ICT helps the teachers to customize teaching materials to suit the needs and ability levels of their students.
3. It acts as an incentive for students to learn. The technology can be effective in engaging them in their schoolwork.
4. ICT helps to make learning more interesting. It helps in increasing levels of interest, for example through the use of colour, animation and sound. It also facilitates multi-sensory learning through multimedia presentations, animation and video.
5. ICT helps students to work at their own pace and level. ICT contributes to the development of a personalized or step-by-step learning scheme. It provides opportunities for students to learn in different ways.
6. ICT facilitates student-centerd learning and can encourage students to take responsibility for their own learning.
7. ICT helps teachers and students to improve how they present information. It facilitates creative presentation of materials and encourages students to take pride in their work.
8. ICT captures student attention for significant time span. The visual impact facilitated by ICT, for example, captures their attention and helps them to retain information.
9. Effective use of ICT puts the teacher in a facilitative rather than a teaching role.
10. The use of ICT increases students' understanding of concepts and helps consolidate learning. In general, it makes learning more memorable.
11. Effective use of ICT, especially in individual, pair and group work with computers, can lead to improved classroom discipline and better management of learning.
12. Teachers also emphasized some of the negative effects that ICT can have if it is not deployed effectively. Some of these are outlined below:

    a. Students can become frustrated with ICT hardware and software in schools which develop regular technical problems. This can discourage them from using computers in their schools.

    b. Students can become irritated when one-to-one access to computers is not given in their lessons (that is, when they don't "get their turn" in a group). In a lesson that involves interaction with the computer it is important that teachers should give an opportunity to all students to use the computer.

To summarize, it is clear that ICT has the potential to influence positively teaching and learning process. While there are drawbacks associated with use of technology, these are outweighed by the potential it offers. It seems incumbent on teachers to maximize the benefits offered by ICT, whenever and wherever possible.

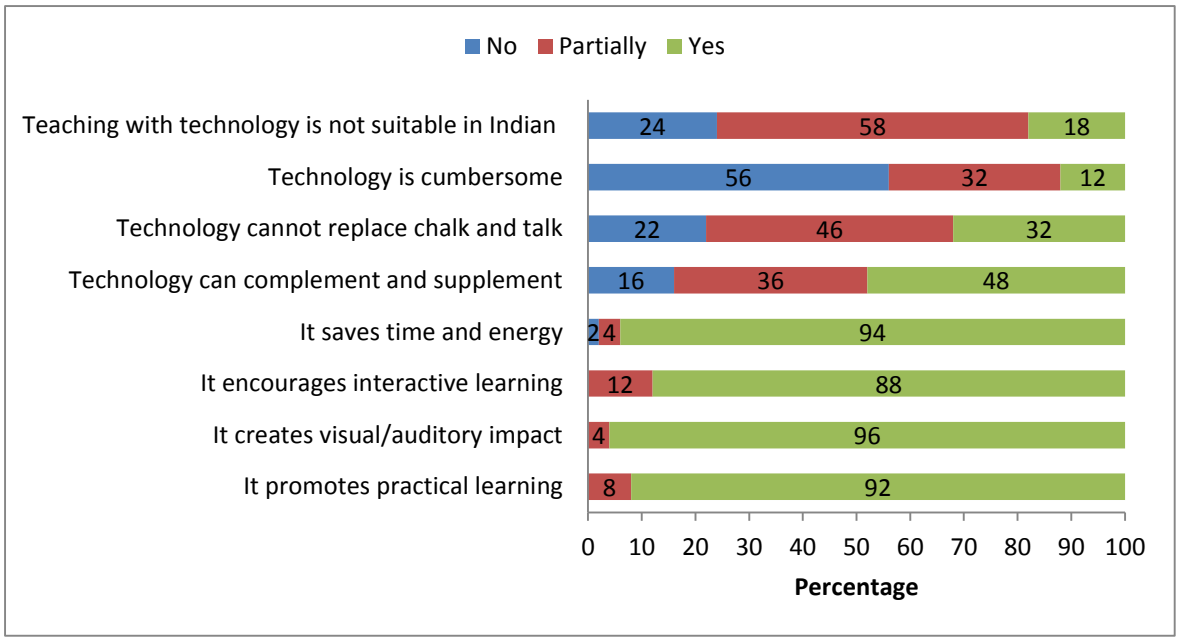

Fig. 3.27 |Student perception about use of technology

3.5. ICT in school administration

The study found that 95% of schools used computers for general office use, 60% used the technology for maintaining students' records, and 80% used computers for accounts work.

The number of computers devoted to this administrative work is usually one or two. The schools which reported designating two computers for this work, one was usually earmarked for the school office, while the other was for the principal. Schools should fully exploit the benefits presented by ICT in school administration.

Numerous attempts to introduce ICT into the education sector have been made - some have yielded good results while some have been less successful in their outcome. Therefore, during this process of carrying out this study, the lessons learned have been compiled and documented to help minimize the risk of failure and maximize the chances of success for future activities in the education sector. The biggest 'digital divide',as observed between urban and rural schools, and government and private schools. However, KendriyaVidyalayas, even though they are government schools are on the better side of this divide. Reasons for the 'digital divide' are all closely related, as observed through this study, are poverty.

Insufficient knowledge of (or comfort with) English - the main language of the computer world as well as limited availability of ICT products in rural areas.

3.6. State wise analysis

It is observed from the analysis of data that the school in Kerala and Gujarat boast of the best infrastructure among all the six States surveyed. Tamil Nadu struggles with internet connectivity in rural areas while Maharashtra suffers from lack of internet connectivity both in rural and urban schools. The Delhi Government schools lack adequate computers and also Internet connectivity.

It is also observed that merely providing devices and connectivity does not automatically translate to efficient usage of ICT in schools unless backed by appropriate strategies and sustainable models.

The state of Kerala is implementing an efficient model of ICT integration in schools through capacity building programs for teachers and providing appropriate e-content. The most important learning from Kerala is that providing appropriate in-service training programs to subject teachers empowers them to create e-content, helps in effective implementation of ICT in the classrooms. ICT is not confined to just computer literacy in the labs, but also used efficiently by the teachers and students in enhancing the teaching learning process. The Akshaya centers are helping to bridge the digital divide in the society.

The state of Gujarat has been most successful in providing computers and broadband to schools. The state has also developed e-content in alignment with the SCERT and Departments of Education for enhancing quality of learning.

