Changing Patterns of Communication in Education:

A Study of Educational Technology in Two Schools in Delhi

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Doctor of Philosophy

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DECLARATION

Date: 17/02/2021

I, **Jagjit Kaur**, hereby declare that this thesis entitled ***"Changing Patterns of Communication in Education: A Study of Educational Technology in Two Schools in Delhi"*** is based on my original research work and, to the best of my knowledge, has not been submitted in whole or in part in this university or in any another universities for the award of any degree.

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CERTIFICATE

We recommend that this thesis be placed before the examiner(s) for evaluation and award of the degree of Doctor of Philosophy.

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"Tu khud ki khoj me nikal,

Tu kisliye hataash hai,

Tu chal, tere wajood ki,

Samay ko bhi talaash hai,

Samay ko bhi talaash hai.

Jo tujse lipte bediyaan,

Samajh na inko vastra tu,

Ye bediyaan pighaal ke,

Bana le inko shastra tu.

Charitra jab pavitra hai,

To kyun hai ye dasha teri,

Ye papiyon ko haqq nahi,

Ki le pariksha teri.

Jala ke bhasm kar use,

Jo kroorta ka jaal hai,

Tu aarti ki lau nahi,

Tu krodh ki mashal hai.

Chunar uda ke dhwaj bana,

Gagan bhi kapkapega,

Agar teri chunar giri,

To bhookamp aaega.

Tu khud ki khoj me nikal,

Tu kisliye hataash hai,

Tu chal, tere wajood ki,

Samay ko bhi talaash hai."

(Poem by Tanveer Gazi, From the Film-"Pink")

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Chapter 1

Introduction to Educational Technology

Introduction

As the modern world increasingly relies on technological solutions with the rapid pace of 'rationalization', one may be compelled to ask the question- how the determinants of technologies shape human life and social systems. It is widely debated in the domain of politics, economy, popular media, and culture. The educational progress too is driven by the technologically mediated apparatuses for governance, academic work, and co-curricular activities. As the interaction between the education systems and the technologies get intensified, there are visible changes in the contours of the classroom processes, the role of the stakeholders and the students. Of late, the outbreak of the Covid-19 pandemic has reinforced technological solutions for imparting education across all sections. The sudden shift from schools and conventional classroom learning to virtual platforms are the real challenges in a diverse country like India and at the same time create certain possibilities. The present research holds relevance as it aimed to comprehend the changes in the education systems with the introduction of technologies in physical spaces such as schools. As technology diminishes the space factor in learning and re-defines the new spaces through virtual platforms, it is significant to explore the role of technologies in physical and learning spaces such as schools and the changes it brings about in those spaces. These emerging spaces are the key sites for interpreting the transition from spaces in education with limited use technology to the exclusive usage of technology deploying virtual platforms. The application of technological devices and capture in these physical and learning spaces eventually redefine the role of stakeholders. Communication not only holds a key function in curricula transaction but also transforms the teaching and learning process with the adaptation of media technology. In our times, technological forces are the powerful instruments to communicate the curriculum and intensify the talks of agencies. It is in this backdrop that this study aimed to explore the impact of information and communication technologies (ICT) on the education systems, especially

schools. It focused on the means of changes in the communication patterns among the participating agencies in the schools.

The proliferation of technologies around us is visible in our daily lives. New devices are penetrating the market on a daily basis to fulfill human (un)desirable needs. Technologies are undoubtedly changing the social milieu around us. One can casually observe in public places where people have habituated to use such technological devices frequently and they often ignore the real-life events in their vicinity. The educational system too has been influenced by communication technologies. A study by Emily Drago puts forth that more than 62% of students of the university used mobile phones despite being aware of the reduction in face-face communication. (Drago, 2015, p. 1) This can't be discounted to underline the contributions of technology in our lives such as ease in communication, reducing labor, quick work execution among others. As these technologies are infiltrating every sphere of our lives, education can't remain devoid of it and as a result, one sees the expansion of Information Communication Technologies (ICT) devices in schools and colleges. According to a report by Moulishree Shrivastava, India's e-learning market is second after the U.S.A. and is expected to grow at a compounded annual rate of 17.4% between 2013 and 2018. (Srivastava, 2015) The impact of technology on society can't be divorced from the impact on the teaching-learning process as it is the students who comprise the participants in the society and the schools. Similarly, the impact of technological devices on the communication patterns in the classroom needs to be observed more closely. The objective of this study, therefore, is to make sense of the integration of ICT in the education system and evaluate the impact of the educational-technological devices on the communication patterns in the classroom.

Michael Young was of the view that rather than providing a simplistic anti-technology argument, sociologists should offer a holistic view of technology which places it in the context of its usage. This would encapsulate understanding 'people's relation to technology', which for this study would mean the teachers, students, and parents. (Young, 1984) As we know, the classroom is not a linear space, but it involves a complex interplay of various dynamics such as the role, location, and personality of the teacher, the experiences and location of the students, the school administrative control among other factors. These factors mediate how the ICT devices mediate the classroom transactions and thereby, the communication patterns. Moreover, the socio-psychological traits of the classroom as a whole and the cultural context of participants belong to the diverse class, caste, regions need to be taken into account. This

study probed into such objectives by engaging in participant observations in two schools in Delhi-NCR, one which was a private school using ICT devices and the other was a Government School using ICT devices to be able to realize the difference in classroom transactions keeping other factors constant such as location, class, and so on. The interviews of the participants and the content analysis of the curriculum materials supplement the observations aiding in a more vivid analysis. The methods and contents of observations, interviews are further elaborated in the methodology section.

Education is a critical location in which knowledge is being generated and imparted through the established institutionalized structures such as schools, colleges, and universities. Though multiple factors play a role in the process of education such as policies, governing structures among others, it is the immediate classroom context that effectively drives the dynamics of education among the participating agencies and groups. More specifically, the curricula content, the medium, and the engaged participants together constitute the classroom culture. No doubt, it is the curricula content that informs what is considered valid knowledge. However, it is also equally important to think about the role of the medium through which the body of knowledge is being generated, transmitted, and imbibed.

The act of communication determines how and to what extent ideas and values are being conceived in a given situation. In modern society, communication acts as a powerful medium for generating, sharing, and reformulating knowledge. Hence, communication can be understood as a type of social interaction that involves the transmission of meanings with the effective usage of symbols (Dahama, 2010). Moreover, communication is a vital part of social interactions and human relationships. Every society patterns the act of communication and creates structures around it depending upon the very nature of society, particularly, the socio-economic-political institutions and their shared values and customs. What is being shared and patterned through the act of communication, subsequently then, influences the interactions in different contexts. Education is one such sphere in which the act of communication for interaction has been consciously played out both theoretically and empirically. It can be an operational tool to shape the teaching-learning process effectively. Lim and Chai (2004) state that technological devices such as ICT can help reduce the ‘communication barriers of space and time’. Similarly, it can be a scale to assess the outcomes of teaching and learning. It can also be an effective tool for the holistic understanding of the education system itself. In other words, the act of communication unleashes multiple strands in the process of education. This

study, therefore, aimed to understand and explain how varieties of communication channels inform and influence the educational process in the school setting.

As has been said, the shared patterns of communication are influenced by the socio-political-economic nature of society. A major overhaul that took place in society was during the period of the industrial revolution led by the invention of technology as a medium of communication. New machines were invented for different kinds of work and with it, new ways and means of communication developed. The notion of technological development seeped into the arena of education too. The emergence of technology in the sphere of education has evolved from chalkboards in the 1890s, pencils in the 1900s, radio lessons in the 1920s to the present context of the usage of computers. If one traces the trajectory of the evolution of these devices, it can be said that these technologies changed how education was imparted and transmitted in the classroom. For instance, the photocopier machine in 1959 enabled the 'mass-production of material' for school purposes. Then, in 1990, when the world wide web was opened for 'commercial usage', there was a change in academia in terms of the ways of studying and 'communication methods. (Purdue Online, 2020a) Albirini (2007, p. 229) states that the introduction of technology in the classrooms in the United States was furthered by a 'corporate-military' nexus with the twin aims of profit expansion and developing social control.

Due to the invention and increasing usage of technology in the present times of liberalization, globalization, and privatization, there has been an increasing demand for technological devices by schools. Though one school of thought would emphasize the skill-development, reduction in labor due to the introduction of technology, other schools would highlight that the shackles of the technology have become more insidious. Carbone (1995) is of the view that though the major aim behind 'restructuring' of the classrooms was to transform the educational scenario for better outcomes such as 'to facilitate communication, meta-cognition, active learning, reflective practice, transdisciplinary education, and even human values' but its interaction with various dynamics such as the teacher's autonomy, economic control and so on lead to varied questionable outcomes at the school level which needs to be critically seen. He further states that this leads to the de-skilling of teachers, reducing the knowledge to objective facts and supplements the interests of the corporates. McFarlane (2010, p. 2) states that though there are many benefits of techno-driven communication, "communication in our modern technologically fast-paced society suffers from "social myopia" because individuals now desire fast and brief communication with less emphasis

placed on appropriateness in linguistic forms, respectful and orderly expressions, and quality effectiveness which is a time-consuming process". He further adds that the sphere of education is 'becoming adaptive' to the 'fast-paced technological environment' leading to a 'modern communication crisis' where there is an increase in lack of 'effective communication'. There are various ways in which technological spaces have overshadowed human communication. How these communication patterns defined by technological solutions condition the social structure and change the space for communication were some of the questions undertaken in this study.

Problem of study

Education is integral to society and is inextricably linked with the other systems of society. Any shift in the sub-system such as economy, polity, the culture will reflect on education because of their close interlinkages. From a sociological point of view, education holds a specific function of socialization by introducing the young learners to follow the norms, customs, and systems of society. (Durkheim, 1956) Through deliberative communicative action teaching and learning takes place in education.

Communication is integral to the curriculum transactions and classroom discourse. Today technological apparatuses are extensively used to make this process effective. The role and importance of communication cannot be undermined in the classroom context where the process of the teaching-learning undergoes through the medium of communication. As has been discussed, the communication patterns are socially and contextually determined and so, with the increase in the introduction of technological devices in the classroom, the communication patterns are bound to change. Bruner (1974) talks about the dependence of learning and thinking upon the culture and with technology being perceived as the 'artifacts of culture', education is bound to emphasize the role of technology in the process of teaching-learning. Technology will be bound by the educational objectives and will change the course of transactions happening in the classroom. In the American context, the introduction of the technology has necessitated the need for restructuring schools which involves the teacher's role, the skill development of the students such as communication, problem-solving among other factors. (Carbone, 1995, p. 11) Communication adapts and adjusts to the changing circumstances. With the introduction of new technologies in education, there is a 'diminution of space/factor in learning'. (Pathak, 2002, p. 161) Similarly, the changes in other structural processes such as the teacher's authority and the student's participation. The project of

modernity had led to the development of technology and its advancement with time. To situate the purpose of usage of technology and its ramifications in the classroom, it is vital to locate the historical trajectory of usage of technology and its pedagogical implications. Though communication is a very important part of the classroom discourse, it is not an ideologically neutral medium for dissemination. Education, during the pre-colonial period, was intricately linked to the village economy and served the purpose of equipping the students with the skills required in the economy. As the written communication was not present, the focus was on 'accent and pronunciation of the words' which had to be preserved. (NCERT, 2005) Oral tradition and folklore inform us of the usage of chalk, slate by the students for studying before the colonial period. With the colonial invasion of India, printing was introduced in 1885. The availability of the written text increased and western education proliferated across India. Further, as Krishna Kumar argues education during this period was 'examination-centered' and 'textbook driven', the proliferation of technology in the classrooms was hardly visible. (Kumar, 1991)

After independence, the education reports and policies emphasize the significance of introducing technology in the classrooms. The Fifth five-year plan set up schemes for expansion of technology in the realm of education which was 'setting up an educational technology unit in the Ministry of Education and Social Welfare, establishing a center for educational technology (CET) in NCERT, assisting states for setting up educational technology cells and their programs on 100% basis and strengthening a few education initiatives for undertaking education technology programs'. (Goswami, 2014) Since then, there were several initiatives by the state and private sectors such as SITE, INSAT which promoted the expansion of educational technology.[1] All such initiatives served the purpose of bridging the gap of social inequality through the medium of education. Communication, therefore, was more or less 'textbook driven' with few references to technology due to limited proliferation. Though the initiatives expanded, their impact was limited due to various constraints such as paucity of resources, the traditional habits of using textbooks, the weak monitoring mechanisms among others. (NCERT, 2006) In the 1990s as the internet was made accessible for the public, the proliferation of technology has widely expanded. This period increased dependence on

[1] SITE (Satellite Instructional Television Experiment)- A programme introduced by Government of India in 1975-76. (Karnik, 2015)
INSAT- A satellite called Indian National Satellite launched in 1983 and used for educational purposes. (Indian Space Research Organization, 2020a)

technology as various reports would justify.[2] So, it can be said that with the advent of technological communication and its increasing usage, there has been a change in the processes of the educational institutions due to the restructuring and re-patterning of the content and the manner of communication:

- Content of Communication- The content of communication entails the question of 'what' of communication, that is, the content of the conversation between the individuals or the group. When educational technology enters the classroom, there are supplementary texts introduced in the classroom via these technologies which offered a better learning experience for the students. There are ways in which the content of communication has changed during academic learning. Whether the mode of conversation between the teacher and student be effective with the introduction of the technological devices within and outside of the classroom. Subsequently, whether the quality of discussions can be improved with the introduction of these technological devices are some of the changes discussed.
- Manner of Communication- How communication takes place in a technology-driven class? A study between technology-driven and non-technology driven classrooms may inform its effect upon the students and teachers in the former settings. The process of communication takes place at three-facets which involves the device, the teachers, and the students in a classroom setting. The communication, thus, is expected to alter during and after the class sessions. As technology is taken to be a critical factor of communication in education, one needs to examine whether face-to-face communication witnesses new dynamics in this environment such as long or short conversations.

In the wake of globalization, liberalization, and privatization, technology has not only created its industry in society but also intruded into the education system as well. The corporate groups governing educational institutions devise new technologies, methods, and tools which aid expansion in the teaching-learning process. On the other side of the spectrum, it generates a fear that technology may replace the conventional medium for communication. This doesn't happen in a vacuum but in the context of the changing patterns of communication in society at

[2] It is being estimated that India will be the second largest market for e-learning after the US. The current market share is estimated at sector US$ 2-3 billion, and is expected to be at US$ 40 billion by 2017, as per India Brand Equity Foundation report, October 2016. (India Brand Equity Foundation, 2016)

various levels. How these technological devices structure and shape the communication patterns in society is beyond the control of those who use them for fulfilling various needs. This study, therefore, aimed to investigate the changing patterns of communication in the education system driven by the ever-increasing dependency on technological apparatuses. Moreover, it examined the anticipated changes in the wider socio-economic context of society.

Research Objectives

The research objectives of the study were:

- To study the importance of the information and communication technologies in shaping the societal forces historically and their relevance and application for the educational purpose.
- To examine the communication networks and processes in and around the school system that tends to influence the teaching-learning process between agencies and systems such as school-parents, school-school, teacher-student, teacher-teacher, teacher-parent, school-teacher.
- To capture the pattern of changes and their effectiveness in oral and textual communication with the introduction of educational technology. And whether such changes redefine the role of teacher, student, and other participating agencies in the school system.
- To explore the production and reproduction of communication patterns while adapting technologies of communication in the school context and find out its ideological underpinnings.

Conceptual framework

History and context

As has been discussed, the emergence of technology in the sphere of education has evolved from chalkboards in the 1890s, pencils in the 1900s, radio lessons in the 1920s to the present context of the usage of computers. If one traces the trajectory of the evolution of these devices, one can observe how these technological adaptations changed how education was imparted and transmitted in the classroom from time to time. For instance, the photocopier machine in 1959 enabled the ‘mass-production of material’ for school purposes. Then, in 1990, when the world

wide web was opened for 'commercial usage', there was a change in academia in terms of the ways of studying and 'communication methods.' (Purdue Online, 2020a)

Albirini (2007, pp. 229-231) gives a historical account of the interaction between digital technologies and the realm of education in the United States. It was in the 1950s that digital media took upon itself the mission of 'technologizing schools', furthered by the information industry's agenda to legitimize itself through the 'knowledge system'. As these technologies evolved, it was purported that the technology would 'revolutionize education' to 'democratize education', 'decentralized instruction', 'remove hierarchies in communication and interaction' among other motives. The early behaviorist technology programs were developed to 'cure the ills of the traditional classroom' and the belief that the information can be conveyed 'more effectively than the teachers'. This model was critiqued on account of 'ignoring the learner satisfaction, creativity, and social values.' In the 1980s, it was the technological programs based on the 'constructivism' that gained momentum leading to 'procedures for facilitating learner processing and interaction from procedures for manipulating instructional materials'. This too was later criticized on the ground of an 'add-on to a central curriculum'. After the 1990s, it was the internet-based programs that were incorporated in the curriculum which didn't rely on any theoretical model but its impact on the classroom dynamics.

The rapid expansion of technology in India took place mainly after independence. One of the earliest educational technology initiatives was SITE in 1975-76 which used television and radio for disseminating varied courses and programs. Then, the Centre for Educational Technology (CET) was set up by the Ministry of Education in 1970 under NCERT for 'formative and summative research', 'in-service training' among other programs. (NCERT, 2006) There have been numerous initiatives by the government and the private sector to extend the usage of ICT in the sphere of education such as EDUSAT satellite, NPTEL, programs by organizations such as UGC's- Consortium for Educational Communication(CEC), among others, since then.[3] ICT in India has expanded to increase accessibility, affordability, and

[3] EDUSAT- Also known as GSAT-3, was the first educational satellite launched by ISRO. It is 'meant for distant classroom education from school level to higher education.'
(Indian Space Research Organization, 2020b)
NPTEL- National Programme on technology enhanced learning is 'an initiative by seven IIT's' for creating course material for engineering and science. (IGNOU)
CEC- The consortium for educational communication known as CEC is an 'Inter University centres' set up by 'University Grants Commission' to address the goal of providing higher education through the use of television. (Consortium for Educational Communication, 2021)

quality of education. (Mehta & Kalra, 2006) The purpose of increasing the spread of educational technology in developing countries like India has been to expand its reach among all the strata of society, towards achieving more equity. Though the range of programs has been wide, many of these schemes have not been implemented with rigor.

Rapid structural changes like globalization, liberalization, and privatization have invented and adapted new technicalities and order in society. Technological development and progress associated with these changes have not only widened its scope but also re-casted the very structure of society as well. In this context, there is a need for understanding the purposes and how such technologies are facilitated for what purposes. The process of Globalization was initiated with the policies of liberalization and privatization in the 1990s was to provide the context to understand these changes. Broadly, it was in the 1990s that the Indian economy being opened for foreign investors for investment in the country. Liberalization policies relaxed earlier restrictions particularly in areas of the economy by 'lowering trade barriers, opening up markets to imports, eliminating restrictions on foreign capital'. (Goldman, 2005, p. 92) This was accompanied by the process of globalization which is a 'trans-territorial' concept and includes an 'all-embracing reach' of all the events in the society, 'organized at multiple levels-local, provincial, national, regional, continental and global'. (Mann, 1986) According to Giddens (1990), globalization intensifies worldwide social relations which link distant localities in such a way that local happenings are shaped by events occurring many miles away and vice versa. Smith (1998, p. 371) highlights some of the important changes in the education sector due to the processes of neoliberalism and globalization which is 'tying the financing of education to target projects, such as the 'technologization of instruction'. It is through technology that the globalization of knowledge systems takes place in the world. Giddens (1990, p. 76) argues that there has been a 'worldwide diffusion of technologies, not just in production but all spheres of our lives'. This, then, impacts the means through which education is disseminated, communication in this context.

To draw the linkage between educational technology and interpersonal communication, one needs to understand first how the diffusion of information takes place from the media to the public both theoretically and pragmatically, as discussed in the further sections.

Research Questions

As has been suggested in the review of literature, technology plays a vital role in shaping the other socio-economic-political subsystems of society. As Adorno states, technology itself becomes an 'industry' that creates 'false needs' to perform the function of the advancement of technology. (Adorno, 1991) It develops social control over the humans where they work for the maintenance of the system itself. Communication, thus, is geared towards fulfilling the ideological agenda of the system and adapts accordingly to the social systems of control created by technology.

This study began by looking at how technology eventually implicates the communication patterns in the educational domain. A socio-historical approach became salient to explore the contextual determinants of technology on the subsystems in society. The history of the evolution of technology, especially educational technology, and its sociological implications in the pedagogical practices was useful to explain the changing communication patterns today. Given the nature of fast adapting technological apparatuses in school education, this study explored the complex network of communications, its actual operation, and effects on the social relationship between the agencies such as the school-parents, school-other schools, teacher-parents, and then, teacher-students, school-teachers inside the school system. It, was, therefore, imperative to factor these communication networks and processes with the introduction of communication technology and the extent of the effect on the communication patterns in the school system. In a specified context of school and society, how the educational technological devices are shaping the discourse of the classroom entailed the subject of inquiry in this study. It problematizes the communication in the classroom between the teacher and the students through the medium of oral communication, texts, any other means if used. And at last, an attempt was made to examine the factors that facilitated the interdependence between technology and human relations. For instance, once the students are habituated to search material online, the students would find it easy, quick to do it next time too which might be helpful for the learners but then, this creates 'new needs' in Adorno's (1991) terms, which homogenizes the space of classroom learning and further facilitates interdependence between the technology and humans.

The research questions identified under this study were:

- Why the information and communication technologies are significant as historical force and social process and their relevance for the contemporary education systems?
- What are the communication networks, processes that exist in and around the school system, and patterns of relationship between agencies and systems like school-parents, school-school, teacher-student, teacher-teacher, teacher-parent, school-teacher that influence the teaching-learning process?
- How have the educational technologies changed communication patterns in the curriculum transaction, pedagogical practices, and classroom discourses? What is the role of technological artifacts in redefining the role of the teachers, students, and other participating agencies in the classroom?
- How the technological apparatuses of communication produce and re-produce changes in the communication patterns in a school context and what are the ideological underpinnings of such technological adaptation?

Methodology

This study examined the impact of technological apparatuses especially media-technology on the communication patterns in the education system. Given the significance of the problem under this study, both the content and the manner of communication patterns were explored. Both the qualitative and interpretative methods were deployed to collect first-hand information. Specific research questions and checklists have been prepared to gather the primary information from the teachers and the students in the sample schools chosen for the field investigation. An attempt was being made to understand the extent/levels of interaction taking place in the school focusing on how technology has been instrumental in informing the agencies in the school step into a new mode of communication and interaction. The Information gathered through primary investigation was analyzed, codified, and described in the light of sociological theories and supplemented with existing studies and literature**.** Following the interpretative tradition, this study makes sense of the situational properties that shape the communication pattern of students and their learning processes with the usage of information and communication technology.

The conceptual tools used in this study were:

- Technological devices- These can be defined as the devices invented as a result of the application of science to solve the practical purposes of fulfilling daily needs.

According to dictionary (Merriam Webster), technology means "the science of the application of knowledge to practical purposes". For this study, technological devices encompass all the devices used by the participants such as computers, mobile phones, tablets, including web services for varied purposes. Also, educational technology means the use of ICT in the classrooms devised by various corporate groups for academic purposes.

- Information Communication Technology- Blurton (1999) defines ICT as a varied collection of technological gear and resources which are used to communicate. These are a diverse set of technological tools and resources used to communicate and to create, disseminate, store, and manage information. For the purpose of this paper, ICT has been covered under the wider category of educational technology.
- Communication- In simple terms, it means the exchange of messages between two individuals or groups for a specific purpose, involving the decoding of meanings at both ends. According to Luhmann (1995), 'communication is the evolutionary operator of the social system'. Communication can be both verbal and non-verbal and can take place in varying forms such as symbols, oral messages, written messages among other forms. It is the basis for the social existence of humans and aids in the performance of our daily chores. Education is a process of learning and so, communication forms a basic premise in the facilitation of the same.

Participant observations of the classrooms where such technological devices were being used was one of the methods being used for the research. This was coupled along with the observations of the classrooms where educational technologies were not used. It was useful in capturing the processes of communication in the classroom and the changes due to the usage of technological devices. As the study intended to observe the communication patterns, certain themes were used based on the objectives of the study. It offers better insights into the processes of the institution as it gives space to the researcher to go beyond the themes already conceptualized. Both the content and the manner of the communication were in mind while observing the teaching-learning process taking place with the help of technological aids in the classroom. The tentative themes for the observation were:

- The usage of educational technology for specific academic purposes such as quiz, question-solving, watching videos, and so on.

- The content of the conversations while technological devices are used in the classroom and the ones without it.
- The change in behavior and perception of learners and teachers in the process of learning while technological devices are being used.
- The retention and the assessment (with and without educational technology) after such devices are used in the classroom to know the impact of technological devices.
- The usage of technological devices for non-academic purposes and their role in the classroom.
- The re-defining role of teachers and students in the classroom with the introduction of technology.

Semi-structured interviews were conducted among the teachers/ students/parents/industry organizations such as curriculum developers to understand how educational technologies are developed and deployed in the field of teaching and learning. (See Appendix II) This aids to learn the perspectives of agencies on various dynamics of the changes brought by the educational technologies. Following themes were identified for the conduct of interviews:

- The perception of the teachers, students, and parents towards the usage of technology for teaching and learning.
- The purposes and the time for which the teachers encourage the usage of technology to the learners in and outside of the classroom discourses.
- The views of the teachers, parents, and the students in the changing classroom discourses, the habits of the learners, and the societal processes due to the introduction of educational technology.
- The views of the teachers, the students, and the parents on the changing communication patterns inside and outside the classroom with the proliferation of educational technology.
- The factors affecting the usage of technology for different purposes such as homework, games, and so on.

Content analysis as an approach involves analyzing the characteristics of the content of the technologies by keeping in mind the purpose of doing the research. It involves understanding the nature of the content, the process of its production, and the possible influence on the teacher and the students. Content analysis was supported with other methods to map the

full picture of the dynamics of the working of the media. As this study aimed to investigate the role of educational technologies in influencing the communication patterns in the educational system, the content analysis entailed the conversations between the agencies. To get a preliminary understanding of the proliferation of technology in the lives of the students in and outside the school before this study, semi-structured interviews of about 15 school attending students were held, the findings of which will be highlighted in the further section.

Insights from preliminary conversations

To capture the glimpses of the proliferation of the technology and its impacts on the lives of the school students in the age group of 15-18 years, the researcher conducted semi-structured surveys of around 15 students of different schools. The responses generated indicate the extent of interaction with the technological devices in and outside the school and their role in education. The findings indicate that the mobile phone was the commonly used device by all the students, followed by television and laptops. As all of them had personal mobile phones, they used them for maximum hours, sometimes even brought them into the school. This was followed by watching television in the range of two to six hours, followed by a laptop by some for one to two hours per day. Almost all of them informed that they used a mobile phone for 'fun' and 'entertainment', mostly for social networking such as Facebook, WhatsApp, and Instagram to 'chat, upload their photographs, for sharing photographs and for emergencies'. They relied on television for 'watching cartoons, serials, news, listening to songs', laptop for 'games and watching videos.' A boy student said he heard radio for 'listening to cricket score, news' and much more. While most of them held personal mobile phones and laptops after class ninth except one boy who got it in the class sixth. The students were introduced to television since their childhood.

When asked about the length of time they spent on studying after school, a boy student who was in class twelfth said that he studied two-three hours, another one in the class tenth said he studied for four-six hours. But a large section of them studied from one to three hours without the aid of any technological devices. While responding to the impact of usage of such devices on the education of the students, some said that it made a positive impact on their studies as they could find out some words or meanings. Others said that only limited usage has been beneficial for them. A few of them revealed that they get distracted while using technology. The researcher also learned from the students that there was no impact of technology on their studies. Children's parents too had views on the usage of technology and

the responses varied from harmful impact due to 'distraction', beneficial impact if used in limits and believing that it can be useful for education, as viewed by the students. Some parents stopped their children from using such devices as they cared for health reasons such as vision problems, etc, as stated by the student's. The teachers of some of the students felt that '*scope hai but limited use karo tab*', (There is scope but when you use for limited time) while some other teachers felt the students should limit social entertainment through technological devices such as 'gaming, social networking sites' but use it for studies as one child wrote, 'technology is best for us'.

The ICT devices being used in the school varied from smart boards by Extramarks to desktop computers which were used for computer class and a few other subjects. Some students complained that even they were not allowed to enter the computer room. The usage of technological devices in the school varied from computer programs, course-related worksheets, word meanings of the chapter, and some extra information related to history. The teachers encouraged the students to use technology for searching information on websites, some students said, *'sab waste hota hai, sirf paise lag jaate hain cyber café me'*, (It's all waste, only more money is spent in cyber cafes), as the assignments that students got for homework such as on 'global warming, save water, festivals such as Guru Gobind Singh's birthday' were of the similar nature. One of them mentioned that they were encouraged to make course-related assignments such as 'on reflection and refraction', or 'make PowerPoint presentations for subjects or competitions', 'develop communication skills by writing on various topics on the computer' among varied assignments. Another student stated that the teachers encouraged them to use technology because 'the CBSE board required them to do so'. Some students were of the view that mobile applications like google talk have eased how they use the technology as they just have to speak the question and they can get the answer.

Empirical site

The empirical site of this study was a sample unit comprised of two schools in Delhi, the capital city of India. A sociological explanation of the expansion of the urban cities entails that urban cities usually expand to the neighboring areas as they eventually attract more population and it is usually in the vicinity of these urban fringes that the industrial units are located. According to Delhi Master Plan 2021, the industry for "computer hardware, software industry and industries doing system integration using computer hardware and software", "Industries catering to the information needs of uses by providing databases or access to databases spread

throughout the globe", "Industries providing the facilities for sophisticated testing of different or all components of the information technology", "Telecommunications and enabling services" and so on need to be located in NCT of Delhi. (Master plan of Delhi, 2021) These locales necessitate the demand for creating a new ecosystem including school facilities for the working population in these industries. Since ICT industries are driven by skilled professionals, they routinize the usage of ICT at homes for day-to-day activities. These observed behavioral changes shape the expectation of their student's education as well. The schools that came up in these new geographical spaces would outline the style of functioning according to the perception and requirements of the IT professionals. The new synergy that symbiotically establishes between corporate outlets, schools, and the urban population navigates ICT as a new set of skills to be imparted to the new generation of learners. The schools chosen for the fieldwork are located in an urban locale, especially in the vicinity of the proliferation of the ICT industry, the zone where the impact of the ICT proliferation is widespread in the first place.

Out of a total of approximately 600 government schools and 700 private schools in Delhi-NCR, that is Gurgaon, (Department of School Education, Haryana, 2016), the choice of selecting a Government school was based on the condition that it was the only English medium school in the district that used ICT for learning to an extent. For choosing the Government school, a tentative list of all the schools in the district was prepared, followed by contacting them via telephonic conversations and subsequently visiting the school. For choosing the private school, approximately 100 schools were contacted through e-mails, calls, and visits, and depending on the response, one private school was chosen in the same area to keep the location the same to be able to control the influencing factors. The usage of ICT was a major factor in choosing both the schools besides keeping the location constant. This study employed participant observations in two schools in Delhi-NCR, one being the private school (Qmark School) and the other being the public-funded school (Beanbone School) to understand the diversity of classroom discourses. The intention behind choosing these two schools was to see the different ways in which the market forces pushing technology in the private schools and how the state enforces introducing educational technology in the government schools. The primary information was collected at the secondary level (class VI-VIII) to gauge the opinions/responses of the students and to see the actual visualization of ICT at senior grades where teaching-learning becomes more rigorous (for every school easily introduces it at the primary level).

The study is based upon a semi-ethnographic work carried out in the selected schools. The methods used for data collection include participant observations of the classrooms, semi-structured interviews of the agencies involved in the curricula transactions, the content analysis of the ICT related materials used in the school curriculum. Specific checklists/schedules were prepared for the teachers, the students, the principals, the parents, and the corporates. (See Appendix II) These were then revised after administering in the field, keeping the mind the participants, their exposure to ICT. It enabled to get the insider's perspective on the usage and relevance of ICT in education and reify these observations with the theoretical underpinnings of ICT policy discourses. To capture the glimpses of the market demand for the ICT in education, certain databases from organizations were utilized along with the visits to ICT fairs and corporate conferences. (See Appendix III) The data collected from these organizations were tabulated and analyzed to demonstrate the varieties of ICT products according to the market demands. Although the study deployed a qualitative method, an attempt was made to collect responses on the questionnaire from approximately 90 students of class VI-VIII of the Qmark School on the identified parameters. Although checklists were prepared for the Beanbone school as well, since ICT was introduced after class X, the checklists had to be altered qualitatively keeping in mind their exposure to ICT. The data was tabulated and the responses were analyzed through stata software for a better representation of information. The first school, the Qmark School was a private school in Delhi-NCR which aimed to provide 'child-centered learning' to the students using technology as an aid to learning. It was set up a decade back to provide an education based on 'experiential learning'. Technology is one of the means through which experiential learning can be improved. The second sample school, the Beanbone School was a government-run school in the vicinity that had been the beneficiary of various government schemes for technological up-gradation of the school and its curriculum. But here adaptation of ICT was less intensive than the first school.

This study illustrates the details of how communication be effective in the school settings because of the adaptation of information technology and as a result, the effectiveness of existing social relationships as well as social networks that establish between agencies. It finds out the different layers of relationships, for instance, student-student, teacher-teacher, and so on tend to evolve in a school setting and what extent these layers (social relationships and networks) critically engage with technology in terms of making social interaction more nuanced. It focuses on the social setting of the school driven by the educational technology and explores it through field observation. Subsequently, it probes into the incorporation of

educational technologies in the curriculum and pedagogy and account for the perspective of the agencies such as students, teachers, non-teaching staff, management, parents. To examine the impact of communication due to technology on society in general, the survey and interview of the parents of the students and teachers were conducted. The observations of the school, especially the classroom helped understand the role, importance, and usage of technology in education. To makes sense of the intersubjective dimension of the interaction between the content of the technology, teachers, and students, content analysis of the curriculum was carried out.

Rationale/Relevance of the study

As has been discussed, technology has begun to play a central role in our lives and inside the walls of the classroom. It is changing the way we live, perceive our surroundings, and our relationships with each other. Communication, being central to our everyday interactions and social processes, has been undergoing changes with technological innovations and adaptation. This study aimed to examine the impact of techno-driven learning driven by the new modes of communication to understand how these new emerging structures shape our everyday transactions. It provides insights into how technology is adapted in the classroom discourses for effective learning. This study also significant to enquire the relationship between the technology industry and the education system, school in the changing global context. Besides looking at the various ways in which technology impacts us, this study provides glimpses of the development of the educational technology-based industries and their relationship with the education system. The conflicting claims of the usefulness of technology and its limiting impact are further explored.

Nature and Scope of Study

The study encompasses broad scope:

- To account for the changes in the teaching and learning processes with the adaptation of educational technology in the classroom context.
- To examine the impact of educational technology-driven instruction on communication patterns and processes.
- To make sense of the perspective of the teachers, parents, students, and the school administration about the usage and influence of technology on the teaching-learning process.

It focuses on the changing pattern of classroom interactions and communication with the introduction of technology-driven instruction in curricula transactions. It offers a descriptive analysis in the light of field-based observation, interviews, and content analysis which is further elaborated later on.

Summary

This chapter discusses the introduction to the context of the study and then highlights the objectives and research questions. It posits the problem of the study in a global and national context to fathom its uniqueness, usefulness, and implications in the field of school education. The chapter revolves around the questions of:

1. Why is technology becoming an important part of our lives?
2. What role and place is it acquiring in the domain of education? What impact does the technology bring about in the education systems?
3. How do we understand the intersection between technology and education in the present and the coming times?

The chapter elaborates on the methodology for the study, the methods for data collection, and the tools chosen for the data collection and analysis. The last section elucidates the insights from preliminary observations from some secondary grade students on the role and meaning of technology in their lives and the nature, scope, and relevance of this study. The chapter addresses that technology in education isn't a new phenomenon, although the emergence of computers in education for pedagogical purposes has been a recent innovative idea. Although such approaches have global discourse, their specificity to the developing nations such as India needs to be looked at critically as it has implications for the students, the teachers, and the parents involved in the school system. Also, it is important to dwell upon this problem of integration of technology in education by understanding its impact on the field as per the objectives of the study.

Chapter Scheme

The brief chapter scheme and its description for the thesis are described as under:

1) Introduction to Educational Technology- This chapter highlights the introduction, the problem of the study, the research questions, the objectives, and the methodology of the study by placing the problem in a contextual framework.

2) Theorizing technology, communication, and education- The chapter provides insights into the theoretical literature on communication, technology, and education thereby, their linkages with education. It reviews the related researches in the same domain to be able to place the uniqueness of the research in the present context. It explores the learning theories in education and the relevance of technology-enabled learning in their contexts. The chapter also highlights the implications of the emerging technologies in education in the present times.

3) Integrating Communication Technologies in Education: Policy discourses on ICT in India– The chapter highlights the conceptual terminologies surrounding ICT to decipher its meaning specifically and in a better manner. It dwells upon the debates surrounding national policy on ICT in Education in India and the proliferation of the policy discourse at the state level in India. It discusses the linkages between the IT and ICT industry in India and the history of the ICT market in India to situate the debates in a relevant context.