Kendriya Vidyalayas are well equipped with the latest technology tools, peripheral devices and good Internet connectivity. Students and teachers get adequate access to computers and internet. Teachers are trained to integrate ICT in their classrooms supported by sound Digital Content. The e-Classroom model of KVs is a pace setting initiative for future classrooms. It could be replicated by the states in their Smart Schools. Besides the support from the Sangathan, the schools at the regional level are further taking initiatives to implement technology innovations.

4. Summary and Recommendations

4.1. Backdrop

Today's knowledge economy demands for a highly skilled, well educated workforce that has the ability to work independently and creatively, thus it becomes imperative that the learners need to be provided with innovative learning opportunities and resources to succeed in the demanding work environment.

ICTs stand for Information and Communication Technologies and are defined as a "diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information" (UNDP 2000). These technologies include hardware like computers, printers, scanners and software like multimedia objects, videos and animations and many more.

Information and Communication Technologies can facilitate not only the acquisition of knowledge but also provide variety of education solutions. The intelligent and creative use of technology can lead to providing equitable learning opportunities to the underserved/ marginal segment of society, thereby empowering learners across various segments.

Understanding the imperative need to provide access and equitable learning opportunities, Government of India has formulated various schemes and measures to utilize the potential of smart technologies to achieve the education vision. The National Policy on Education, as modified in 1992, stressed upon employing educational technology to improve quality of education.

This led to two major centrally sponsored schemes namely: Educational Technology (ET) and Computer Literacy and Studies in Schools (CLASS), paving way for a more comprehensive central sponsored scheme - Information and Communication Technology @ Schools in 2004.

In the following year, NCERT brought out the National Curriculum Framework recommending the inclusion of ICT across the curriculum. Thereafter, the National Policy on ICT in School Education 2009 was put into effect after its revision 2012, and under the policy various schemes were formulated and implemented by the government in different states and Union Territories.

With the convergence of such policies and schemes, it has thus become very important to take a comprehensive view of the efficacy of making such substantial investment in ICT over the past decade.

With the above implementation, students, teachers and principals have used ICT in larger way. To see the availability and use if ICT in schools this study has been undertaken with the following objectives:

1. To study the actual access and usage of ICT by teachers and students in secondary schools.
2. To compare the ICT usage by teachers and students in rural and urban areas.
3. To study the factors affecting ICT access and usage by teachers and students.
4. To provide suggestions and the recommendations regarding optimal usage for improving the actual access and usage of ICT by students and teachers in secondary schools.

4.2. Research design

Both quantitative and qualitative methodology using survey methodology was adopted for this study. It also included methodology for conducting the study, sample tool was used for data collection and data analysis.

4.2.1. Sampling

The study was conducted in six states as approved in the Terms of Reference, namely Gujarat, Delhi, Kerala, Maharashtra, Tamil Nadu and Puducherry. Two districts in every state were selected - one being the capital district and the other being a district that was located farther from the state capital to have rural and urban representation. The districts were North West districts from Delhi; Ahmadabad and Valsad from Gujarat; Thiruvanathaputram and Kannur from Kerala; Mumbai Suburban and Nagpur from Maharashtra; Puducherry and Karaikal from Puducherry; Chennai and Coimbatore from Tamil Nadu.

The criterias were formulated for the selection of schools, and it included the schools with classes till 12th standard, minimum student strength of 200, number of teachers not less than six, student teacher ratio of 45:1 and last, but an important criterion was that the school should be a co-educational institution. The sample included schools of State Governments, Kendriya Vidyalaya, Navodaya Vidyalaya and private schools located both in rural and urban areas.

A sample of 110 schools were selected across the states, which included 12 from Puducherry, 9 from Delhi, 20 from Gujarat, 20 from Kerala, 17 from Tamil Nadu and 32 from Maharashtra through lottery method. The sample also included 542 teachers, 713 students and 55 principals drawn from rural and urban schools located in different districts of six states.

4.2.2. Tools used:

Following tools were developed and used for the study:

1. **Student questionnaire -** The questionnaire for the students consists of ten major areas across five broad issues. Starting with the profile of the students, their perception of ICT, availability of ICT infrastructure in school, competency and creative usage of ICT and benefits and challenges in using ICT in classrooms.
2. **Teacher questionnaire -** The questionnaire for the teacher consists of 13 broad themes to understand the perception, attitudes and usage of ICT. Starting with the profile and educational qualification of the teachers, the questions included categorization of school by management, availability and usage of ICT infrastructure, benefits and challenges in using ICT in classrooms, their own knowledge and competency levels of various technologies, and the impact of ICT enabled teaching on the students.
3. **Principal questionnaire -** The questionnaire for the principals consists of 46 questions related to the profile of the school, availability of infrastructure, use of ICT by teachers in different subject areas and students' responses and impact on the students.
4. All the above tools were piloted with the small sample, which provided crucial inputs. The questions were restructured in the questionnaire from the learnings from the pilot.
5. **Case study -** For validating the data, case studies of schools were covered where ICT have been used successfully.
6. **Focused group discussion -** Focused group discussions were conducted with a small group of students to get an insight about their perceptions, availability, usage and usefulness in schools and also to validate the data collected through questionnaire.
7. **Field notes -** During data collection, the field investigators noted important observations and points in their diaries.

4.3. Procedure for data collection and analysis

An orientation program for 24 Research Facilitators was organized to train them about the research design including sample, tool used and techniques of data collection from students, teachers and principals covered in the sample. The research facilitators prepared a schedule of visits in all the districts located in the six states for data collection. They collected data from 542 teachers, 713 students and 55 principals. Focused group discussions were also conducted based on the questionnaire of students with 4 to 5 students for eliciting information about the

availability and use of ICT. The field notes were meticulously taken by the field facilitators.

All data gathered during the study was analyzed using descriptive statistical method. The results were presented in percentages and counts in all tables and charts. The data were also triangulated collected through questionnaires, focused group discussions, case studies and field notes.

4.4. Major findings

The following major findings emerged out of the analysis of the data of the study:

4.4.1. Infrastructure

The findings related to infrastructure including availability of computers internet connections, ICT peripherals, school website and placement of computers in schools are presented in this section.