4) Integrating ICT in Schools: Classroom ethnography- The chapter presents narratives from the field structured around the varied disciplines taught in the school's classrooms using ICT. It highlights the observations and findings from the field by the use of methods such as observation, interviews, and content analysis.

5) The Ramifications of ICT in the school systems- This chapter is an analysis of the findings as per appropriate themes and available literature. It is a reflection of the findings to understand the actual role of ICT in impacting the agencies involved in the school system, the curriculum, the administrative work, and thereby, the entire education system.

6) Conclusion and Summary- The chapter concludes the thesis by providing the final gist of all the debates along with a summary of all the chapters and the way forward for the same. It highlights that although technology has been normalized to a great extent, its usage in the

realm of education needs to be critically reviewed as it has implications that are difficult to challenge later on.

Chapter 2

Technology, Communication, and Education: Theoretical Reflections

Introduction

Presentation of field data through the statistical analysis in the following chapter maps out the proliferation and the role of technology in the contemporary world. These structural transformations have a significant impact on schooling. The adaptation of technological apparatuses in the schools shapes the ongoing discourse of classroom processes, pedagogical practices, and curriculum transactions. As these observable changes are insulated into the body of the educational system today, adaptations of technology foregrounds a unique context. To understand the nuances of these debates, it is vital to explore the conceptual schemes, theoretical formulations, and policy discourses centered on technology, communication, and education.

This chapter examines the theoretical progress in conceptualizing technology through the lens of anthropology and sociology. It analyses the relationship between technology and society and the usage of technology in the field of education. As the usage of technology in the school curriculum becomes routinized, the impact of its usage and the corresponding challenges are described in the further sections. There is a dualistic relationship between the theory and the field practices, both influence and inform each other in varying ways. So, the sociological theories on technology, education, and communication and their relevance for the current research practices are described further. The next section summarizes the current researches on education, technology, and communication. At last, the various types of educational technologies are explained to gain a better understanding of the emerging trends in the Indian education system.

Understanding Technology

The concept of technology has been defined differently in various disciplines across time and space with progress in theoretical orientation. As discussed earlier, the process of globalization has led to a demand for knowledge in Information Technology. It not only paved the way for increasing the flow of technological devices but also instrumental in the growth of the

knowledge economy. (Ghosh, 2010) Combined with this, the corporate nexus backing the rise of the information technology market and the adaption of more technologies in all the spheres of our lives has further supported the need for the learning processes to cater to the demands of the knowledge economy and therefore, become more technologically-oriented. (Yves, 2007) In this context, the natural sciences look at technology as tools that can provide aid in the better application of techniques and methods for the development of the disciplines. Besides this, technology also provides "motivation and direction for theory and research" in the sciences. (Rutherford, 1994) The disciplines of mathematics, statistics, engineering, and computation perceive technology as systems based upon the logic of calculated precisions as a solution to the varied problems posed in society. Technology, according to them, is an ever-evolving conceptual object to seek better solutions based upon rational calculations and precise formulas. In the domain of human sciences, anthropologists view technology as a "total social phenomenon', that is, it is "material, social and symbolic". So, technology is not just a device that can/cannot be consequential but a phenomenon that has a "social vision" and has consequences for all forms of social existence. (Pfaffenberger, 1988) There are two major viewpoints in anthropological debates. At one level, it views technology as leading to consequential changes in society. On the other side, technology is independent of any such changes, is vital in relation with the societal elements, and therefore, creating new logics of existence with its diffusion. Sociologists seek to understand the changes and emerging patterns of social behavior whilst the amplification of technology in the social systems. If natural sciences are concerned with the development of technology for better tools for the overall development and solving practical problems, humanities inform the human interaction with technology and its ramifications on the socio-cultural system. As the socio-economic-political context changes, what implications does it hold for the knowledge systems and the impact on the curriculum transactions? Changes in social behavior with less face-to-face communication and more virtual relationships due to the digital infiltrations in our lives, the role of the teachers, the students, and the parents are important aspects to be pondered. This study aims to reflect upon the changing social behavior among the agencies involved in the school system as the curriculum becomes digitized with the introduction of ICT. Theorists like Cleary view that educational technology is concerned with the overall methodology and sets of techniques employed in the application of instructional principles'. (Cleary et al., 1976) Luppicini (2005) sees it as a force within and outside the domain of education, hence it is important to specify the standpoint from which one is defining technology. From a social science perspective, technology is viewed beyond 'material construction' by taking into account the 'social

significance' into consideration. This means that technology employs 'material construction uses as well as intellectual and social contexts' and it is 'interrelated with social values'. (Luppicini, 2005, p. 104)

As technology is viewed in its social context, it is 'value-laden' as highlighted by McGinn (1978) in various ways which are:

1) "The value of a technique reflects the values of who makes it and uses it.
2) Technology is optimistic in assigning value to "technological progress."
3) Technology is value laded insofar as the use of resources for advance may preclude their use in other work that may improve life.
4) The institutionalization of modern technology allows the direction of technology to be influenced externally by companies rather than by practitioners
5) Products of technology are expressions of individual and cultural values of designers."

According to the American Sociological Association, "Technology involves the use of techniques, processes and material objects to produce goods, provide services and connect people". Sociologists aim to understand how technology shapes 'social organizations, social relationships, the communication between humans, and how organizations modify technologies to achieve their goals'. (American Sociological Association, n.d.)

Goodman (1972, p. 52) defines "technology as a social activity, involving people and ideas, methods and machines, dynamic structures, communications, values, and tools; but always people." He further elaborates that the objective of any technology is "to achieve an efficient and rational division of labor, subject to human control, between people and the support systems they evolve, to amplify human creativity, not to replace it". After locating the meaning of technology for the purposes of this study, the next section will highlight the impact and challenges of technology in education.

Technology in Education: Impact and Challenges

Although technology consummates many functions in society such as reducing certain kinds of human labor, swift communication, easy accessibility etc., it is important to visualize the impact of technology on the education sector for a better understanding of the same. The document on technology roadmap (TIFAC, 2017, p. 138) highlights a few positive impacts of the technology on the education sector as under:

- It aids ‘the needs of the teachers such as access to educational material, developing peer-peer links, learning and upgrading pedagogical skills, supplementing the material that learners can themselves access, understanding the latest developments in their discipline, acquiring conceptual clarity, mock teaching sessions and virtual classrooms and comprehending the needs of specific learners’.
- Though in a regular classroom, the curriculum is transacted through the teacher but technology ‘opens the possibilities of creating new knowledge’ such as ‘integration of history, theory, and data, opens new pedagogical possibilities, language neutrality’,’ differential learner-centric delivery’, ‘widens scalability of delivery.’ This can be aided through technologies such as ‘cloud computing’, ‘the internet of things’, and so on.
- With the introduction of technology in the classroom, ‘sharing ideas and information (communication), building interdependence (interaction), and seeking mutual benefit (exchange) can be enhanced by the utilization of appropriate technologies such as natural language interpretation, real-time translation’ and so on.
- As the world will move towards the knowledge economy, people would demand ‘on the job training’ and ‘lifelong learning’ programs by use of technologies such as ‘3D printing, haptic interfaces’, and so on.
- The models are based on ‘big data analytics’ which match ‘the aptitude of the learner’ and ‘the field of the study’ for better and ‘innovative evaluation’ of the learners.
- Apart from the classroom processes, ‘administration, management and governance’ can be improved by the use of technologies such as ‘5G telephony, cloud computing’ and so on.

Though there are a lot of positive impacts on the use of technologies in the education sector, it poses many challenges. Education is meant to achieving varied goals such as skill development, learning values, holistic learning but technology is based on a basic premise of ‘means-ends thinking’. Boody (Muffoletto, 2001, pp. 16-17) argues that it is not the use of specific technology for the educational purpose which is problematic but ‘technological thinking’. When technology is seen as the ultimate solution for all educational problems, there is an imposition of technology in the school for all the issues concerned can be described as ‘technologism’. Broody, further argues, that ‘technological thinking’ is ‘means-end thinking’, that is, ‘thinking that takes an end given it and finds the means of accomplishment without mediating on the nature/value of the end/connections between other important ends’. Whereas education aims at developing individuals who can ‘think critically, communicate effectively

and work constructively with others.' (Muffoletto, 2001, p. 15) So, technology to an extent is helpful in skill development, but hardly promises the solution for the current and upcoming issues that the education system encounter today.

Challenges

Learning through educational technologies can pose a lot of challenges as well. J. Slevin (Freitas, 2012, p. 308) highlights four such challenges described as under:

- 'The Challenge resulting from e-learning contributing to the shake-up of a traditional organization of education across time-space'.
- 'The Challenge of e-learning successes remaining patchy and often the result of individual enthusiasm and ground-up developments rather than the concerted effort of an organization geared to delivering excellence'.
- 'On the supply side, an industry providing e-learning hardware and software are challenged to find ways of organizing such provision in support of the more efficient deployment of e-learning'.
- 'Many people in the world live without any formal education and many jobs do not require a single qualification to get them'.

The challenges of using technology in the classroom specifically for teachers, students, and the other agencies involved have not yet been studied. And the manner in which the educationists would handle these challenges in the long term is still not clear.

Sociological relevance: Theoretical developments

The invention of 'mass media' as a medium of communication and its implications led to the emergence of diverse disciplinary studies on the impact of mass media on structuring the communication patterns in society. Several sociologists, psychologists, historians tried to understand the influence of mass media on people's thoughts, their relationships with each other, and the structuring and restructuring of society as a whole. Social psychology as a discipline has been greatly concerned with the domain of communication and media technologies historically. Some proponents of such writings have been Herbert Mead among others whose contributions have will be discussed in the further sections.

The decline of social-psychological models has led to an increased focus on more sociological approaches. Some of the general principles followed among these models are (McQuail, 1985, p. 94):

- The influence of social structures in determining the relationship between the communicating parties.
- The purpose behind choosing and perceiving media messages are as significant as the motives for sending the same.
- The media technologies are not neutral but the result of institutionalized mechanisms and exert an influence on the messages being sent.
- Messages are part of broader systems of social and cultural meaning with diverse functions and interpretations.

As the societal structures and processes are discussed in the domain of sociology, this section analyses the effect of media technologies on the communication structures, through these theoretical lenses.

The foundational theories comprehend the processes and patterns of communication in the liberal pluralist tradition. It is being argued that "media systems in liberal democracies are the outcome of an adjustment between demand and supply for information and cultural services". (McQuail, 1985, p. 96) The proponents of this school place trust in the existence of democracy in the society which grants freedom and independence to all the existing institutions. The role of media technologies in such a society, therefore, is to propagate ideas that contribute to the maintenance of democracy. The viewpoint represented through media is fairly moderate, benefitting all the sections of the society. The media has considerable freedom to put forth their reports in the public as it too is organized around the guiding principles of democracy. This view has been critiqued on several grounds such as 'the position from where the media product might be consumed is disregarded', 'the media are assumed of providing a transparent reflection of reality', and 'all individuals are deemed to have the same opportunity for observation'. (Holmes, 2005, p. 22)

According to the functionalist school of education, education as an institution of society aims to realize several functions in society. Talcott Parsons viewed the education system as an instrument for maintaining 'social order' in society. Schools imbibe knowledge and shape the personality of the learners. (Blackledge, 1985) Parsons highlights that schools perform two

important functions, that of, ‘socialization’ and ‘allocation’. (ibid) The achievement-based ‘differentiation’ based on which school divides the students to occupy different hierarchal positions is one of the ways to socialize the individuals. The functionalist view technology as fulfilling certain social goals. As ‘functions’ and ‘roles’ are the two terms functionalists emphasize upon, educational technology too has defined ‘functions’ and ‘roles’ in society. Educational technology would perform the role of ‘social integration’ by ‘socializing’ the students to be more ‘competitive’ for attaining ‘hierarchal positions’ in society. The content of such technologies would acquaint the learners with new skills and functions required for performing different ‘roles’ in society.

The classical Marxian understanding views education as an institution through which the bourgeois maintain their dominance over the proletariat classes. Society, for them, consists of two parts- the base, that is, the economic structure and the superstructure, that is, the other social institutions such as family and so on. According to the Marxist viewpoint, it is the economy that decides the course of other institutions in society. The education system, being a part of the superstructure, helps to reproduce other systems in the society. (Blackledge, 1985, p. 134) The Marxist would, therefore, view educational technology too as a tool that perpetuates social inequality. The theories of Marxism highlight the importance of ‘class’ as a factor in determining the realities portrayed by media technologies. They purport that these new technologies are owned by the upper classes and it is their realities that are disseminated through this medium. The technological devices would be a medium for the upper classes to maintain their dominant position in society. The mass media contributes to socialization which encourages the lower rungs of the society to accept the opinion of the media without questioning. The institution of media generates an ideology in favor of the dominant classes and creates its acceptance among the masses. The ‘forces of production’ which refers to the ‘tools and machines’ and the ‘skills and methods’ utilized for production impact the ‘relations of production’, ‘system of ownership and control of property involved in the production process’. (Blackledge, 1985, p. 115) It is these ‘relations of production’ that get reflected in the classroom processes too between the teachers, the students, and other agencies involved and impact the communication and curricular processes being implemented in the school system, as educational technology becomes important in the classroom.

The reinvention of Marxism in the 1940s with the outbreak of the Frankfurt school conceptualized the critical theory by prominent thinkers such as Theodor Adorno and Max

Horkheimer. They indeed introduced the concept of 'culture industry' to demonstrate as societies become more advanced, the markets for basic commodities are drained. The capitalist economy creates new needs also termed as 'false needs' to fulfill the interests of the capitalist growth which provide conditions to the market economy to grow. It is the 'culture industry' which creates these new conspicuous needs. The outgrowth of media technologies and its strong dependence on the market economy is central to the progress of the culture industry. Cultural communication through the usage of media technologies is organized around the needs of the capitalist market economy. All the products are 'standardized, emptied of aesthetic merit and capable of mass production' and 'they are consumed on scales as vast as those on which they are produced'. It is through these institutions and instruments that the new needs are germinated and controlled by a few sections of the society 'to be sold to many' and 'culture itself becomes a commodity in all kinds of forms'. (Holmes, 2005, p. 24)

In this process, the 'culture industry doesn't only produce standardized content' but also 'the audience by way of a circle of manipulation and the retroactive need in which the unity of the system ever grows stronger'. (Holmes, 2005, p. 25) The consumers not only consume what is being offered by new media technologies but the consumers in themselves are constituted by the technology industry. The patterns of communication, thus, are structured accordingly to facilitate the capitalist market economy.

The proponents of contemporary theories on Marxism see that media technologies do not establish control over the masses by directly controlling the content and form of media but through 'hegemony'. This is done by 'striving to limit the boundaries of the making of meaning to exclude definitions of social reality' which are in contravention with the interests and thought processes of the dominant groups. (Holmes, 2005, p. 28)

For Gramsci, the media technologies aim at exercising the 'consensual form of power' over the working classes in the interests of the ruling class. (Holmes, 2005, p. 28) The 'hegemony' is not maintained by directly controlling media but through the 'organic intellectuals' of the ruling class. Besides creating 'false consciousnesses' by laying down ideology for the working class, the ruling class "continually strives to limit the boundaries of the making of meaning to exclude definitions of social reality which conflict with their horizon of thought". (Holmes, 2005, p. 28)

The ideological state apparatus, defined by Louis Althusser, has become a more important conceptual tool in explaining the complex matrix of the modern state. The dominant power groups not only present content that favors the market economy but the development of the media technologies 'integrates the consensual integration of individuals that occurs in the structure' as well. He argues that 'the very idea of individuality is created in the communication process itself' and so, with the emergence of media technologies, the 'selfhood' is created and experienced in communication with these technologies. As these media technologies are backed by ideology, the very constitution of the individuals while communicating with such apparatuses is ideologically driven. Thus, 'ideology is active in maintaining the status quo of the existing relations of production and in the reproduction of social relations'. (Holmes, 2005, p. 31)

Another strand in sociology is the symbolic interactionism developed in response to the critique of the 'positivist school of thought' and the 'rise of postmodernism' which emphasized the importance of 'context' and 'individual meaning construction.' (Freitas, 2012, p. 261) It emphasizes the significance of social interaction in the classroom and the school as the challenge and solution for all the issues concerning education. It views learning as a 'shared' practice and humans as 'social beings'. It is through interacting with the fellow beings that we construct knowledge and learn. The meaning that we ascribe to the curriculum in our school context, is based on our individual experiences and engagement with it. Educational technology is regarded as an interface between the lived reality and the reality created through interaction with the technology.

Bourdieu stated that learning is derived from the work of 'social capital.' 'Social Capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships'. (Freitas, 2012, p. 273) It is through these 'relationships' that 'members of the group' enjoy the 'backing of the collectively-owned capital or credential'. The larger the network, the wider the extent of the social capital enjoyed by the members of the group. The process of formation of these 'relationships' is 'a product of investment strategies, individual or collective, consciously or unconsciously' practiced leading to 'social formation'. It is, then, through 'exchange' and 'mutual recognition' of these 'relationships' through 'rites' and other means that these 'relationships' 'reproduce' themselves. (Freitas, 2012, p. 274) For the context of learning, there are two kinds of classroom-environments that aid learning -'teaching curriculum' where the learner is required

to follow the prescribed standards and participation of the learner is defined and 'learning curriculum' where the teacher acts as a guide for the learner to shape his/her experience as per individual needs and capacities. This 'learning curriculum characterizes the community' and formation of social relations and 'social capital'. Learning is an activity through which school students participate in the knowledge created by the adults of their community with their individual experiences rather than 'replicating the performances of others'. (Freitas, 2012, pp. 277-279) How is this learning shaped in a technologically driven context needs to be understood closely.

Paulo Freire critiqued the 'banking concept of education' where the teacher 'fills' the students 'with the contents of his narration' and the students are required to 'memorize the narrated account'. 'Education becomes an act of depositing' and 'instead of communicating, the teacher issues communiqués and makes deposits which the students receive and repeat'. (Freitas, 2012, p. 265) Paulo Friere, though, has been viewed from the critical theoretical lens too but the interactionist view Friere as an intellectual who re-defined the meaning of 'dialogue' in learning and communication. According to Freire's pedagogy, 'the meaning of existence' for 'humans' formulate through the 'interactional conversations or dialogues' that aid humans to 'the first question, that is, the story being narrated about them and then the one that they might narrate themselves'. (Freitas, 2012, p. 299) As Friere's project is the 'emancipation' of the 'oppressed', the meaning of education lies in bringing awareness about the lived realities and its oppression for those oppressed. The educational technologies, should, therefore, create spaces for 'dialogue' that can lead to such awareness. Friere (1997, p. 57) argues that the challenges with the educational technology are that there is 'domination over information' and there is a 'network of power' which manages and regulates it. If the participants are made aware of such challenges through 'dialogue', then these technologies can be an empowering tool for the 'oppressed' and the 'oppressor'.

Further, there have been various sociological ideas of post-structuralism that evokes the reality of the image itself than what function that the image serves. Jean Baudrillard denunciates that representation of the images through media has become so delineated from reality to the extent that it bears no resemblance to reality. The image becomes the measurement tool for 'access to social reality'. (Holmes, 2005, p. 37) 'Everywhere socialization is measured according to exposure through media messages'. (Baudrillard, 1983, p. 96) He explains "four phases of representation of image:

- Is the reflection of a basic reality
- Masks and perverts a basic reality
- Masks the absence of a basic reality
- Bears no relation to reality whatsoever, it is its own pure simulacrum" (Holmes, 2005, p. 36)

For him, the image becomes such a potent part of our existence that we become increasingly deviated from the reality where communication is disposed as 'instead of causing communication, it exhausts itself in the staging of communication'. Also, 'the relationships that pass through media relationships suffer from the condition of simulacra, that is, the what is consumed through media becomes more real than what it supposedly refers to'.

Michel Foucault would, however, place media technologies as the institutions of modernity that have assumed power with the decline of the 'older forms of power'. These institutions perform the function of 'surveillance' and bolster the 'disciplinary regimes' over the various sections of the society. In modern societies, these institutions do not practice overt control but discipline the bodies and the minds of the people for the maintenance of the ruling class dominance.

Marshall Mcluhan (1964) doesn't rely on the discourse of 'homogenization' of the media experiences as has been argued by the contemporary Marxists. Rather, he emphasizes the 'multi-dimensional account of the communication medium' where each experience has its reality. Though media does play a role in determining 'technologically constituted social relationships' with each having its relevance, one or more of these dynamics may dominate the arena of perception of social reality. (Holmes, 2005, p. 39) After discussing the sociological theories on technology, the next section will discuss the sociological theories on communication.

Sociological theories on communication

Theories on communication have been variously defined in different disciplinary frameworks. According to sociologist Charles Cooley (1909), communication means "the mechanism by which human relations exist or develop - all the symbols of the mind together with means of transmitting them through space and maintaining them in time". "It includes facial expressions, attitudes, gestures, tone of voice, the spoken, written and printed word, railways, telegraphic,

telephone, everything which includes the very latest achievement in the conquest of space and time". It entails the exchange of information, ideas, beliefs, attitudes, and value systems from one group to another. A communication, then, is an extremely potential space for the transmission of cultural know-how and the space to create new meanings and metaphors too.

Communication, no doubt, aids to realize many goals and purposes. Dahama (2010) highlights certain critical functions of communication as follow:

- Information function: Information is very important for the survival of humans. Information about things, events, fellow humans is vital to understand the environmental context around. It is through communication that information is transferred. So, the transmission of information is the basic function of communication.
- Command or Instructive function: When a person superior in authority gives an order to the ones in lower positions in comparison, in formal and informal spaces, the person instructs/commands the person by using communication as a tool.
- Influence or persuasive function: It influences the person with whom the communication is being taken. Aristotle defined "the study of communication as the search for all the available means of persuasion".
- Integrative Function: Another function of communication is 'self-integration' at the level of interpersonal communication. At the level of organization, among other things, this function entails proceduralisation and bureaucratization.

Communication can also serve diverse, immediate, and long-term functions according to the requirements of the context. A study conducted by Canan P. Zeki on the university student's perception of nonverbal communication such as eye contact (by using content analysis of the student's write-ups on 'critical moments reflection') showed that students perceived different non-verbal expressions for communication differently. While some perceived it as a source for motivation, others for concentration. Although the perception varied, most of the students felt that the eye contact with the teacher made them comfortable, confident, and important. (Zeki, 2009)

In the sphere of education, besides the organizational function of communication in schools, universities for better functioning and administration, there is an important domain of the classroom where communication happens for learning and development. Classroom

communication is impacted by factors such as the personality of the teacher and the students, the immediate context of learning, the school proceedings, the content of the course, and the familial-cultural context of the teachers and the students.

The act of communication between people was either conducted through verbal, non-verbal, or written means before the advent of computer technologies, as has been discussed. But with computer technology gaining ground in modern times, there has been a new layer added to the communication between people. Communication these days is either mediated through these technological devices themselves. Subsequently, these communicative technologies have become the agent for social transformation with differing standpoints, according to which these technologies are placed. (McQuail, 1985) This can be explored further by understanding the relationship between communication technologies, their content, and the audience.

- Communication technologies as an institution- Various technological devices can be varied according to the content to be produced, relations with the audience, and so on. Organizations belonging to the media industry utilize varying strategies for achieving the desired ends. There have been varying studies drawing connections between technology-corporate nexus, by analyzing the content produced, connections between technology and audience among other factors. The role of the individual in an organization, the impact of the institution as an encompassing structure, work culture are some of the influential factors around which debates have been organized in technology-media studies. As educational technology too has become an organized industry, its relevance and importance will have to be looked at through various dimensions.
- The content of technologies- The content of communication technologies comprises the production of the educational content based on an ideological standpoint, individual understanding of the anchor/writer. The content then impacts how the audience perceives the content and analyses it. Some scholars highlight that by producing a particular kind of content, the technology industry produces a culture in itself as they propose a unique understanding of the concepts and thereby society in itself. Several studies have analyzed the impact of the version of reality presented by the technology by terming it as objective or subjective.

- The audience of technologies- The relationship between educational technology as an organization and other technological aids, content, and audience is a complex interplay of various factors that have been analyzed in different ways. The agency of the audience versus the technological portrayal of concepts at a structural level is one of the core dilemmas to be looked at while understanding this relationship. The impact of technologies varies differently among different kinds of audience based on the interplay of various factors such as education levels, ethnicity among others. Also, the social context of the audience plays an important role in determining how the audience receives the messages of technological devices.

John Dewey states "When communication takes place, all-natural events are subject to reconsideration and revision". (Dewey, 1925, p. 58) For Dewey, humans are social beings who live in an environment, surrounded by other living beings. The essence of this shared existence comes through communication. Communication, for Dewey, is an art that aids us in exploring our natural and social environment.

George Herbert Mead was another thinker who gave importance to communication in maintaining social relations in the sociocultural tradition. Human beings are social animals and communication is a tool for the development of the 'self' in the 'society'. He argues that 'the self and the society originates and develops in communication'. (Mead, 1934, p. 76) Communication is not a medium for the development of the self but is in itself a 'constitutive category' as humans don't think first and then communicate, rather they develop during the process of communication itself. Through understanding the concept of 'significant others' and 'generalized others', he argued that it is by understanding the perception of others in the relationship through communication that a person comes to an understanding of his/her self.

The phenomenological perspective argues that people interpret messages and experiences as per their understanding while in communication. It is through one's subjective perception that one understands the world. There are three schools of phenomenology such as classical, phenomenology of perception, and hermeneutic phenomenology. If classical phenomenologists such as Edmund Husserl place importance on the objective dimension of truth which can be 'ascertained through direct experience' by keeping one's 'biases' aside, that is, without the knower's 'subjective categories'. In contrast, the other phenomenologists who assert the phenomenology of perception such as Maurice Merleau-Ponty believe that 'a dialogic relationship exists between people as interpreters and the things they are interpreting'.

It means that it is ‘the people who give meaning to the things in the world through their subjective experience’. (Littlejohn, 2008, pp. 38-39) Hermeneutic phenomenologists such as Heidegger proposes that ‘the reality is known through natural experience by merely existing in the world’. Communication is the means to experience. It is by communication that one experiences the world. ‘Language is packed with the meaning’ which helps us in communicating with the world and ‘creating new thoughts’, forming our world view. (Littlejohn, 2008, pp. 38-39)

From a critical theory standpoint, communication is understood as ‘how messages reinforce oppression in society’. As communication involves the ‘discourse’ and ‘texts’ that are ideologically oriented, attention is drawn towards how these promote certain ideologies while subverting the interests of some other groups. (Littlejohn, 2008, p. 46) According to Jurgen Habermas, ‘Deliberative communication as a pragmatist proposal, could be seen as an attempt to develop where the communicative practice is about creating both consensus and contestation, a kind of sharing of common references and at the same time, a process of making room for contestation, for pluralism and the creation of a public’. (Habermas, 1984 qouted in Murphy and Fleming, 2010) In the context of this research, though effective communication would be specifically understood and defined as per the specific objectives of the study, some of the features of communication, as Habermas proposes, can help in better understanding the dynamics of communication that are:

“i) that nobody who could make a relevant contribution may be excluded;

ii) that all participants are granted an equal opportunity to make contributions;

iii) that the participants must mean what they say;

iv) that communication must be freed from external and internal coercion so that the “yes” or “no” stances that participants adopt on criticizable validity claims are motivated solely by the rational force of the better reasons”. (Habermas, 1998, p. 44 quoted in Murphy and Fleming, 2010).

Education, Technology, and Communication

In the realm of education, technology enables many shreds of implications to the students, teachers, and the other stakeholders being involved in the process of teaching and learning. It

has been widely acknowledged that technology effectively facilitates independent learning, access to instant information, enhances skill formation such as processing complex information among many others. (Mabel CPO Okojie et al.,2006) For the teachers, the technology used in the classroom can help develop collaborative learning, critically looking at various sources of information, and many other benefits. (NCERT, 2006)

Besides expanding the avenues for 'access to education' and contributing new discourses in education, technology has expanded opportunities for 'communication and collaboration'. For instance, students can now engage in group projects with other school students or online groups that were not possible earlier via conventional modes such as conferences, emails among other mediums. The role of teachers and the students have seen significant changes with technology entering the classroom space-providing vast amounts of information. The students are no longer dependent on the teacher as the only source of information, rather take their responsibility for learning. The teacher's role has been assumed to be of a 'guide' to assist the students in their learning. (Purdue Online, 2020b) As has been discussed, it is some of these benefits of technology that have been instrumental in driving the project of technologization of schools, classrooms, and the teaching-learning process.

The vitality of technology and its impact on people's lives is discussed by Murdock and Golding (1973), arguing that 'mass media' plays an important role in defining the 'meaning systems' used by people in understanding 'social structure' and 'social processes'. The technological devices in the classroom, therefore, define the thought patterns and conceptual frameworks of the students. Therefore, the study of communication needs to be put at the center stage by taking diverse inputs from the entire disciplinary field to gauge a perspective about the impact of technology on communication. Socialization in and of technology with certain new values and beliefs would create a greater impact on the users. (Holz, 1979, p. 210)

The study of communication in education has hardly received attention from educators even though communication is an important means through which education takes place, Lewis argues. (Lewis, 1952) The new technological developments have created and satisfied needs such as 'social needs', 'aesthetic needs' and in turn, have created a demand for these technologies and the process has led to a circular motion. (Lewis, 1952, p. 29) "As more, and more refined instruments are produced, and there is a wider and deeper penetration of their uses into every aspect of human activity, so there is a great demand for them". (Lewis, 1952, p. 30) In matters of educational technology too, it almost works as a loop where the first

technology is introduced to fulfill certain initial goals and gradually its increasing dependency generates new needs for which another set of technological devices are required.

The emergence of new technologies in the modern world is very complex in its comprehension. “Societies are being shaped by the forces such as of mass media by which men communicate by the 'content of communication”, 'medium is the message' and it is the technology of communication that influence every important aspect. (McLuhan, 1964) “The ownership facilities, the purposeful use of communication, controls on communication reflect the political philosophy of a given society”. (Mehta, 1987, p. 6) Further, communication patterns reflect the ‘value patterns’ of society and are an image of the wider culture of the society. (Mehta, 1987, p. 6) Consumer culture is growing fast because of the outgrowth of new technologies. While these devices work in tandem with communication expansion, a ‘mechanistic’ kind of communication is being fostered in the process. What we need is interpersonal communication mediated between stimulus and response to recognize the value of humanism along with the mechanical progress. A participatory communication strategy needs to be evolved so that the agency of humans is taken into consideration. Communication coupled with education needs to serve many purposes such as empowerment, poverty, removal of illiteracy, and so on.

The diminishing role of geographical borders worldwide is necessitated by the need to develop ‘technological, organizational, and institutional media’. These technologies are aiding new forms of communication, thereby playing an indirect role in ‘reshaping community and changing lifestyles’. (Comor, 2001, p. 390) How the internet is used to highlight the ideological purposes of promoting its usage such as making of global consumer society to protect the private interests are very much part of the development. But the immediate social and cultural factors too are involved in the process of such information as humans learn to manage and process information from childhood itself. For instance, poverty as a sociological factor changes the manner and purpose of usage of these new technologies as its accessibility will be limited to socio-economically marginalized groups due to the commercial interests driving these new technologies. The usage of these technologies is being pushed to the ‘detriment of democratic potentials’ and are inclined towards ‘immediate’ and ‘individual’ needs than the ‘long term’ and ‘collective’ needs. (Comor, 2001, p. 405)

Innis was of the view that the technological proliferation will deepen the ‘political, economic and cultural crisis’ in the form of ‘environmental crisis, increased commercialization

with no demand' as the limits to technology reaches a point of saturation. This would lead to perceive the world and its issues 'here and now' and loss the 'cultural capacity to comprehend problems in terms of a relatively balanced consideration of both space and time'. (Innis, 1982, pp. 61-91)

Cakir provides the example of design education to enunciate the changing role of communication in the world characterized by ideologies of neoliberalism. The technological revolution that took place in the 1990s along with the ideologies of liberalization and privatization has created a 'new form of capitalism called techno-capitalism'. (Cakir, 2012, p. 712) This has led to an overemphasis on design and design education which subsumes the essentiality of the product**.** The design education systems serve the interests of the markets where consumers are produced in the form of students. Design is not only 'creative capital' but 'creative labor' because 'it could signal the transformation or regeneration of localities, but also of the self'. (Julier, 2009, p. 223 cited in Cakir, 2012, p. 714) The students of communication design learn 'the art of persuasion, creating them in meaningful ways, and crafting strategies to broadcast them to the world'. The need to look at art critically and its transformative role in society is overlooked. So, the new technological inventions coupled with neoliberal outlook generate sensibilities where design becomes important and new labor is required to fulfill the same through various courses in design education and communication design education. The purpose and manner of communication, thus, are reinvented to convince the customers of the designs created.

Yet another study by Simsek and Arat highlight the impact of usage of technology on the learning process of the students. (Simsek, 2015) The authors highlight that education is one of the tools through which knowledge is imparted among the students and it has to align with the emerging trends in society. With the development of new communication devices, the purposes for which these devices are used have expanded to include functions other than communication such as learning, conferences among others. Education technology, therefore, aims to fulfill different functions of education such as designing the curricular materials, techniques for imparting knowledge**,** evaluating the responses among others. The results showed that though 79% students out of total 398 students used educational technology, they used it mostly for online databases with a mean of 2.84, newsgroups on education with a mean of 2.80, communicating with friends from the department with a mean of 3.04 but never for communicating with the faculty. A mean of 3.15 depicted that technology helped the student's

in learning, mean of 3.30 suggested that because of technology, the students could understand the courses very well. This shows the positive impact of the technology on the student's which can further be fostered through various ways such as effective usage of other technologies such as television, increasing interaction with the faculty through the technological means, and enabling diverse usage of the available tools and techniques. (Simsek, 2015)

Carbone (1995) argues that teaching and learning processes don't happen in a vacuum in the classroom but evolve in an 'institutional context'. The context in which the technology is organized and implemented is equally important while highlighting the implications of technology in the classroom. It is further stated that technology has led to 'deskilling of teachers' as the uniform technological course design doesn't need the teachers to 'set curricular goals, design lessons, individualize instruction'. Ironically, the over-emphasis on educational technology reduces the teacher as labor. Also, the technology-centric learning in the classroom would limit the learning space to explore what can be 'quantified', that is, 'instrumental rationality', thereby, 'devaluing' other forms of knowing such as subjective understanding. Privatization accentuated the increasing use of technology as it enables profit maximization a as new mode of 'cultural power'. This means those who control it would regulate for generating more profits and discriminate against those who can't afford it. (Carbone, 1995) The insights from these studies shed light on the complex interplay of technology, education, and the changing dynamics of communication.

Schertler (2006, pp. 221-222) argues that 'new media technologies create concepts to find ways of teaching and learning'. It is through the 'communicational component' between the 'teacher-learner' and the 'learner-learner' that the 'content delivery' takes place. Though the main aim of education is 'knowledge transfer', the 'communication processes between the teachers and the students determine the success of the web-based educational programs'. According to Schertler (2006, p. 225), there are two types of e-teaching scenarios- a micro-didactical part and a macro-didactical part. 'A micro-didactical part focuses on course contents as it uses computer-based applications like drill and practice, tutorial applications, and so on'. Whereas a macro-didactical part refers to 'the teacher-student and student-student communication within the e-learning network' beyond the need for content delivery. The findings from the study show that 'the micro didactical part runs the risk of creating inactive knowledge that can't be used outside the learning context but if combined with the

communication process of the macro-didactical part, the students can construct applicable knowledge on their own'. (Schertler, 2006, p. 225)

Learning theories: Technology, Communication and Education

Depending upon the prevailing learning theory, the role of communication has been defined in the arena of education. At the beginning of the era of e-learning, it was the behaviorism that dominated the learning theories and so, it was the behaviorist models that formed the premise of e-learning theories and models. In an e-teaching scenario, the behaviorist models help the teacher 'to communicate the basic principles of a subject' to the learners, which the learners have to rote-memorize and retain. (Schertler, 2006, p. 222) Behaviorism is based on modeling the learner's mind to adapt the behavior taught by the teacher and keep repeating it to fix it in one's mind. The content of e-learning was simple tasks which the learners had to perform, learn the skills being taught, and revisiting them again and again. The behavorist theories have been critiqued for limiting the meaning of learning to just repetitive patterns.

The cognitive models of learning re-defines the domain of education. As these models focus on individualized learning, the central theme of learning is the 'individual behavior'. For e-learning models to be implemented, this theory would emphasize how the e-learning content can trigger an individual's cognitive schemas and thereby, aid learning. It looks at 'information processing within the cognitive structure of the students and analyses decision making, implementation and application of logic'. (Schertler, 2006, p. 223) As different learners are at different stages of learning and have individualized needs, the e-learning 'presentation and interaction modules' have to be designed as per the individual needs to facilitate learning. For instance, a 'linear learning path for beginners and complex learning paths for advanced students' derived from a cognitive model-based understanding of learning and development. (Schertler, 2006, p. 223) These models were critiqued as they reduced 'the complexity of human behavior to information processing'.