4.4.1.1. *Availability and access of computer in schools(Table3.1)*

1. The State Government schools in Gujarat and Kerala were well equipped followed by Tamil Nadu. A total of 15 and 18 schools surveyed in both Gujarat and in Kerala respectively have more than 20 computers out of 19 schools surveyed.
2. Tamil Nadu schools (SG) also boast of good infrastructure with 8 out of the 11 State Government schools having more than 20 computers.
3. In Delhi, 6 State Government schools were surveyed and it was found that 2 schools had less than 10 computers.
4. In Maharashtra, 4 out of 5 State Government schools surveyed in rural and urban areas had less than 10 computers whereas in Puducherry, 4 state government schools had less than 10 computers.
5. It was found that Central Government schools (KVs/ NVs) were well equipped with computers. All Central Government schools surveyed, except one in Delhi, had more than 20 computers.

In 4.4.1.2. *Adequacy of ICT infrastructure: teacher perspective*

1. Around 48% teachers said that the infrastructure was sufficient for teaching ICT as a subject. Only about 22% teacher said that ICT was sufficient for teaching learning other subjects. However,28% of teachers said that infrastructure was deficient for integrating ICT in teaching-learning other subjects. 24% teachers said that the ICT infrastructure often remained unutilized.
2. About 70% of the KVS teachers felt that ICT infrastructure was sufficient in their schools for teaching and learning IT as a subject (fig.3.3). It was inadequate for integrating ICT in teaching-learning other subjects. More than 50% teachers belonging to urban schools said that ICT was sufficient in their

schools but it was found unutilized in 20 of the government schools. The study also revealed that the level of penetration of ICT infrastructure was better in the urban schools compared to the rural schools.

3. Principals of the rural schools who had access to the basic ICT infrastructure, such as computers, TV and radio expressed grave concerns about the quality of hardware. Some schools still had computers, provided years ago, lying unopened in their original cases. The justification provided was lack of trained teachers/ technical staff to handle and take responsibility of the ICT infrastructure. The other reasons given by the teachers were lack of awareness of the meaning of technology use and integration in the context of K-12 education, lack of awareness on different ways in which technology-enabled learning environments can be created in an educational institution, lack of training on pedagogical changes that need to brought about with introduction of technology in classroom practice and lack of resources and support, availability and access.

4.4.1.3. *Student-computer ratio in schools*

1. The student-computer ratio (SCR) varied from 35:1 to 60:1 in rural schools though the situation was significantly different in Jawahar Navodaya Vidyalayas (15:1) which are a special category of schools and are funded by Government of India. The SCR also varied significantly in urban schools - 25:1 to 50:1 for private schools and 35:1 to 150:1 in government and government-aided schools. However, the situation was much better in Kendriya Vidyalayas that have an SCR range of 14:1 to 24:1.(Table3.3)

2. Holistically, only two schools were having student-computer ratio between 15 to 24 per computer, 10 schools between 25 to 50 students and 15 schools between 51 to 75 students per computer. Maximum number of schools were having student computer ratio between 76 to 100 and 101 to 150 students per computer.

3. There was lot of variation in the number of usable computers in each of the schools studied. It varied significantly in rural and urban schools and in different types of schools as well. In rural schools, the number of usable computers ranged from 10 to 35 computers per school. In urban schools, the range was from 15-40 computers, which is far less from the optimum quantity – generally taken as 5:1 to 10:1 - that is required for effective learning by each student of the school.

4.4.1.4. *Internet connection*

1. Almost all schools reported having internet connection, either broadband or dial up, while in a few instances it was reported that there was no access to the internet at all. In 34 of the sampled schools, internet connection (where it did exist) appeared limited to 1 to 5 computers. Whereas 10 schools reported

that internet connection was in 6 to 10 computers. 20 and more computers were found only in 43 schools (fig.3.5) 80% of students reported that "internet access was strictly reserved for staff or for supervised groups of students."

2. Gujarat and Kerala were the front runners for internet connectivity, with 10-11 schools respectively having more than 20 computers with internet connectivity (Table 3.4). Kerala also has better connectivity in government schools over private schools. Tamil Nadu lagged behind in connectivity, with majority of rural state government schools only having 5-10computers with internet connection. In Maharashtra, all rural and majority of urban schools surveyed had ten or less internet connected computers. Most State Government schools in Delhi have only 1-5 internet connected computers.

4.4.1.5. *ICT peripherals*

1. School principals stated that about 70% schools were having one scanner but Smart Boards were not available in equal number of schools. One Projector was available in about 55% schools. More than one printer was available in about 25% schools. The range of peripherals available in schools varied and no standard pattern emerged from the data to distinguish rural from urban schools, though overall availability was found to be low in most of the rural schools(fig.3.6)
2. The availability is definitely better in some private schools (not all), especially in urban areas and Kendriya Vidyalayas (KVs). The most commonly available gadget was the printer. However, its use by students, barring the students of JNVs was limited. Moreover it also be noted that the schools in Gujarat had one dish-TV per school whilst in other states it was available in only 50% of the schools.
3. Private schools, KVs and government aided schools were in a better position to provide e-learning experience to their students as compared to government schools. While more than 90% of the schools outsource the e-learning material. 10% of the teachers reported that they prepared their own educational CDs. Most commonly available e-materials were for Mathematics and Science. Few reports from the study, schools mentioned software being available for only particular curricular areas.
4. Kerala had the highest number of schools using teacher-created digital lessons, which attributed to the integrated teacher training. Gujarat also took the lead, with many schools using educational CDs. Subject wise data analysis revealed a relatively high proportion of teachers using subject specific software to teach Science and Social science followed by Mathematics, but was seldom used for language learning.

4.4.1.6. *School websites*

An average of 40% of all teachers, about 50% from urban and 30% from rural schools, stated that their school had a website. 70% of the Kendriya Vidyalayas had their own website. Only 5% schools reported that their web page contained a reference to, or details of, project work or other work done by students. 50% of students did not know whether their school had a website.

4.4.1.7. *ICT maintenance and technical support*

Only 2% rural schools and 20% urban schools had made provision for technical support and regular maintenance of their hardware (mostly private schools and JNVs). Schools with no hardware maintenance system stated that this acted as a significant impediment to the development of ICT in their school.

4.4.1.8. *Availability of electricity*

Approximately, 80% of the urban schools and 54% of the rural sampled schools of this study reported that they had regular supply of electricity. The problem of irregular electricity supply was observed more in the rural schools than the urban schools. However, wherever there was a problem with electricity, schools reported that they had installed a UPS that provides power for 1-2 hours however long power cuts caused a problem.

4.4.1.9. *Placement of computers in schools*

Most of the schools preferred to have a dedicated computer lab or room. 50% of the principals felt that the main advantage of having a computer room was that it provided a more conducive environment for learning ICT than the classroom. 50% of the schools had networked computers in their computer labs. About 95% of the schools did not place computers in the library. The situation was more or less same in rural and urban schools and also in government, government-aided, private and KVS with little variations. The computer room was generally used for teaching computer skills to full class groups and one computer was usually shared by 2-4 students or sometimes even more. 96% respondents said that computer should be placed in classroom for teaching-learning point of view.

4.4.1.10. *Time table*

Approximately three-fourth of the schools quantified the time for which computer rooms were used. In general a computer class in the computer room was of 35-40 minutes duration. The occupancy of the computer room ranged from 30% to almost 90%, with the average being slightly more than 60%.

4.4.2. Access to computers and peripherals

The access to computers and peripherals by teachers and students has been discussed in this part of the chapter.

4.4.2.1. *Access by teachers*

Only a few urban schools have computers in staff rooms – that too only in private schools and Kendriya Vidyalayas. On an average, 40% teachers in any school were able to access computers. The situation was worse in rural schools where in almost three-fourth of schools, only a total of 25% teachers could access computers. Teachers reported that household responsibilities prevent them from using computer at home though more than half of teachers had computers at home.

4.4.2.2. *Access by students*

1. The Principals and teachers reported that only 25-45% students in rural schools had access to computers and other peripherals in schools. On the other hand this ranges from 25 to 100% in urban schools which might be due to better conditions in private schools and Kendriya Vidyalayas. Access to computers at home was still low in rural areas (20%) and for students of government schools (20%), but 60% students had access to computers at home in private schools (fig3.13).
2. In Gujarat, 75% students were having computers at home whereas in Kerala and Maharashtra, 72% and 68% were having computer at home. Similarly 58% students in Gujarat and Maharashtra were having internet connection too. In Tamil Nadu and Puducherry, 35% and 28% students respectively were found having computer at home. In Tamil Nadu and Puducherry, 27% and 28% students respectively were having internet facility at home.
3. Quite a large number of students (53%) did not have a computer at home because the high cost – affordability is an issue in the target audience studied in this report. 34% students used cyber cafe and small number, around 6% were not comfortable using technology.

4.4.2.3. *Availability of manpower for ICT*

A major barrier to ICT integration in schools seems to be non-availability of ICT coordinator in the schools or integration of ICT in teaching learning process. Teachers trained in ICT varied from 10% to 65% in rural schools and 5% to 100% in urban schools(fig.3.15). Within the type of schools as well, there was large variation in the proportion of trained teachers. The principals felt that teachers competencies in use of ICT was just average.

4.4.2.4. *Public Private Partnership for improving access and use of ICT*

Only a few private schools in the study reported having a contract with private agencies for making ICT operational in their schools. All those schools which were in partnership with private organization were located in urban area. None of the rural schools reported any such arrangement.

4.4.3. Use of ICT

This section focuses the views of teachers and students about use of ICT.

4.4.3.1. *Use of ICT peripherals*

1. Printers were found to be the most commonly used ICT peripherals for educational purpose in schools. Nearly 65% teachers never used printer, 75% never used scanner and digital projector. The next most frequently used peripheral was smart board being used at least two or three times a month by 15% of the teachers though the availability of such boards was limited to only 30% of the study schools. Only 5% teachers reported using scanner, digital projector and digital white board at least once a week.
2. Analyzing data by subject area revealed that a relatively high proportion of teachers of English and Science used ICT peripherals in comparison with teachers of Mathematics and Social science. However, in absolute terms, the use of peripherals was still very low. For example, 80% of the teachers from rural schools and 50% of urban teachers reported never having used a printer in their teaching process.
3. The reasons cited for the low usage of technology by the teachers are that the infrastructure in schools is generally "busy" with classes for completing the computer Application/ computer science syllabi, the logistics involved in booking an audio visual (AV) room (for schools that have an audiovisual room – many don't) in advance, getting students to the AV room and back to classroom wastes precious class time, there is no policy or mandate for teachers to conduct such classes – curriculum may require it but implementation is undefined, the teachers have to invest considerable time to plan and prepare technology enabled lessons – on personal time and initiative. Many teachers perceive the students' higher knowledge of technology as a threat.
4. Some schools have tried to resolve the issue of limited access to technology during schools hours by keeping school computer labs open after school hours. However, some respondents of such schools confess to serious logistical issues such as security concerns, extra duty hours for the computer lab in-charge, special time table for access to name a few, as being the constraints in making this model a success. Besides, many government schools run two

school shifts per day. Some rural schools make use of the school premises for other social and educational purposes, like adult education or vocational training for which the labs are engaged.

4.4.3.2. *ICT Skills of teachers*

1. Only 10-15% teachers considered themselves 'highly satisfactory' or 'satisfactory' together in the use of technology and equal number of teachers considered themselves 'below average' in terms of knowledge and competency in ICT. More than 75% of teachers' self-perception about knowledge and competency indicated an average level. This shows an overwhelming number of teachers rated themselves as "average" on skills, competency, preparedness and comfort.

2. Teacher skills in ICT were low in rural schools and in government school teachers. The proficiency of using computer for developing presentations, internet surfing, email including word processing was low in rural and government schools. Only in KV, more than 90% teachers had proficiency of using all the skills of computer.

3. 4.4.3.3.***Teachers' view on ICT skills of students***

   About 50% teachers said that urban private and KV students in senior classes had developed some competency in ICT skills related with the use of word-processing and internet. Rural students lag behind their urban peers. Similarly, from teachers' point of view ICT skills of government school students were not as good as those of private and Kendriya Vidyalaya students.

4.4.3.4. *Use of ICT in teaching different subjects*

The study found that not only does ICT predominates core curricular areas, such as English, Science and Mathematics, but ICT is also used for teaching in Social sciences, music and arts, though relatively less in frequency. ICT was used most frequently to promote learning in science. However, only 22% of these teachers used ICT in their teaching of Science at least once a week. At the same time, 20% to 25% reported using ICT for about 2-3 times a month and less than twice a month respectively. For other subjects like Social sciences, Mathematics, English and music, there was very limited usage, around 10% in a week and about 12-15%, about 2 to 3 times in a month. The minimum use of ICT i.e. less than twice a month was reported by teachers for teaching art. It is clear from this examination that the use of ICT is somewhat limited in schools using it in more traditional subjects. The potential for using ICT to develop critical life skills, such as communication, problem solving and independent thinking was not realized by school and teachers.