The constructivist models resolve the problem of 'inactive knowledge' by guiding 'the students to construct their own knowledge' and 'be aware of the situational context' in which the students construct knowledge. (Schertler, 2006, p. 223) The role of the teacher is to guide the 'schemas' of the learners based upon individual experiences and aid the learners in developing new schemas for learning new content. The role of educational technology is to stimulate such experiences based upon the previous knowledge of the learners. The role of the

teacher is of a ‘guide’ who facilitates the learning experience based upon the learner’s responses. Communication, thus, becomes critical to initiate learning. In a classroom scenario, one can visualize these models of learning depending upon varied factors such as teacher’s belief, school’s philosophy etc. Therefore, the usage of Edtech in accordance with these learning theories is important to understand the dynamics of Edtech and its impact on the teaching-learning process.

Types of Educational technologies

As the technological reach expands in society, the domain of education would experience transformation. The usage of educational technologies in the schools would appropriate the ‘creation, usage, and management’ of suitable ‘resources’ and ‘processes’ to support learning in the classroom. Although there are varied classifications of the kinds of technologies that converge the current demands, the one listed under is comprehensive as it covers all kinds of technologies in detail. This classification seemingly considers the emergence of new technologies from a computer sciences/statistical perspective and then, looks at their impact on the realm of education. A wide-ranging technological apparatus can transform the education sector and they are broadly categorized into six groups. (TIFAC, 2017, p. 117) They are:

1. Information and Communication Technologies (ICT)
2. Artificial Intelligence (AI)
3. Display and User Interface
4. Internet
5. Computational
6. Simulation and Modelling

A brief discussion of every component is as follows: -

1.Information and Communication Technologies (ICT) –There are wide varieties of ICT technologies being launched, some of which are described here along with the implications of such technologies for the school systems.

- ‘5G Telephony’- It is a technology related to ‘the fifth generation of cellular wireless standards’. The system will provide ‘an all IP based mobile broadband solution’ for devices such as smartphones, computers, and so on. In the educational sphere, 5G technology ‘would provide fast and secure content delivery’. As the

content for the educational activities would be available in seconds, it would help the 'remote classrooms' by 'improving the quality' and 'reducing latency'. Not only the quality which will be improved by services such as 'video-on-demand, 3D image transmission, access to repositories and libraries', but the educational experience can also become more interesting by 'multimedia streaming' and 'infotainment services'. The 'study on the go' concept would become a reality with access to 'near-real learning experience' even in remote locations.

- 'Mesh Networking'- 'A type of networking where each node must not only capture and disseminate its data but also serve as a relay for other nodes, that is, it must collaborate to propagate the data in the network'. For instance, 'Voice Over Internet Protocol' is one of the applications of such a network. It would be helpful in 'real-time communication', thereby enabling possibilities for 'distance education', 'virtual classrooms', and so on. By connecting people in near real-time, it would aid in better monitoring and evaluation of the classroom processes and the learners. Besides enhancing 'collaborative learning' by connecting people through the network, it would also facilitate 'peer-peer interaction' in the absence of the server too.
- 'Cloud Computing'- It is a 'service' where 'shared resources, information, and software are provided to computers and other devices as a utility (like the electricity grid) over a network (the internet). For educational purposes, it would enable access to a variety of services for both the learners and the teachers. The learners can use such services to not only access the 'learning material, software, virtual labs, repositories', but they can also access it anywhere without the need for carrying textbooks. The availability of 'shared computers' would enable researchers to connect easily and make 'lifelong learning an authentic possibility'. It can help in achieving 'economies of scale' and enable the 'cloud to become the resource for all forms of education'.

2. Artificial intelligence technologies (AI)-

    - 'Natural Language Interpretation'- It is 'a field of computer science and linguistics concerned with the interactions between computers and human(natural) languages'. The development of 'machine-human interfaces' that can be operated even without human aid would lead to 'mainstreaming of

the left-outs from the educational system'. It would be an excellent tool to 'promote pedagogic innovation in language instruction', 'improve the digitization of the manuscripts' as a part of 'heritage studies', and 'enhance ease of testing and assessment among the learners'. It would also be an empowering tool for disabled people to become 'digital natives' and 'learners'.

- 'Machine Translation'- 'It is the use of computer software to translate text or speech from one natural language to another'. For instance, Google Translate along with other 'natural language interpretation technology' can help in 'removing language barriers'. When machines would translate in other languages based on the 'context' of the natural language rather than 'word by word translation', the 'content' used for the educational practices would become more dynamic and easily accessible. It would encourage 'independent learning' as anybody would be able to translate easily and the computers too would catch 'contextual nuances, usage of phrases' by interacting with the humans. A significant advantage would be that many 'heterogeneous groups' of 'researchers' would be able to carry out 'collaborative learning' seamlessly.
- 'Machine Vision'- It is 'the application of a range of technologies and methods to provide imaging-based automatic inspection process control and robot guidance in industrial applications. It is a fundamental technology for improved robotics and artificial intelligence'. This technology has applications in the 'evaluation processes, assignments of a large number of learners'. If combined with 'neuro-linguistic programming', it could help in 'faster evaluation of examination answer scripts'. It could also be an aid in improving 'simulated learning for training'.
- 'Context-Aware Computing'- Computer devices that can gauge information about the 'circumstances' in which they are operating and 'react' accordingly formulate 'context-aware computing'. In the context of education, if the computers can grasp the nuances of the context in which they are operating, the 'online learning' can be improved as the 'reality quotient' would be improved. The learning can be improved through this 'predictive-proactive approach' as the device can go beyond the stored content of the data being taught in the class by capturing the teacher's gestures, actions, and so on, making it an inclusive

learning experience. It can also help in making ‘real-time assessment’ of the environment and ‘take corrective actions’ if required instantly.

3. Display and user interface technologies-

- ‘Handheld Devices’- These are ‘mobile computer integrated into a flat touch with internet connectivity’. When learners will be able to access material at their convenience, learning would not only become quicker but transformed in various ways. The ‘classroom aids such as projector would be replaced’ and the ‘classroom activities such as online attendance, distribution of learning material, spot evaluation of a class, tracking the progress of the study, assignment submission’ would become much easier and less cumbersome. Pedagogically, the teachers would be relieved of administrative work and would be able to focus on ‘designing problems to enable learning in a constructivist manner’.
- ‘Wearable Technologies’- These are ‘devices that can be worn by users, taking the form of an accessory such as jewellery, sunglasses, or even actual items of clothing’. Such technologies would make the educational experience more mobile and ‘conveniently integrated with everyday life and movements’. These devices can be used in the enhancement of sensory experience (feel something which you are not directly touching), as an ‘experimental tool’ that can ‘transform the experience of field-based research’ and easy ‘accessibility’ of the data in the surroundings.
- ‘Volumetric Screens’- It is a ‘graphic display device that forms a visual representation of an object in three physical dimensions’. They create ‘3D imagery via the emission scattering or relaying of illumination from well-defined regions in (x,y,z) space. This technology could help in ‘enhancing the quality of illustrations and animations’ utilized in education. Especially in medical education, ‘the magnification of objects on the 3D screen and better visualization’ could aid in better learning. ‘Feel-as-you-touch’ based apps could become a reality and ‘virtual prototypes’ could help in better manufacturing of the products.
- ‘Gesture Recognition’- It ‘enables humans to interface with the machine and interact without any mechanical device’. As this technology would reduce the

need to use input devices such as a mouse, keyboard, and so on, it would make learning easy for learners with a physical disability, language disability, or those who are disabled in using these devices. It would not only make learning quick but more 'learner-friendly' as 'content delivery' would become very 'simple and cheap'. 'Virtual classrooms', 'simulated learning', and 'gaming' would become a reality.

- 'Pico Projector'- It is an 'emerging technology that applies to the use of an image projector in a handheld device'. This technology will eliminate the need to set up 'fixed infrastructure and hardware' or carry laptops as one would be able to make presentations through a mobile device. Especially in the rural areas, 'high portability' and 'less consumption of power' would make it a boon for the 'non-connected remote areas'. It would be useful in 'field-learning experiences such as forestry, botany, archaeology, and geology'.
- 'Fabric Embedded Screens'- These are 'subset of wearable computers'. They are 'miniature electronic devices worn by the bearer under, with or on top of clothing'. This technology would help in connecting with a larger audience, especially where there is no connectivity or 'on-the-go' devices are required. It has been developed for 'general or specific purpose information technologies and media development'. 'Integration of this technology with mobile telephony would vastly increase its utility'.
- 'Haptic Interfaces'- These are 'communication or interface with a computer mainly through vibration as a sensory cue'. They are 'output-oriented' and 'are used to acquire information from the device' as opposed to the 'gesture-based computing' which is 'input based'. Such use of technology where 'sensations' are used to convey 'non-verbal cues' and 'information to the user' can make 'virtual labs' a reality in the future.
- 'Skin Embedded Screens'- It is a 'blood powered electronic device which is embedded under skin to mimic a tattoo, display videos, or act as a phone or computer'. As the skin acts as a 'video display', this technology can replace 'LED' or 'LCD' screens and can have many applications in 'forensics', 'ergonomics', 'collecting data about person's history', 'mental state of the learners' and so on.

- ‘Speech Recognition’- It is referred to as the ‘ability of a machine to identify words and phrases in spoken language and convert them to a machine-readable format’. This technology can help in processes such as the development of ‘spoken language skills’, ‘translation’, and foster ‘language-neutral communication’.
- ‘Brain-Computer Interface’- This is referred to as a ‘system that allows a person to control a computer or other electronic device using brainwaves with no physical movement required’. Such applications can help in developing ‘personalized interaction’, ‘regaining lost motor skills’, ‘hands-free applications’, and so on.
- ‘Immersive Virtual Reality’- It is ‘an artificial, interactive, computer-created scene or environment wherein users feel just as immersed as they usually feel in reality’. These applications could make understanding of subjects that require visual or spatial understanding very comprehensible such as geography and history. That is, it would make ‘practical experience’ training more easy and enhanced.
- ‘Multi-Touch Interface’- A ‘touch sensing surface can recognize the presence of two or more points of contact with the surface’. This technology can be used in educational games, understanding ‘algorithmic models’, ‘3D modeling’ where virtual models can aid in better grasping of the concepts taught.

4.Internet Technologies-

- ‘Mobile apps’- These are ‘application software, emphasizing ease of use, that is specifically designed to run on mobile devices and displays such as smartphones. These can be used for multiple purposes such as ‘content creation’, ‘interpretation of specific courses’, ‘sharing findings’, ‘creative learning’, and so on. They are used by many content creation ventures working in the education industry.
- ‘Massive Open Online Courses’- These are online courses on the internet that provide open access to an unlimited number of learners’. These courses have wide appeal as thousands of learners can access such courses irrespective of ‘age, location or educational background’ according to their own ‘pace’ and ‘style’.

- ‘Internet of Things’- It means ‘a global network infrastructure, linking physical and virtual objects through the exploitation of data capture and communication capabilities, that includes existing and evolving Internet and network development’. Besides reducing ‘distance’ by connecting people and infrastructure, it will also lead to ‘global educational integration’. The cost of providing education would reduce due to the reduction in ‘transportation cost’, ‘physical cost’, and ‘financial hurdles’.

5.‘Computational Technologies’-

- ‘Digital Identity’- This will ‘enable the users to create a single digital identity that can be used in any place where a login is required to access a website or service’. Besides being a medium to access various ‘educational activities’, this can ensure access to ‘educational records’, ‘attendance’, ‘evaluation’, and multiple details about the learner or the teacher.
- ‘Big Data Analytics’- It is the ‘process of examining large data sets to uncover hitherto hidden patterns and correlations, thereby enabling more reliable predictors’. This can be used to ‘enable teachers and schools to tailor educational opportunities to each learner’s level of need and ability’. The data collected from extra-curricular sources can be combined with the curricular progress of the child to make larger inferences using big data.
- ‘Modular Computers’- It is ‘a multi-processing computer system in which processing memory and peripheral units can be added or removed without disrupting its operation’. Not only the ‘cost’ of computers would reduce, the ‘updated contents’ would enable ‘sharing of interactive web pages easy’ and faster.
- ‘Computational Photography’- These are ‘digital image capture and processing techniques that use digital computation instead of optical processes’. As this enables the creation of ‘3D photography’ and ‘HDR imaging’, it can be useful in ‘image creation’ for subjects like biology, medical education, and so on. It can create ‘models, prototypes’ of 2D objects in 3D and therefore, help in the creation of ‘value-added educational material’.
- ‘Neuro- Informatics’- It is a ‘research field encompassing the organization of neuroscience data by the application of computational models and analytical

tools'. With the development of 'databases' analyzed by 'neuro-informatics', the discovery of 'new learning styles', 'technologies that facilitate human-machine interaction', 'innovative ways of problem-solving' can be developed.

- 'Photonics'- It is a 'technology involved in the properties and transmission of photons'. This technology would help in 'desktop quantum computing' and 'improve quality, density, speed of communication' which would be helpful in the education system. 'Learners would store encyclopedia in nano-scale optical chips which will possibly have the capacity to be integrated with the human mind'.
- 'Quantum Computing'- 'Using Quantum physics properties of atoms or nuclei as quantum bits, or qubits, to function as a computer's processor and memory'. As it is a 'faster' and 'effective' 'computing capability', it would 'enhance the pace of discovery of new knowledge' and impact 'teaching-learning processes' too.

6.'Simulation and Modelling Technologies'-

- 'Gamification'- It is the application of 'game mechanics and design techniques to engage and motivate people to achieve specified goals'. These are more fun-driven ways of engaging the learners in various concepts and are widely used in schools these days. Not only is the learner motivated to gain 'points', 'the learner's achievements can be judged using badging or ranking systems'.
- '3D Printing'- It refers to the 'manufacture of end-use products using additive/layer manufacturing technique'. This would 'provide better insights in understanding structures in all branches of education, facilitate more authentic exploration of objects, improve models/diagrams used in teaching, and do-it-yourself activities in learning spaces'. It will 'become a part of the skill domain' and aid in 'new knowledge' formation (TIFAC, 2017)

Summary

This chapter draws on the nature of the technology from different disciplinary traditions while defining the meaning and purpose of using the technological apparatuses in the field of education. It is important to visualize technology from different vantage points to understand its vitality for the education sector. The chapter locates the changing behavior of teachers,

students, and parents in this larger shift of the nature of technology and its perspective in different disciplinary orientations. It discusses the functions of technology in society and therefore, its enabling and limiting contributions for the education systems. Further, the chapter discusses the sociological (theoretical) outlook in envisaging technology, deciphering communication and learning theories in understanding technology, communication, and education. The theoretical exploration and explanation help this study to locate the recent changes and their context. After discussing the recent researches in the realm of education, technology, and communication, the chapter discusses the varied classifications of upcoming technologies and their relevance to the realm of education. The chapter highlights that varied theoretical outlooks are a pre-requisite in realizing the functions of technology and their derivatives in the present context.

Chapter 3

Integrating Communication Technologies in Education: Policy discourses on ICT in India

Policy outlines and Schemes on ICT in India

Today people from different walks of life use technological artifacts, products, and tools for different purposes in diverse ways to find out the standard and viable solution to the problems they face. The invention and proliferation of information communication technologies are one of the key sights in which people across the globe, intensify interaction across the cultural and geographical spaces. As the problems of human conditions are complex in their very nature, it is tough to keep maintaining any standard procedure for the application and intended results of technological artifacts developed in the field of communication. As part of the regulatory system, policies at the national, regional, and global levels have laid down series of modalities in the forms of rules and regulations to govern the complex nature of information technological artifacts in the life of people at large. (Lokesh, 2014) This chapter takes into account the evolution of the ICT policies and practices with special reference to its integration in the educational processes in India and its states. (See Appendix IV) The introduction of IT and ICT are late arrival in the Indian subcontinent in which policies and the schemes act as the guiding mechanisms for its expansion and monitoring. This chapter highlights the national policy debates on ICT in education. It traces the historical roots, social linkages, and its reach in different parts of India.

ICT in education- India and the world

As the importance of 'microcomputers' in making education effective was realized in the 1980s, there was a huge investment being made to install 'microcomputers' in the formal educational system, especially in schools. It was mainly treated as a supplementary to the existing system and hence couldn't become an intrinsic part of it. As a result, the investment in these technologies began to decline in the world in the late 1990s. However, when the World Wide Web (www) came into existence, there was a curiosity generated to learn and use such technology. The ICT then re-surfaced as the students were sought their preparations for "lifelong learning in an information society". Through the means of education, students

acquired desirable skills required for the information society such as “autonomous learning, communication skills, authentic problem solving” and so on. Moreover, nations across the world took a serious interest in investment in ICT. Though the initial phase of IT was introduced around the 1980s, its focus was more on ‘learning about technology’. But, by the introduction of technology as a separate subject, the focus then shifted to ICT as it was intended to bringing about changes in the classroom practices and education system. (Pelgrum and Law, 2003)

Before explicating India’s ICT policy in education, it is important to locate it in the global context. It is reported that among the 67 countries surveyed, about 68.7% had adopted a national policy on ICT by the year 2000. (Ham and Cha, 2009) Although India adopted the National Policy on ICT in 2013, its debate was started way back in the 1980s to be located in Indian history vis-à-vis global history to gauge its meaning and approach. India was under colonial rule until 1947 and the curriculum in the schools was framed for the colonial interest and its remnants continued to exist even after independence in India. The implementation of the ICT curriculum needs to be seen vis-à-vis the hegemonic discourse that informed the overall curriculum in the Indian Education system. Ham and Cha (2009) highlight that “the historical trajectory of Nations in relation to international politics often account for the nature of a country’s school curriculum”. Moreover, the liberalization of the Indian economy in the 1990s led to more economic interdependence followed by the adoption of more policies of a similar kind. In all cases, it is known that the adoption of ICT curriculum worldwide is a consequence of the increased usage of ICT in the countries engaged in the global world system. International organizations such as UNESCO began to cognize the use of ICT and its curriculum since the 1980s when ICT literacy came to be recognized and accepted as an important part of the school curriculum by educationists worldwide. India too persuaded the same goals as were propagated worldwide by the educationists and international organizations. In the educational institution and its curriculum, the knowledge systems get accredited worldwide and all the nations involved in the global world-system. (Ham and Cha, 2009)

Defining ICT and related terminologies

The introduction of computer gadgets in education dates back to the early 1980s when they become prevalent across the countries. Subsequently, the educational policies across the nations laid out the necessity of teaching computer programs in schools. As technology became more advanced in the late 1980s, they were then be called ‘Information Technology’ rather

than the ‘computers’. It implies a shift from a simple function of computation to the multiple levels of technological capabilities including the capacity to “store and retrieve information”. The term ‘Information and Communication Technology’ is a relatively new term to refer to all the technological devices prevalent these days. This term became popular around the 1990s when e-mail as a medium became popular means of exchanging communication among people. (Pelgrum and Law, 2003, p. 19) Though IT refers to “the tools- the equipment, the infrastructure, and the resources”, ICT refers to “the functions- what you do with it”. There can be many definitions of ICT but simply put, it “covers a broad and expanding multitude of machines, capabilities, and opportunities”. (Galloway, 2009, p. 19) Ratheeswari (2018, p. 1) points out that ICT is similar to IT but ICT “provides access to information through telecommunication”. He states that this incorporates the use of “internet, wireless networks, cellphones, and other communication mediums”. UNESCO defines ICT as a “form of technology that is used to transmit, process, store, create, display, share, or exchange information by electronic means. It includes radio, television, video, DVD, telephone, satellite systems, computer, network hardware, and software as well as the equipment and services associated with these technologies such as videoconferencing, e-mail, and blogs”. (UNESCO ICT in Education Programme, 2007) It means ICT is a set of devices of communication advanced through the development of cutting-edge technologies. From the above definitions, it becomes clear that ICT can be understood as a combination of hardware devices such as the desktop, the software applications to facilitate the usage of these hardware devices, and the functional usage of these devices as a whole for various purposes. However, how communication taking place between people involved in the usage of these technological devices hold a vital factor in understanding what ICT means.

ICT has many applications spanning across areas such as health, gender, education, development, and so on. For instance, a country can choose to distribute mobile phones among women to increase awareness rates among women. In the sphere of education, there have been various reasons for the spread and proliferation of ICT such as creating an ICT literate workforce, co-opt the ICT technologies in education as they become socially meaningful in society, as has been discussed in the other sections. The technologies that are used in education are broadly referred to in the three following terms:

1. Information and Communication Technology (ICT): The term highlights the role of computer devices in facilitating communication.

2. Creative Digital Technology: It means new technologies designed for specific purposes such as graphic designing,3D animation, robotics.
3. Data Communication Technology: It highlights the role of educational programs meant to equip the learners for managing the infrastructure of the hardware and software systems of the ICT devices.

Educational Technology, is another term, synonymously used with the usage of ICT in the education system. Though educational technology is a wider term, it has varied meanings for different practitioners. Lumsdaine (1964) describes two meanings in 'educational technology' literature:

1. Educational technology for the developments in the disciplines of engineering or technology for the teaching-learning process. This would mean that there should be new developments of hardware tools/aids specifically for the teaching-learning processes, not necessarily the reproduction of technologies developed for other purposes in the domain of education.
2. Educational technology as the application of new skills in education developed as a result of "scientific principles to instruction". This would mean the usage of new scientific principles in theories to be utilized in the educational process.

It was in the early 1990s when the World Wide Web and its applications spread in the world. Although there were many applications of the internet, the use of the internet for the teaching-learning process started in 1996 onwards. It is in this context that, Tony Bates (2004, p. 273) defines the meaning of E-learning which is the use of the internet for regular classroom teaching. Bates (2004, p. 273) provides various examples of the same such as "online discussion forums", "web searches", websites dedicated to various textbooks, and so on. There can be varied uses and range of uses of the internet-based resources for classroom teaching. Friesen (2009, p. 4) views e-learning as the "intersection of education, teaching and learning with information and communication technologies". To summarize, e-learning is the usage of electronic media for teaching and learning.

Although ICT in education is a comparatively new phenomenon, there are debates and experiments about the inclusion of Artificial Intelligence (AI) in education. It is a set of algorithms based on statistics that enable a computer to work like/better than humans. AI too has applications across various fields but organizations such as UNESCO have developed platforms to enable school students to be AI literate. Although issues are involved in ICT

literacy and its technology, the market of this sector is widespread to talk about AI literacy. How would AI be useful for school students, what would be the implications of the proliferation of AI for our society, are humans equipped with regulations and systems to deal with these technologies are bigger questions that need further deliberation?

Since the focus of this chapter is to discuss the ICT in Education policy in India, it is vital to discuss ICT being defined by the Indian National Policy on ICT 2012. The policy defines ICT as "all devices, tools, content, resources, forums, and services, digital and those that can be converted into or delivered through digital forms, which can be deployed for realizing the goals of teaching-learning, enhancing access to and reach of resources, the building of capacities, as well as management of the educational system". This compromises of the 'hardware devices', 'software applications', 'interactive digital content', 'internet and other satellite communication devices', 'radio and television services', 'web-based content repositories', 'interactive forums', 'learning management systems', and 'management information systems'. Also, it incorporates the 'processes for digitization, deployment, management of content, development, and deployment of platforms and processes for capacity development, and creation of forums for interaction and exchange'. (Ministry of Human Resource Development, 2012) Here, ICT is not just a set of devices and applications but also a set of processes involved in the creation of the content and its management. Therefore, without undermining the functions of devices and applications, there are complex processes that need adequate attention as they involve in the working of those devices and the agencies engage in it. This study takes into account not just the devices installed in the classroom, software applications that the teachers/students/parents use but also the processes involved, that is, the classroom processes such as the teaching of academic subjects, the school management's governance, the training processes by various agencies through the medium of communication. The definition of ICT can be summarized in the following categories to make it more succinct:

- The Hardware device
- Software applications
- The Processes Involved in management, creation of content, and its deployment
- The Content of the device

While attempting to understand the meaning of ICT and related terminologies, it is important to define the role of these technologies in the field of education. There are two

important dimensions of education- what to teach and how to teach. The technologies in education are concerned with the process in which the content is delivered, that is, how to teach at the outset. Although the purposes for the usage of ICT are varied and are concerned with the improvement in the quality of content, the first and foremost concern is with the use of the technologies for improving the ways of teaching. (Barker, 1986)

IT and ICT linkages

The initiatives to expand the spaces of ICT owes to pool the advantages of the advanced, low cost, and remote delivery model. ICT is a combination of two sectors- Information Technology (IT) and Communication. It is, therefore, vital to draw the linkages between national policy on ICT and the developments in the policy on IT. It is difficult to imagine the growth in the ICT sector without the growth and development in the IT sector. Nowadays, the age of information society coincides with the developments of both IT and the ICT. For instance, the Information Society Index, by the "World Times and International Data Corporation" processes a 'country's preparedness' across these four pointers:

- Information: Creating the capacity to send and receive information by telephone, television, radio, and fax.
- Computer: Extending access to computers in schools, workplaces, and homes, building networks, and using the software.
- Internet: Expanding the internet in schools, workplaces, and homes and enabling electronic commerce.
- Social: Building people's capacity to use information through education, freedom of the press, and civil liberty. (Ahuja, 2001)

Both IT and ICT are intrinsic to the society we live in today. The following section highlights the initiatives in the IT sector and their linkages with the development of ICT in the Indian context.

The market for the IT industry has grown enormously and the size of the market for information technology has grown from 3.4% in 2000-01 to 7.5% in 2011-12 (NASSCOM, 2013). The advancement in the IT and ITES sector has led to the growth of India's knowledge economy. This has led to an increase in the economy of the service sector especially in GDP

rate, employment, and exports. With the expansion of the IT industry, the education sector has shifted from its earlier attention. It is being noted that the states in India which lead to approximately 90% exports of the IT sector are seen to be having 6-7 times more colleges than the other states. (Kumar and Anita, 2014, p. 8).

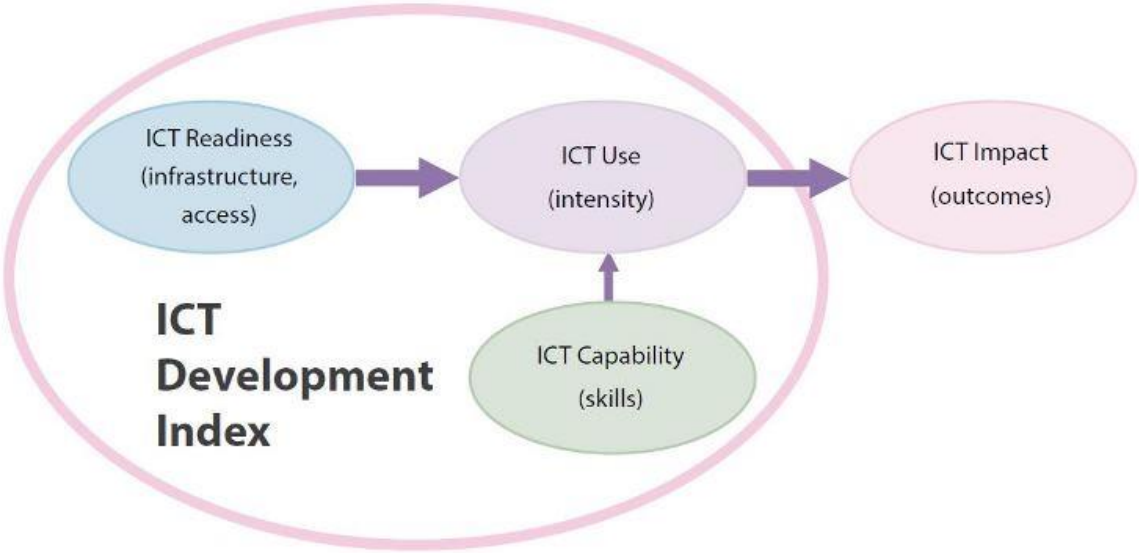
The developments in the IT sector can be traced back to the late 60s when a host of 'software export policies' were initiated by the state. India's computer services industry began in Mumbai in 1967 with the formation of the Tata group in partnership with Burroughs. The Indian government imported computers from the Soviet Union which were then used in laboratories and companies. In the 1970s-80s, the policies promoted the protection of domestic hardware through restricted competitiveness. The National Informatics Centre was set up in March 1975 followed by Indian companies such as Infotech, Wipro in 1977-80. Then, in 1986, the state declared a new policy to develop a strong software sector, trailed by a World Market Policy in 1988 and beginning of Software Technology Park from India (STPI) scheme. After that, the National Taskforce on Information Technology and Software Development (NTITSD) was established in 1998 to formulate long-term plans and remove impediments to the growth of the IT sector. The internet services were offered by Videsh Sanchar Nigam Ltd (VSNL) since august 1995 initially and expanded to a network of 42 nodes operated by the Department of Telecommunication and VSNL in 1998. The proliferation of internet services has since then expanded with the optical fiber system being introduced in the country. The formation of the Ministry of Information Technology was in itself a gigantic step towards the advancement of the IT initiatives in India in 2000 along with establishing a task force on human resource development for developing long-term strategies to increase the number of well-trained IT professionals. The other recent initiatives include upgrading the Education and Research Network connecting various universities and regional engineering colleges, reducing 'custom duties on IT products', permit 100% foreign investment, and framing the Information Technology Act (Kumar and Anita, 2014, p. 11). The 11th five-year plan states that "our vision is to make India the most preferred destination for providing the IT and ITES and to create the required system to demonstrate the full potential of Indian skill and enterprise in this vital sector". (Planning Commission, 2007). The increase in focus on initiatives for IT programs and schemes as mentioned below highlights the same. Some e-governance initiatives have been introduced by the state for improving the accessibility to quality education, cost-efficient, and quality healthcare and postal services at affordable costs. To ensure more public services being delivered on a wider scale, the Electronic Delivery of Services Bill (EDSB) had been approved

by the government in 2011. The accessibility of ICT services to the common man, public services under all e-governance projects will be made available by leveraging the expanding mobile technology. (Kumar and Anita, 2014, p. 12) In 2007, it was realized that computers and the internet can be used for many other purposes than communication such as e-learning. This gave a boost to the personal computer literacy industry on a large scale. The data for the use of computers by households and its increase is mentioned below.

Before discussing the actual policy debates in the context of India, it is vital to understand the expanse of the ICT sector in India in the present context. In the Indian context, there is no one organization/agency which spans the entire gamut of the ICT sector. This may be due to the late arrival of ICT in India, leading to slow expansion and difficulties in mapping the same in an organized manner. However, there are numerous indices to understand the expanse of the ICT sector provided by various organizations such as Eurostat, International Telecommunication Union (ITU), The United Nations Conference on Trade and Development (UNCTAD), Organization for Economic Co-operation and Development (OECD), The Partnership on Measuring ICT for Development. Although all the organizations work in tandem with each other and provide useful insights on measuring ICT related developments, an important index has been produced annually by ITU since 2009 called the ICT Development Index (IDI). It has been used by countries to measure ICT developments between countries and over the period using 11 indicators. To measure a country's evolution towards an information society, it provides three stages: ICT readiness, ICT intensity, and ICT impact.

a. ICT readiness depicts the level of infrastructure and access to ICT's.
b. ICT intensity depicts the level of usage of ICT's in society.
c. ICT impact shows the results of the effective usage of ICT's.

Figure 3.1: Three stages in the development of an information society



Source: International Telecommunication Union, www.itu.int

The 11 indicators that combine to form the ICT Development Index are as follows:

ICT access (carries weight indice of 0.40)

1. Fixed Telephone subscriptions per 100 inhabitants
2. Mobile-cellular telephone subscriptions per 100 inhabitants
3. International Internet bandwidth (bit/s) per internet user
4. Percentage of households with a computer
5. Percentage of households with internet access

ICT Use (carries weight indice of 0.40)

6. Percentage of individuals using the internet
7. Fixed broadband subscriptions per 100 inhabitants
8. Active-mobile broadband subscriptions per 100 inhabitants

ICT Skills (carries weight indice of 0.20)

9. Mean years of schooling
10. Secondary gross enrolment ratio

11. Tertiary gross enrolment ratio (ITU)

The ICT industry usually comprises of information technology and telecommunications industry. Information technology comprises of computer and related devices industry and telecommunications comprises cellphones, the internet, and other digital networks. (SESEI 2019) In the context of India, the IT industry comprises the software industry and Information technology-enabled services (ITES) which also includes the business process outsourcing industry (BPO). The Indian IT sector has emerged rapidly contributing to about 55% market share of the US$ 185-190 billion global services sourcing business in 2017-18. (SESEI 2019) So, to capture the Indian IT industry and its development, some of these indicators need to be traced in the Indian setting. These indicators can be traced individually from the statistical accounts of various government agencies. However, the IDI index for India has been calculated for 2016, the values for which can be seen underneath. (See Table 3.1)

Table 3.1: IDI ranking for India 2016

Key indicators for India	**Index**
Fixed telephone subscriptions per 100 inhabitants	1.9
Mobile cellular subscriptions per 100 inhabitants	87
Fixed broadband subscriptions per 100 inhabitants	1.4
Active mobile broadband subscriptions per 100 inhabitants	16.8
Percentage of individuals using the internet	29.5
International Internet bandwidth per internet user (Bit/s)	16
Percentage of households with a computer	15.2
Percentage of households with internet access	22.6
Mean years of schooling	6.3
Secondary gross enrolment ratio	74.28
Tertiary gross enrolment ratio	25.54
IDI Rank	138

Source: International Telecommunication Union, www.itu.int., 2016

Although the latest IDI index has been calculated for India for 2016, some of the gross figures for the Indian population for 2016-18 and gross figures per 100 inhabitants are available as under. (See table 3.2, table 3.3)

Table 3.2: ICT indicators for India 2016-2018

Key Indicators	**2016**	**2017**	**2018**
Fixed telephone subscriptions	2,44,04,000	2,32,34,687	2,18,68,192
Mobile- cellular telephone subscriptions	1,12,78,09,000	1,16,89,02,277	1,17,60,21,869
Fixed broadband subscriptions	1.86,53,312	1,78,56,024	1,81,70,000
Percentage of Individuals using the internet	22	34.45	N/A
Proportion of households with a computer	N/A	N/A	16.6
Percentage of households with internet	22.0	N/A	N/A

Source: International Telecommunication Union, www.itu.int., updated December 2019

Table 3.3: ICT indicators for India 2016- 2018 (per 100 inhabitants)

Key Indicators	**2016**	**2017**	**2018**
Fixed telephone subscriptions	1.84	1.74	1.62
Mobile- cellular telephone subscriptions	85.15	87.32	86.94
Fixed broadband subscriptions	1.41	1.33	1.34

Source: International Telecommunication Union, www.itu.int., updated December 2019

It is important to locate the gross values for ICT indicators of India in the wider context of Asia and the Pacific for 2016-2019. The gross values for ICT indicators for Asia and the pacific for 2016-2019 and gross values per 100 inhabitants for Asia and the Pacific for 2016-2019 are given as under. (See table 3.4, table 3.5)

Table 3.4: ICT indicators for Asia and the Pacific (in millions)

Key Indicators	**2016**	**2017**	**2018**	**2019**
Fixed telephone subscriptions	411	395	390	378
Mobile-cellular telephone subscriptions	4094	4351	4460	4768
Active-mobile broadband subscriptions	1927	2522	3003	3802
Fixed broadband subscriptions	459	525	565	614
Population covered by a mobile-cellular network	4017	4100	4145	4188
Population covered by at least a 3G mobile network	3580	3818	3993	4049
Population covered by at least an LTE/WiMAX mobile network	3016	3655	3862	3907
International bandwidth in Gbit/S	78,248	1,19,489	1,43,232	2,10,908
Households with a computer	N/A	N/A	N/A	N/A
Households with internet access at home	N/A	N/A	N/A	N/A
Individuals using the internet	1592	1832	1955	2066

Source: International Telecommunication Union, www.itu.int., updated 28th October 2019

Table 3.5: ICT indicators for Asia and the Pacific (per 100 inhabitants)

Key Indicators	**2016**	**2017**	**2018**	**2019**
Fixed telephone subscriptions (per 100 inhabitants)	9.9	9.5	9.2	8.9
Mobile-cellular telephone subscriptions (per 100 inhabitants)	98.8	104.0	105.3	111.7
Active-mobile broadband subscriptions (per 100 inhabitants)	46.5	60.3	70.9	89.0
Fixed broadband subscriptions (per 100 inhabitants)	11.1	12.9	13.3	14.4
Population covered by a mobile-cellular network (per 100 inhabitants)	96.6	97.7	97.9	98.1

Population covered by atleast a 3G mobile network (per 100 inhabitants)	86.6	91.5	94.9	95.4
Population covered by atleast an LTE/WiMAX mobile network (per 100 inhabitants)	72.5	87.1	91.2	91.5
International bandwidth in Gbit/S (bandwidth per internet user Kbit/S)	49	65	73	102
Households with a computer (%)	39.2	40.7	42.2	43.5
Households with internet access at home (%)	42.2	45.5	48.3	50.9
Individuals using the internet (%)	38.3	43.6	46.2	48.4

Source: International Telecommunication Union, www.itu.int., updated 28th October 2019

It is vital to note that though these are few variables that map out the ICT landscape in India, organizations and various countries also look at some other variables to know the developments in the ICT sector. Some of these variables are ICT goods, trade-in ICT goods, export and import of ICT goods, ICT services and their trade, export, and import of ICT services, ICT demand, ICT enabled goods and services, ICT use by businesses, and e-commerce. (UNCTAD, 2020) As education is itself considered a 'service' provided, the ICT in education comes under the realm of ICT services in India. The revenue from IT services reached US$86 billion, making a share of 51.8% in the total IT sector revenues in 2018. (SESEI, 2019) After looking at these key quantitative indicators for India and Asia, it is important to critically view the policy highlights on ICT in the Indian context.