4.4.3.5. *Use of ICT by students*

1. Students exhibited a modest view of their own skills. It was found that students own perception about their ICT skills as 'good' was found in equal percentage of students (40%) both in rural and urban areas. However, in urban areas, students' own perception about their skills as 'very good' was more number of students in urban areas (12%) than rural (6%) areas. Nonetheless, their perceptions matched with their teachers' views. The reasons for rural students' somewhat low skills can be attributed to the lesser availability of infrastructure in schools and at home as well.
2. A large proportion of students were using computers for about an hour in a week. 50% of the government school students were not using computers in school at all. Although the infrastructure was good in private schools, but the extent of usage of computers was rather low (less than 30%) in the schools. This perhaps, is due to lack of motivation and support from the school.
3. Majority of students stated that using a computer helped them with their school work. This was mainly through the use of internet for projects. Only 24% reported using computer in their houses for homework assignment.
4. Close to 50% students used computer extensively when it came to communicating with friends via email, blogs and other social networks. Other tasks performed on the internet were information collection on the topic of personal interest (38%) nevertheless this is done after school hours. Students' lack of proficiency in the English language acted as barrier in collecting and understanding information from the internet.
5. 40% of students stated that they learnt most about computers by teaching on their own (45% stating that they taught themselves how to use the internet) while 33% stated that they learnt most through their teachers. More students in schools with a high student-computer ratio stated that they were using computers to work with word-processing, presentation and other applications. A small proportion also reported being able to create a multimedia presentation.
6. As a subject, ICT was accorded of much less importance than other more conventional subjects whilst time for using ICTs for learning other conventional subject was not allocated at all. In most cases, each student gets approximately 30–40 minutes (1 period in the timetable) on the computer per week. The respondents in at least 35% schools mentioned sharing of computers between two or three students during such classes to be the norm hence the hands-on time that a single student gets is even less, perhaps 15 minutes per week.

7. Schools did not have a clear policy mandate on using ICTs for subject related curricular work. As a result technology integration for subject learning was not planned by the schools. Principals observed that they and their teachers lacked appropriate training on technology integration with other subjects which affected the decision making processes as well.

4.4.4. Impact of ICT on teaching and learning

Teachers were of the view that, when used effectively, ICT contributes to teaching and learning in many ways. The benefits of ICT reported by the teachers were obtaining instant information, making learning interesting, creative presentation of material, improved classroom discipline and management.

4.4.5. ICT in school administration

1. The study found that 95% of schools used computers for general office use, 60% used the technology for maintaining students' records, and 80% used computers for accounts work. The number of computers devoted to this work is usually one or two. Of the schools that reported designating two computers for this work, one was usually earmarked for the school office, while the other was for the principal.
2. It is also observed that merely providing devices and connectivity does not automatically translate to efficient usage of ICT in schools unless backed by appropriate strategies and sustainable models.

4.5. Recommendations

Following recommendations are made based on the findings of the study:

4.5.1. Improving school ICT infrastructure and access

1. The government should focus on providing quality computers, printers, projectors etc. along with software and smooth internet connectivity. At the same time, it should make provision for regular maintenance of facilities. Specific funds should be earmarked for these activities and disbursed at regular intervals. This is more important for rural areas.
2. Schools should provide access to computers with internet connectivity even after school hours to address the needs of such students who do not have personal computers at home. A small room with few computers can be made available for the benefit of neighborhood children after school hours .This room can have a separate entrance for easy access. Access to community centers can be an alternative model.

3. Involvement of private vendors in providing infrastructure to school may be considered. State Governments should prepare a well defined contract which clearly stated responsibilities.
4. Computer lab should not be the exclusive domain of the computer teacher. Encouragement and involvement of other subject teachers in use of ICT in classrooms should be promoted to ensure better subject teaching and learning.

4.5.2. Deployment of ICT resources in schools

1. Computers should be made available in general classrooms instead of being confined to designated rooms alone to make teaching learning more effective. Alternatively, schools could consider setting up a mobile ICT facility comprising for example, a laptop computer, a printer, and a digital projector – something like mobile laptop trolleys (computers on wheels) that can be wheeled from room to room. This will also resolve security issues because these can be moved easily to a more secure centralized space after use.
2. Multimedia resource room with a projector, computer and Smart Board should be set up for the use by students and teachers for demonstration.
3. A few computers should be placed in the staff room for teachers to facilitate preparation of assignments, question papers, worksheets, result sheets and so on.
4. One or two computer with internet connection may be placed in the library to encourage students for searching information related to their subjects.
5. Efforts should be made by the school to promote awareness among students and teachers on the availability of ICT resources.

4.5.3. Professional development of teachers and principals

1. Teachers need to be empowered and motivated through training, to use ICT for curriculum transaction. Such programs should be organized on a continuous basis.
2. Schools should regularly monitor the ICT training needs of their staff and develop and implement training plans as appropriate. Clustering of small schools for the purpose of such courses might be explored in certain circumstances.
3. Establishment of teachers discussion groups, which connect on a regular basis to share successes and challenges in order to establish professional learning communities within the school and among other schools, should be set up.

4. There is a need to focus and develop teaching-learning resources by the teachers and the students. The material should be placed on the website for encouraging others to develop need based material and also for sharing.

5. For efficient school administration, schools should fully exploit the benefits presented by ICT.

To summarize, it is evident that ICT applications are becoming an indispensable part of contemporary cultures. The easy access, smart deployment and judicious usage of ICT can enhance the quality of teaching learning. Schools should efficiently utilize the benefits of ICT in creating an effective learning environments, thus impacting the overall quality of school education.

References

Al-Ansari, H. (2006). Internet use by the faculty members of Kuwait University. The Electronic Library Vol.24, No. (6), Pp; 791-803.