Emerging policy concerns on education

Educational Technology Initiatives in Colonial India

Though the Indian economy was not in a very bad shape during the colonial period, the economic benefits were reaped by the colonizers for their benefits. The educational scenario during the colonial period emphasized producing a class of citizens who could work for the British Government. The syllabi, the textbooks, and the pedagogical methods, therefore, emphasized rote memorization, the study of foreign texts and languages, limited understanding of the subjects among many others. (Kumar, 1991) The investment in education too was limited as was specified in the Charter Act of 1813. As can be seen through the curricular documents, education aimed to create bureaucrats who could work for the colonizers, therefore, it was the

textbook-centered education that was promoted. The textbook, in itself, was the technology that was relevant during that period. Kumar (1991) highlights that it was the textbook that was the basis for examinations, classroom interaction, and learning. This system of the textbook-centered curriculum has been criticized during later years in the Indian context as it hampered the critical abilities of the learners. It is important to note that none of the policy documents during this period mention technology in education though there is a mention of "Technical Education" in Lord Curzon's Educational Policy and the Indian Educational Policy 1913. This technical education was aimed at "higher forms of instruction" for the training of engineers, technicians, electricians, revenue officers, and so on. (Garg, 2001, p. 263) This Technical education was linked with the commercial industry and "Export trades". (Garg, 2001, p. 263) These courses were to be provided by educational institutions such as the Indian Institute of Science, Technical Institute at Bombay among many others. Since the workforce had to be created for the software industry and other such prevalent markets, technical education was to be imparted. The introduction of ICT in education dates back to the colonial period when the British administration started the first radio broadcast in by the 'Radio Club of Mumbai' in June 1923. The British Broadcasting Corporation (BBC), through radio, 'aired educational and cultural programs in India'. After almost 14 years, the All India Radio (AIR) aired the programs related to education in 1937 (Agrawal, 2005, p. 14)

Educational Technology Initiatives in Post-Colonial India

After independence, the economy was not in a very good state and the focus was to boost the manufacturing sector along with social development. (Mukherjee, 2016) The role of education too reflected concerns related to "National progress and security". (Ministry of Human Resource Development, 1968) This period, in general, bestowed a lot of hope in Science and Technology for the progress of the nation. This was reflected in many spheres such as the development of "scientific policy under the leadership of Jawaharlal Nehru", with a "special emphasis on science and technology research". The National Policy on Education 1968 highlighted the "development of science and technology" through education and for educational development, leading to "National integration." (Ministry of Human Resource Development, 1968)

National Policy on Education 1986

The initial phase of the educational technology in the Indian education system can be traced back to 1971 at a time when the proposal for 'the educational technology project was included in the 5th five-year plan'. (Goswami, 2014, p. 8) The project had kept various objectives such as an 'educational technology unit' that was to be set up in the Ministry of education and social welfare. Further, the plan visualized a 'Centre for Educational Technology' to be set up in the NCERT by providing 100% assistance to the states for setting up 'education technology cells' along with the firming up of educational institutions for 'undertaking education technology programs'. An educational television channel, the Satellite Instructional Television Experiment (SITE) was streamed in six states in 1975-1976. Though there were many developments undertaken in making and installing hardware and software such as the involvement of agencies other than Doordarshan for 'video production and broadcasting', the 'supportive structures' couldn't sustain for long (NCERT, 2006). The Central Institute of Educational Technology (CIET) was established under its tutelage by merging the CET and Department of teaching aids of NCERT in 1984. Moreover, an 'educational technology division' was created under the MHRD Ministry and some ET cells were made State Institutes of Educational Technology (SIET) besides opening new ET cells in some other states. The CIET along with SIET's have undertaken training and research in educational television and radio production. They have functioned as a central coordinating agency for all production and utilization efforts. The CIET assumed the task of fulfilling various educational objectives through the means of modern technology. But the projects couldn't be fully implemented due to a lack of support systems and non-appreciation of the usefulness of the educational programs. As the production and broadcast expanded along with the provision of hardware in the schools, the main tasks of the CIET and SIET's were shifted towards the production of video and audio programs. The program, however, couldn't be successful as there was neither effective relation between the broadcaster and the school teacher nor useful for a particular age group and their priorities (NCERT, 2006).

The context in which the policies emerge defines the landscape of the policy documents. It is, therefore, important to see the context in which the 1986 policy emerged. The annual growth rate of the economy was around 3.5% between the 1950s-1980s and the per capita income too remained very low during this period. Since the growth rate was so low, other sectors demanded more funds than were being invested in education. Politically, the

government couldn't educate the masses to exercise effective political power to participate in the development programs. Socially, there was rampant unemployment, problems of equity of resources, distribution among many others. The satellites have been an integral part of the country for many decades. The "Satellite Instructional Television Experiment" was started with the aid of the ATS 6 satellite of the USA in 1975-1976 and is seen as the 'largest techno-social experiment'. The Indian National Satellite (INSAT) was launched for educational purposes in 1980 for telecommunication purposes. The 'INSAT for education' was regarded as a tripartite project, supported by United Nations Development Programme (UNDP), United Nations Educational, Scientific, and Cultural Organization (UNESCO), and Government of India (GOI). With the INSAT-1B, the primary schools were provided the facility of approximately 3 hours/day educational programs through television and 2 hours/day for adults in the evening. Also, ISRO launches 'geostationary satellites' which are used in several ways for television and radio content. The video libraries too started in the 1980s and mushroomed all over the country, they collapsed soon with the increasing growth of television and satellites. (Agrawal, 2005, p. 15) All these developments in the context of the development of other sectors such as India's film industry which used technology extensively. India's film industry has been over 100 years old and owned and controlled by the private sector. It has produced films of various genres such as 'full-length', 'short films', 'documentaries', 'feature films' among many others. The radio and television industry have an intrinsic connection with this industry. (Agrawal, 2005, p. 14)

The National Policy on Education 1986 gave special emphasis to the role of educational technology in the policy document titled "Media and Educational Technology". The policy highlighted that educational technology can be an important medium through which the problem of access to education can be dealt with. While visualizing the larger goal of educational technology, the policy stated that educational technology will be useful in "the spread of useful information, the training, and re-training of teachers, to improve quality, sharpen awareness of art and culture, inculcate abiding values both in the formal and the non-formal sectors". For the purposes of the requirement of infrastructure, the policy said that although there would be maximum usage of "available infrastructure" and the "solar packs" in villages without electricity. As the content of the educational technology forms the core of any EdTech program, the policy stated that "relevant and culturally compatible educational programs" would be furthered with the use of available resources. It highlighted that the constraints of "time and distance" can be overcome through technology as it helps in reaching

out to “the most distant areas and the most deprived sections of beneficiaries simultaneously with the areas of comparative affluence and ready availability”. The policy document also put forth a word of caution for the Radio and T.V. programs “which militate against proper educational objectives” and promotes “Children’s films of high quality and usefulness”. (Ministry of Human Resource Development, 1986)

The National Policy on Education of 1986 scripted the importance of ‘educational technology to be part of improving the quality of education’ with two centrally sponsored schemes namely Computer Literacy and Studies in Schools (CLASS) and Educational Technology (ET). The concept CLASS was conceived as a collaborative project with Ministry of Human Resource Development (MHRD), Department of Electronics, and NCERT which aimed at achieving computer literacy through resource centers and schools. Under this scheme, 2 BBC computer and software was provided along with the training of the teachers and the students. Agarwal (2005) found out that the response to the usage of computers in the school was positive regardless of the nature of the school. But the CLASS project was dismal due to lack of infrastructure, inadequate hands-on experience to the teachers and the students. The time gap between the training of teachers and setting up of projects and initiation of the project was another setback. Lack of interaction between the schools and the resource centers have also affected. (Agrawal, 2005 and NCERT, 2006) The ET scheme, on the other hand, is instituted as the Centre for Educational Technology (CET) in 1974 under NCERT with six centers across India under the Fifth Five Year plan. (NCERT, 2006) The CET units were reported to be efficient as they worked towards the specific educational needs of the marginalized communities. It had launched ‘multimedia programs’ in the domain of in-service teaching as well. But with the new directives in the early 1980s by the MHRD Ministry, such co-ordination couldn’t survive. (NCERT, 2006)

National Policy on Education 1992

Many committees were constituted such as B.S. Bhatia Committee 1994, Kiran Karnik Committee 1997, and T.N. Dhar Committee 2004, to suggest new initiatives for education but no effective resolutions were taken to realize the outcome. (NCERT, 2006) With time, the internet and telephonic services have expanded because of the deregulation of airwaves, the telecommunication industry, the increase in technologies used for educational purposes, and the expansion of the usage of these technologies.

It is important to note that ICT services expanded in the education sector in the context of the expansion of other sectors such as telecommunication, television, and internet services. Television and its industry expanded exponentially with the economic reforms in 1992. The national television popularly known as Doordarshan was earlier a government-owned enterprise and later by Public Service Broadcasting Corporation known as Prasar Bharati. Though there are many channels besides those owned by private companies, there is a special program jointly operated by the Ministry of Human Resource Development and Information and Broadcasting, Indira Gandhi National Open University (IGNOU) and Prasar Bharati called the DD-Gyan Darshan dedicated 24-hour educational television channel in 2000. Subsequently, India's technology education channel, DD-Gyan Darshan was launched jointly by Indian Institute of Technology (IIT) and IGNOU in 2003. It was aimed at the students of engineering and technology. Of late, the 'Gyan Vani', India's first educational radio station was started in 2002 which targeted different types of learners. After the 1991 reforms for initiation of liberalization, privatization, and globalization of the Indian education system, the corporate sectors have made investments in the domain of "educational broadcasting, especially, in convergence technology, incorporating technology-driven training to overcome scarce human resources such as hospitality education, post-secondary training refresher courses, short-term knowledge upgrading and updating of professional knowledge and skills". The telecommunication industry was earlier controlled by the government but now has been taken by autonomous corporations such as Bharat Sanchar Nigam Limited (BSNL), Videsh Sanchar Nigam Limited (VSNL), Mahanagar Telephone Nigam Limited (MTNL), and private companies too now. (Agrawal, 2005)

With the emergence of internet-driven services, the state has introduced computers for the provision of information and the improvement of public services. The usage of the internet has increased over the years for administrative and governance purposes and a new era of public-private partnerships has ushered in the ownership, management, and distribution of internet services. (Agrawal, 2005) With the changing times, the internet has proliferated in the daily lives of people and the result has been the telecommunication industry and cable companies entering the internet market, making it accessible and cheap.

The CLASS program was revised twice, first, it was during 1993-2004 and then in 2000. In the first revision, personal computers were installed in the school followed by provided computer literacy in 10,000 schools, computer-assisted learning in 1,000 schools, and

computer-based learning in 100 schools. But these initiatives couldn't bring the expected benefits due to ambiguity of purpose, tentative policies, and faltering practices. (NCERT, 2006)

Apart from television and radio, computer learning and the internet became the more prominent medium for educational purposes. The national task force on Human Resource Development in educational technology made endorsements for the usage of Internet and IT-based technologies for education. The launch of EDUSAT in 2004, a satellite dedicated to the broadcast of educational programs was one such effort. It enabled separate channels for 'agriculture', 'technology', and '5000 FM community broadcasting stations' was to be used for educational institutions. (Agrawal, 2005, p. 19) These schemes carved the way for a more focused centrally sponsored program named Information and Communication Technology @ Schools in 2004. Now it is subsumed under Rashtriya Madhyamik Shiksha Abhiyan (RMSA, n.d.b).

In the post-liberal era, education was looked at as a commodity in the Indian context. Ghosh (2010) highlights that "the demand for knowledge in Information Technology is the direct result of globalization". Economies have become "interdependent through the flow of factors of production such as capital, labor, and technology". The developing countries are no more in a disadvantageous position but are "integrated into the world system in a new way through the relocation of conventional industries by the West known as outsourcing". This "rise of the information society in the West" is a result of the "wider application of information technology in all spheres of life". (Ghosh, 2010, pp. 245-246) As the market for information technology expanded, the firms in the developed world attracted talent from all over the world including India to fill the gaps in the availability of trained professionals in the developed world. This led to the mushrooming of Information technology training institutes in these countries including India with hubs of information technology institutes in Andhra Pradesh and Tamil Nadu. (Ghosh, 2010)

The National Curricular Framework 2005

The National Curricular Framework (NCF) 2005 emphasized the importance of ICT in school education. It mentioned the problem of educational technology is only limited to the "dissemination of information" and "to address the scarcity of good teachers" which is the result of poor recruitment policies. The NCF lays certain objectives for the usage of educational technology in the school system. The policies for educational technology need to be used "at

all the levels of schools- cluster and block resource centers, district, state, and national level institutes" to provide "hands-on experience" using educational technology. The role of the teachers and the students must not be restricted to "consumers" but "producers" if there has to be some curricular reform through educational technology. The educational technology content should be a replica of the classroom content but be developed for "non-didactic exploration" so that the learners can relate with the content and learn as per their "interest." The NCF highlighted the role of educational technology material not only in English but also in the regional languages of India. It has been observed that there is a dearth of ICT content in regional Indian languages and so, NCF aims to promote the same for the adoption of ICT in non-English medium schools as well.

Another popular educational scheme like 'Sarva Shiksha Abhiyan' too underlined the significance of quality education through ICT. Similarly, the Central Advisory Board of Education (CABE) endorsed the application of ICT in its report on 'Universal Secondary Education' in 2005. (National Policy on ICT, 2012) To outreach the media technology in the field of education, international agencies such as UNESCO have agreed to accredit educational media programs across the globe including India. Under this program, the "Delhi School Television Project" has targeted "20,000 students in 150 higher secondary schools in Delhi". (Neurath, 1968) Both the mediums, radio and television have been used extensively for educational purposes although the expansion of television has been spectacular. The influx of open and distance education gave further impetus to the expansion of educational technology. A lot of radio programs being launched for educational purposes. But a few of them are being launched by the Central Institute of Educational Technology (CIET) and NCERT, such as 'on India's freedom struggle' and so on for the students between 6-14 years. The National Literacy Mission also used radio broadcasting along with textbooks and language drills, especially for, for female adult learners in four states — Bihar, Madhya Pradesh, Rajasthan, and Uttar Pradesh. (Agrawal, 2005, p. 17)

ICT in School Education 2012

Society stepped into the 'information age' with the developments in ICT and the proliferation of technologies coupled with its 'social and economic significance'. It was in the 1980s that the World Bank and UNESCO began to emphasize the role of ICT in providing support to enhance education. When ICT becomes the norm for society, the education system was to be adopted itself, and the learners to be prepared to find a place in the age of 'information society'.

Once this rhetoric was given importance, there were global efforts to include ICT in the school systems. Ham and Cha (2009) mention that in 2000, the G8 countries accepted a charter to facilitate 'digital literacy' among the school student's to make them prepared for the "information age".

The Aims and Objectives of the policy

As India began to aspire to be one of the knowledge economies, adopting the ICT and its infrastructure became significant.[4] Learning as a goal for any nation-state is linked to the propagation of the idea of moving towards building a knowledge economy. Yves (2007) states that "the future of learning" is related to the "instrumental objectives" of "adapting the learning institutions and labor force to the requirements of the knowledge economy". The widespread distribution of ICT and its importance in furthering the goal of better learning makes ICT an important tool for the countries striving to become knowledge economies. The second important goal for school education was an improvement in the access and the quality of the education for which it aims to take certain measures.[5] The policy states that this is to be done with the enhancement of ICT-enabled processes at all levels in the school system such as the availability of ICT materials aimed at improving 'access' and 'quality' of education. The third important goal is the attainment of ICT literacy. The route to achieving this is not only by making the agencies 'ICT literate' but creating an environment of better utilization of ICT and related services.[6] The goal of ICT literacy is unavoidable for any nation as it expands its rungs

[4] The ICT policy in school education of 2012 intends to "preparing the youth to participate creatively in the establishment, sustenance and growth of a knowledge society leading to all round socio-economic development of the nation and global competitiveness". (Ministry of Human Resource Development, 2012)

[5] Its mission is "to devise, catalyse, support and sustain ICT and ICT enabled activities and processes in order to improve access, quality and efficiency in the school system". It also aims 'development of …localized quality content… and critical use of shared resources', 'development of professional networks of teachers, resource persons and schools…for continuing education of teachers…,academic support to students…,management and networking of school managers', 'research, evaluation and experimentation in ICT tools and ICT enabled practices…". (Ministry of Human Resource Development, 2012)

[6] Furthermore, the policy goals aim at "Creating …an environment to develop a community knowledgeable about ICT', 'an ICT literate community which can deploy, utilize, benefit from ICT…' and 'an environment of …sharing to the creation of a demand for optimal utilization and optimal returns on the potentials of ICT in education". Finally, to "motivate and enable wider participation of all sections of society…through appropriate utilization of ICT". (Ministry of Human Resource Development, 2012)

more in society and becomes the new normal. While analyzing the competencies that are required in engaging with ICT, two dimensions need to be kept in mind. The first is knowing the usage of ICT itself, which is referred to as ICT literacy in the policy document. This encapsulates learning the usage of the ICT devices themselves such as learning to work with Microsoft Word and Google mail. The national policy defines ICT literacy in terms of levels of competence. These competencies are defined by many factors such as the 'level at which ICT is introduced, local conditions, and the frequency of access to the ICT facilities'. The second dimension is the usage of ICT for enhancing the quality of the teaching-learning processes. Many of these goals repeat in the National Policy on Education 2020.

ICT in Indian Schools

As India has 'one of the largest school infrastructures in the primary education system in the world', the questions of 'equity' and 'quality' are very pertinent. The introduction of the ICT was seen as the answer to these questions globally. The national policy documents describe these questions as it becomes more 'accessible, reliable, and mature' through ICT (Ministry of Human Resource Development, 2012). It has been discussed in the previous sections that ICT has 'enabled the convergence of a wide array of technology-based and technology-mediated resources for teaching-learning', therefore, it helps in addressing various challenges of the Indian education system. One such challenge is the 'distribution of sparse educational resources across various media and forms, along with the catalyzing adoption, and the translation of resources'. Through ICT, not only can the 'information' be distributed easily, it can be adapted to the requirements of the varied conditions.

The second challenge is to 'make different audio and video resources available in different languages, media standards, and formats'. ICT is a medium through which dissemination and translation can happen quickly and be shared in a fraction of seconds.

The third is 'to enhance the reach and usage' of print resources, especially in 'Indian languages'. ICT can be a gainful medium to 'digitize and disseminate the existing print resources'. The National Council for Educational Research and Training (NCERT) has made all the NCERT books available online in the present context. Although there are benefits of the availability of e-books, the non-availability of computers and the internet at remote places face many hurdles.

The fourth challenge is the quality of 'teacher capacity building' and 'the school ability to manage and improve efficiencies' due to 'school size' and 'conventional methods of training

and support'. ICT can bridge this gap effectively by enhancing networking for efficient shared training and diffusion for large groups with ease.

The last issue is the mere information delivery for education and using ICT to nurture 'creative, aesthetic, analytical, and problem-solving abilities in students and teachers'. (Ministry of Human Resource Development, 2012)

ICT and School Infrastructure

The availability of the infrastructure forms the core of the implementation of ICT. The policy document talks about two types of infrastructure for the schools:

- "Core ICT infrastructure"
- "Enabling Infrastructure"

The infrastructure constitutes both the hardware and the software components.[7] The development of the content and its usage forms the core area of the curricular material to be used for ICT teaching-learning. The policy encourages the teachers and the students to "develop digital learning resources collaboratively and contribute to the proposed digital repositories" and promotes 'collective ownership'. The digital resources can take many forms such as "e-books, animations, lessons, exercises, interactive games, models and simulations, videos, presentation slides, plain text materials, graphics, or any combinations of the above". Besides these, the policy recognizes the "raw content resources like photographs, video, audio and animations" and altering them to suit different academic needs. The conversion of print materials such as laboratory manuals, problem sets, activities' and so on into digital resources too is an important part of ICT content development. As has been mentioned earlier, the 'web-based repositories' would be developed as per 'educational standards' and content to be shared

[7] The hardware comprises of the "printer, scanner, projector, digital camera, audio recorders and such other devices". There should be atleast one of all these devices in the school along with "atleast one computer laboratory with at least 10 networked computer access points to begin with", going further to 20 access points. Also, one computer should be accessible to not more than two students. For ICT enabled academic teaching and learning, the policy states that atleast one classroom should have 'audio visual facilities' for the teaching of academic subjects. The policy emphasizes on expansion of a variety of devices such as 'still and video cameras, music and audio devices, digital microscopes and telescopes, digital probes for investigation of various physical parameters' to elaborate the scope of the process of teaching and learning. Though the emphasis is on equipping the computer labs and the classrooms, the policy indicates the making ICT devices available at other places too such as library, common room and so on. Also, the provision of 'appropriate hardware for satellite terminals' in some schools is indicated in the policy statement. (Ministry of Human Resource Development, 2012)

across the community and schools to ensure a wider reach of the resources. (Ministry of Human Resource Development, 2012)

The policy remarks about the enabling infrastructure such as electricity, fire extinguishers, and so on for effective utilization of the ICT enabled infrastructure. The policy states that "state shall endeavor to provide universal, equitable, open and free access to ICT and ICT enabled tools and resources to all students and teachers". As has been known that the resources for education are required for 'different subjects, curriculum, ages/grade levels and languages' as per the different 'socio-economic-language' variations, the usage of "Unicode fonts" would ensure 'universal access, compatibility and amenability to transliteration and translation'.(Ministry of Human Resource Development, 2012) In the context of no regular supply of electricity in many parts of India, how would this goal be fulfilled and how long will it take are some of the questions that need to be thought about. Sood (2001) states that ICT is like "putting the cart before the horse," especially in the Indian context, where there is a dearth of basic resources like electricity, sanitation, etc. He further elaborates that IT/ICT can be used for developmental purposes once the basic problems of the people are addressed. Though the situation has improved now with almost full electrification of the country's towns and villages, the regular supply remains an issue. (Alexander and Padmanabhan, 2019)

A variety of software should be encouraged to be accessible and used such as "the graphics and animation, desktop publishing, web designing, databases, and programming tools" and so on to enhance the teaching and learning process. As the aim for software learning is "favoring a pedagogy of learning which promotes active learning, participatory and collaborative practices and sharing of knowledge", the policy states that the software applications should be 'free and open-source'. The teachers and the students would be encouraged to create and 'disseminate' the software such as "specialized software for different subjects, simulations, virtual laboratories, modeling, and problem-solving applications".[8] (Ministry of Human Resource Development, 2012)

[8] A very important part of the policy statement is the 'single area local network' so that resources can be shared appropriately between the teachers, students, community, schools and so on. Also, the policy directs the schools to not only ensure 'broadband connectivity' for videos, 'interactive programs' but also, 'offline access' to this content. The policy asks for 'an EDUSAT network will be planned at each state with interactive terminals (SIT) and receive only terminals (ROT)'. It is vital that the teachers and the students be trained to use these online resources with safety 'to guard against cyber-attacks and other security measures'. (Ministry of Human Resource Development, 2012)

The school management and the teaching-learning process

Before discussing the teaching-learning process, it is important to highlight the recommendations of the policy for school management. The policy facilitates the "adoption of e-governance" along with the usage of the 'Management Information System' (MIS) for various administrative purposes in the school system.[9] The MIS will be integrated with the proposed statewide web-based system". This would be further facilitated by a 'school-wide local area network' which would automate processes like 'library automation, locally cached offline access to internet resources, office automation, maintenance of records, student tracking, resource planning, using the existing ICT infrastructure" and save 'cost, time and effort'. (Ministry of Human Resource Development, 2012) Again, the regular availability of the core and the enabling infrastructure would be a pre-requisite for this proposal to succeed. It can be seen that this kind of centralized system for administrative purposes is becoming a norm in private as well as government schools. Although the proposal for this is to reduce the workload, the teachers in the schools saw this as an additional burden as would be elaborated in the chapters ahead. So, what purposes does ICT serve or what problems does it solve are important questions that need to be thought about. Also, these solutions have become a means of surveillance for the teachers, the students, and other agencies involved in the school system.

As has been discussed earlier, it is the teaching-learning process that is central to any change in the education system. The introduction of ICT can open a plethora of options for the teacher to 'improve the quality and efficiency of teaching-learning process' from "projecting media to support a lesson, to multimedia self-learning modules, to simulations to the virtual learning environment". Analytically speaking, setting the computer lab would begin with enable ICT literacy and gradually get upgraded into ICT enabled classroom as was visualized in the policy statement. Once classrooms are equipped with ICT devices, the use of classrooms

[9] The policy defines the school information management system as "a single window clearing house on all information related to the secondary school system". It would be a 'nation-wide network' in which all the agencies such as teachers, students, school managers and others involved in the education system would participate. This would collaborate all the 'content', 'professional development platforms', 'resources', 'student support services' and so on, to facilitate 'decision making' and 'research and development'. Such a system would be a broad platform for academic needs, governance and ensure 'universal access to information, content and resources'. (Ministry of Human Resource Development, 2012)

should be the course of the adoption of ICT in the classroom as per the policy statement. It is imperative for the teachers to 'critically evaluate' and then 'select' these resources to make the teaching-learning process more effective. The policy informs the development of the digital resources on the teachers and 'sharing it through digital repositories' (Ministry of Human Resource Development, 2012).[10] The extra responsibility for the teachers to find and use these resources is questioned by the teachers themselves.

Though the policy talks in detail about the capacity development of teachers by the agencies involved, it is known that the training for the in-service teachers almost becomes a routine affair for them in the wake of the extra responsibilities that they have to carry. For the pre-service teachers as well, the quality of the majority of the courses is questionable and the training for usage of ICT in such circumstances becomes questionable.

ICT for skill development

To enhance the skill development in ICT, the policy aims at developing 'job-oriented courses in ICT' for higher secondary level students by 'linking them with the need of ICT enabled industries/establishment in the neighborhood'. These courses would not only be 'limited to ICT based occupations' but 'enhance productivities in a wide range of other occupations' such as 'accounting, data handling' etc. "The courses will be modular and students will be provided a wide range of choices, catering to a variety of job options, hardware and software platforms, tools, and resources". The students would be appropriately counseled to choose their careers and courses developed accordingly. The policy statement opines that the institutes should 'integrate ICT' in the 'vocational courses' that they offer. The courses need to be following the 'National Vocation Education Qualifications Framework' and should offer the options of 'reskilling' with 'multiple entries and exit options'. Also, the system of 'on-demand evaluation and certification' will be encouraged 'to enable the students to obtain timely qualifications'. (Ministry of Human Resource Development, 2012) The vocationalization of ICT courses for preparing the students for the IT and related job market needs to be scrutinized as it goes against another goal of training the students to develop higher-order skills such as creativity etc. The same goal resonates in the policy 2020 as well. So, is the segregation of different classes of

[10] At the secondary level ICT was proposed in the school curriculum-in the computer lab and for teaching academic subjects- as per the national policy. (Ministry of Human Resource Development, 2012)

students for different kinds of job markets instilled in the policy goals itself are some of the questions that need to be pondered upon.

ICT for open and distance learning

For the 'non-formal system of education', 'dropouts', 'students who cannot continue formal education', ICT opens up 'alternate possibilities' by not just 'strengthening the existing formal system of education' but 'opening it up for the non-formal' sector too. The policy predicts the role of ICT in strengthening the existing open schooling systems by enabling 'access to e-books, digital learning resources, digital repositories' as 'student support services'. The policy states that "all Open and Distance Learning Systems will be automated and provide online, all services including admissions, examinations, e-Accreditation and grievance redressal on the lines of the National Institute of Open Schooling". This would not only lead to ICT literacy but make the agencies competent enough to network with other organizations and expand the scope of their learning. Also, the already stated directives in the previous sections such as 'online on-demand exams, multiple entries and exit points', if extended to the domain of open learning, would result in ICT being used judiciously for open and distance learning. (Ministry of Human Resource Development, 2012) The major benefit that ICT can provide is for the non-formal sector by the provision of resources in a digital form. It is important to keep in mind that education is beyond the content, it's a process of learning which is a major drawback that the students of the non-formal system face. How these problems can be addressed should be thought about in more detail.

ICT for student's with special needs

To accomplish the aim of 'inclusive education', the policy directs the schools to ensure appropriate 'access' of the 'ICT software tools and applications' such as 'screen readers, braille printers' etc. to the teachers and the students. By including the component of 'ICT enabled school education', the school agencies need to be 'sensitized to the issues of the students with special needs and the potential of ICT to address them'. It has been highlighted that all 'web-based interfaces' will 'confirm to the international guidelines for accessibility'. Also, 'due to absence of appropriate vocabulary for different subject areas in the different Indian languages and the unfamiliarity of the cultural context', the 'digital communication and resources' can become inaccessible to students and teachers', so the initiative to 'encourage dictionaries in Indian languages' need to be encouraged along with translations in various languages.

(Ministry of Human Resource Development, 2012) ICT and related resources can be extremely beneficial for students with special needs. The development of new software for learning for students with special needs has proved to be remarkably beneficial as many studies suggest.

The policy mentions steps for its implementation through various agencies in detail.[11]

ICT@School Scheme

The ICT@School scheme was revised during the 11th plan period as is mentioned in the scheme document. Earlier, the scheme was called 'Scheme of Educational Technology' under which '100% assistance was given to 6 state institutes of Educational Technology (SIET) and the States/UTs were assisted for procurement of radio cum cassette players and color TVs'. This scheme was started in 1972 during the 4th plan and later revised and modified. After this, the 'Computer Literacy and Studies in Schools (CLASS) project was introduced as a pilot project in 1984-1985 with the use of BBC micros'. This scheme was 'centrally sponsored' and was widened to 'provide financial grants to educational institutions including new government and government-aided secondary and higher secondary schools'. The 'supply' of the 'software' and its usage was meant only for 'higher secondary schools'. Then in 1998, the 'National Taskforce on Information Technology and Software Development' suggested precise points for the inclusion of 'IT in the education sector' such as 'making computers accessible through the Vidyarthi Computer Scheme, Shikshak Computer Scheme, and School Computer Schemes'. The task force recommended 'smart schools' as a pilot in select districts and '1% to 3% of the total budget to be spent on provision of computers to all educational institutions up to secondary and higher secondary level during the next five years'. (Ministry of Human Resource Development, 2005) Based on this, the points for revision of the scheme were made and the scheme was revised in January 2010, to be implemented during the 11th plan. The points taken into consideration during the revision of the scheme are:

1. "Expansion with emphasis on quality and equity"- To ensure equity, the scheme should be expanded to cover 'all government and government-aided secondary and higher secondary schools' with 'emphasis on educationally backward blocks and areas with the concentration of SC, ST, minority and weaker sections'. This should be

[11]The Programme Monitoring and Evaluation Group (PMEG) of the Department of School Education and Literacy, Ministry of Human Resource Development, will be responsible for looking at the implementation of the schools across the country.

accompanied by a regular power supply and the internet to assure the apt usage of the ICT program.

2. "Demonstration Effect"- It was stated that there should be 'smart schools' at the 'district levels' to model as 'demonstration schools for neighboring schools'.
3. "Teacher engagement and better in-service and pre-service training"- As it is the teacher who plays a major role in the implementation of ICT, the training of the teachers at both the 'in-service and pre-service level' should include training on 'effective use of ICT in teaching and learning process'. Also, an ICT teacher specifically for teaching ICT in the school should be there.
4. "Development of e-content"- There is a need to develop the e-content for the enhancement of 'comprehension levels of students in various subjects'. This content can be developed by the authorized agencies and the teachers too.
5. "Monitoring and Management"- The suggestions emphasize strong 'monitoring and management' for 'delivery of set targets'.
6. Agencies for monitoring and management- The scheme emphasizes the importance of 'School Management Committee, Parents Teacher association, local bodies' in management, and an "online web-based portal for real-time monitoring and transparency".

Components of the Scheme

The four components of the scheme are stated as under:

1. The first component is the "partnership with the state governments and union territories administrations' for providing computer-aided education to secondary and higher secondary government and government-aided schools".
2. The second component is "the establishment of smart schools, which shall be technology demonstrators".[12]

[12] "Establishment of Smart Schools" -To begin with it has extended to '31 Kendriya Vidyalayas' and '33 Jawahar Navodaya Vidyalayas' and '150 schools' would be established in the districts 'by converting the state government schools' and serve as 'role model' for neighbourhood schools. A very important pointer that the state highlights is that it is not the use of information technology' but 'the use of skills and values' too would be an important for student's in such schools. Not only minimum one school in each district would be computerized, atleast one section from class 9 to class 12 would be 'fully computerized', that is, if a school has 160 computers and has deployed 40 computers each for class 9 to 12, it would be called a 'smart school'. (Ministry of Human Resource Development, 2005)

3. The third component is the "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".
4. The fourth component is "the development of e-content, mainly through Central Institute of Education Technologies (CIET), six State Institutes of Education Technologies (SIETs), and 5 Regional Institutes of Education (RIEs), as also through outsourcing".[13]

National Policy on Education 2020

The National Policy on Education 2020 has discussed elaborately Technology in Education. No Education policy in the context of India has emphasized the importance of technology for education as the present policy. This makes one question- Why is Technology in Education very important in the present times? Why is there a belief in educational technology to address the problems of the expanse of educational access and improvement in educational quality? To understand these questions, it becomes imperative to look at the context of the emergence of the National Policy on Education 2020. The important points to be considered are:

1. There is an increase in the usage of technological devices worldwide for all purposes and therefore, in the Indian context as well.

[13] Development of infrastructure- As the existing teacher training courses do not have any component of educational media, the void can filled by "developing and deploying the Interactive Multimedia (both in the form of Learning Objects (LOs) as well as Interactive Multi Media Packages (IMMPs) at 12 Multimedia Development Laboratories to be set up with the requisite equipment and personnel". The content developed can be adapted to different situations such as 'regional languages' etc. to bring universality and prevent the wastage of the resources. B) Training of teachers in instructional design- As "each of these 12 labs is expected to produce at least 240 IIMPs (of one-hour duration) per year, there will be a need for Instructional Designers, for which selected teachers would be appropriately trained". After the training, these teachers would be required to prepare instructional designs for the development of IMMPs. C) Outsourcing of development of IIMPs (and learning objects)- The scheme emphasizes that the "learning objects could be developed for Classes IX to XII on subjects like Mathematics, Science (Physics, Chemistry and Biology), English, Hindi (and other Regional Languages) and Social Sciences through outsourcing to various organizations like University departments (of Education or Educational Technology), reputed e-learning firms or NGOs working in the area of Learning Resources development". (Ministry of Human Resource Development, 2005)

2. There is a great belief in the solutions that these technologies offer a wide range of problems in society.
3. There is an increase in the market solutions offered by corporates, NGOs, for the realm of education.
4. The focus on the Digitization of India through programs such as Digital India highlights the importance of digital devices in the present context.
5. As has been said by various economists, the world has entered the 4th Industrial revolution which bases itself on the proliferation of these technologies.
6. The countries in the world are aspiring to become knowledge economies and technology would be playing an important role in the same.

Also, there have been certain measures by the state such as the National Digital communications Policy 2018 for enhancement of the digital communications sector, National cybersecurity policy 2013 for dealing with the need of cyber threats in the present times among many others that contextualized the writing of technology in education chapter that needs to be considered. It is in the context of these changes that the technologies, especially, educational technologies are gaining importance in the Indian context. Besides the importance given to technology in general in the budget, the market for educational technology is forecasted to grow at about $1.96 billion by 2021. (Agarwal, 2017) Though this policy placed a lot of importance on technology in education, it is vital to discuss the major points to understand the intent of the policy and its action plan.

The first major highlight of the policy is on teacher preparation and development. There is a lot of importance placed on teacher preparation and training for ICT in the policy. It is stated that though the first-time learners need a physical classroom for learning, the teachers are intelligent enough to make the most of the online courses. Besides emphasizing teachers using technology in the classroom, the policy also highlights the importance of 'online, open, and distance education' in the teacher education program. The policy states that the involved agencies should be re-engineered for the online mode, they should not be only involved in plain recordings of the classroom interactions to use ICT.

The important question that arises while reading the policy is - Why is so much responsibility placed on the teacher for receiving the training, using the ICT devices, acquainting the learners with the usage of ICT, and so on? Many studies highlight that the teachers in the schools are already overburdened with academic and co-curricular work. The

introduction and usage of digital devices would then add to their workload. Secondly, the policy mentions the training mechanism for only in-service teachers. Is the adoption of ICT a cost-cutting solution offered to the education system instead of betterment of the quality of the education?

The vital point stated in the policy is the improvement of the teaching, learning, and evaluation process. The policy emphasizes the importance of promoting digital literacy by integrating computational thinking at the school level at the primary level, offering optional subjects on programming at the upper primary and secondary stages, and providing digital infrastructure and personal devices to the students. Besides this, the policy emphasizes the development of educational software in major Indian languages for assessment purposes, for learners with disabilities, and students in remote areas. The policy also aims at installing video viewing equipment along with offering advanced online courses to the students through online platforms such as SWAYAM.