Alexander, J.O. (1999). Collaborative design, constructivist learning, information technology immersion, & electronic communities: a case study. Interpersonal Computing and Technology: An Electronic Journal for the 21st Century No.7

Bhattacharya, I. & Sharma, K. (2007), 'India in the knowledge economy – an electronic paradigm', International Journal of Educational Management Vol. 21 No. 6

Bottino, R. M. (2003),'ICT, national policies, and impact on schools and teachers' development' 'CRPIT '03: Proceedings of the 3.1 and 3.3 working groups conference on International federation for information processing', Australian Computer Society, Inc., Darlinghurst, Australia.

Bransford, J. (ed.). (1999). How people learn: Brain, Mind, Experience, and School. Washington, DC: National Research Council.

Davis, N.E., &Tearle, P. (Eds.).(1999). A core curriculum for telematics in teacher training. Available: www.ex.ac.uk/telematics.T3/corecurr/tteach98.htm

Doering, A., Hughes, J. & Huffman, D. (2003).Preservice teachers: Are we thinking with technology?. Journal of Research on Technology in Education, 35(3), 342-361.

Haddad, W. &Jurich, S. (2002). ICT for education: Potential and Potency. In W. Haddad & D. Drexler (Eds.), Technologies for Education: Potential, Parameters, and Prospects. Washington, DC: Academy for Educational Development and Paris: UNESCO

Jonassen, D. H. (1999).Computers as mind tools for schools: Engaging critical thinking (second Ed.). Englewood Cliffs, NJ: Prentice Hall.

Kumar A (2002), Department of IT goes to school VIA VIP constituencies, Financial Express, October 9, 2002.

Kubicek, J.(2008). Inquiry-based learning, nature of science, and computer technology: New possibilities in science education. Canadian Journal of learning and Technology 31(1) Winter / hiver 2005. Retrieved http://www.cjlt.ca/index.php/cjlt/article/view/149/142

Laborda, J. G., &Royo, T. M. (2007). Book review: How to teach English with Technology (Gavin Dudeney& Nicky Hockly). Educational Technology & Society, 10 (3), 320-324. Retrieved August 2012 http://www.ifets.info/journals/10_3/22.pdf

Lemke, C., & Coughlin, E.C. (1998).Technology in American schools. Available: www.mff.org/pnbs/ME158.pdf.

Lim, C.P., Hang, D. (2003). Computers & Education Volume 41, Issue 1, August 2003, Pages 49–63

Lin Cheng-Yao National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics; Eurasia Journal of Mathematics, Science & Technology Education, 2008, 4(2), 135-142

Mason, R. (2000). The Internet and Higher Education, Volume 3, Issues 1–2, 1st Quarter–2nd Quarter 2000, Pages 63-74

Mooji, T. (1999).Guidelines to Pedagogical Use of ICT in Education. Paper presented at the 8th Conference of the 'European Association for Research on Learning and Instruction' (EARLI). Goteborg, Sweden, August 1999.

National Council of Teachers of Mathematic.(2000). Principles and standards for school mathematics.Rseton, VA:Author

National Curriculum Framework.(2005). National Council of Education Research and Training, New Delhi.

Plomp, T.; Pelgrum, W. J. & Law, N. (2007), 'SITES2006—International comparative survey of pedagogical practices and ICT in education', Education and Information Technologies Vol.12, No. (2), Pp; 83- 92.

Poole G., Bates A.W., (1999) "Effective Teaching with Technology in Higher Education", USA – Jossey Bass.

Position paper, National focus group on Education Technology, NCF 2005, NCERT, India

Report of the Steering Committee on Secondary, Higher & Technical Education for Tenth Five Year-Plan (2002-2007). Retrieved August 2012 http://planningcommission.nic.in/aboutus/committee/strgrp/stgp_scndry.pdf

Sanyal, B. C. (2001), 'New functions of higher education and ICT to achieve education for all', Paper prepared for the Expert Roundtable on University and Technology-for- Literacy and Education Partnership in Developing Countries, International Institute for Educational Planning, UNESCO, September 10 to 12, Paris.

Sharma, R. (2003), 'Barriers in Using Technology for Education in Developing Countries', IEEE0-7803-7724-9103.Singapore schools', Computers & Education Vol .41, No.(1),Pp; 49--63.

Smeets, E. (2001). Does ICT contribute to powerful learning environments in primary education? Computers & Education, No. 44,Pp; 343-355.

Smeets, E. &Mooji, T. (2001). Pupil-centered learning, ICT and teacher behavior: Observations in educational practice. British Journal of Educational Technology, 32 (4), 403-417.

UNESCO (2002) Information and Communication Technology in Education–A Curriculum for Schools and Programme for Teacher Development. Paris: UNESCO.

UNESCO Communication and Information portal:GESCI: Bangalore chosen as India Headquarters for UN Technology in Education Initiative, accessed on 27 Dec. 2012http://portal.unesco.org/ci/en/ev.php-URL_ID=19610&URL_DO=DO_TOPIC&URL_SECTION=201.html

Yuen, AH.K.,Law,N., Wong, K.C. (2003) "ICT implementation and school leadership: Case studies of ICT integration in teaching and learning", Journal of Educational Administration, Vol. 41 Iss: 2, pp.158 – 170

Yuen, A.H.K., Lee, M.W., Law, N. & Chan, A. (2008). Factors Predicting Impact of ICT-Use on Students: An Exploration of Teachers' Perceptions. The proceedings of IRC.

Yusuf, M.O. (2005). Information and communication education: Analyzing the Nigerian national policy for information technology. International Education Journal Vol. 6 No. (3), Pp; 316-321.

Yusuf, M.O. (2005). Integrating Information and Communication Technologies in Nigeria Tertiary Education.An Online Journals of Africa Education Research Network.

Tools of the study

i. Student Questionnaire

Profile

Name: _____

Class:_____

School: _____

City, District, State: _____

_____

Type of school

Area ☐ Rural ☐ Urban ☐ Peri-Urban

Management ☐ State Government ☐ Central Government ☐ Private

Gender ☐ Boy ☐ Girl

Number of members in family: _____

Family members' highest educational qualification and occupation

	Educational qualification	Occupation
Mother		
Father		
Sibling 1 (brother/sister, if any)		
Sibling 2		

Are you the first generation to go to school? ☐ Yes ☐ No

Technology components | knowledge, access and usage

Infrastructure at home (please tick whichever is applicable for you)

	Yes	No
Do you have computer?		
Do you have internet connection?		
Do you have a cyber café close to your house?		

	Yes	No
Do you have television?		
Do you watch educational programs on TV?		
Do you have CD player?		
Do you use the CD player for educational purposes?		
Do you have mobile phone?		
Do you use the mobile for any educational purpose?		

What is the specific reason you do not have a computer at home?

☐ Cost is too high ☐ My parents are not supportive

☐ I make do with cyber café ☐ I am not comfortable using technology

☐ Any other

Infrastructure at school (multiple coding possible)

TECHNOLOGY TOOLS	YES (PLEASE SPECIFY TOOL WITH NAME, IF KNOWN)	NO	NOT AWARE
Audio/language lab			
Common service centre in the neighborhood			
Community/Campus radio station			
Computers			
Dish TV connections			
Educational CDs/DVDs			
Internet facilities			
Multimedia tools (handheld devices, Interactive Boards, YouTube Videos, documentaries)			
Multimedia Presentations (PowerPoint, Flash)			
Radio (GyanVani, AIR educational programs, school's own audio shows)			
School Blog			
School Website			
Subject specific softwares in computers			

TECHNOLOGY TOOLS	YES (PLEASE SPECIFY TOOL WITH NAME, IF KNOWN)	NO	NOT AWARE
Television			
Thumb drives/ pen drives/USB drives			
Video conferencing/V-Sat/teleconferencing			

Knowledge of technology and Competency

Which of the following technology tools you frequently use (tick all the tools that you use)

TOOLS	YES	NO
E-books/encyclopedia		
Internet surfing/ Email		
Spreadsheet		
Presentations		
Word Processing Software		
Photoshop/Corel Draw		
Programming languages (C++, HTML, Visual Basic, Java, etc)		
Social gaming		
Social networking		
Song download		
Subject specific handhelds/softwares		

How do you rate yourself in use of technology? Rate yourself in a scale of 1-6

	Highly satisfactory (6)	Satisfactory (5)	Average (4)	Fast Grasping (3)	Below Average (2)	Not Satisfactory (1)
Skill sets						
Competency						
Preparedness						
Comfort						

Heterogeneity of use

In which areas is technology being used in your school?

	Yes	No	Not aware
Teaching-learning IT as a subject			
Teaching-learning other subjects			
Research for project work			
Assessment and evaluation			
Administrative (admission, attendance, monitoring)			
Communication (announcements, circulars, rules and guidelines, etc)			
Library and reference			
Educational recreation (debate, quiz, Sudoku, etc)			
Any other			

How do you feel it is different from learning through chalk and talk method?

	YES	PARTIALLY	NO
It promotes practical learning			
It creates visual/auditory impact			
It encourages interactive learning			
It saves time and energy			
Technology can complement and supplement			
Technology cannot replace chalk and talk			
Technology is cumbersome			
Teaching with technology is not suitable for Indian context			
Any other			

Innovative/ creative use of ICT

How creatively do you use technology for educational purposes? Kindly share with us an instance.

Please indicate the subject for which you use ICT the most.

Benefits and Challenges

How did technology benefit you in your learning and life? Share with us your story.

What are the challenges you face for integrating technology in learning? Share with us your story.

ii. Teacher Questionnaire

Profile

Name: _____

School:

_____

City/District/State: _____

Contact email/mobile: _____

Type of school

Area: ☐ Rural ☐ Urban ☐ Peri-Urban

Management : ☐ State Government ☐ Central Government ☐ Private

Gender: ☐ Male ☐ Female

Educational Qualification

☐ BA/BSc/BCom ☐ MA/MSc/MCom ☐ B. Ed ☐ M. Ed

☐ Any other (degree/diploma/certificate): _____

Classes taught with subjects (specify the subjects)

Below IX	
IX	
X	
XI	
XII	

What do you understand by Education Technology & its use in classrooms?

_____

_____

_____

_____

_____

What are the benefits of integrating technology in your teaching-learning process? What challenges did you face?

Educational	Attitudinal	Behavioral	Socio-economic
How has use of technology contributed to knowledge enhancement, for you and your students?	How has ICT changed students' attitude towards learning?	Do you see any change in attendance pattern? What?	Does student's motivation differ with economic and family educational background? How?
Do you feel any development in student Performance? Explain.	Does ICT create apprehension & anxiety?	Do you find your students more motivated to attend class? Explain.	Does gender play a role in differential attitude towards ICT use? How?
How has ICT enhanced your teaching capacity?	Do you find you & your students more confident and extrovert?	Do you find students intellectually more aspired and curious?	How does the factor of sharing resources at home (due to more number of siblings) affect student's productivity in school?

Infrastructure

Do you have the following in your school?

Computers ☐ Yes ☐ No

Where are the computers available? ☐ Computer Lab ☐ Classroom

☐ Administration

If Yes, No. of Computers ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ >20

Is Internet Available? ☐ Yes ☐ No

If yes, what is the type of Internet available? ☐ Dial Up ☐ Broadband

Do you have the following available in the school?

Television ☐ Yes ☐ No If yes, how many: _____

Dish TV connections ☐ Yes ☐ No If yes, how many: _____

V-SAT ☐ Yes ☐ No If yes, how many : _____

Radio ☐ Yes ☐ No If yes, how many : _____

CCTV ☐ Yes ☐ No If yes, how many: _____

Do you use

a) Multimedia/Presentations ▫ Yes ▫ No

If yes, they have been developed by

☐ Teachers ☐ Downloaded from Internet ☐ Procured from External Agency

☐ School Curriculum Developers

☐ Any Other: _____

b) Audio-Visual Documentaries ▫ Yes ▫ No

If yes, they have been developed by

☐ Teachers ☐ Downloaded from Internet ☐ Procured from External Agency

☐ School Curriculum Developers

☐ Any Other: _____

c) Educational CDs/DVDs ☐ Yes ☐ No

If yes, they have been developed by

☐ Teachers ☐ Downloaded from Internet ☐ Procured from External Agency

☐ School Curriculum Developers

☐ Any Other: _____

Do you have the following in your school?

Technology Aides	Type/ subject/ language	Numbers	Do not have any	Not aware
Subject specific softwares in computers				
School Website				
School Blog				
Audio/Language Lab				
Result Software				
Common service centre in the neighbourhood				
School computer lab used beyond school hours for students/ teachers/				

Technology AIdes	Type/ subject/ language	Numbers	Do not have any	Not aware
parents				
Community Radio Station				

Do you think this infrastructure is sufficient, in general and for your subject teaching?