While one perceives the policy for the improvement of the teaching-learning processes, one is forced to think whether the recommendation of offering programming courses for secondary level (as a means for vocational education) coincides well with the notion of integration of ICT across the school curriculum. This further brings out the question of class and ICT since the vocational courses are offered to a particular class of students in a particular school system. So, is the policy looking at ICT as a skill to be provided to the students from lower classes, for better career prospects? Also, how IT/ICT is offered as a vocational subject is discussed in the next chapters.

There has been a plethora of research on improving the teaching-learning processes through various means. Some of these problems are excessive rote learning, curriculum focused on development on lower-level skills and not higher-order thinking, use of ICT for filler during the free time, and so on. Though the policy offers ICT as a solution for improving the teaching-learning process, it doesn't address these questions and it is quite possible that ICT can be adapted to the existing pedagogical techniques such as videos can be used as fillers, PowerPoint presentations can be used for rote learning as has been discussed in the next chapters. So, the integration of ICT for improving the teaching-learning process needs to dwell in more detail.

As has been mentioned, the policy proposes the development of educational software in Indian languages. As the data in the next chapter would reveal, there are numerous private companies

already working in the development of educational software, does this pave the way for more such market initiatives or opens/accepts the introduction of ICT through market models?

The third important measure mentioned in the policy is the enhancement of educational access through digitization. To enhance access to the educational process and the content, the policy aims at making content material such as textbooks, etc. available through "open educational repositories such as National Digital Library" and keeping it up to date through "online feedback". The policy also emphasizes the development of software for student's with special needs along with the "tools for language translation of educational content into major Indian languages". (Ministry of Human Resource Development, 2020) Although the draft aims at increasing access to education through digital resources, the prevailing situation in the schools is very different. For instance, there is hardly any digital infrastructure available in government schools. In such a situation how would the access to education increase.

It also raises the question of democracy processes while introducing ICT in education. The policy aims to make educational access maximum through ICT and therefore, make education and its processes more reachable and democratic. What does the increase in educational access mean for our democracy and how can it be achieved? The fourth important dimension is the streamlining of educational planning and management. The policy states that a "National Repository of Educational Data" (NRED) will be created for the maintenance of all records of students, teachers, institutions, and so on as a part of the Digital India program. This platform will also assess the learning outcomes of individuals and institutions while adhering to national norms and maintaining the privacy of the data. The policy also aims at making an analysis of trends on "quality of school education" in India and also tracks the progress of migrant learners. The administrative data such as attendance, admissions, etc. too will be uploaded on NRED for improving efficiency and accuracy. It proposes to overcome the problem of fake degrees and certificates through National Academic Depository and blockchain technology. How would blockchain technologies solve the problem of fake degrees needs more elaboration and explanation? The policy mentions that the local communities/panchayats, small and medium corporations will make sense of the data themselves but the purposes and processes of usage need more explanation.

In the context of educational management, it is important to note that giant software companies such as Microsoft are already collecting varieties of data on education. Recent researches also say that data would be the next important thing in the world. So, what

importance does the data collected by such an agency holds and how would it be used and protected? This raises the questions of business models based upon data, the question of cyber-security, the means of data collection among many others.

The last important point that the policy mentions is about disruptive technologies. The policy places heavy emphasis on the role of disruptive technologies such as artificial intelligence, virtual reality, etc. Not only the policy aims at researching and identifying such technologies, but it also aims at skilling the targeted population for appropriate usage of such technologies. The policy aims at creating awareness about the disruptive effects of such technologies and "in the issues of privacy, laws, and standards associated with data handling and data protection". (Ministry of Human Resource Development, 2020) Before the introduction of such technologies in the realm of education, there has to be a thorough analysis of the benefits and relevance of such technologies for the education system.

Further, for the implementation of the policy objectives, the policy aims to create two vital bodies, one-The National Education Technology Forum (NETF)- an autonomous body to provide the platform for the free exchange of ideas on the use of technology to improve learning, assessment, and other processes[14], second- The National Repository of Educational Data- which will "maintain all records related to institutions, teachers, and students in a digital form". (Ministry of Human Resource Development, 2020)

Summary

This chapter discussed the historical account of the evolution of ICT in India in response to the global discourses on ICT. It began with defining the concept of ICT and related terminologies and the significance of its impact on the social system. Further, it moved on to the policy discourse in the Indian context beginning from the pre-colonial period to the policies after independence. As has been mentioned, it was in 1971 (5^{th} five-year plan) that the talks for the inclusion of technical education first began in the Indian context. The 1986 policy on education elaborated on the importance of educational technology in educational institutions. During this period, there were many efforts to promote the implementation and usage of educational technology such as the implementation of CIET among many others. This gained momentum

[14] The NETF will initially strive for public funds but also drive funds from neutral technology industry bodies such as NASSCOM. It will build 'institutional capabilities', provide 'independent evidence-based advice', 'new directions for research', 'strategic thrust areas' and so on.

in the 1990s with the proliferation of the world wide web. This gave a boost to the ICT industry and its expansion in the educational realm was further increased. The chapter further elaborated on the insights from the National Curricular framework 2005 and finally, National policy on ICT 2012 to explain the relevance and efforts towards implementation of ICT in the Indian context. It is to be noted that almost all the policies introduce ICT as a beneficial tool for educational purposes (since the same rhetoric goes for technology as beneficial for the human world), the policies signal a 'neutral' project without any insights into the social, political and economic repercussions. Comparative studies on the policies reveal the changing context of co-opting ICT in varying ways, thereby changing the language in the policy discourses. For instance, the recent National policy on education 2020 emphasizes the development of software tools in Indian languages. This needs to be seen in the context of emphasis upon Indian knowledge systems, Indian languages, etc. by the present political, social, and economic structures and systems. Although the chapter placed the policies in the wider context of India and the world, tracing the trajectory of the increasing importance of ICT in the educational policies until a National policy on ICT in 2012, it is vital to see its implementation and its actual achievements. The next chapters would highlight that although there is a recognition among the educationists regarding the importance of ICT, it occupies a rather moderate space in the educational institutions. The picture on the field offers a grim reality of the usage and implementation of ICT for academic, administrative, and other school purposes, as would be delved into the next chapters.

Chapter 4
Integrating ICT in Schools: Classroom ethnography

Introduction

The public policies on ICT broadly outline the vision and define the operational definition to chart out how they can be implemented effectively behind the introduction of technologies and the proposed measures. How these policies get translated on the ground not only facilitates in implementation of the vision but also provides feedback for the policy statements to be improved upon. The introduction of digital technologies in the schools was then explored through visits to the two schools- the Qmark School and the Beanbone School. The Qmark school was a privately-owned school and the Beanbone school was a government school in the same district in Delhi-NCR, Gurgaon, as has been mentioned earlier too. This chapter provides a detailed ethnographic account of these two schools based on the observations, interviews of the agencies involved in the school. The analysis follows a thick description of the classroom teaching of various disciplines under the sub-headings of languages, sciences, social sciences, and co-curricular activities. It covers narrative from the classrooms and outside the classrooms to provide a comprehensive picture of the changes in the academic and non-academic activities in the school system with the introduction of ICT as a tool.

As has been mentioned that it is the curriculum through which ICT intervenes in the education system. The curriculum is transacted within the frontiers of the classroom. The classroom is the microcosm central to any debate around the formal education system. The major part of the classroom transactions involves the teaching-learning using specific disciplines and extracurricular activities. As ICT becomes part of the classroom culture through smartboards, virtual reality devices etc., any discussion around the changes it ushers in the school system has to consider the classroom. This chapter, therefore, elaborates the teaching-learning of varied disciplines (including the co-curricular activities) in an ICT and a non-ICT classroom. It provides glimpses of the everyday transactions that take place in the ICT classrooms through the means of teaching specific disciplines in the school curriculum. The teaching-learning process that takes place through these disciplines furnishes the ground for larger issues that emerge with the introduction of ICT's in the school systems. The following sections then, bring out the detailed descriptions of the teaching-learning of varied disciplines from the field to narrate the actual practices with special reference to educational technologies.

It lays out everyday transactions from the classrooms of the two schools to gauge the implications of using ICT in school education.

To begin with, the chapter delineates the nuances of ICT usage in language classrooms in the schools. It recounts the tales of the interplay of ICT and the language of the diverse subjects that are being taught in the curriculum in the school contexts. The chapter begins with the teaching-learning of French, Spanish, German, English, and Hindi in the Qmark school and Sanskrit and English class in the Beanbone School. It discusses the interactions between the teachers and the students, providing glimpses into the changes like the nature of language as ICT encapsulates the curriculum of the schools. As the chapter progresses, it discusses the teaching-learning of various subjects such as science and its divisions in streams of chemistry, biology and physics, mathematics and social science, and its streams such as geography and history. Besides canvassing the language of these disciplines in an ICT classroom, the chapter foregrounds the pedagogical strategies adopted by the teachers, the children's responses to ICT, and the changing context of the classroom with ICT shaping its contours in new ways. These interactions offer novel insights into viewing the school curriculum and its application as it configures with the ICT being included in the teaching-learning of the diverse subjects. Further, the chapter calls attention to the place of Information Technology (IT) as a discipline in the school curriculum and its transaction, particularly the overt emphasis on the usage of IT, its fixed position with the core subjects, and the territory of its vast curriculum across grades in the school. Additionally, the chapter accounts for the usage of ICT for co-curricular activities such as life skills, robotics, virtual reality, art and craft and for special students in the Qmark school and Retail and other activities such as Mid Day Meal etc. in the Beanbone School. The co-curricular accentuates the hidden curriculum along with the introduction of new IT-related disciplines in the school curriculum. This illuminates the fresh approach to see the context surrounding the school curriculum, in this case, the co-curricular and its co-relation with the ICT industry and Government policies that further impact the core school curriculum as ICT takes a vital place in the schools. Moreover, how schools get organized in terms of creating a database by the usage of ICT gadgets and software are another site that can be studied in the further sections. The chapter outlines the landscape the ICT frames in the schools, its classrooms, the curriculum, and the participants involved in interacting with it. It discusses the nuances of ICT in the Qmark school at first and later progresses with the parallel themes in the context of the Beanbone school.

The Qmark School[15]

The Nuances of Smartboard

Each class in the Qmark school had a smartboard inbuilt on the wall of the classroom. This device involved a screen that could be used as a projector screen and the blackboard installed at the front wall of the classroom. Every teacher was required to enter her username and the password for the system to work, every time she thought of using it for a class. The parts such as a mouse, keyboard, etc. were separately kept in the cupboard and sometimes, it was the duty of the class monitor to manage the parts, switch on the projector, keep the parts safe in the cupboard. The videos were mostly selected by the teachers at their discretion, which may sometimes be discussed in the faculty meetings of the subject teachers. These smartboards in the classrooms were centrally managed by an in-house school team that looked after the management issues, software issues, administrative work-related issues such as attendance etc., and so on among many others. All the videos, software etc. could be installed in the system from the IT labs only, which gave access to incorporate content, edit content etc. in the software.

Teaching the languages

French (Observation I, Class VIII-A)

The school provides the option of choosing one language among the four languages such as Sanskrit, German, French, and Spanish, as a part of the school curriculum. The textbooks for Spanish are published by KP Publishers, which is an Indian Publishing house. The textbooks are accompanied by audio and video content which is developed as per the textbook content. The teacher said that before these books, the books published by European publishers were recommended by the school. The usage of ICT was seen most frequently in the third language classes in comparison to the other subjects. Because these languages are not native to the present Indian context, the important technique used by the teachers for making the students learn the language was the translation, from English to French and vice-versa. In one of the classes, the teacher played a video showing movement and asked the students when the video ended, “What was the video all about?” There were varied responses like “movement that the

[15] The Private school has been re-named as the Qmark School for the purposes of this study and to maintain the confidentiality of the school.

sick went through, movement of jack" and so on. The teacher then asked, "Was it the movement of a person or object?, Can an object move on its own?" And then she continued, "It was about the verb of movement." The teacher then gave a few examples where she wrote the sentences in English and the verb for the same in French on the whiteboard. She said, "Jack was born-*naitre*, sick entered the palace- *entrex*, at his space-*reste*, got down-*descentre*, went above the house-sorter, to return-*rontrer*" and discussed a total of 17 verbs in their course.

Though the teacher tried to converse in French with the students by giving commands for sit down, very good, correct in the French, she said that the student's couldn't reach that level at this grade where all the conversation happens in French. In another example of translation, the teacher tried to translate from French to English. She showed a video to the students on the screen followed by a discussion. She asked, "So what experience is the video talking about? What is the main statement saying?" A student answered, "We go to Paris." The teacher corrects it and says, "It is saying let's go to Paris. Come let's go to Paris which is in France." Then, the teacher asked to convert the phrase, "*Le Vive driote*" and translated it as "What is at the right?" She reminded the students that we did an activity where we learned about the prepositions and asked the students to describe the statement in French displayed on the screen in sentences. The student's described the first statement as "It has 20 states", another one said "20 cities", the third child said, "constituency, *SST me padha tha*.(Constituency, we read in SST)" The teacher corrected it as "districts" instead of other options the students had said. The teacher asked, "Is the city masculine or feminine?" The student's answered feminine and so, the teacher said, "That's why it would be *Elle*." After that, the teacher asked the meaning of "*C'est*" from the same sentence. A child answered, "It is at the center." The teacher corrected the child and said, "It is at the center of." The French teacher told the researcher that the literature and grammatical aspects are taught separately, just like any other language is being taught.

French (Observation II, Class VI-A)

The teacher shows a picture of sausages and says, "This is *Shakatry*- a place where excellent meat of pigs and different types of sausages can be bought." The next picture is of a *fromagerie*, the teacher asks, "Can you identify what is this?" The students look at the picture and can't answer. The teacher says, "This is known for exclusive varieties of cheese. Since the country has exclusive varieties of cheese, so there is an exclusive shop for the same." The teacher shows the next picture of creamery along with the products to the students and asks, "What do we get

here?" The teacher says, "*du le, du forma*." A student Rishabh translates it into English, "Milk, Cheese." The teacher adds further options, "*Papie*. You buy it from school and office." The teacher asks the students to open page 64 and see the recipe of *Librakper*. A student Jemini asks, "Is it related to the kitchen?" The teacher asks, "What is the name of the object?" Jemini says, "Kitchen." The teacher further says, "*Vale*." The student says, "Recipe of pancake." The teacher further asks, "What are vessels called in English?" Rimi says, "Utensils." The teacher asks, "How do you pronounce utensils in French?" Rimi answers, "It's *Uthensil* in French. There is an S added between U and T." The teacher further asks, "What are the utensils used for this recipe?" The students start prompting the names in English, "Frying pan, bowl, etc." and the video proceeds with the names in French. As the video tells about the names for ingredients in French, the teacher says, "Try to speak in French. What is a spoon called?" Tanu says, "It is called *Culiar*." The teacher further asks, "What is half called?" The student says, "*Demme*." The teacher asks for 'once more half' and the student says, "*Denne Crie*."

The video highlights the method of preparation. The teacher asks, "What has to be put in the recipe?" The students prompt, "Add salt, sugar and oil", "Mix it with a spoon", "Keep on stirring", "Keep for one hour" and so on. The students convert French sentences spoken in the video in English. A student Nimit converts a sentence spoken in French in English as, "Put the butter." The teacher corrects him as, "Heat the batter with the butter." The teacher further asks the meaning of words such as '*coficure*', '*miet*', and so on. Romil prompts, "Chocolate." The teacher asks, "No, What is it?" The other students prompt, "Pomegranate", "Cherry", "Jam." The teacher replies, "Yes, Jam." The teacher translates the whole sentence, "The pancake has to be eaten with jam, honey, and butter."

The teacher asks the students to turn to page 68 and do the listening activity. She asks them, "It would be a little tricky because you are doing the sentences for the first time, so I would replay it." The teacher asks the questions from the students, "*Kilia de Persa*?" Anish replies, "Who are the people?" The teacher further asks, "What are they talking about?" Saman replies, "They are talking about exams." She asks, "Who has passed and failed?" Saman raises his hand and the teacher says, "Will Saman give all the answers?" Saman answers, "Pick has passed and Ritu has failed." The teacher asks, "Who has not come to school?" Taniya says, "*Pierre*." The teacher says, "Can you see the options given on the board. Pick and write against the questions given." She guides the students in completing the blanks. She asks, "How has Trevia done? Good or bad?" Dewan says, "Good." The teacher, then, points at Q11 which

highlights the conversation between Samuel and Aradhana. As written in the blanks, she asks, "What is *bourg*?" The student says, "Bakery." The teacher asks, "Which is the meat shop? Should I write animal meat?" Biyanka says, "*Du Bof*." The teacher asks, "What about Cow mutton? *Du Kole*. I just told you about *Cremery*." Biyanka replies, "*Du Le*." The teacher adds, "*Du Fromagerie*- from a cheese shop, you can get cream too." She starts recapitulation and asks, "What do we get from *bulongry*? What is a cake called?" Raj says, "*Du Pam*." The teacher says, "I am still not finding student's participation. What do we get at *Episery*- a grocer's shop?" Manas replies, "Tea, spices, sauces." The teacher translates them into French, "*Du the, Du Cafe, Du Elise*." Upasana says, "*Mashe*, supermarket contains bread." The teacher replies, "It contains or it has, *La Mashe* for fruits and vegetables." The students laugh at the onion and the teacher tells them to not laugh at the same.

The teacher moves to the next question to match the following. She asks, "May I have one return ticket?- This sentence would be spoken at?" The students prompt, "Railway station." After that, the teacher asks the students, "How many of you do not have the textbooks?" Manish responds, "Forgot." The teacher says, "Do you forget to sleep, food, how can you forget your book?" Another student Ramika replies, "*Dola out bus*." The teacher translates the sentence, "In the bus." She further asks, "I had given q12 for homework, how many of you have tried that? Let me do that in the class. Arrange the sentence." A student Rihana translates the sentence, "Can you order cream in a restaurant?" The teacher says, "She has ordered a hot chocolate with some cream. Just check where is the negative expression." As the students are not able to answer it, the teacher says, "My Goodness. *Kelan* -a negative expression comes after past participle. How much time is left? Can we read the chapter, the rest of the grammar is not important?"

The teacher starts reading the sentences with the video. She stops in between and asks for the meaning of the sentences. A student says after she speaks a sentence in French, "France is known for wine and cheese. More than 300 types of cheese are found in France. The three main brands of wine are commonly used by people." A student Tanmay asks the teacher, "Ma'am, do these people take three meals a day like us?" The teacher says, "Yes." The teacher asks the class teacher to change the batteries. The students give the option of getting a mouse from the other class. The bell rings, the teacher asks the students to complete page 61 till the next class.

French (Observation III, Class VIII-B)

The teacher asks the students to open page number 57 along with the video she plays on the projector. She plays the video showing a couple talking in French, pauses it, and asks the students, "Translate the statement this woman said in English." A student Vishal says, "We go to Paris." The teacher corrects him and says, "Come, Let's go to Paris which is in France." She further says, "Didn't we learn that in chapter 9 that tenses are translated in the imperative sense." She plays the video further and pauses it to as the students the meaning of the statement, "*Le Vive Drote*." The students are not able to answer it and she answers, "What is at the right? Remember we did an activity where we learned prepositions, so *drote* means at the right." The video continues with the pictures along with the statements. The teacher again pauses the video and asks the students, "What is 20 referred to in the video?" Some students give random answers, "20 states", "20 cities", "20 constituencies" etc. The teacher corrects them and says, "It's 20 districts. And the city is feminine." The teacher asks the meaning of *C'est* from the sentence. A student Garv replies, "It is at the center." Another student says, "It is at the center of." The teacher further asks, "When you visit in taxi or bus, it is very *commode*, meaning?" Some students prompt the answers, "Convenient." The teacher corrects them and says, "Comfortable." She asks, "What does *Fer* mean?" Nisha says, "Iron." She further enquires, "Who is *Napoleo*?" The student Aarav says, "The emperor." She further asks, "What is the known fate in the history of France?" A student Bishman replies, "French Revolution which had an important role to play there." She tells the students to define Mona Lisa. A student Fahaan replies, "It is a painting by Leonardo kept in the museum of art." The teacher clarifies, "Does the statement say kept in the museum of art?" She reiterates, "It is kept in the museum of art which is modern art. You need to remember these names for cultural history." She shows the picture on the screen and asks, "Why are different ministries required?" A student Tanmay answers, "For different political issues, state, city, country issues." She continues, "Okay, tell me the number of countries in the EU?" Rihaan replies, "27." The teacher points at the word on the whiteboard and asks the students to pronounce it. A student Jordan says, "Magazine." The teacher corrects him and says, "It's *Magasins* meaning malls, not magazine because the meaning of the word changes."

The teacher asks them to do question 2 on page 57 to fill in the prepositions on the textual exercise. She writes the two prepositions on the whiteboard *Au/En*. The students get very engrossed in the activity and work in pairs on the same. She asks them to consider the

gender of the words into consideration. After the students have finished the activity in the book, she writes the preposition for masculine countries as *En,* feminine countries as *Au,* and cities as a. She asks the students, "Which topic are we discussing here?" Some students prompt different answers, "Preposition", "Things used to describe countries" etc. The teacher specifies, "Here we are going to learn about the adverbs or prepositions of places. She writes the first category on the board, "Expressing going to a place." She asks the students to go to page 67 and divide the countries based on whether they are masculine or feminine. A student Rahul asks, "Ma'am Afganistan is masculine or feminine?" The teacher pronounces it and says, "It's masculine and beginning with a vowel too." When the students pronounce Pakistan, they start laughing. The teacher asks them to be silent and helps them frame the sentence for the same. She says, "*Arjan est en Pakistan*. For a masculine country, the structure of the sentence is - going to/at a place/masculine singular." A student Diwan does a mistake while framing the sentence and the teacher tells him, "You have been through too much downloading for the day, that's why you are not getting it." The bell rings and she tells the students to complete the exercise and she would complete the rest in the next class.

Spanish (Observation I, Class VI-B)

The teacher tells the researcher that as a part of third language teaching, the school offers four subjects which are –Sanskrit, French, German, and Spanish. The teacher begins the class by referring to the picture in the book and asks for the experience of the students in English. After that, she plays the audio in Spanish and then, again refers to the pictures in the book for its interpretation. She asks, "Can you fill in the missing points of information?" A student responds, "Ma'am, Can I draw the path?" (the audio talks about the path to a place in Spain) The teacher writes the date on the whiteboard in Spanish. The teacher, then, takes up the words/phrases for direction in Spanish and asks for their translation in English. She says, "*El Kamino*", does actions for the students to guess the meaning by making waves through hands. A student says, "way to the water." She responds, "Good." She, then, moves to other phrases, "*Entrence*" and a student responds, "Entrance." She tells a student to sit down in Spanish, "*Vivian Espera*." She, then, asks the students if they didn't understand any word/vocabulary and the students respond, "No".

She continues with her class and says, You remember we did this verb-*K Significa Crusar*" (halts for the students to guess the answer) and says, "to cross." The teacher asks the learners to work in pairs on the task given in the book of discovering the direction for the

elephant. The teacher goes to every desk of the students to help them. The teacher gives the next exercise to the learners to find the missing words based on the audio. She asks them to check the phrases with the pictures to be able to guess the missing words. The teacher asks, "So, Giraffe is sitting next to which animal?" A student says, "Tiger." She asks again, "Tiger? Count properly." Another student says, "Ma'am, it's Elephant." She responds, "Yes" and asks the learners to move on to the next questions. The teacher tells the researcher (while taking a round of the class) that earlier they used to use books from Spanish countries itself but now they have been following books by ECE and Analsa publishers, Goyal Publishers which have got the rights to publish Spanish books now. She gives them the homework to complete preposition, picture matching questions, and the animal vocabulary practice until the next class.

German (Observation I, Class VII-A)

The teacher says that she would show a video about a situation in Germany and asks the students about the content of the chapters. The students prompt different answers about the contents of the video, "Explains the room in the house", "Tells about the street in Germany." The teacher says, "The video tells about the different kinds of rooms and small sentences on the same. You remember we had done nouns and adjectives for rooms that day. We had also done jumbled sentences that had to be translated in German." The teacher tries to play the video but due to a technical issue, the video can't be played. She calls the Spanish teacher from the other class to help her out with the video but the video doesn't work. She tells the researcher that the lesson can't be played through the ICT medium and so, she would continue using the book to utilize her class.

The teacher asks the students to translate, "*Balcom*" and writes on the whiteboard, "I have a balcony." She revises the grammar concept with the students and says, "Remember we did this, adjectives and cases have an ending. We did change adjectives to cases too, connectors, articles, email writing too." She continues, "When you are describing your house, proper nouns, adjectives, or verbs are used." She asks the students to open their books and see what the picture in the chapter is talking about. The teacher reads the sentence in German, "*Shroffrimmer not bedzimmer*" and explains its meaning as "to sleep." She asks a student named Vanik to read the written text in German and the other students are engrossed in comprehending it because it requires effort. The student reads, "*I am familian house*." The teacher asks the learners to comprehend it and a student Vimon prompts, "Where a family is staying." She explains that in joint families, the grandmother, grandfather, etc used to live

together and the picture is referring to such a family. The student continues reading, she makes him stop at Heidelberg and asks the class, “What does this mean? It has nothing related to the German language.” Some students make random guesses such as, “Mountains”, “river” and so on. The teacher provides some hints such as, “This place is famous for homeopathic medicines. It has mountains.” And she finally explains, “This place is located in Germany and is very famous for many things such as medicines, mountains, etc. Like Homeopathy comes from Germany, Ayurveda comes from India.” She asks the students to read about it on google. The student again resumes reading and the teacher stops him in another word, “*Globuli*.” She explains its meaning as white balls dipped in sugar syrup. The bell rings and the teacher tells the students that this would be continued in the next class.

English (Observation I, Class VII-A)

The teacher starts the video of Malala and her journey, sponsored by the New York Times. The students silently watch the movie, some of them can’t relate to it, so open their newspapers. The documentary is about how Malala re-visits her country and home and searches for her school material. The area is still under the threat of terrorists and her family takes a lot of precautions while going there. She shares the experience of her family members and the role of her father in taking them away from such circumstances.

The teacher stands on one side as the movie proceeds and stops in between, ask the students, “Have all the students seen the other movie on similes and metaphors?” The students get excited about it and ask the teacher to play it again. The teacher plays the video on similes and metaphors and asks the students, “What is the difference between a simile and a metaphor?” A student Rahul raises his hand and says, “In a simile, like/as is used, while in a metaphor, whatever one wants to say is directly said.” The teacher goes out to finish some of her work and comes back before this video ends. The students remember the song in the video and sing along, “Simile and Metaphor, they both look very similar...”

After this, the teacher plays the third video on Prepositions. The students sing this video along too and are very enthusiastic even though the video is being repeated. Then, the teacher plays the fourth video on alliterations. She asks the students, “Do you remember what does alliteration means?” A student gets up and says, “Tongue twister.” The teacher replies, “No, they don’t come in alliteration.” The teacher says, “Have you heard about words like Dunkin Donuts, Pay Pal, etc.?” She continues, “These are called alliterations. Look for them on other

sources like youtube, google, etc." A girl, Aishna asks the teacher, "Ma'am can we see the necklace movie?" The teacher tells Aishna, "You always want to see that Cinderella movie." The teacher plays the movie and then another boy, Rijutu shouts, "Ma'am, can u play the Malala movie?" The teacher stops that, resumes the Malala movie, and tells the students, "You have to read the subtitles because the language is different, you won't be able to understand it fully." The teacher goes out of the class, so now the students are not viewing it seriously. Some students start playing, imitating the language of the movie but some others on the front seat are still seriously watching it. The teacher played so many movies one after the other for the researcher too as she knew that the researcher wanted to see the role of ICT in the classroom.

English (Observation II, Class VI-A)

The teacher starts with the grammar topic- conjunctive adverb. She gives two examples to explain, "1) The company President will be in the building, so act accordingly. 2) Not only on those days but when guests are here, behave." She asks the students to take out their notebooks, write the date, and start writing the exercise questions. She writes, "Fill in the blanks" on the board and continues, "1. I ran to the door, _____ she had already left. 2. Do you work ____ you can." Daman answers the first blank as "But." Sarika answers for the second blank as "as." The teacher corrects Sarika and says, "It can be if, when." The teacher asks the answer for the next sentence, "We owe you _____ we don't have time." Tanmay replies, "but." She writes the next sentence, "Ram _____ Ali have volunteered to prepare the soft boards." Anamika says, "Ma'am, it should be Sita." Latik replies, "And" The teacher asks, "Have they taken any responsibility?" Bhavya replies, "Prepare boards." The teacher says, "Something which you find very difficult."

She writes the next sentence, "He is ____ a lion and _____ a cheat." Some students prompt, "both, and", "neither, nor", "either, or." The teacher says, "All can be correct." A student Vivaan says, "Ma'am, It should be a cheater." The teacher replies, "It can be a cheat too." She writes another sentence, "Would you like a cup of tea ___ Coffee?" Akshay asks, "Ma'am, can I write juice or coffee?" The teacher replies, "It's up to you to write anything." The teacher writes the next sentence, "___ Jack ____Jonty will be the new captain." A student Rihaan says, "Ma'am, I will write Santa Banta." Another student Govind replies, Ma'am it can be neither, nor." The teacher laughs and says, "Because you want to be the captain." The teacher writes the next sentence, "The Path is short _____ steep." A student Dorima asks, "Ma'am, what is steep?" The teacher asks her to use the dictionary. Some students prompt the

answers, “Or”, “and”, “but” and so on. The teacher says, “It has to be ‘and’ because the meaning of steep goes along with short.” The teacher writes the next sentence, “Ring me ____ you arrive.” Naithan says, “When” The teacher asks them to write their answers. Mandeep says, “Asap” The teacher asks him, “Don’t use short forms.”

The teacher writes the next sentence, “He is older _____ I thought.” Naithan replies, “then” The teacher asks him for the spellings and he says, “Than.” The teacher continues with the next sentence, “_____ it is hard work, I enjoyed the job.” Some students prompt, “since”, “Therefore” and so on. The teacher says, “You are changing the meaning by adding your own words.” The teacher tells the class, “It should be –Although. We did this example just now, see when to sue which word.” The teacher gives one exercise for homework and tells the students, “We will do one more exercise tomorrow. Read the table on pages 133, 134.” A student says, “Ma’am why homework? We have a homework period now.” The teacher says, “I will not spoonfeed you this exercise. Whether you do it in the homework period or otherwise, just do it and clarify your doubts with me.”

English (Observation III, Class VI-B)

The teacher starts by asking, “What have we done till now? Prepositions?” She points at Yash and says, “We are here to talk, and we can do that only when you stop talking and begin the class.” The students start prompting, “Prepositions”, “Pronunciations” etc. The teacher says, “I don’t want to know all the topics but the last topic that we did.” A student Reham says, “Ma’am, we did prepositions of place, time, and direction.” The teacher quotes an example, “The charts are displayed on the board. In this sentence, some relation is shown by the word on. It shows the relation between the chart and the board.” The teacher writes the three types of prepositions on the board- time, place, and direction. She says, “The examples of on, it, at in the prepositions of time can be- On Monday, In a year, At that place, etc.” She asks for more examples from the students and they say, “I was absent on Monday”, “Diwali comes once in a year”, “I went shopping at that place” etc. The teacher says, “These prepositions can be used for a place too. Like we say Throw it in the dustbin, the desk is at the corner, etc.”

The teacher asks the students to not look at the notebook and frame their examples. A student Raman frames the sentences for preposition of direction and says, “That temple is located in southwest India.” The teacher asks the students to write down these examples in their notebooks. She further says, “Write the examples for on and at too.” She takes a round of the

class and tells Abhinav, “Write the date first on the page, you are too casual in your approach.” A student Abhinav asks, “Ma’am, Can I write- The highest post office is in Sikkim.” The teacher says, “Sikkim is in Himachal Pradesh, remember that part.” Another student Mitali asks, “Ma’am, can I write- My mother is in the kitchen.” The teacher says, “Yes, but also add- near the refrigeration-doing what?” Himani sitting next to Mitali laughs and says, “Eating from the refrigerator.” The teacher says, “I mean be specific about the place like she was standing at the bus stop. When we are specific- we use at like Take a left turn at the traffic light. In the sentence, they live on the first floor- because the building can have many flats. In another sentence, does the train stop at Jalandhar- At is used because the train is going from station to station and not going inside.”

The teacher asks Ipshita, “Why do you forget grammar notebooks when work has been done since last week?” She asks, “Is anyone left with the notebook.” All the students prompt, “Manu.” The teacher says, “Manu will stay for the extra class.” The teacher continues with the other examples from the book and asks the students to note down these too in their notebooks. She says, “Make more sentences at home. For now, write down these examples in the notebook.” Tanmay asks, “Ma’am we have to write more examples?” The teacher responds, “You are doing it or not? Write on the next page- fill in the blanks with suitable prepositions.” Suvika asks, “How much time is left?” The teacher says, “What do you have to do? I am here till 2.30.” The teacher says, “The point is that it would be homework time. Would you teach us then?” The teacher says, “You do the work now. We will change the seating arrangement tomorrow.”

The teacher starts writing the sentences on the board, the students prompt the answers and the teacher explains the answer. She writes, “I will see you ____ 9.30 ____ Sunday.” The students say, “At, on” Suvika explains, “At because it is a specific time, on because it is on Sunday.” She narrates the next sentence, “Mr. Bhaskar lives ____ 7 rose garden road. The students say, “on, at/near” The teacher says, “All are correct.” She says the next sentence, “It has been raining heavily here ____ morning.” The students prompt the answer, “For, since.” The teacher says, “Did I say since 11.30? So, it has to be for. In the usage of ‘since’, we can count the time.” A student Rajita asks, “But the properties of since, for both suit a sentence, so it would be an exception.” The teacher asks the next question, “I congratulated him ____ getting a job.” The students reply, “after, before, on” The teacher says, “Think clearly, We are using prepositions. The answer would be on.” The teacher asks the next sentence, “Can u

translate _____ Spanish? How many of you can do it?" The students tell the answer, "From. We can use google, it depends on the passage for translation." The teacher asks, "Can you translate from Sanskrit?" The bell rings, the teacher tells the class to keep talking now as she would discuss the concepts tomorrow. She writes the homework on the board to complete the exercise, some students translate in Sanskrit and others start making fun of them and the class ends.

English (Observation IV, Class VII-C)

The teacher asks the students to keep the newspaper in their bags. She says, "I am 3 minutes late, still SST books are out. Still, my book is not on the table." She asks the students, "We did prepositions last time. Tell me who all have not done the holiday homework. Stand up. See, it's the same people always. You had an autumn break for five days and you didn't work. Was it too much? You just had to take the printout and paste it into your notebook. Give me a good reason for that." The students start speaking the answers one by one, "I was not well", "I was out of the station, just came yesterday morning", "I was not aware", "I went to dadi's house, so no work, only cooking and washing", "I have done one worksheet and others still have to be done", "I am left with only worksheet 6 which is on co-relative, I couldn't understand" and so on. The teacher says, "It is so simple. Write the names of these students.

Switch on the system now. Is the shared data working now? I wanted to show you a video." Before the video begins, the teacher says, "Remember, what we wrote in the definition of the conjunctions- Join words, sentences, etc. What was the mnemonic for coordinating conjunctions- famboys. I want you to be thorough with the definition of famboys." The teacher refers to the example in the video and asks, "Appu and I went for a walk. So, where is the coordinating conjunction?" Bhairavi speaks, "And" The teacher says, "Good job. Now write this in your notebook. The conjunctions join phrases to phrases and clauses to clauses." The students are very interested in watching the video. She further explains, "Co-relatives join the phrases and clauses in pairs. We did these, give me two examples." A student Manvi replies, "Either or, Neither nor." The teacher asks Neil, "You don't know any example, only Manvi knows." Neil replies, "Not only, but also." So, the teacher asks, "Now you all understand this?" The students say, "Yes ma'am." The video proceeds further after the explanation of co-relative to subordinating conjunctions. The teacher adds, "These are also called subordinates. The rule famboys is for coordinating conjunctions. These subordinates will fall under that."

The source of the video is by Appu series. After the video ends, the teacher says, “We have already done the preposition video and then did it in the notebook too. Now, open the grammar book. Go to page 130, I had asked you to go through this during vacations. We have done prepositions from the book too.” The teacher plays the preposition video for recapitulation. The students sing the song in the video along with the video and check the song in the book too alongside. The source of the video is by cbazillion.com. The teacher asks, “Prepositions tell what?” A student Yamini replies, “Meaning.” The video ends and the teacher asks, “You have to see the other videos too?” The students say, “Yes” and the teacher finally says, “It is more like PPT, I don’t want to play this, so let’s stop.”

The teacher tells the students to give headings to those who haven’t done the work. She tells them, “Leave two-three pages and continue with today’s work. Write the topic in the index and continue with the same work. Those who haven’t got the grammar notebook, stand up.” Neil stands up. The teacher says, “What happened Neil? You didn’t check the time table. I will write it in your diary.” She writes on the board, “The food was served at the table, She was sitting on the couch.” As the students write this in their notebook, she tells the students, “Now write the example of day and date in your notebook. We will celebrate on Monday. My birthday is on the 15th of December. (writes on the board)” The teacher gives other examples, “You can also write on Friday morning, on Saturday night, etc.” As the students have written the examples, the teacher says, “Now, let us move to the third example- In. With season-in winter, year- in 2018, month- in October, part of the day- in the morning. We shifted to this house in March 2018.” A student Rabi says, “May I go to the washroom?” The teacher says, “Do you go and say hi and come back. Say, May I use the restroom?” After the students have written the examples, the teacher says, “Now, let’s move to the example of within. When we say, I will be back in 2 hours, we can extend the time. But when we say within two hours, we mean in less than two hours.”

When the students have written this, the teacher tells the students to take out their books and fill in the blanks. She corrects a student, “Write single L for until not double L.” As she takes a round of the class, she says, “When I said comma, why did you write it in a tabular form? Change it.” She tells another student, “Don’t talk when I am speaking. Don’t repeat my last words.” A student Ishan says, “Ma’am, these examples are not there in the book.” The teacher replies, “That is why I have given you an additional list. Rather than prepositions, I have given you types to elaborate function.” She asks the students to go to prepositions of place

in the book and fill in the blanks. She asks, "He stood _____ the end of the queue." The students shout, "At." She further asks, "Where did you paste the posters?" Some students reply, "On the wall." She explains, "We say books are on the table. When the preposition tells about the time, it is the preposition of time. When it tells about the place, it is the preposition of place." A student does untidy work, the teacher asks him, "Should I fold the page? Your marks for notebook assessment depend on this." The teacher says, "Quickly finish it, I am counting 5,4,3,2,1, and time over." The teacher moves to the example of In, over/under, and says, "There is little milk in the bottle. It was just over my head." She further says, "Look at other prepositions of place. Finish writing so that you can do a lot of practice. I will explain to you 'Through' when I give you the first worksheet." A student Kawal looks at the book and says, "Preposition of direction." The teacher corrects him and says, "Preposition showing direction. We will write only the bullet points for this." She writes on the board, "To-Went to the mall, Towards- Threw the ball towards me, Into-Jumped into the river, out of –out of the bag, up-look up. Now you frame sentences for these and write them down in the notebook." The bell rings, the teacher says, "I will not leave till the time you don't complete this work." After she dictates all the examples, she asks the students to give their literature books to her and finish the given work.

Hindi (Observation I, Class VI-A)

The teacher has already covered the poem on Rani of Jhansi but she plays the video of the poem for recapitulation. The video starts with a loud voice suggesting the roar of the arrival of the Rani of Jhansi. Then, the teacher tells the students to open their books and listen to the poem in the video simultaneously. The video shows running horses and the recital of the poem in the background. As the students get engrossed in the video, the teacher pauses the video and asks, "*Is shabd ko kaise pronounce kia jaata hai*? (How do we pronounce this word?) (pointing to the word in the video)" A student Tarang gets up and says, "Barchi." The teacher resumes the video and emphasizes the difficult Hindi words in the poem. She again pauses the video and asks the students, "*Jhansi ki Rani ko kyun yaad kia jaata hai*? (Why do we remember Rani of Jhansi?)" She asks Vaibhav to get up and answer, "*Kyunki vo bahot bahadur thi*. (Because she was very brave)" The poem proceeds with the sequence of events that happened in Rani's life. The students move near the whiteboard as they get very excited about the expressions in the video and its powerful impact. The teacher asks the students, "*Jhansi ki Rani kaise kaise ladi? Unki jang ko hum khaas kyun maante hain?(*How did Rani of Jhansi Fight? Why do we

see her battle as a special one?)*"* The students get a little confused about the question and answer randomly, "*Vo maidan me jaa kar ladi thi*", "*Vo mardaani thi*" ("She fought on the battlefield", "She was a brave lady") etc. The teacher again asks, "*Vo itni shakti se kaise lad paayi*? (How could she fight with such valor?). " The students, then, answer, "*Ma'am vo veer thi*", "*Unka pati mar gya tha, fir bhi vo ladti rahi*." ("She was gallant", "Her husband had died", "Still she kept fighting")

As the video proceeds, some students tally the words of the video with the book, some sing the poem along as they have already done it. The events of the poem proceed from rani as nana's favorite child to her fighting on the horse to her getting married, going for the war, and finally dying on the war field. The pictures in the video were easy enough to be drawn by the students. The teacher says, "*Ye shabd jaise aag, Junoon, etc. Yaad rakhna, ye paper me likhne se acche number milenge.*" (Remember these words like fire, passion etc., you will get good marks if you write them in examinations.") A student asks, "*Ma'am, is poem ka lekhak bhi hume yaad rakhna hai na?"(*Ma'am, do we need to remember the writer of this poem?") The teacher replies, "*Kavita ka lekhak nahi, kavi hota hai*." ("A poem has a poet, not a writer")The teacher asks, "*Ye poem kab likhi gyi thi?"*(When was this poem written?") A student Garv replies, "*Ma'am, 1976 me likhi thi.*" ("Ma'am, it was written in 1976.")

When the poem ends, the teacher asks the whole class, "What did you understand by this poem? Or you only enjoyed the music?" The students speak words/phrases, "*Ma'am, Junoon dekha", "Drid Ichha Shakti rakho", "Aalsi banoge to kuch nahi hoga", "nidar aur saahsi bano"* and so on. ("Ma'am, we saw passion", "Keep the power of desire strong", "If you become lazy, nothing would happen", "Become fearless and powerful". The teacher further asks, "*Hum aisa kyun bolte hain ki vo veergati ko prapt hui or mari nahi?"* ("Why do we say that she was a martyr and did not simply die?") Some students say, "*Ma'am, vo angrezon ke kabze me thi aur ghayal hokar mari", "vo ghode se gir kar uthi thi*", "*ladaai ke samay uske saath bachha bhi tha"* and so on. *(*"Ma'am, she was captured by the English and died after she was wounded", "She got up after she fell from the horse", "She was carrying her child while fighting") The teacher asks the students to watch the movie of Jhansi ki rani for more clarification. The teacher tells the researcher that though this is something that students enjoy watching she can't carry on the class with ICT daily as it consumes a lot of time.

Science

Chemistry (Observation I, Class VIII-A)

The teacher reads the formulas written on the board, “C+O=CO, C+O2=CO2” and explains that, “If oxygen is in limited supply, decomposition happens to form a substance called coke. She refers to the PowerPoint presentation she had shown to the students to write the question-answers. She asks the students, “Remember we had seen the video showing other products that are made of carbon in the absence of oxygen, tell me a few of them.” She repeats the products and writes the names on the board, “Coke, Coal Tar, and gas, Ammonical Liquor.” She further says, “Coke has the same formula as major coal, Coal Tar is a mixture of organic compounds used in surfacing of roads, now bitumen obtained from petroleum is used for the same, Ammonical Liquor is ammonia gas dissolved in water, has a pungent smell and is used in the preparation of fertilizers.” She writes the formula for ammonium sulfate on the board as Am + H2SO4 and tells the students that this is what is used as a fertilizer.

She plays the video of the formation of coal again in the class so that the students can recollect their concepts. She stops the video in between to reiterate the process highlighted in the video. She says, “When coal is heated with oxygen, it becomes volatile to gaseous form, it is then made to pass through another delivery tube, then soluble compounds dissolve with the water, the leftover gas is passed through another tube which is called coal gas, the left out residue is called coke.” She continues, “The heat is passed through the burner as it is called in the laboratory terms and the process of condensation of liquid is called distillation.” A student asks, “Ma’am is it the same coke that we drink?” and she laughs, “No.” She reiterates the formulas for coal gas, coke, and their uses through the video. The students were very attentively listening to the video. The teacher again asks the students, “So, what are the products formed after heating coal?” A student Ravikansh says, “Coke”, another named Ishu says, “Monoxide gas” and the teacher corrects it with “Coal Gas.” The students couldn’t retain too many formulas at once and were getting confused in re-collecting the chemical reactions. She said, “Coke is a pure form of carbon, and metals, yarns, dyes, etc are made of it.” A student Rishabh asks, “Ma’am if we further burn the coke, what would happen?” The teacher says, “Then the gases would be formed, in excess oxygen CO2, and in absence of oxygen CO.” She asks the students to copy the questions from the PowerPoint presentation displayed on the board. A student Ishan asks, “Ma’am, do we write on the rule side of the notebook?” and she replies, “Yes.”

The video introduces new names to the students such as ‘reducing agent’, ‘naphthalene balls’ etc. which some students are not able to grasp. A student named Ishan asks, “What is the reducing agent?” The teacher responds, “It is an agent that removes oxygen from the compound. When we extract metals from mineral ores such as zinc ore, the ores are converted into oxides of metals which are then reduced to get the final product such as Zinc with the residues such as CO.” She explains the other unknown word in the video-the the naphthalene balls-“The naphthalene balls are the white balls kept in woolens to prevent from silverfish.”

Chemistry (Observation II, Class VIII-B)

The teacher starts by explaining the importance of oxygen in our bodies. She says, “Haemoglobin is the carrier of oxygen in our body. It helps in the oxidation of food. Carbon-di-oxide doesn’t let that happen and therefore, people die.” She relates this with the importance of oxygen for the burning of coal and continues, “When coal is burnt, we keep our doors and windows open because oxygen is important for the extraction of different materials. The coal breaks into simple substances such as coke (solid residue) and volatile gas (passes through water) to form coal tar which is a liquid.”

She uses the whiteboard to write the formula for carbon-di-oxide along with the video for the burning of coal being played on the other side. She first explains the process of formation and burning of coal and then, plays the video for the same. A student Nihani asks, “Ma’am, What is distillation? (from the video)” The teacher replies, “When we heat the substance, it turns into the gaseous form which is called distillation.” As the video pauses, she asks the students to draw the table for the residue products one gets during the formation of coal. A student Jagriti asks, “Ma’am, should we draw on the blank side or ruled side?” The teacher says, “it’s up to you but just do neat work.” She looks at the notebook of a student and tells him, “You copy other stuff later, just finish this work now.” It is the same video that she showed in the other class and so, the students have certain doubts related to the concepts and the words in the video. A student Ishaan asks, “What is a reducing agent?” The teacher answers, “We find mineral ores in the natural form. We convert them into oxides by heating and when we treat, for instance, coal residue with the coke, the oxygen is removed. The substance which removes oxygen from the substance is called reducing agent.” A student Daksh tells the teacher, “Ma’am, I don’t want to watch the video.” The teacher tells Daksh to leave the class in that case. In the video, it is being said that this process happens when the vacuum is being created. A student Harsh asks the teacher, “How would they create this vacuum?” Shikha

answers, “By removing oxygen.” The teacher further adds, “When the metal is burnt, oxygen component is used and the rest is removed through various processes.” The bell rings, the teacher writes the logbook and leaves the class.

Chemistry (Observation III, Class VI-A)

The teacher asks the students to take out their notebooks and starts dictating the question-answers to the students. She asks the students, “Is the formation of clay a reversible reaction or irreversible change?” A student Rubina responds, “When chemical bonds are happening, it is an irreversible change.” The teacher reiterates that she explained the same the day before. She dictates the answer for the same from the book in her language. She dictates the next question, “When Idli has been steamed, is the reaction reversible or irreversible? How do we judge if the reaction is reversible or irreversible?” Some student’s prompt, “The smell changes”, some other prompt, “The taste changes.” The teacher fills in the gap, “the smell, the taste, and the state of matter changes, that is how we say it is a chemical change.”

The teacher asks the students to write the answers on their own and she would check them. A student, Naman writes in his notebook that “because some chemical bonding happens, it is a chemical change.” The teacher scolds him and says, “Are we writing fiction? You have to state the exact reasons for the same.” She asks the next question and writes the answer for the same in their notebooks, “Are mixing of cement and water irreversible?” She continues, “Is the mixture semi-solid or liquid? Because of the chemical bonding, the water and cement can’t be separated.” She asks the learners to try and write this in the pointer form and takes a round of the class to check the spelling of the learners. She asks the next question, “Why is the settling of the curd irreversible? It is because of the same reactions. Does the color of the curd change?” Some students say, “It turns to yellow”, some others say, “It remains the same.” The teacher says, “It is because the color of the curd turns yellow, otherwise it remains the same.”

Chemistry (Observation IV, Class VIII-B)

For chemistry homework and assessment, the students were asked to prepare Powerpoint presentations during the summer break period and e-mail them to the teacher. The teacher, then, could finalize any date for presentations by the students. In class 8^{th}, the chemistry teacher asked the students to finish presenting their presentations. A student, Aashika, started her presentation on constellations, the slides for which were divided into what are constellations, who devised the term for the same, which ones are called modern constellations and the types

of constellations. She was reading the exact lines and phrases on the slides of the presentation she had prepared. The students' audience, were then asked to ask questions from Aashika. One student asked her, “How many constellations are there?” and she answered, “88.” The other students were trying to confuse her and ask difficult questions. Another student asked her, “Name the famous constellations” and she answered, “Orion, Aquilles, Ursa Major.” The teacher intervened and asked her, “Name the famous constellations which we have studied in the class.” She waited for a moment and recalled, “Orion, Ursa Major, Cassiopeia.”

Then, another child started the presentation on astronauts. He started reading from the slides but he was forming his sentences after reading the first sentence from the slides. He spoke about what do astronauts do, famous astronauts, their accomplishments, and so on. The questions asked by the students were, “Who was the first Indian citizen to go to space?” and he answered, “Rakesh Sharma.” Another student asked about another name for astronaut and he said, “Cosmonaut.” Some students were also trying to ask difficult questions such as “Which aircraft did the first Indian citizen board?” and the student presenting couldn’t answer the same. The teacher also said that only two questions were allowed and he could look up the rest of the answers later.

The third student started presenting on Cassiopia and was reading the content from the slides. Later, a student asked her, “By whom was the first constellation cataloged?” and she answered, “Greek (Patolini).” Another student asked her, “Tell the other name for Lion?” and she couldn’t recall the same. The next student asked her about the formation of Cassiopia, a question related to her slide and she said, “She was the wife of Cyprus who died, and therefore, the slide was named after her.” The teacher said it was incorrect and asked, “Did her mother place the constellation in the northern hemisphere?” and she couldn’t answer. The last question asked was, “In which century was Telenor satellite discovered?” and she said, “2nd century.” The kind of questions students asked was mostly factual, related to the content of the subject but the student’s enjoyed drilling the other child who was presenting his slides. Though the teacher had initially announced that only two students would be allowed to ask questions, a lot of other students raised hands at the excitement of being the person asking the question and not the answerer.

After the presentations ended, the teacher played the video on the formation of coal which she had already shown to the students earlier. Though the connection between the two topics was not there, the teacher aimed to finish the presentations and the revision of the coal

formation topic done earlier. The video played was showing the process of formation of coal from rocks to peat formation to the burning of peat and so on. Simultaneously, the teacher asked about the meaning of fossil as the word was used in the video and said, “It refers to the dead remains of the plants/animals buried millions of years ago.” She was constantly explaining the new/difficult words to the students in between and also, repeating the processes explained in the video for the students to remember them better. For instance, if the video discussed the process of carbonization, the teacher repeated the same by saying that “plants have cellulose such as C, H, O out of which H, O are lost in water vapor and only C is left which is known as carbonization.” As the video proceeds, it talks about the physical and chemical changes that happen during the process of fossilization. The teacher stopped in between to explain to the students why is it both the physical and the chemical changes and said, “It is a chemical change because a new sublime is formed which can’t be converted back.” Moving further, the teacher stops the video at the layers of the soil and says, “And the remaining left part if called a fossil.”

Though most of the students were interested in watching the video, one of them was reading the newspaper maybe because he was not interested or he had seen the video. Though the visuals in the video were a bit abstract such as the surface of the earth in the form of layers of soil shown, the formation of peat, and so on, the teacher tried to stop in between and explain the same. A lot of concepts such as re-carbonization, dehydration, and so on were discussed at a very fast pace in the video which might become difficult for the students to grasp and remember. The teacher too brought in some more concepts to explain the difficult parts in the video. For instance, when the teacher was discussing the transformation of energy, she asked the students, “In what form do plants take the energy?” and the students answered, “Light” and then she continued, “Do you remember about the law of conservation of energy? Energy is neither created nor destroyed. So, all plant energy is released when coal is burnt. So, the energy from the light which plants absorb is transformed into heat energy.” The accent of the language of the video was a British English accent.

As the video ends, the teacher asks the students to note down the question/answers from the PowerPoint slide projected on the board. The teacher repeats the questions displayed so that the students can follow her while writing.

Biology (Observation I, Class VII-A)

The teacher asks the students to sit in groups for the subject enrichment activity. When asked, the teacher told the researcher that this is a method of child-centric evaluation that happens every term for all the subjects. This is an addition to the test-based evaluation that happens for the students. The teacher asks a group, "Why is the circulation of the heart called the double circulatory system?" A student Romil in the group is unable to answer. She quickly moves on to the next question, "Name this valve (shows a picture)." The students raise their hands in excitement. The teacher tells them, "The one whom I am asking would answer. The rest of you don't be in a hurry." The student answers, "Pulmonary valve." She asks the next student Rimita, "What is the resting pulse of the human body?" Rimita answers, "72." She further asks, "Haemoglobin is found in which cells of the body?" Rimita replies, "RBC's."

The teacher moves to the second group. She asks Abhay, "How many blood vessels are found in the human body?" Abhay asks, "Ma'am, blood cells?" She says, "What did I say? Blood vessels, not cells." Abhay can't answer, so the teacher moves on to the next question, "Which arteries carry de-oxygenated blood in our body?" She gives them a hint," There is only one artery which does that." Garima replies, "Pulmonary artery." Garima pronounces it as, "Pumolary" and the teacher corrects her as "Pulmonary" The teacher, then, asks, "What is our pulse rate?" Taniya replies, "Ma'am, 24 in one minute." She further enquires, "Why does our pulse come in our veins?" She answers, "Because the heart pumps and that comes in our pulse which is felt through our veins." She asks Sahib, "What does blood constitute of?" Sahib doubtfully says, "Oxygen." She again reiterates, "It carries oxygen, what does it constitute of?" Sahib is unable to reply, so she moves on to the next question.

The teacher moves to the third group. She asks Vishesh, "What is the main function of RBC(Red Blood Cells)?" Vishesh replies, "They transport the blood." She gives a chance to Rumi to reply, "It binds the oxygen and hemoglobin and transports oxygen." The students in the other groups revising their concepts while their turn is yet to come. She asks Harshal, "What is the purpose of WBC's(White Blood Cells)?" Harshal replies, "They help in fighting diseases and developing the immune system." The teacher announces some pointers for evaluation. She says, "You are required to use scientific terms for answering. And if you are not able to answer, your points would be affected." Every group had developed a scientific model and they were required to show its working as a part of subject enrichment. This group had developed a pulse reader and so, the teacher asks the group, "What tool is this?" Aisha replies, "It helps in

checking heartbeat." The teacher tells the group, "First you try to hear the heartbeat, then I would hear it." As soon as the viva gets over, the students start checking their wrong answers from their book. The teacher tells Saniya to draw the path for blood purification on the whiteboard. She goes to the board and draws it. The teacher asks her to name it too. She asks Prabhav, "Which side of the heart holds deoxygenated blood?" The group is not able to answer. She says, "You need to prepare from day 1, you can't do it at the end." She asks the name of the valve in the diagram and no one can answer it. There is a student of short stature named Vinayak who says, "*Ma'am, ye to humaare syllabus me hi nahi tha*." ("Ma'am, this wasn't in our syllabus") The teacher tells him, "You don't have to refer to NCERT only but you have to focus on the smartboard, PPT's, etc. too."

The teacher goes to the whiteboard to mark the marks of every group based on three criteria- Content, Discipline, Presentation, and model. Before she marks them, she asks each group, "How do you think you have done?" Vinayak replies, "Very Well." The Teacher laughs and then marks all the groups according to their performance.

Biology (Observation II, Class VII-B)

The teacher plays the video of the skeleton system for recapitulation. The source of the video is by makemegenius.com. Through the video, two students explain the entire skeleton system and add on some fun facts in between. The teacher asks the students, "What kind of joint is the joint on the neck?" A student Girven answers, "It's a cylindrical joint which is fixed." The teacher further asks, "How many bones do we have in our body?" A student Bhairav replies, "206." She further asks, "Which is the ball and socket joint?" A student Rehmaan points out the joint on the whiteboard and comes back to his seat. The teacher, again, asks, "What are the functions of the skeleton? It has been shown in the video too and you have studied that in grade five too." The teacher herself answers, "It provides structural support to the body." She continues, "What is the function of the ribcage?" Ria asks, "Ma'am, structure?" A student Garima, then, answers, "It protects our heart and lungs." The teacher again asks, "How many bones does a child have in his body when he is born? Where are the rest of the bones gone when we grow up?" A student Wayan answers, "Ma'am, we have 300 bones in our body when we are born. They fuse when we grow up." The teacher enquires, "How many bones do we have in our spine?" A student Fiza answers, "33." The girl in the video says, "All these bones are vertebrates."

The teacher further asks, “What if we have one long bone and not 33 small bones?” Fiza answers, “Then, we won’t be able to move or bend our back.” The teacher asks, “What is Pelvis?” She answers, “It is the same structure on which we are sitting. It is the largest bone in our body.” In the video, the child tells about the smallest bone in our body which is in our earlobe. Further, the girl in the video tells the boy, ‘Do you know how can we improve our bone strength?” The boy asks, “How?” The girl replies, “We can do that by taking calcium, vitamin D, and sunlight daily.”

After the first video finishes, the teacher plays the second video on the skeleton system too. The video talks about the types of joints in our skeleton system. She pauses the video and asks, “Which joint do we have in our legs?” A student Abhishek replies, “Hind joint.” The video proceeds with the further recapitulation of the kind of joints in our body. The teacher asks, “All our bones are immovable except the lower joint which is movable. Do you know which joint is that?” The students are not able to reply, so the teacher says, “It is called the synovial joint.” As the video ends, the students start asking the teacher for more videos and the teacher says, “We do not have more videos on the skeleton system.” Another student says, “Ma’am, show the heart video.” The teacher plays the third video on the working of the heart. The source for the video is from the entire publisher. The teacher asks the students, “Look at the diagram of the heart properly and how the contraction of the muscles takes place.” The video describes the working of different ventricles in the heart and the process of blood purification which happens through the heart. After the video ends, the teacher asks the students to come back to the book to page 69. She asks them to fill in the blanks with the name of the joints on page 69 such as where are fizz joints found, what is a skull made of, which is the hind joint etc., and complete page 70, 77 for homework. She explains the difficult words on the page such as cartilages which mean the soft bones which are not as strong as the ear and nose. The bell rings and the class gets over.

Biology (Observation III, Class VII-C)

The teacher starts with the new chapter, asks Preeti to remove what is already written on the whiteboard. She asks the students, “We already did chapter 3 in PA 2 in the autumn break, now take out page 66, we will learn about the body movement now.” A student Vansh tells the teacher, “We are going to Gwalior in this break.” The teacher tells the class, “I know that. Now let’s start the chapter. Already your time table has been reduced by 5 minutes because the last period for homework has been added. Be attentive and conscious and let’s begin with the

chapter." The teacher writes the name of the chapter on the board, "Body Movements." She asks, "What does it mean?" Shivank replies, "Body which moves." The other students start laughing. Shivank says, "Skeleton of the body." The teacher asks him, "What is a skeleton?" and tells the other students to not answer. Shivank replies, "Our body is made up of skeleton." Another student Ramsha says, "Skeleton supports and gives shape to our body." The teacher asks, "What do you know about body movements?" Sarika says, "It means how the body moves and what would happen if it doesn't move." Another student Gaurav replies, "It refers to the parts of the body which help in body movement." Another student Harsh replies, "It refers to the different movement of body and joints."

The teacher asks the first student on the desk to start reading and keep passing after finishing the reading of one paragraph. She tells the students, "Now, no washroom, no water." As the first student stops reading, she asks the class to sit still and observe the movement. She says, "When you write, your wrist moves. When you talk, your neck and eyes move." She asks the students to fill the table in the book related to body movements and do not discuss each other. A student struggles with the pencil while writing and the teacher tells him, "Write with the pen but neatly." Chitran asks his partner Darsh, "What is the limb of the fish?" Darsh replies, "Fin." The teacher asks the book question, "How does the snake move?" Chitran replies, "It crawls." The teacher says, "Different animals move differently. Some swim, some crawl, some hop." She asks the students to move on to exercise 8.1 about the human body and movement. The teacher asks the students, "How can we play badminton?" Ramsha replies, "Because we can move our wrist and hand." Another student Garima replies, "Because of our joints." The teacher says, "Joint is not a new term. Different body parts move because of joint." Darsh replies, "Muscles then. Even joints have different types like soft joints etc." The teacher asks, "Why can't we move our neck at 360 degrees but hands." The students try to move their arms and wrists. The teacher explains, "We can rotate our whole arm. See. (moves the arm in one direction)"

She asks the students to fill the table further. A student reads ankle for elbow and says, "These students are confusing me. I will read from activity 1 now." The teacher asks Bhairav to attach the elbow tightly with the scale and asks, "Can you move your arm now?" Bhairav says, "No." The teacher explains, "Where two body parts join such as fingers, wrist, the place of joining are called joints." She asks the students to stop talking and mark the important points. She says, "I will give two-three more activities for the autumn break." As the reading continues,

she stops the student from reading and draws the ball and socket joint on the board, and explains the same to the students.

Biology (Observation IV, Class VII-A)

The teacher was already continuing with the lesson on the animals and their body parts when the researcher entered. A student Krishika asks the teacher, "Ma'am tell us about the body parts of the ostrich?" The teacher replies, "An ostrich runs very fast but it can't fly that high." Krishika continues, "It has got long legs, that is, why it can run very fast." The teacher asks, "What kind of lips has it got?" A student Gandharva replies, "It has got hind limbs." The teacher says, "It has got limbs connected to the breast area. Due to the expansion and contraction of muscles there, it can run fast." The teacher further asks, "How do fishes swim?" As the students quietly listen, she asks, "Due to the streamlined body, fishes can swim in the water." A student Ramini asks, "Why are birds streamlined then?" The teacher says, "If you fold the paper boat and drown in water, would it go easily?" Ramini says, "No Ma'am." The teacher explains, "Similarly, the birds have such a body structure so that they can cut through the air." The teacher enquires, "Did I tell you about the vacuum?" The students say, "No, Ma'am." The teacher explains, "The birds create a vacuum when they fly which helps in their movement." A student Jaskirat says, "Birds have big brains." The teacher laughs and says, "Tomorrow you will say that they sing too like Cinderella." The bell rings, she asks them to read the chapter and get the notebook on Monday.

Physics (Observation I, Class VIII-A)

The teacher tells the students to make a working model in the holidays and not buy it from the market. She shows the sample to the students of a kaleidoscope in groups and asks them to place it at 120 degrees. She says, "I won't answer any question because you are not waiting for your turn." The teacher asks, "Why do things change when you look from Kaleidoscope? Because it works on the principle of multiple reflections." The teacher asks, "How do you rotate it?" She shows the usage of Kaleidoscope to the students.

She dictates the definition of Kaleidoscope and asks the students to note it down in their notebooks. She says, "It has three plain mirrors inclined at the angle of 60 degrees to each other." A student Hamza asks, "Ma'am, can it not be of more than three mirrors?" The teacher says, "It can be but you keep it simple. And don't make it of more than three mirrors." She shows another model of Kaleidoscope and says, "There is a drastic difference in both the

models. This one has three mirrors. While this one has a slide in between. You rotate and you would see the colorful patterns." A student Darsh says, "Ma'am, we haven't seen the triangular one." The teacher says, "The triangular one is the three-mirror model." Darsh asks, "Ma'am, we have to put a thin chip inside?" The teacher replies, "Yes." The teacher shows three mirrors to the students and says, "You can put alphabets, mirrors, beats, etc in the Kaleidoscope and see the object from the end and image from the other. Because we can't change the object in this one, we have to move the Kaleidoscope accordingly." A student Tanmay asks, "Can we put a single object/picture instead of beads?" The teacher says, "It's up to you. You want to put a single image?" Tanmay says, "Like the image of a flower." The teacher says, "You can put but the image of flower would be overlapped, so you won't be able to identify. There is no sensible pattern but just a beautiful pattern for you to observe." Another student Lavi asks, "Ma'am, these beads have been inside for so many years, would they be fresh?" The teacher replies, "No." The teacher explains, "You can use butter paper on one end and a hole on the other side." The bell rings, the teacher tells them to make the model during their holidays and finish with the left over-exercise.

Physics (Observation II, Class VIII-C)

The teacher asks, "Can you name parts of the human eye?" A student Eliana says, "Optic Nerve, Lens." The teacher further asks, "If I was to explain the working of an eye using these parts, can you do it for me? The good ones will take side seats so that my attention doesn't go there." A student Garima reads from the book. Another student Rama starts reading from her notebook and Garim intervenes, "*Koi zaroorat nahi, chup Raho*." (No need to speak, shut up") The teacher says, "Yes, it is the same explanation because that is how the human eye works."

The teacher refers to the board and explains, "In a normal eye, the image is formed on the retina. So why do we wear specs then?" A student Yamini says, "Because the vision is not clear, so the lens is added to help see with clarity." The teacher asks Rishabh, "When did you get your specs?" Rishabh says, "2017." She further asks, "What problem did you face?" Rishabh says, "I was not able to see properly." The teacher asks, "Can you read on your hand properly?" Rishabh answers, "Yes." The teacher asks, "So, you have myopia. You can't see the far-off objects but you can see the nearby objects clearly." Rishabh says, "I had these defects from birth." The teacher explains, "There are two kinds of defects- Myopia and Hypermetropia. Our grandparents were not able to see the paper clearly which is hypermetropia. Both these defects have a correction."

The teacher starts a video on the defects of the eye and asks the students to tell them if they have any problems. In the video, a child is asked by the doctor why he wears specs at times and doesn't wear them at times. The video then explains the far point of the eye as infinity. The teacher asks, "What does it mean? A point that the human eye can see clearly which is not measured is called infinity." She asks, "What is the near point?" Fara replies, "25 cm." The teacher says, "Let us try out an activity. Hold your pen in the right hand, stretch your action, and bring the pen closer. Can you see it?" As the students move the pen closer, the teacher asks, "How is the vision? Don't feel the strain?" The student Upasana says, "Yes." The teacher says, "You are lying. Because the eye can see the object clearly to 25 cm and beyond that, if you bring the pencil closer, you will be straining your eye. When you are reading, the minimum distance should be 25 cm." A student Qamar asks, "The doctor advises to wear specs, there are points of specs." The teacher says, "That is as per your power." The teacher shows the video by smart learning to the students. The video gives the example of a ball and why it is not clear in the video. The teacher asks, "In a normal eye, the Rays converge at the retina but when myopia, the image is formed in front. See." Pushpa asks, "Why does this happen?" The video elaborates on the reason for these defects such as the elongation of the ball, the curvature of the lens which is less than the infinity.

The teacher pauses the video and asks, "What is the curvature of the lens?" Yamini replies, "It is thin at the center and thick at the edges." The teacher adds, "The lenses of the specs are thick at the center and thin at the edges." As the video explains the ray diagram, the teacher says, "Don't get confused with the ray diagram. You would see the same in class 10th, it is just to see what is myopia. Raise your hands if you have any doubt." Sumant raises his hand and asks, "The lens depends on the size and also shape?" The teacher says, "Yes, it depends on shape too." The teacher plays the second video on hypermetropia. Some students start moving as she plays the second video. The teacher asks, "Tell me the role of ciliary muscles." Roshni replies, "They are present at the bottom of the eyeball/lens and help in the closing of the eye." Dilawar replies, "They help in keeping the eye in proper position too." Sakshi says, "It helps in increasing or decreasing the size of the eye." Umesh says, "They help in keeping the eye in the proper position." The teacher adds, "for far, it is a thin eye. For near, it is a thick eye. In old age, the person can't see closer objects due to weakening of ciliary muscles." Raumya says, "That is why we should have carrots." Tarun says, "Now we even have surgery for contact lenses." The teacher loos at the video and says, "The convex lens is thin at the side and thick at the center. So is it converging or diverging?" Some students prompt

it is converging, some prompt it is diverging. The teacher asks, “Who was teaching this to you last year?” The students don’t say anything and the teacher says, “It is sad. You should know the name of your teacher.” The teacher draws the converging lens on the board and shows focus to the students. She asks, “Why is a convex lens called a converging lens? Because it converges the rays at the focal point.” As the video gets over, the students prompt, “Video over.” Daman asks, “Can hypermetropia be fixed?” Harshit replies, “Yes, through laser surgery.” Ishita says, “But it has side effects too.” The teacher says, “We will do this topic later. But I have been through laser surgery for a year now and I can't see any side effects.” The students start the discussion amongst each other. Neha says, “We see the side effects in the older people.” Pam asks, “Does it pain?” Now if this story has ended, can we write the answers?

The teacher starts dictating the question-answers to the students. She dictates, “Define near point and far point of the normal human eye?” A student says, “It is very peaceful while writing.” Neha says, “For animals, it is different.” The teacher says, “Yes, it is different but we will discuss that later.” Another student Farah says, “Yes, there are green spectacles.” The teacher continues, “Hurry up, we will start with the Braille.” Saumya says, “We have to learn it. It is very difficult.” The teacher tells Soumya, “Have you spoken anything sense?” She asks the class, “You want me to give question-answers for homework? Write- explain about primary defects of vision.” Pam says, “Is chapter done?” The teacher says, “Yes, it is informally done.” She further asks, “What do you know about visually challenged people?” Rita says, “They can't see.” The teacher says, “But that is a very vague answer. Do they have Myopia?” Rita says, “No, they are extremely visually challenged.” Taniya says, “They are hardly able to see,” The teacher says, “So, those who can’t see at all, can we call them blind?” Taniya replies, “I would say they are suffering from blindness, not blind.” Wasan says, “Those who can’t see the colors correctly are called color blind.”

Mathematics (Observation I, Class VIII-B)

The teacher wrote on the whiteboard the topic for the day-Congruence of triangles. The class monitor takes the list of talkative students to the teacher. She names the students and tells them to meet her at the end of the class. She opens the mathematics textbook, asks the students to do question 2 in the lab notebook. She asks the students to note down the heading in their notebook and simultaneously, writes on the whiteboard –the two conditions of congruency. She asks the students to do activity 6 as per the index. She starts explaining the concept on the whiteboard, “If two triangles are equal in area, there are two conditions-equal area and congruent, equal

area and not congruent." She draws two triangles on the board and further writes, "How do we calculate the area of the triangle? Half*base*height. Did we not do this grade 6?" The students start writing simultaneously, she tells them to drop their pens and only focus on the board. She explains the base and height on the board and says, "We learned in the median chapter that any line making 90-degree angles on one side of the triangle is the perpendicular of the triangle. Now you remember we calculated the area of a triangle using the grid sheet. Take out your graph papers." A student Tarang asks, "Ma'am why it's base*height and not length*breadth?" The teacher clarifies, "Will two triangles be congruent in that manner? Yes, the size and shape are the same, different in symmetry but congruent." The students draw the triangle in the grid sheet of the written measurement. The teacher guides further, "Tell me the three equal parts in the triangle. L=l, b=b, and bd is common. Now, can you use the SAS theorem?" Some students prompt, "Yes", "no" and so on. The teacher writes on the board as she explains, "L=L, B=B, and LA=LC." As the students finish writing this on the board, she asks, "Can I apply RHS? Angle A=Angle C, H=BD, S=AB=CB"

After that, she asks the students to take out another graph paper and fold it into half to form two triangles. The students get very excited about cutting the graph paper and pasting it in the notebook. The teacher asks them, "How do you think that the area of the two triangles would be equal?" A student Vaibhav replies, "Because the boxes are the same." The teacher responds, "There are many other ways of arriving in the area too. Will these triangles be congruent?" The students are a little confused, so she breaks the steps to ask, "Will the sides and angles be equal?" Gaurav replies, "Yes ma'am." She continues, "Will both be right-angled triangles?" The students get confused. She further enquires, "Will both be equilateral triangles? Isosceles? Scalene?" Nisha gets up, "Yes ma'am they would be all." The teacher says, "Yes" and explains the logic behind the same, "See, because the sides and angles are equal and one angle is a right angle, these triangles fulfill the criteria of all kinds of triangles." She asks the students to measure the area of these triangles now. She guides the students in counting the base and the height by counting the number of boxes in the triangle. She asks, "If I change one angle of the triangle, will they be congruent?" The students shout, "No ma'am." As the students start calculating the area by the formula of half*base*height, the bell rings. She asks them to complete the activity at home and bring their notebooks to the next class.

Mathematics (Observation II, Class VI-A)

The teacher enters the class and says, “Since we had done ratio, now let’s recall that and move to proportion.” The teacher shows the video of Lodhaguru to the students. In the video, the name of the protagonist is introduced as Shakti Singh and the students laugh at listening to that. The teacher tells the students, “We are not here to make fun of the video but understand it.” The students start watching the video. There is some problem with playing the video, so the student has to replay it again and again for the video to work. In the video, the king doesn’t take any tax from the citizens, so he leaves the development on the citizens too. A student Aranjay talks and the teacher asks him, “Come in front and let the others also listen.” As the video has to be played again and again, a student Dhananjay asks the teacher, “Ma’am, there is no fun in watching the video as it’s stopping again and again. Can we watch another video?” Another group of students laughs at the expression of Kalyan Singh in the video. The teacher says, “Since you are not co-operating, we should stop.” The teacher stops the video to replay it and the students who were laughing say, “*Arey yaar, Kitna mazedaar tha*.” (“Ahh! It was so much fun”) The teacher tells the students to see this part carefully for conceptual clarity. A student Rahul says, “Ma’am, he has not even touched the drum and the music is being played.” The other students start laughing and the teacher says, “It’s the effect of animation, that is why it is like this.”