In General ☐ Sufficient ☐ Deficient ☐ Often remain unutilized

For Subject Teaching ☐ Sufficient ☐ Deficient ☐ Often remain unutilized

What else, do you think, can be included in your infrastructure to use technology more effectively?

Technology Tools	Indicate Numbers	Order of Preference
Audio/language lab		
Common service centre in the neighbourhood		
Community/Campus radio station		
Computers		
Dish TV connections		
Educational CDs/DVDs		
Internet facilities		
Multimedia tools (handheld devices, Interactive Boards, YouTube Videos, documentaries)		
Multimedia Presentations		
Presentations made on Flash software		
Radio (GyanVani, AIR educational programs, school's own audio shows)		
School Blog		
School Website		
Subject specific software in computers		
Television		
Thumb drives/ pen drives/USB drives		
Video conferencing/V-Sat/teleconferencing		

Knowledge of technology and Competency

Which of the following technology tools you frequently use (tick all the tools that you use)

Tools	Yes	No
E-books/ Encyclopaedia		
Internet surfing/ Email		
Spread sheet		
Word Processing software		
Presentations		
Photoshop/Corel Draw		
Programming languages		
Social gaming		
Social networking		
Downloading		
Subject specific handhelds/software		

How do you rate yourself in use of technology? Rate yourself in a scale of 1-6

	Highly satisfactory (6)	Satisfactory (5)	Average (4)	Fast Grasping (3)	Below Average (2)	Not Satisfactory (1)
Skill sets						
Competency						
Preparedness						
Comfort						

Heterogeneity of use

In which areas you are applying technology in school or planning to apply? Tick in the relevant box

	Currently using	Has potential, but not using	Planning to use in near future	I need training
Teaching				
Preparing lesson plans				
Research				
Clarification on topics				
New teaching methodology				

	Currently using	Has potential, but not using	Planning to use in near future	I need training
Preparing test papers				
Assessment and evaluation				
Administrative				
Internal communication				
Self professional development				
Educational recreation				

How do you feel it is different from using the normal chalk and talk method?

	Yes	Partially	No
It promotes practical learning			
It creates visual/auditory impact			
It encourages interactive learning			
It saves time and energy in drawing diagrams on board			
Technology is cumbersome			
Difficult to use in class due to heterogeneity of student aptitude			
Teaching with technology is not suitable for Indian context			
Technology cannot replace chalk and talk,			
Technology can complement and supplement			
Any other			
Remarks, if any			

How effective is technology in overcoming hard-spots in subject teaching?

Subjects:	V. Effective	Effective	Like chalk & talk method	Not Effective	Not explored much
English					
Hindi					
Local Language					
Mathematics					

Subjects:	V. Effective	Effective	Like chalk & talk method	Not Effective	Not explored much
Natural Sciences					
Accountancy					
Economics					
Social Sciences					
Home Sciences					
Any other					

Do you encourage students to use technology beyond school hours (kindly elucidate)

Yes	How?
No	Why?

Innovative/ creative use of ICT

How creatively do you use technology to teach your students? Share with us an instance

How do you engage students to creatively use technology? Share with us an instance

Student response and reaction

How do the students react to technology? Mention percentage of students with such reaction

	Percentage of students
Very enthusiastic	
Enthusiastic	
Average	
Lukewarm	
Passive	

How do you rate their comfort, competency and preparedness in use of technology?

Mention percentage of students with such reaction

	Highly satisfactory (6)	satisfactory (5)	Average (4)	fast grasping (3)	below average (2)	not satisfactory (1)
Skill						
Competency						
Preparedness						
Comfort						

School Support

How has your school supported you in integrating technology? (please specify)

Integration in classroom

Integration in curriculum

Support through training

Infrastructure support

Flexibility of integration

Other incentives

Any technology-oriented project being run in your school by government/private/corporate?

Procedures they follow

Is there any prescribed norm/guideline by state govt/ academic boards/ school on integration of technology in administration, curriculum and delivery

Would you like to have standard operating procedures given to you or you would want flexibility in integration/implementation?

How do you think it could be better implemented?

Share with us a success story/event/anecdotes on ICT use for teaching-learning in your school.

iii Principal Questionnaire

Name of the School : _____

Address:

_____

_____

_____

Type of school

Area: ☐ Rural ☐ Urban ☐ Peri-Urban

Management: ☐ State Government ☐ Central Government ☐ Private

Planning

1. What are successful examples of how ICTs have been introduced and maintained in your school?
2. What types of information do you provide and must be provided to schools to aid in the introduction and maintenance of ICT-related equipment and to promote ICT-related instruction?
3. Bringing the technology/computers from of lab to the classrooms – how do you perceive & what challenges?

ICTs on teaching, learning and achievement

1. What is the impact of 'technology-integration' in the teaching learning process in your school?
2. What is the impact of ICTs in education on –

   a. access,

   b. use of,

   c. attitudes toward,

   d. and learning outcomes
3. Are some school subjects better suited for ICT integration than others?
4. How have monitoring and evaluation work related to the uses of ICTs in education been conducted?

Content & Curriculum issues

1. What are the best practices adopted in your school for creating digital content and curricular integration?
2. What are the best practices for implementing education management information systems (EMIS), if any?
3. What issues and special observations would you like to highlight relating to the creation, dissemination and use of technology in teaching learning?

Cost:

1. Budget (percentage) allocated for ICT use in school- allocation for different ICT heads- purchase of hardware, software, maintenance, teacher training, etc
2. Factors influencing budget size:

Socio-economic issues:

1. What is the gender impact of ICTs in education on access, use of, attitudes toward, and learning outcomes?
2. Are there differential impacts of ICT use in education on identifiable sub-groups of boys and girls, economically differentiated student groups?
3. How can/should ICTs be integrated in education and disseminated to ensure inclusion?
4. How do different ICT applications, audio/verbal versus visual representations and modes impact education practices and what suits best to your school needs?
5. What model (computer lab, lab in class, etc) suits best for your school needs?

ICT in Education Policy issues

1. What ICT in education policies and guidelines are currently in place in your school, and how do they address all issues?
2. What regulatory issues exist related to connectivity, information access and usage issues, and what guidelines and best practices have emerged?

Education Quality Foundation of India
1208, Padma Tower - 1, 5 Rajendra Place
New Delhi-110008