As the video proceeds, the teacher asks the students, “What can they do to realize what are they doing wrong?” She replies, “They can have a bank, put the milk there, there are 200 jugs already there.” A student Kavya asks, “Ma’am, so will all of them pour water?” The teacher says, “Let’s see. He has a thought to pour in water, do others also think like that.” A student prompts, “Milk will burst.” The students again laugh at the funny expressions and eye movements of the characters in the video. When all of them pour water into the well, the teacher says, “So, all of them thought likewise.” Another student prompts, “They are so responsible, they are all standing in a line.” The students ask questions, “What is the need for milk in a drought?” Another student prompts, “It will help in getting water for the kingdom.” Another student prompts, “Take out the ratio of the people. There is no CCTV. More than 100 people have poured water I guess.”

The teacher starts part two of the video. The students start saying, “I hope it doesn’t lag.” Another student says, “Ohh! It’s breaking again.” The students get restless about the video not playing properly. Another student says, “We will bring the media player the next time.”

The teacher says, “Let us play from some other folder.” Vansh says, “Ma’am, Let’s play with windows media player.” Manak says, “Use VLC, that is the best.” The teacher says, “Yes. It’s VLC file only.” The teacher continues, “Let us wind it up.” The students start prompting, “We will start proportion”, “Ma’am, pause”, “Please finish the video”, “Ma’am, show this in homework time”, “audio is better” and so on. A student Yashika asks, “Ma’am, water is mixed with water.” The teacher asks, “Why?” Yashika replies, “Because there is more water than milk.” The teacher asks, “If there was more water than milk, then wouldn’t it be mixed?” The students give varied responses to the video, “They had enough, still they didn’t pour”, “The poor man gave and his milk got wasted” and so on. The students laugh at the clever man and the teacher says, “Mostly people acted cleverly.” As the video stops in between, Gandharv prompts, “Ma’am, close it and play again.” The students stay silent when the video plays again. In the video when the King comes, Gandharv says, “Ma’am, they are lying because the king is here.” The video ends with the message, “If we run away from our responsibility, we will get watery milk.” A student Rohan prompts, “Ma’am, they all have fingers on their hands.” The teacher says, “Now if the video stops, I will close it.” The teacher asks about the motive of the video. Some students prompt the answers, “That we have two choices in life”, “ratio of milk/water and difference between liars and honest people”, “ratio of taxes is less than the ratio of development.” The teacher explains, “The quantity of water is greater than the quantity of milk, so comparison of two quantities.” Dhairya prompts, “The rich man is clever, he should have poured some milk.”

The teacher says, “Now let us compare the two quantities by division which will be the ratio. For proportion, we have to equate the two ratios. The equality of two ratios is called a proportion.” The teacher asks a student to switch on the lights and starts writing the questions on the board. The teacher writes, “Proportion is denoted as ‘=’ or ‘::’ and the ratio is denoted as ‘:’ ” She further explains, the first and last are called the extreme terms and the in-between terms are called the middle terms. She writes an example on the board to show the difference between the two.” She further explains, “If a, b, c, d are in proportion, we can write them as a/b=c/d, and a*d= b*c.” She asks the students to open exercise 12.2 and read q 1. She reads q 1 and says, “The sequence is important when we read about the proportion.” She tells them, “One way to solve is to find ratio and then solve.” A student Harsh says, “Ma’am, we can even find if it comes in the table and then multiplies.” The teacher solves the first question and then asks them, Try to solve the next question on your own.” A student Harsh solves it by the fraction method and his partner Gaurav solves it by the multiplication method, so Gaurav tells

Harsh, “They are in proportion. You have done wrong.” Harsh says, “You don’t know how to calculate. I have used the fraction method.” The teacher tells them, “Both the methods are correct but you Harsh see your answer, you have done some calculation mistake. I would take the test on Thursday, complete all the other questions.” Harsh laughs and says, “Ma’am, I would be absent on Thursday.” The teacher says, “We will see that. You complete the questions right now.”

Mathematics (Observation III, Class VII-A)

The teacher shows a video on Algebra, the source of the video is Bodhaguru. The video explains the concepts in algebra with the help of various variables such as objects, age, numbers, etc. It further explains the DMAS rule which has to be followed in calculations such as divide, multiply, plus, minus. It defines the meaning of algebraic expressions and their uses. The teacher says, “I had already explained this in the class.” As the video ends, the teacher asks the students to take out their notebooks and start solving the questions. She is called by the head of the department of mathematics for some work. Some students work on their own, some start making noise and moving in the class. She returns after the class period get over.

Social Science

Geography (Observation I, Class VII-B)

The teacher asks the students to note down the new time table. Due to the government notification of no homework for the students, the school has introduced a new concept of keeping the last period dedicated for the homework by cutting five minutes from each period. She asks a student Vishal to make a column on the right side of the whiteboard and write homework so that every teacher can write the homework there. She says, “I will come and check homework in the last period.” She dictates the time table to the students and they note it down in their notebooks. She tells them that their teacher for physics and chemistry has changed. After that, she asks them to take out their geography books but not open them. She says, “Let’s recap the previous chapter question answers.” She asks the students, “Land is a natural resource. Comment.” Zorawar replies, “It has value or utility which makes it resourceful. It is a natural resource if used without disturbance.” The teacher says, “You have missed one basic character.” Manan replies, “That it is a natural resource and has usability.” The teacher says, “That it is a gift.” The teacher asks the second question, “There is a difference in population due to varied characteristics of land and climate. Elaborate with one example.”

A student Gaurav replies, “People avoid living in uncomfortable areas like much colder areas.” The teacher further elaborates on this, “The areas with extreme climatic conditions are sparsely populated.” She continues, “How does the land affect the existence of soil?” A student Ishan replies, “Where land is fertile, means the soil is fertile, so more agriculture can be done, so it means it has more population.” The teacher asks the next question, “Explain Common Property Resources. The teacher gives some hint to the students, “Is it private or community land?” Ramani replies, “Property not owned by individual or group of people.” The teacher asks Ramani to further elaborate on this, “Why is it called Common land?” Ramani says, “Because it is owned by a group of people and can be used for agriculture, construction, etc.” The teacher elaborates, “Because there are common ways of using this land for fodder, fruits, agriculture, etc.”

After this, she asks the students to open page 13. The teacher asks the first bench student to start reading and stop on halts and commas. After the student has read a paragraph, she asks, “What is weathering and how is soil formed?” Kawal replies, “It refers to the erosion of rocks and breaking of rocks.” The teacher asks, “Only rocks?” Kawal says, “No, it can be minerals too.” She asks the students to open their notebooks, draw figure 2 in their notebooks. She says, “I want all these layers in the box.” She asks, “What is parent rock written in the diagram? It is the foundation rock for the soil.” She adds, “Underline the topography in the diagram. What is topography?” Gaurav replies, “It is the type of land.” She says, “We will do mulching, etc. in the next class. Draw the diagram in the time that is left.” She points at a group of students sitting at the last, “You better not talk. Else I am going to make you sit separately.” She sees the logbook of the class and asks, “Who is maintaining the logbook? No teacher has signed the logbook.” A student Yashasvi is tearing pages, so the teacher tells him, “You start writing the heading, instead of tearing pages. And draw both the diagrams on different pages.”

History- Research and Development (Observation I, Class VIII-B)

The teacher tells the researcher that each class is given a piece of research and development project by the Head Of Department(HOD) and they have to present that to the audience. The teacher prepares the demo presentation along with the students for the final program. This assignment holds five marks for the assessment. A student, Jayati presents from the Powerpoint Presentation (PPT) displayed on the board. The teacher asks the question, “Why red worms are there in compost? How do they help in decomposition?” Jayati replies, “Red worms help in decomposing materials.” The teacher further adds, “They lay eggs, multiply and decompose

the material quickly, this way our task is simplified." The teacher sends Jayati back and tells her, "You prepare it again. You have to know when your speech is ending."

Another student Mayank comes to present his slides, "Weeds are unwanted plants which grow around main plants. It is necessary for competition and helps in the erosion of the soil." The teacher tells Mayank, "Keep your hands at the back. Do more research on this and make it ready by tomorrow." The students sitting as the audience ask, "Can we ask questions?" The teacher says, "No, it's not open right now. let him conclude." Garv reads from the slides for the conclusion, "Each child is supposed to do vermin composting. It helps us in the collection of waste from the kitchen." The teacher says, "Highlight that Point." Another student points out the wrong spellings in the video. The teacher tells the team to correct it. The students start explaining the PPT further. Lavika says, "These are the steps to create a compost. A pit should be aerated, have moisture." Some of the students speak without looking at the PPT, some others see their diary and speak. Bishmeen continues, "Each child would collect the waste and the teacher would guide."

In the end, Garv plays a video on composting. The video shows the weeds helping in decomposition and where can the students buy them online. The teacher asks the students to change the picture of the bin in the picture and change the spellings. She asks the class, "Wear full sleeves as so many students are suffering from Dengue." A girl Nayani asks, "Ma'am, Can we wear black colored leggings?" The teacher says, "Yes but you have to cover yourself fully."

History (Observation II, Class VIII-C)

The teacher asks the students to take out their history books. The students say they didn't know that they had to get history today, so they got geography. The teacher replies, "Only when I say that you have to get history, you would get history. I posted it twice in the group." She tells them, "Now we would start history and you may get your notebooks on Monday too." She asks two students to arrange the books from the other section so that she can start with the chapter and not waste time. The Didi gets copies for the students from the stationary shop and drops them in the classroom.

The teacher asks the students, "Have you heard these two words-tribes and nomads? I remember you had heard that in the previous chapter?" A student Akash answers, "Tribes don't follow the religion." Another student Umesh answers, "Nomads don't have a place to live, they keep moving for food, etc." The teacher explains, "Migrants and nomads are different. The

migrants move due to floods etc. and the nomads move due to climate etc." A student Emmanuel asks, "Ma'am, who are hunters or gatherers then?" The teacher further asks, "Do you see these construction laborers around you today? They make their house, settle as a community, and then make a new house." The teacher tells the two students with the books to distribute one book on each table. She asks to give a separate book to Tanmay because he disturbs the class. She continues, "Nomads move from one place to another in search of food and livelihood." She enquirers further, "Have you heard of the prehistoric era?" A student Mayank answers, "It is the time before archives have been studied." The teacher corrects him and says, "It is the time when there was no written account." Priyanka adds, "People moved where the soil was fertile and left the other place." The teacher continues, "Then, with the beginning of agriculture, these armies moved to explore new places. Even today people move for better education, livelihood, and new culture." She asks, "Do you think these people change themselves as they move." Lovika replies, "With the new environment and resources, their food and clothes changes. Even their language, religion, and culture too change."

The teacher says, "Now let us discuss tribes. These are the people who live a different life in a group or clan. They follow their own rules, regulations and do not believe in the Brahmanical caste system but equal society. These tribes are found today in Chhattisgarh, Bengal, Bihar, Andhra Pradesh, Telangana, and Assam. They change their place a little bit with time. Later, they adopted the caste-based system in society but some haven't accepted it until date. These groups adopted new religions like when Pakistan disassociated from India, some tribes adopted Islam. Some others started ruling like the group of Rajputs." She continues, "In the initial societies, there was no authentic information because there was no written account. In the medieval period, there was evidence found, and the history of Tribal people was written like there are museums for the study of Gonds, Bhils, and Ahoms." She asks the students, "Have you heard of some tribes which were subjugated by the Mughals?" She asks roll number 1 to start reading the chapter from the book. Vamik read the first paragraph. She tells the students, "You can't mark the important lines since you do not have your books." As the student reads, the teacher says, "These people believe in gender and birthright. In the individual societies, Varnas became rigid due to the Brahmanas." As the student stops reading, "When you studied Khilji, it was not in the Gangetic and thick forest was there as people were living there. I have explained to you contemporary times." A student Karan asks, "Do you mean the modern times?" The teacher asks Karan to look at the dictionary and look for the meaning of these words, She also asks them to explore Baluchistan, Pakistan, Afghanistan to better

understand this chapter." She further says, "We study gaddi tribe in class five in Himachal Pradesh. So, in winters they come down and in summers, they go up." The bell rings, she asks them to do the homework and she would show them a video in the next class.

History (Observation III, Class VIII-A)

The teacher displays the PPT slides for the students to note down in their notebooks. She asks a student, "Anu, collect all the maps. Have I not ticked these? Write the name and class at the back of the map." The teacher asks all the students, "How many of you are making notes at home as I asked you to do?" Some students reply, "Ma'am, we have started." She asks the students, "Those who have done, help others in doing the work. Now we will watch 2-3 videos and then, move on to the next chapter." She looks at the map of Pawan and says, "Mark the subtropical region in the Northern Hemisphere because we are doing the Ganga region only. Listen, students, we are giving you notes only for this chapter. We won't do that for the next chapter. You make your notes." Fiza answers, "That is better because it helps in reading, writing, answering, and remembering." She further asks, "How many of you can make PPT?" Almost all the students raise their hands. She says, "For subject enrichment, search about the Bhakti, Sufi movement, etc. and make a PPT. This is known as learning through experience. This would be after PA2 exams because it would be added to the final exams."

The teacher plays the video on the Ahom Kingdom. The speakers for the device stop working, so a student checks if all the wires are correctly placed. The teacher says, "Call an IT person, check his room number, and call him." The student fixes the wire, the video starts playing with the sound. The source of the video is by Mexus Education 2011. The video talks about a father telling his son to read a journal and find out about the Gond community. It explains the areas where they lived such as Gondwana, their occupation, their administration system- Centralized, their religion- Gad, and son. It, then, talks about Akbarnama and its 3 volumes. The teacher asks, "You had studied about Akbarnama in the last class. So, What is Ain-i-Akbari about?" A student Rihaan says, "It is about the administration of the Akbar empire." The teacher asks, "Is shifting cultivation clear to you?" The students say, "Yes ma'am." The video proceeds with the conversation between the father and the son about the Gadkatan which was captured by the Muslims long back and all the wealth was seized. The father, in the video, tells about the Kings and the Queens of that period and discusses the map showing their dynasty. The students carefully listen as it is all new information for them.

As the video ends, the teacher says, “We have got information on Gonds through Akbarnama.” A student Rihaan asks, “Ma’am, Where is Gadkatan?” The teacher says, “It is a Mahoba now. It is not present.” Rihaan asks, “Ma’am, is the land present?” The teacher says, “It is present in Madhya Pradesh and Chhattisgarh.” The teacher refers to the book and says, “Even Central India some parts. They are not living the way they were living at that time.” The teacher plays the second video on the Bhil community and the source of the video is by Arihant. The video talks about the location where Bhils are found such as Madhya Pradesh, Gujarat, Maharashtra, and Chhattisgarh. It says that Bhils were bowmen and they are found 39% in Rajasthan. The teacher pauses the video and says, “Do not think I am a Bhil.”

She again plays the video and it talks about the Ghoomar dance form of Bhils and the ritual of men paying dowry in the community. As the video ends, the teacher plays the third video on Ahoms. The video talks about their king Sohomo, their location- near Brahmputra, the period of their existence- the 14th century, and their palaces at Gragaon. The teacher says, “It is mentioned in your ancient India book that the kings called him Swagdev.” The students repeat, “Silkworm costumes” as is said in the video. The teacher says, “Assam silk is still famous today.” The video proceeds with the other information on Ahoms such as manuscripts, moamoria rebellion, and so on. The students lose interest now as the video is filled with a lot of information. The teacher pauses the video and says, “Remember Ahoms came from Burma, at the end suffered from Burmese attack. Their art is great but they have the greatest racial and cultural ramification.” A student Garima asks, “Are Ahoms still in our country?” The teacher replies, “They are there but they are not very prominent. See the encyclopedia for more videos. Now, they are living traditionally. After contact with the caste-based society, you can’t make out who Ahoms are. They majorly control the north-eastern and western part.”

As the video ends, the teacher tells the students, “Now the chapter is over. We will do the mapwork the next time. Can we start the next chapter now? Open your history books.” The teacher tells Naman, “When you do an activity of research on tribes, you will get the answer whether they are present today or not.” As the teacher starts with the new chapter, she asks the students, “Last year we went to Qutub Complex. Did you see the Minar carefully? Naseeha was there and you were reading carefully too. So, what did you see?” The students give answers, “Minor detailing and design”, “Verses from Quran”, “the last section were made by Sultans or Mughals” and so on. The teacher further asks, “So, The British maintained and didn’t add anything to it. Earlier, it was till 5th storey but then, the top two floors fell down. Many

incidents happened, so the government stopped the entry." A student Mitali says, "But they showed that the British made it?" The teacher says, "It was a complete slave dynasty structure." Akash asks, "Ma'am, what about Jama Masjid?" The teacher says, "It is also known as Quwat-e-Islam Mosque." Other students prompt, "It has a gumbad", "Pillars of temples", "Proctors of Islam" and so on. The teacher says, "They did that so that only Islam could be practiced, destroyed and constructed mosques to establish their religion." A student Vihaan asks, "Is the design of mosque and minaret different?" The teacher replies, "The arch of Mosque is different because it came from Turkey. Tell me, How many of you have gone to Agra?" Almost all the students raise their hands. The teacher asks, "Describe the arch of Red fort, Taj Mahal, Fatehpur Sikri? How are they different?" A student Taniya replies, "They are different from each other. Taj is hollow, one can hear the voice back from its many holes, we can see the entire mosque from each hole." The teacher asks, "Are they all Mughal structures? Fatehpuri is a mixture of Mughal and Rajput architecture. Fort of Jaipur?" Piyush replies, "It is a combination of Hindus and Muslims. It has mirrors. One pillar on one side and the other on the next side." The teacher asks, "Ellora temple?" Dewan replies, "It is dedicated to Shiv Ji. The sculpture is a wall disrupted due to two invasions by Russia." The teacher corrects him and says, "It is Turkish and not Russian."

IT as a discipline (Observation I, Class VI-B)

The school head shared with the researcher that under the ICT curriculum, there are workshops for ardiobotics, Philip, etc. too which the school organizes now and then.

The IT lab infrastructure comprises about 30-40 desktops on a round table. Each student is provided individual desktop to work on during their practical class. Usually, the teachers who have work on the internet or school database sit with some desktops on one end while the ICT classes are going on. The books used for the ICT curriculum are by KP Publishers from class 5^{th} onwards. The lab has three smartboards and whiteboards for the use of the teacher. Every ICT lab has two teachers, one as the ICT head and the other one as the support teacher.

The teacher writes the equations and formulas on the whiteboard on how to calculate percentages in the Microsoft Excel document. She first explains how to calculate percentage in mathematics, "Suppose a child has scored 90/100 in mathematics, 60/100 in science, 85/100 in social sciences, now to calculate the percentage, we will add all the marks, that is, 90+60+85=235, divide the sum by total marks, that is, 235/300*100=178%." She asks the

students to apply mathematics function in excel and start calculating the percentage of the given question in the book. Some students know the mathematics formula function, so use that to calculate the percentage, some others use shortcuts to calculate the sum and the percentage, some find maximum marks for each subject, some can't understand how to type the range of marks and wait for the teacher to help them. As the cognitive level for the content of the curriculum is different for each student, some students couldn't calculate any figure but the teacher leaves them on their own for the day. In the end, the teacher asks the students to save the file in their name and shut down the computers. The teacher told the researcher that this is done so that the students can continue the work from where they left the next time.

In the next class, the class teachers come to the ICT lab for publishing the report card of the students. The class teachers are requested to upload the marks of each student on the school database, re-check it, and then get the published copy for each student from the ICT lab. The software for entering the marks is based on ERP software. This software covers exam fees, attendance, parent's login, and other administrative things of the school. This software is handled by the IT team of the school. The ICT teacher maintains the record for completion of the report book work of teachers on the whiteboard for her reference.

The teacher asks the students to use an adobe flash player and make their drawings on it. The students make different things such as some make butterflies using the ovals, some make ovals with different colors, some students use the onion skin tool to create a shadow image, some flip the image, some use Ctrl+G to create a repeated shadow image, and so on. The students use their imagination to create different images. The teacher says, "Though onion skin tool is not in your course, you can still use it if you know how to use it." After that, she asks the students to try the rotation masking tool if they were done practicing the previous tool. The teacher shares with the researcher that "pictures are easy for the students to use/experiment, so they like working with these tools." Some students make rotating stars, some make animals moving in the water and some others make demons flying in two different directions. This class had five girls and four of them had repeated what the teacher had shown as the sample diagram.

IT – Substitution period (Observation II, Class VI-C)

Though the students are allowed to do whatever they want to do, the teacher tells the students to calculate the percentage for the report card, that is, enter their half-yearly marks and make their report card. The teacher writes the report card, name, and half-yearly exam marks subject-

wise. A student Baram says, “Ma’am, these marks are out of 80, so the method will not be correct.” The teacher replies, “Let’s skip that because usually marks are out of 100.” The teacher says, “Those of you who have done excel can practice it there.” The students enter the marks, calculate the percentage, and color the report cards. A student Kamal calculates 0% marks, the teacher goes to his table and says, “How can it be 0%?” She corrects the formula and asks him to calculate it again. Some students calculate the individual percentage of each subject, some others write the marks horizontally, some others also enter the grades next to their marks. The bell rings, the teacher asks them to save their report cards and finish them the next time.

IT Week (Observation I, Class I-III)

The IT Head told the researcher that there is an IT week being organized for class I-III. And for the senior classes, there are workshops throughout the year or during the summer break to enhance their skills. The IT head said that she is planning an IT week for the senior classes too but not shortly.

The junior wing ICT head told the researcher that though this IT week happens in other schools too but not at this level at which we have organized. There was an inauguration for the week by the principal, the pictures of which were shown by the teacher to the researcher. The IT room was decorated with charts and lamps with IT week written on them. All the classes were told in advance about the inter-class competition that they had to participate in during this week. The teacher said that the themes for the competition were decided with approval from the principal and sent to the parents 15 days before the competition. The drawings of the students would be judged at three levels- first by the IT teachers based on the diversity and usage of tools the students use, then the academic heads based on the written messages in the drawing, and finally, the writing head on the theme coherence. The final drafts of the students would be put on the software for judgment at these levels.

The teacher writes the themes on the board such as mountains, jungle, desert, garden, and asks the students to begin their drawings for an hour. While few of the students make the scenery of the mountains and the garden as their parents would have prepared them, some others erase it again and again. The teacher goes to their desks and asks them to color the pictures they have already made, otherwise the time would get over. There is a special child named Ayaan in the class who doesn’t make anything. The teacher told the researcher that he

would only make the drawing if she helps him out. She helps the other students first and in the end, persuades him, "*Beta kuch to banaao*." ("Child, make something") Ayaan tells his neighbor Aarav, "*Eh, Kya Kar raha hai in bus, work shuru kar*." ("You, what are you doing in bus, start the work") The child, Saurabh wants to make something but he doesn't know how to use the tools. He complains about other student sitting next to him, "*Ma'am, ye muje laat maar rha hai*." ("Ma'am, he is kicking me with his leg") The teacher tells him, "*Vo nahi maar rha, tum apne computer pe dekho*." (He is not kicking, you look at your computer") The teacher doesn't give him extra attention to this competition and tells the researcher that she helps him individually during the class periods. She tells him to move out of his seat because he is creating disturbance for other student's, so he gets scared and asks, "Ma'am where are you taking me?." The teacher tells him, "Nowhere, just changing your place of seating." When the researcher goes at the end of the class, a student Gaurav tells the researcher, "*Me magic dikhaun*?" ("Should I show magic?") The researcher says yes and he plays the slide show for the card he has made. Another child Vivaan tells the researcher, "*Ma'am, meri drawing dekho, mene ise (pointing to the girl sitting next to him) bhi kahaa tha ki rain banaa le."* ("Ma'am, see my drawing, I told her too to draw the rain") At the end of one hour, the students who couldn't complete started crying and shouting, the teacher goes to their desks and helps them finish it. The teacher too was very happy about her initiative and the resulting drawing of the students.

After the bell rang, class 3 students came to the competition. One student shouts from outside, "Ma'am, we have prepared well for the exam." The teacher asks them to stand in a line and attend to their roll call. She takes the attendance, wishes them all the best, and calls them inside. She says, "Ma'am, will arrange the seat for you today." She makes the students sit in apt places. She tells the researcher that all the classes have one theory and one practical period for ICT. She explains it to the students, "Today, you won't be able to put pictures from clipart but you have to go to the Insert tab, select the picture and insert it in your card." The teacher demonstrates this action on the smartboard for the students. A student Arjun asks, "Ma'am, can we color the picture, put a border, and paste these pics." The teacher replies, "Yes, you can do anything with your card under the theme you have chosen." A student, Aisha asks the teacher, "Ma'am, my picture position isn't changing." The teacher goes to his desk and shows him the tool for the rotation of the pictures. The students want to ask others for help but they hesitate to do that in front of me. A student, Arti is making a poster for Diwali with small font size, so the teacher goes to her desk to tell her to increase the font size. Another

student Vihaan tells the researcher, “See, I have given the effect to color” and is very happy about seeing the color.

The teacher asks the researcher to give feedback to the principal ma’am. Most of the students are very excited about the page color and so, they are changing it again and again. A student writes a paragraph on “What we have forgotten about Diwali, we burst crackers.” Another student corrects the English of his partner, “Celebrate himself, not celebrated himself.” Some others make invitation posters for Diwali Mela Bazaar in their locality/apartments. A student Rohan writes the story of Lord Rama and the reason behind the celebration of Diwali. A student writes in his poster, “We will do pooja on Diwali.” and tells his partner, “*Tu pooja mat likh, kuch or likh le*.” (“You don’t write Pooja, write something else”) Another student Benu makes a party card stating, “Come to our Diwali party, Guys and Girls.” Many of the students make a scene, rub it, repeatit again. The bell rings, the teachers save the files and ask them to leave.

The School Database

The School has created its database, based on Enterprise Resource Planning (ERP) software for administrative and academic work. The IT department of the school handles this software and its functioning. The administrative work involves attendance maintenance, parents-teachers interaction portals such as login Id’s, parents separate logins for queries/information, teacher’s login Id’s, the school portal and website for information access, fee submission, SMS circulation, maintaining connections with the other branches and the head branch. The academic work involves uploading ICT content like videos, PPT, films, documentaries, and so on. Then, there are other things like report card publication, workshops on ICT-related themes like cybersecurity, threats of the online world, etc. for which the school’s database and ICT devices are used as per requirement.

The teachers have been provided their login IDs. So, they can access the database from anywhere but they are not allowed to use any CD/ pen drive for uploading the material or transfer of material due to the threat of virus transmission. They have to go to the IT or ICT room for uploading/downloading/transfer of any such material.

Life Skills (Observation I, Class VII-B)

The teacher asks the students, “Are we ready?” The students have a code word for replying and they say, “Chios.” She asks, “Now one person tell me what did we do in the last class?” Some students prompt and say, “My body”, “Mirror.” etc. The teacher says that today we will talk about superpowers and asks the students, “What are superpowers?” She commands, “Take a deep breath and then think and speak. Now tell me one word for a superpower?” A student Nigam raises her hand and says, “Special ability, magical powers.” Another student Harsh prompts, “Special powers, uniqueness, powerful and imaginative abilities, not in the real world, extraordinary skills.” Another student Darshan stands up and says, “Special powers different from others, talent, ability, unusual.” The teacher concludes, “So, superpowers are extraordinary powers that we possess.”

She further asks the students, “What is your superpower?” A student makes fun of the other student, “Ma’am, he is eating a lot.” The teacher says, “Our superpowers are always positive.” The students give varied responses like, “Run fast, read in mind very fast, piano, online games, dance, making friends, etc.” The teacher, then, asks, “Why is it a superpower? It is tough to make friends whom we can believe? What if we are all good in one thing, how would the world be?” A student Manas replies, “There would be no learning, no jobs, no opposition related to uniqueness, no audience, same culture, 1 festival, and no difference in talent.” As the students start talking among themselves, the teacher shouts, “Teacher time guys!” Then, she asks, “How many students are good in English, social science, dance, etc.? Only 10% are good in all subjects, right? So, does that mean we are bad learners? Why don’t we get the same marks?” The students reply, “No ma’am.” She takes this further, “When you show off your marks after half-yearly, it means you don’t respect all superpowers, right?” The students start shouting the answers and she says, “Your answer doesn’t become better by shouting, so stop.” She says, “You don’t have to feel bad about your few marks here because these won’t even matter once you graduate. No teasing from now.” The teacher giggles and asks, “How many can cook a cake or a vegetable? Or know martial arts?” So many students raise their hands, so she says, “Get the cakes next week. Send your friends and family to martial arts.” After this, many students start prompting their superpowers, “Ma’am, I have the drawing and sketching superpower”, “baking superpower”, “cycling fast superpower” and so on. The bell rings, the teacher leaves the class and all the students engage in their activities like some create rubber impressions on the desk, some start playing pencil scissor in the group, some roll

the book as mike and play, some start drawing, one student imitate the dance moves and another one laughs at him. All the girls in the class were working.

Life Skills (Observation II, Sparsh Video)

The two girl students of the senior class came and started talking about the NGO Sparsh and fundraising for the same. One girl said, "Do you know that special student's do not ask their parents for phones, barbies, or dresses like you guys. You have seen the Sparsh school, right. So you know about their needs and how do they need our help. So, we have got booklets here to raise funds for them." Another girl continues, "Last year, the funds were used by Sparsh school for various purposes. Now we would show you a PPT on the same." The first girl continues, "Do you know what is Philanthropy? It means working for other's welfare. Like giving money to the disadvantaged. It is the art of giving without any benefits involved. At festivals like Diwali, we can save money and give it to them. Each Rs 500 makes a difference in their lives."

As she moves the slides of PPT, the other girl takes over and says, "Are you a leader?" The students don't say much. She shouts again, "Are you a leader?" Now, the students shout, "Yes" She continues, "You will lead a happy life because you have money. Even the thalis and colors are expensive, so we need funds for these deprived students." She further asks, "What qualities do you have? Being optimistic, teamwork, determination. Don't you? So, you and we have to make this productive." The first girl takes over, "How many of you are courageous?" Some students raise hands and she says, "Very good. Self-confidence is required for being courageous." She asks, "Are you a good leader?" The students say, "Yes." She reads from the PPT, "A good leader should be a good human, should be generous and think about others." She reads from further slides, "With great power comes great responsibility. So, think about your role models-Bill Gates. Who was he?" A student replies, "He was the CEO." The girl says, "Yes and he was a philanthropist too." Another student names Stephen Hawkings as his role model. The girl asks the class to clap for him. So, do your parents encourage you to do such things as gratitude?" The students reply, "Yes." The other girl takes over and asks, "Are we blessed? It is our responsibility to show empathy. Do you know what empathy means? It means understanding the needs of others. We learn so much in our life skills period. So, after we have wasted 15 minutes here, how many of you would help?" The other girl says, "Collect money from your neighborhood and you would feel good about it. This NGO has been working for the last 33 years and your help would matter. We have been talking to so many student's and

your responses matter." The last slide shows that the video has been created by Blueairchampions.com.

Robotics (Observation I, Class VI-A)

The class teacher comes with the students to the PBL room. The robotics teacher tells the students, "You know your groups, so join your group." The teacher asks the students, "We have seen four wheels working. Is there any difference in turning?" A student Vaibhav replies, "Sir, we have to do like this (shows a part of the robotic device)" The teacher tells them, "Are you dragging the front wheels?" Taniya replies, "Sir, only the front wheels are working." The teacher says, "I will give you a castor wheel instead of the two front wheels and we will see the difference. Make the base spot up to two wheels where I told you." The students get confused about how to go about it and the teacher asks, "You want to see the pictures to make it. *Bhool gye*?" ("…, Have you forgotten?") The teacher gives the pictures in the groups and says, "Put the plate in the center and do not fix the center wheels because I haven't given you the same." A student Gaurav says to his partner, "Make the connecting plates. *Ise banao*." ("…,make this") Another student Jaydeep asks the teacher, "How many holes do we leave here?" The teacher says, "You have come after vacation. So, you have forgotten everything. If you don't remember the holes, just put some plate in the center." A student Naithan says, "Let us connect the screws and another tyre first." The teacher asks, "Do you see the rotating chances?" Naithan replies, "I am doing axle and I can't do." The teacher asks Naithan to see Lisa and do it together with her. The teacher explains the steps, "*Pehle code bahar nikaalo, connect this and then again bahar nikaalo*."("First take the code out, connect this and take it out again") Kavya says, "We can connect it from both ends. One out and another handle in." Another student Yashna tries to put the screws and tighten them. Pranay tells Udar, "*Ise haath se karle*." ("Do it with a hand") They both do it quickly with the hand but join it wrong. The teacher tells them, "*Ye teda jod Diya hai*." ("This has been connected slantly") A student Vashi tells the teacher, "Sir, *Alan key de do*." ("Sir, give the Alan key please")

The teacher asks the students, "Have you all completed? I will give you brakes now and you apply it to your device. I will tell you how. (The teacher distributes the brakes to the students)" The teacher demonstrates how to attach the brake and says, "You don't need L plate, just attach like this and then the brake." Naithan asks, "Why is it not tight?" The teacher responds, "*Sabko tight Karo, tab Hoga*." ("Tighten all of them, then it would be tight") A student completes making the robot and moves it with the remote in the class. The other

students get encouraged to complete their work too. As the bell rings, the teacher asks the students to keep the materials back in the kit box and practice this next time.

Virtual reality (Observation I, Class VI-B)

The teacher introduced the concept of the forest by saying, "Lions have become extinct now. Fifty years ago, they were found at many places in India and now, they are only found in Gir National Forest. In the last few years, around 1000 species have become extinct due to deforestation, poaching, cutting of trees by humans, etc." he continues, "Have you heard of IUCN?" The students look at him with blank looks and he again continues, "It's full form is International Union for Conservation of nature. This organization makes categories based on the remaining population and the extent of the threat to the animal population. For instance, Least Concerned are more in numbers than Near Threatened which is more than endangered which is in turn more than extinct. Then, there is a category called Extinct in the wild which survives in the captive by nature lovers but can't be found freely anywhere. IUCN also makes a red list of threatened species." The teacher continues, "Have you heard of Project Tiger? It started in 1973. Under the project, jungles were identified as National Parks where you can neither cut forest nor kill animals." He asks the students, "How can we help their efforts sitting from here? Because the primary risk to these species is deforestation, so we can plant a tree."

Virtual reality (Observation II, Class VII-A)

The teacher asks the students, "Did some of you enjoy your experience?" She takes the devices from the few students and hands them over to the other students. As the students see the video, they give varied responses. Bashik speaks to himself, *"Mera giraffe ruk gya."* ("My Giraffe has stopped") His partner says, *"Mera Bhi."* ("Even mine") Another student shouts, *"Peeche mud ke dekh Kaun hai* (in the video)" ("Turn to your back and see who is it") The other students who do not have the devices laugh looking at the reactions of the other students. They ask their classmates, "*Mazaa aa rha hai?"* ("Are you having fun?") Harsh keeps pulling the devices off his eyes and checks the reality of the classroom in between. Bashik says, *"Vo Peeche dekh Giraffe fir se wapis aaya."* ("See at the back, the Giraffe has come back") Vani sitting next to him says, *"Aur Elephant bhi."* ("And Elephant too") Another student shouts, *"Mujhe dar lag rha hai tiger se."* ("I am feeling scared of the Tiger") As the video finishes, a student Vivek tells his friend, *"Yaar bohot sai tha."* ("Friend, it was very good") His friend says, *"Mene to do Baar Dekha."* ("I have seen it twice") Shubhangi replies, *"Nahi Vo to bas shuru Hua Tha."*

("No, it had just started") A student goes to the teacher and says, *"Sir, ye Mujhe maarega."* ("Sir, he will hit me") A student imitates the thumping feet of the Elephant by walking similarly. Two girls hug each other in fear. Another student Umang says, "hurr.. hurr…" A student while wearing the device, *"Ye dodo ko pakdo"* ("Catch this Dodo") and tries to reach for another child unknowingly. The other classmates laugh at his behavior. Sakshi wants to put the device again after watching the video but the teacher stops him and says, "Now it's another student's turn." He doesn't want to take the device from him but the teacher takes it from him insisting that his time is over. A girl removes the device from her eyes in fear while Harsh doesn't want to remove that even after watching the video once. The class environment becomes very lively, noisy, and excited after the students have seen the video.

Art and Craft (Observation I, Class VI-B)

The teacher shows pictures on the slides to the students. She explains the elements of the art in those pictures. After she explains the technicalities of drawing and coloring, she asks the students to start drawing in their drawing notebooks. She asks the students, "Those who do not have colors, draw, others start drawing. See the texture of the picture, you have to use only color and knife." A student Kanika asks, "Ma'am, we have drawn only the flower vase?" The teacher says, "Yes." The teacher takes a round of the class and gives instructions to the students, "See the composition if it is horizontal or vertical. Maintain the balance of the space." She further explains, "*Space kya hai?* Space inside the image is a positive space. The space outside the image is negative space." ("What is space?...") The students continue drawing and coloring the images in their book. After a while, the bell rings, the teacher asks the students to complete their work and she would continue with the next work in the next class.

Project-Based Learning Substitution (Observation I)

The teacher tells the researcher that this is the integrated period for all subjects, so I am taking the students to the library in the basement. In the library, the students pick up books of their choice and sit in their groups. A student Rai on a table tells his friend Tanmay, "*aagyi na teacher, aur baat karle*." ("The Teacher has come, see, I told you to not talk more") The students in this group pick up the atlas and start playing the game atlas. The girls on the next table read novels, comics and some of them complete their pending work. Another student reads Abdul Kalam's biography on the next table. While playing Atlas, Naman says, "*Mene Switzerland bola hai*." ("I have said Switzerland") Kashim replies, "*ye mene bol dia tha kuch*

or bol." ("I had spoken that, you say something else") Naman tells Uday, "Ma'am should send him somewhere else, *deewar me ghus jaaye ye*." ("…, He should penetrate in the wall") The other students in the class keep changing the books as they are bored with the title of the books. Ajay reads the GK book and says, "Suriname, *ye kaisa naam hai*." ("Suriname, what kind of name is this?") Yajum reads another name, "St. Lukia, *ye kaisa naam hai*." ("St. Lukia, what kind of name is this?") All of them start laughing behind their books. Another student reads the title, "Journey to the center of the Earth." The teacher sees him talking and says, "I caught you, so don't say anything now. Just be quiet." A student Naman refuses to speak to Gaurav, so Vijay asks Naman, "*Mene thodi mota bola hai, teri dosti mujse hai, Gaurav se nahi. Aur ab to Gaurav bhi mota nahi bolega.*" ("I have not said you are fat, you are friends with me, not Gaurav. Now even Gaurav won't say you are fat") Naman says, "*Me bas isse baat nahi karunga*. *Koi naam nahi hai, mota kya hota hai*." ("I will not talk to him. Period. Don't I have any name, what is fat?") Some students start reading about solar storms, some discuss the revolutionary changes, some open their science textbook and compare their work, some read about Mother Teresa, Dalai Lama posters on the wall. Two girls on another table discuss the same novel they have been reading. The bell rings, the teacher asks the students to go back to their class on the fourth floor.

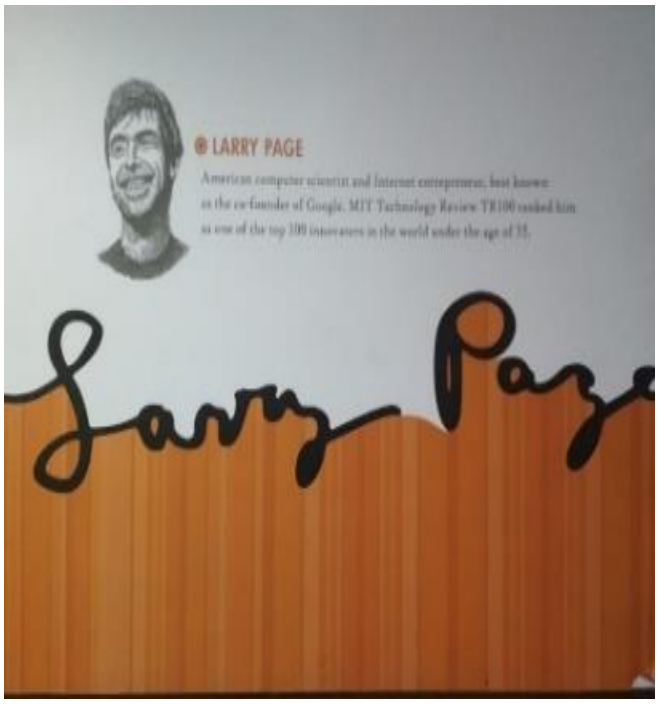
Special Education (Observation I, Class VII Student)

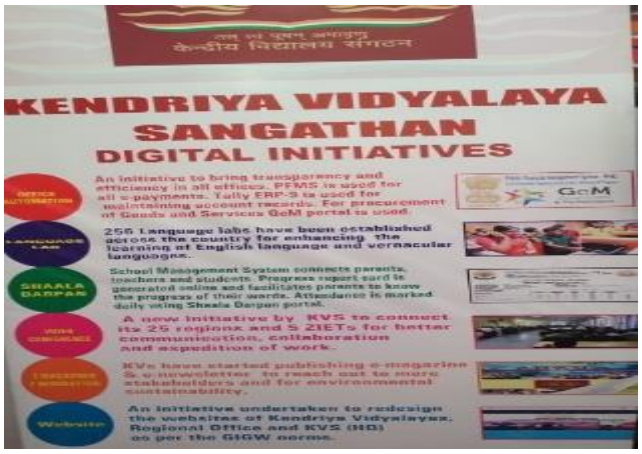
The teacher shared with the researcher that he takes the curriculum of the student's class and lowers the level for him/her to grasp it. He said there is a timetable followed for each student identified as the special child and there is audio-visual aid that he uses with them. There are three teachers dedicated to special education and these students have problems such as dyslexia, Slow learners, etc.

A student Vikrant reads Hindi matras from the book but the teacher reads the entire content along with the words he reads. The student fills in the blanks with the words from what he has read. Though the student can read the words, he faces difficulty in writing the same words. So, the teacher tells him to pronounce the words and then write. The question is, "*Gadhe jungle chod Kar Kahan phuche*?" ("Where did the donkeys go after leaving the Jungle?") The student can say orally, "*Gaon Phuche*" ("Reached village") but he faces difficulty in writing the same. The student is very happy that he can read the words now and tells the teacher happily, "*Me ab reading bhi kar Sakta hoon*." ("I can do the reading too now") The teacher

responds, “Yes. *Ab Ghar par aur practice Kar ke aana*.” (“Yes, now you do more practice at home and come back”.

P 1.1 Poster of 3D printing from the Qmark School	**Description**
	The picture explains the new curricular course-3D printing introduced in the schools as a part of co-curricular activities linked with ICT. It says that 3D printing could help build 3D models related with disciplines such as history etc. and be extremely useful for the school curriculum.

P 1.2 Wall Poster depicting role models from the Qmark School	Description
	The picture shows Larry Page(an American Computer Scientist) displayed as wall art in the school, as one of the inspirations for the students.
P 1.3 IT room depicting IT week in the Qmark School	**Description**
	The picture shows the IT classroom of the junior wing of the Qmark School, that is decorated for the IT week celebrations.
P 1.4 Poster depicting the funding agency for the IT room in the Beanbone school	**Description**

	The picture shows the poster by the funding agency in the Beanbone School that had set up the IT laboratory in the school.
P 1.5 Poster depicting government initiatives to digitize education	**Description**
	The picture shows a poster from an IT Mela at NCERT showing digital initiatives to include ICT in Government schools by the Kendriya Vidyalaya Sangathan.

<u>The Beanbone School</u>[16]

Sanskrit (Observation I, Class VIII-B, C)

This project was a part of the government's initiative to make the students familiar with the Sanskrit Language. The teacher was hired by the government to take the workshop in the school. As the class started, he spoke a Sanskrit bhajan in a loud voice and asked the students to speak after him. The students spoke whatever words they could understand at the first recitation. He emphasized the words again to make them comprehensible for the students.

[16] The Government School has been re-named as the Beanbone School for the purposes of this study and to maintain confidentiality.

When asked whether the students understood Sanskrit to be able to speak it, the teacher said, "*Hume to das din ki workshop leni hai. Usme poori Sanskrit to nahi sikha sakte. Bas bolna sikha sakte hain. Kuch shabad, kuch kavitayein or unke matlab bata sakte hain."*("We have to take the workshop for ten days. We can't teach full Sanskrit in that but only speaking. Some words, some poems and their meanings can be taught") The teacher continued with the Bhajan and the students tried to speak after him. After that, the teacher divided the class into groups as per the student's recitation skills and knowledge of Sanskrit. He gave them the paper with the Sanskrit Bhajan and asked them to learn it for the final event. The students chosen for the final presentation started preparing with the teacher. The teacher told the other students to read the given text with Sanskrit alphabets and shabads which the teacher had already covered in the class. While the teacher prepared the students with the Bhajan, he guided them on how to speak the Bhajan and where to emphasize better pronunciation. As the students in the other group started talking, the teacher said, *"Chup kar ke beth ke padho, varna class ke bahar nikal dunga."* ("Shut up and sit down and study, else I would send you out of the class") The students giggle among each other and start reading the text. The class ends and the teacher asks the groups to be prepared with the Bhajan for the next class.

English (Observation I, Class VIII-A)

The teacher called the students to the English lab. There was a projector with which she had already attached her phone to show videos to the students. As the students settled in the class, the teacher asked a boy named Guru to play the video. The students kept prompting, *"Ma'am, Bluetooth se connect karlo", "Data cable se connect karo."* ("Ma'am, Connect with the Bluetooth", "Connect with the data cable") The teacher tells the researcher, *"Apne ghar pe to me operate kar leti hun ye system but yahaan mushkil hai. Isi sab me bohot time kharaab ho jata hai."* ("I operate this system at my house but its difficult here. A lot of time is wasted in all this") As the system gets connected, the video explaining the planets of the Universe begins. The teacher refers to the parts of the cosmos that the video talks about and says, *"Iski discussion ki thi chapter padte hue?"* ("Had we discussed this while reading the chapter?") The students nod yes and continue watching the video. The video continuously plays and stops as the internet connection from the phone doesn't have enough speed to be able to run the video on the device. After a point, the teacher says, *"Me tumhe ye phone me dikha dungi. Ise band karo, bohot time waste ho raha hai."* ("I will show this to you on the phone. Switch this off, a lot of time has been wasted in all this") Rahul says, *"Ma'am, hotspot me aise hi chalta hai."* ("Ma'am, with

the hotspot, it works like this only") The teacher asks Lohit to close the system and asks the students to take out their books and notebooks. She says, *"Chapter to humne last time pad lia tha. Ab question answers likh lo."* ("We had read the chapter last time. Now write the question answers") The teacher starts dictating the question answers to the students.

English (Observation II, Class VII-B)

The teacher came to the class and asked the students to open their English literature textbooks and notebooks. She said, *"Ye last chapter humne ki tha na -The Girl next door."* ("We had done this last chapter-The Girl next door") Some students nod their heads, some say yes in chorus. The teacher continues, *"To aaj iske back questions khatam karte hain."* ("So, let's finish the back questions of this today") The teacher picks up chalk and asks the students to write the question-answers in their notebooks. She asks the first fill in the blanks from the students, "The girl sits in the _____to sing a song." The students shout, "Garden." The teacher asks the students to write a sentence in their notebook. The teacher further asks, "The girl found _____ in the Garden." Some students shout, "Diamond", "Pearl". The teacher continued with the third sentence, "The girl had a neighbor called _____" The students prompt the answer "Boy", "Riv", "Husband." A student Rajesh says, *"Ma'am, vo to stranger tha na."* ("Ma'am, he was a stranger, No?") The teacher says, "*Pehle English me bolo.* We will all speak in English in the English class. If we don't speak in English, how would we learn the language. *Koshish to karo*." ("First speak in English…Try it atleast") Rajesh says, "Ma'am, the boy was a stranger." The teacher says, *"Yes but pehle to vo ladka tha na. Bina baat kiye to sab hi stranger hote hain."* ("Yes but first he was a boy. Without talking, everyone is a stranger")

The teacher tells the researcher that though she tries to make the students speak in English, she has to support the same with Hindi as the students cannot understand the English language fully. She goes to the question-answers and asks the students to copy the same from the board. She writes elaborate answers on the blackboard looking at the textbook of the other class students and asks the students, *"Note down quickly. Nahi to I will rub it."* ("Note down quickly, else I will rub it") The students start noting down the answers. A student Yash asks his friend Ajay, *"Tu likh le, Meri copy bhar gyi hai. Me tujse Ghar jaa kar le lunga."* ("You write it, My copy has finished. I will take it from you at home") The teacher sees Yash saying that and says, *"Tumhaari copy kabhi bhi sahi hoti hai. Ye baad ke chakkar me exams aa jayenge or tum kuch kaam nahi kar paoge. Fir maangte rehna copy doosron se."* ("Is your

copy ever right? In this lieu of taking it later, exams would come and you won't be able to do anything. Then keep asking for the copy from others") Yash takes out another copy and starts noting the answers from the board. After the students finish writing all the answers, the teacher starts discussing the opposite words with the students. She says, "Now I will ask you a word and you have to tell me the opposite for that. *Opposite samajhte ho na. Ulta shabd."* ("…Do you understand opposite? Opposite word") The teacher says, "Positive." The students shout, "Negative", "Plus", "Attitude." The teacher re-iterates, *"Positive ka opposite- Negative."* ("Opposite of positive-negative") She further continues, *"Long ka opposite."* ("Opposite of long") The students shout, "Small", "Short", "Tall." The teacher clarifies, *"Long ka opposite small hota hai. Tall ka short hota hai."* ("Opposite of long is small, tall is short") The teacher completes the exercise and then says, "I will check all your notebooks in the next class. *Poora kaam kar ke laana notebooks next class me."* ("…Bring the notebooks with the full work in the next class") The bell rings and the teacher leaves the class for the next teacher.

Science

Biology (Observation I, Class-IX,X)

The teacher asks a student Sahil to call all the students of class IX and X in the TV(Television) room. It takes a while as class X comes first and then later class 9th students join in. The teacher asks the students of class IX to sit on the floor. She switches on the TV which has in-built content from an organization called Awasthi-for science and mathematics. Before starting the lesson, on being asked by the researcher, the teacher says that she often brings the students to see this content or sometimes she even shows them videos on her phone to the students related to biology. She adds that this content helps the students not just in understanding the content but also in, retention of the content. While opening the page for the content, she says, "*Me bhi ye bohot dino ke baad chala rahi hun, isliye bhool gyi hun ki kaise chalta hai."* ("I am also working on it after a long time, that's why I have forgotten how does it work.")

When she finally reaches the content after randomly pressing the buttons, she asks the students to look at the board and pay attention to the same. She says, "*Ab idhar dhyaan do*." ("Now pay attention here") She starts with the lesson, "*Ye parts of the plant to yaad honge. Leaves, stem, roots*." ("You would remember these parts of the plant. Leaves, stem, roots.") She points her finger at the text on the TV as she explains the content. She further continues as she moves to the next slide, "We saw types of leaves in our book. Now see the different shapes

of the leaves as per the requirement of the plant." She reads the content for the roots and stem of the plants along with the pictures and says, "*Ab ye questions attempt karte hain jaldi.*" ("Now let us attempt these questions soon.") She moves to the next slide and asks, "Which of the statements are correct? *Ye jaldi se likh lo saath saath.*" ("…Write this quickly together.") The students shout, "B" and write down the correct statement in their notebook. The teacher moves on to the next slide and asks, "*Isme se kaunsa correct hai*: a- Roots transport water to the plant, b- Leaves are always round in shape, c-Stem helps in transporting water." ("Which one of these is correct…") The students shout, "a and c." The teacher asks them to write it down quickly. She says, *"Paper me aise MCQ bhi aa sakte hain."* ("These kinds of MCQ can also come in exams.") She moves to the next slide based on fill in the blanks. She asks, "The external structure of the leaf is called ___." Some students prompt the answer, "Epidermis." The teacher says, "*Yes, likho jaldi*." ("Yes, write quickly.") She further asks, "The external part of the stem is called ____. " The students look confused and the teacher says, "Stem Epidermis." She moves on to the next chapter on Animals. The bell rings and the teacher asks the students to read the chapter and she would continue with the animal's lesson in the next class.

Science laboratory (Observation I, Class VII-C)

There was a science laboratory in the school named Aavishkar. This laboratory was used by a team of teachers associated with an organization that worked with the government for improving science education in the entire district. The laboratory was, therefore, not only used by this government school, the teachers used to bring students from other government schools to this school by bus for science-related activities and then, leave them back to the school when the activity was over. The laboratory had a blackboard in the front and two doors for ventilation as it was a bigger room. The walls of the laboratory were decorated with chart papers related to the science topics made by the teacher and the students. The laboratory had few models related to science such as a telescope, stethoscope, and so on. The students in this room sat on the floor with carpets laid out for them.

On one of the days, the teacher opened the door of the room and made the students of the other school sit for the class. The students removed their shoes and sat inside the room. She started with the topic of measurement with the students. She asked the students, *"Sab is taraf dekho or aaram se betho."* ("All of you see this side and sit") She said, *"Tumne science class me measurement padha hoga. Aaj hum usi pe activity karenge. Tum waapis jaa kar apni class or book se is activity ko jod ke bhi samajhna."* ("You would have studied measurement in the

science class. Today we will do activity on the same. When you go back, link this activity with your class and book and understand it") She adds, *"Agar hume is room ko measure karna hua to kaise karenge?"* ("If we have to measure this room, how will we do that?") The students prompt, *"Ma'am, haathon se", "thumb se", "scale se", "Lakdi se", "inchi tape se"* and so on. ("Ma'am, with hands", "With thumb", "With scale", "With a girl", "With an inch tape") The teacher said, *"Hum ek room ko bohot tareeke se naap sakte hain."* ("We can measure a room in many ways")

She divides the class into groups and asks them to measure the length and the breadth of the room using a scale. She gives the scale to the students, tells them that two students in the group should measure, the other two should write down and the next two in the group should re-check the measurement and the last two should convert the meter into centimeters. The group starts doing the given task by taking help from the teacher in between when required. As the work begins, one student Mayank from a group asks, *"Ma'am, kone kone se naapna hai ya thoda beech me se bhi kar sakte hain."* (The student smiles, shows them the line from where they should measure) ("Ma'am, Do we have to measure from corners or we can do a bit from the center too?") She says, *"Apni mathematics ki teacher se poochna ki agar kone se nahi naapa to naap kaise badal jaega."* ("Ask your mathematics teacher if you don't measure from the corners, how will the measurement change?") The groups start measuring from different directions. A student Rahul in one group tells his team members, *"Line bana lo copy me, 4 columns or usme sab likhte rahenge."* ("Make a line in copy, 4 columns and everybody will write in them") Rahul tells Piyush, *"Jab me yahaan scale rakhun to tu wahaan haath rakh dena jahaan scale khatam ho or fir aage wahin se naapenge."* ("When I keep the scale here, you keep your hand where the scale ends and then measure ahead from there only") The other groups too measure the dimensions.

The teacher roams in the class while the students are doing the task and tell the researcher, *"Ye activity me to scale de sakte hain to bachhe kuch seekte bhi hain. Par ye sensitive objects hum inhe nahi de sakte kyunki fir hume bhi aage se milte nahi hain. To ye cheezein dikha ke hi activity karwa lete hain."* ("In this activity, we give the scale, so students learn something. But these other sensitive objects we can't give them because we don't get them from the authorities. So, we show them these things and do the activity") When asked about the purpose of this endeavor, the teacher says, *"Dekho waise to in bachhon ko kam hi mauke milte hain kuch activity karne ke, is lab ke bahaane ye kuch naya bhi seekh jaate hain*

or inki knowledge bhi achhi ho jati hai. Is se ye science ko practically bhi samaj lete hain." ("See, otherwise these students get less chances of doing any activity, they do something new in the purview of this lab and their knowledge also increases. With this, they can even understand science practically") As the students finish measuring one side of the room, a student Sakshi asks the teacher, *"Ma'am, ye doosri taraf se bhi naapna hai?"* ("Ma'am, we have to measure it from the other side too") The teacher says, *"Nahi, tumhaare group ne bas length naap li, tum usi ko add karo or betho apni jage pe."* ("No, your group has measured the length, you just add that and sit at your place") The teacher asks the other groups to do the work quickly too as they have to return to their school. The teacher tells the researcher, "Sometimes they prepare the students for the competitions too and take them to the science-related places too." When asked about their job and salary, she told the researcher, "Their job is contractual and they are paid by their agency though it comes from the government's project." She asks the students to finish it as soon as possible.

When the students finish the work, she asks the two groups who have measured the length to compare it. Though one group counted it as 63.2 meters and the other counted it as 65 meters, the teacher asks them to take it as 64 as there can be some discrepancy and convert it into centimeters. She, then, asks the other two groups to compare the breadth and convert it into centimeters. As the class ends, she asks the students to keep the scales back and relate this activity with their mathematics and science classrooms by telling their teachers about it.

Information Technology (IT) in the School

The school had one IT room and one small computer adjacent to the Principal's room for all the administrative work of the school. This work included examination marks uploading, setting the question papers, seeing the events and competition updates for the states, finding out information related to subjects, and so on. The Principal also had a computer in her room but that was for exclusive use by the Principal.

There was a TV in the school along with the DTH connection but it hardly used to work. The teachers told the researcher that it used to work earlier and the students were shown DTH programs on those channels. But it has been a long time since it stopped working and it hasn't been repaired since then. The room had the device but it was now used by the school as an extra room.

Another room in the school had a functional TV that was installed by the organization. This organization had installed the device along with the science and the mathematics content for classes IX onwards. The teachers never used the device for any other purpose except showing the content already installed in the device. This content had MCQ'S, quizzes along with an explanation for the curricular topics which were a part of the course for these classes. This room otherwise remained locked as the students could tamper with the device.

The IT room in the school too was set up by a company called Expeditors as a part of their CSR initiative for imparting digital literacy in the schools. It was set up a few years back and has been functional in the school. The government too had introduced a syllabus for IT as a vocational subject which required a functional laboratory and a full-time teacher for the same. This laboratory had about 40 computers but about 5-6 were non-functional. Earlier, the room had a projector too but it was removed due to various reasons. This was a separate room, other than the school building constructed specifically for IT purposes.

IT (Observation II, Class IX-B)

The school has IT as a subject from class IX-XII. It has a computer lab funded by the Corporate Social Responsibility (CSR) project of a Non-Governmental Organization (NGO) from classes I-V, the classes for which take place in another building. For classes VI-VIII, the school doesn't have any computer or IT related subject. The school has classes for one hour.

The students are given various subjects to choose as a vocational subject from options such as geography, biology, etc. Due to the scarcity of staff recruitment, the school has only one vocational teacher, which is, for the IT subject. The books for the subject are installed in the computer system, so the students don't carry any books. As the tests for the students had to start from the next day, they were studying for it during the IT period. The teacher opens the book in a system and starts revising the content for the exam with the students. She says, "Protocols-property- *lene se Pehle* (Before taking), open-source- easy and publicly used, windows- online and free, its property, Linux is easy too, you would find it on google, apple-mac, net wire-windows, *ye humne padhe the- ye bhi property ke under aayenge- isme license Lena hota hai, jab take permission nahi late, key Dalai Hoti hai activation ki*."("…,We had read these-these will come under property- We have to take license in this, until we take permission, there is a key lock for activation"?) The teacher tells the class, "*Baaki bacchon ko*

dekh taaki me aage shuru karwaaun." ("See the other students so that I can start ahead") The girls open their books on the screen.

The teacher tells the researcher that this lab had been installed in the school one year back and it is a CSR project of a company. Ridhima tells the teacher, "Ma'am, *Sahil ki tabiyat theek Nahi hai, isliye vo school nahi aaega."* ("Ma'am, Sahil isn't well, that's why he won't come to school") The teacher starts with the lesson and explains, "*Jaise Ghar pe landline hoti hai, hospital me landline Hota hai hair room me, waise hi IP address hota hai. Do tareeke ke IP address hote hain- public and private. Public me -Har ek ka Alag identified number Hota hai, khareedna Hota hai Jaise BSNL. Aur Private ko khareedna Nahi Hota, within the organization use hota hai- hospitals, etc me- 1+, 2+, etc. Purabi lab me aise hi IP address tha."* ("Like there is a landline at home, there is a landline in hospital in every room, similarly, there is the IP address. There are two kinds of IP addresses-Public and Private. In Public-there is a separate identified number for each, it has to be bought like BSNL. And private doesn't have to be bought, it is used within the organizations like in hospitals etc.-1+, 2+, etc., Purabi lab had this kind of IP address")

The teacher reads the explanation for the same from the book. She tells the students, "*Command Chala Ke Dekho.*" *("*Use the command and see*")* Tilak asks the teacher, "*LAN kya hota hai?*" *("*What is LAN*?")* The teacher replies, "*4 parts hote hain, 2 inches by 32*." *("*There are 4 parts, 2 inches by 32*")* Tilak asks, "*Exam me Aayega*?" *("*Will it come in exam?*")* She looks at the computer and says, "*Vo 256 tha, 0-255 ki range. CMT likho*." *("*That was 256, in the range of 0-255*")* Gaurav says, "*Ma'am, isse bhi show Nahi Kar Raha.*" *("*Ma'am, it is not showing even with this*")* The teacher further explains, "*Ye cellphone ki Tarah hogya. Jab humne google chrome Khola, left side pe IP address dikhataa hai. Jab online shopping karate hain, tab bhi site se connect krna hai, to Hume IP address Chahiye Hota hai. Jaise humaare phone numbers Regional Internal Trajectory manage hai, Ek authority manage Karti hai. Mene Airtel ka sim khareeda, but vo to Airtel se khareeda."*("This is like cellphone. When we opened google chrome, IP address hows on the left side. When we do online shopping, it connects with the site, then we need the IP address. KartaLike our phone numbers are managed by Regional Internal Trajectory, one authority manages it. I have bought airtel sim, but that is from Airtel") The teacher translates all lines from the book in Hindi. She says, "*Agar Ghar pe 3 address hain, to vo change ho sakte hain par Mac address nahi change hota. Dynamic itna secured nahi hota jitna static secured hota hai. Internet public hota hai aur intranet private*

hota hai. IP address ki range hoti hai, number of addresses hote hain. 10.0.0- 4 segments, 10.25.5. Ye yaad rakhlo- kahaan ek hi connection- vo public, baaki private." ("If there are 3 addresses at home, they can be changed but Mac address can't be changed. Dynamic is not as secured as static is. Internet is public and the intranet is private. There is a range of IP addresses, there are several addresses. 10.0.0-4 segments, 10.25.5. Remember this, Where there is one connection- that is pubic, others are private") She adds, "*4 classes rehti hain networking ki, agle session me hogi, last chapter me samajh aa jaengi."* ("There are 4 classes of networking left, will be in the next session, You will understand them in the last chapter")

The teacher tells the researcher that they can understand the basics until class XI. She tells the class, "*Last time commands karwaai thi na- Get net, vo IP address ki complication hai. IP address ke assignment ke topic likh Lena. Suppose BSNL pe call Kia, is number pe call Kia to admin se manage hota. Agar customer care pe karate hain to bhi waise hi manage hoga. Jo IP address ka assignment karate hain, vo alag servers hote hain. Do tareeke ke hote hain- system ki booking ya private or dynamic. DPCC server ka use karate hain- full form- Dynamic control post protocol. Diagram dekho- Individual address- static ka example hai-sabko range de di hai.*" ("I had taught commands last time- Get net, that is a complication of IP address. Write the topics of the assignment of IP address. For instance, you call on BSNL, if you call on this number, it will be managed by the admin. If we make the call to the customer care, it will still be managed in the same way. Those who assign the IP address are different servers. They are of two types of system booking-private or dynamic. They make use of the DPCC server, full form is Dynamic control post protocol. See the diagram-Individual address- it is an example of static-a range is given to all") Sanya asks, "*Range ke Upar add nahi kar sakte."* ("We can't add above the range") The teacher replies, "Agar registry Kari to add kar sakte hain." ("If the registry is done, then it can be added") She continues, "*Jaise 10 system hain, sabke different IP address hain, Burcose- communication ke Liye, connection ke lie nahi hai."* ("Like there are 10 systems, they all have a different IP address, Burcose is for communication, not for connection")

The teacher shares with the researcher that some of her students are 10th pass, they did the course and are doing well now. The students start getting a little distracted now. The teacher further reminds the topic to the students, "*Identical number with the previous number, switch, router, second layer, data transfer equal stage pockets, do cheezein reh gai, vo yaad rakhna hai. Next ping, type command. Network ki connectivity check Karne ke liye ping. Jab hum*

connectivity lete hain to kya connect kar ke chord dete hain. Testing sirf mobile pe, computer pe attach kar ke dekhte hain." ("Identical number with previous number, switch, router, the second layer, data transfer equal stage pockets, two things are left, remember that. Next ping, type command. To check the connectivity of the network, ping. When we take the connectivity, what do we connect to give the chord? Testing only on mobile, we attach it on the computer and see")

The teacher starts reading from the book and continues, "*Jab mail nahi aati to mail id exist nahi karti. Kya vo Saath Saath aati hai, time lagta hai na. Ping-communication- call to the destination- receive to preparation back- round trip- ye process hota hai."* ("When mail doesn't come, mail id doesn't exist. Does it come together, it takes time. This is the process-Ping-communication-call to the destination-receive to preparation back-round trip")*The students sitting in front are not looking at the book. Thoda Dimaag laga ke Padho, tabhi samajh aayegi. Mail Nikalo Purani, 3rd December ki. baaki kaam bhi hai* ("Use your mind while studying, then only you will understand. Take out the old mail of 3rd December. There is other work too")

Dhairya asks, "*IT ka syllabus kya hai?"*("Do you have IT syllabus?") The teacher replies, "*9 sessions, starting se. OSI rata dia hai. Itna kar Lia, Dhyan se dekh lo.*" ("From the starting, 9 sessions. I have made you mug up OSI. You have done this much, see it properly") Some students open paint, pictures, and explores excel, changes the background, desktop, and PPT. Yash says, "*Syllabus zaada hai. 11th class Rehne dete hain."* ("Syllabus is more. Let us leave XI class")

IT (Observation III, Class X-A)

The teacher opened the IT lab along with the researcher. She had a class with the students of class 10th. After waiting for about 10 minutes, some girls came and told the teacher, *"Ma'am, kuch boys to garden activity ke liye gaye hue hain."* ("Ma'am, some boys have gone for the garden activity") Sunaina added, "*Ma'am, or kuch boys to khel rahe hain, vo nahi aa rahe."* ("Ma'am, some other boys are playing, they are not coming") The teacher asks Nayani to call the boys from the playground and says, *"Arey ye gardening kisi or period me nahi ho sakti thi. Ab aaj ki class to aise hi miss ho jaegi, waise bhi exams aane wale hain."* ("Ohh! This gardening couldn't happen in some other period? Now today's class will be missed just like that, anyhow exams are also very near")

Nayani enters the class with the other boys. The teacher asks the boys, *"Kyu games period hai?"* ("Why? Is it games period?") A boy Ram replies, *"Ma'am, hum to aa hi rahe the."* ("Ma'am, we were coming only") The teacher asks the boys to take their computers and even the girls to take their computers in front. Though there are many computers in the lab, not all of them are working. The students have designated places and they go and sit on their computers. The teacher asks them to start practicing the PowerPoint for the upcoming mega parent-teacher meeting in the school. The students start making the slides. The teacher says, *"Ek hi ghanta hai tumhaare paas. Ye nahi ki lage raho or khatam hi na ho."* ("You have only one hour. Don't just be involved in it for long and it doesn't even finish") As the teacher takes a round of the class, the students ask queries from the teacher. A student Bharti asks, "*Ma'am, slides kitni bhi bana sakte hain?"* ("Ma'am, Can we make as many slides?") The teacher replies, *"Haan but main points pe focus karo. Sikhaaya tha na ki slides me excessive information nahi honi chaiye."* ("Yes but focus on the main points. I taught you that there shouldn't be any excessive information in the slides") The teacher comes to the back and sees the slides made by Shikhar. She says, *"Ye achi bana raha hai. Dekh isme border add kar."* ("She is making good one. See, add border in this") As the teacher moves ahead, Tejas sitting next to Shikhar says, *"Ma'am, slide show karke dikhaun?"* ("Ma'am, Should I show you the slide show?") Tejas starts the slide show and it doesn't work properly. The slides move very fast as he had set the time for them accordingly. The teacher tells him, *"Properties me ja, time change kar, ab dubaara chala."* (She guides him on the computer as she says this) ("Go to the properties, change the time, now start again") She adds, *"Thoda font bold kar. Aise parents pad kaise payenge."* (The teacher has asked the students to prepare the PowerPoint presentation and the best one would be shown during the mega Parent-teacher meeting*)* ("Bold the font shape. How will the parents be able to read like this?") The students add borders, colors, and pointers in the PowerPoint presentation to make it more appealing. As the teacher moves to other students in the class, she sees Dhruv's work. She speaks loudly, *"Ye dekho Dhruv ne kitna badiya banaaya hai."* ("See Dhruv has made such good one")

The other students stand up from their seats to see Dhruv's PowerPoint presentation. He starts the slide show for his PowerPoint in which he has written the heading in slant font, vibrant colors for the slide and added five slides with apt headings such as welcome slide, a slide for exhibits in the Parent-teacher meeting, a slide for events that the students participated in, another slide for giving directions to the students and so on. The teacher asks the other students, *"Jaldi khatam karo, bell hone wali hai."* ("Finish it quickly, the bell is going to ring")

Some students first add borders and wallpapers to the slide and then, write the content for the slides. Some other students show their slideshow to the researcher as well. As the bell rings, some students have not completed their PowerPoint slides, they save whatever work they have done and move out for the next class.

Retail (Observation I, Class IX-A)

The students come to the retail lab after the bell rings. The laboratory is decorated with product cans, charts, and materials required for a practical demonstration. The teacher says that she had just joined the school a year back after another teacher from the school got transferred to her school. She tells the researcher that even the course for retail as a vocational subject was introduced only a few years back in the school. She told the researcher that in a year, the students are taken once to a mall or shopping complex to practice the retail skills at the counters of stores such as big bazaar, etc. She was unsure as to what topic to start in front of the researcher.

She asks the students to open their books and revises the customer relations chapter with the students. She asks the students, “Tell me about the first step you take while selling your product?” The students look at their books and say, “Introduce the product.” The teacher continues with the chain for the product and says, “First introduce yourself, then the product, know the choices of the customer, know the habits of the customer, strategize your selling strategy and then sell the product.” She asks the students, “Tell me the components of marketing?” Avni raises her hand and says, “Market Research.” The teacher looks at others and asks, “More?” Darshan gets up and says, “Market view.” The teacher says, “That is not a part of the components of marketing. That side no one would raise hands.” The teacher asks Tanmay to stand and answer. Tanmay stands up, thinks for a while, and says, “Target Market.” The teacher asks the students to look into the book and see the next steps, “Market strategy, Budget.” The teacher, then, reads the next section on product details from the book such as manufacturing date, expiry date, price, and so on. She asks Prateek to pick up a sample can and show the details to the students. She tells the students, “It is important to see the price while buying and tell the details to the customers while selling.”

Arts (Observation I, Class VII-B)

The teacher entered the class as the period started. She asked the students to take out their art books and notebooks. As some students look here and there to arrange for a book from their

friends, the teacher asks them, "*Aaj pta nahi tha period hai. Fir bhi book nahi lekar aaye*?" ("You didn't know you had period today? Still you didn't get the book?") The students reply, "*Ma'am, bhool gye*", "*Book fat gayi hai*" and so on. ("Ma'am, we have forgotten", "Book is torn") The teacher tells the researcher, "*Ye artbook to dubaara khareed nahi sakte, isliye jis copy me bhi karein, hum zaada kuch kehte nahi hain*." ("They can't buy this artbook again, that's why in whichever copy they do, we don't say much to them.")

The teacher asks the students to concentrate on the blackboard and says, "*Pichli class me humne freehand drawing of figures practice kari thi. Ab page number 67 nikaalo. Ab hum drawing of figures ki technique seekhenge*." ("In the last class, we had practiced freehand drawing of figures. Now take out page number 67. Now we will learn the technique of drawing of figures.") She draws a circle to represent face on the board, then draws the rest of the body parts including the chest, stomach, hands, and legs. She divides all the body parts symmetrically into length and breadth. She says, "*Hume koi bhi body part draw karna ho, vo dono taraf symmetrical hona chaiye. Matlab line ke dono taraf head ka same portion aana chaiye, legs ka same and so on."* ("If we have to draw any body part, it should be symmetrical from both sides. It means the same portion of head should come on both sides, same of legs and so on.") She further adds, *"Jab tumne last class me free drawing ki thi, to tumhaare figures kaise tedhe medhe ja rahe the. Ye aaj jo hum practice karenge ise stick drawing kehte hain. Ise practice karne ke baad tum kabhi bhi figures ki drawing galat nahi karoge."*("In the last class we had done free drawing, so our figures were going haywire. Today what we will practice is called stick drawing. After practicing this, you will never go wrong with practicing drawing of figures.")

She asks the students to start the drawing using the technique and she would come and see it on their desks. Some students start drawing sincerely and some others start looking at the other's desks for books to be able to see and draw. The teacher tells the researcher, *"Ye drawing skills seekhne ke chance in bachhon ko or jageh to milte nahi hain, kuch to yahaan bhi seriously kaam nahi karte. In bachhon me se kuch to bohot achhi drawing karte hain. Ye competitions me bhi ja sakte hain. But ye drawing ko seriously lete nahi hain. Fir bhi me bol bol ke koshish karti hun ki kuch to seekhein."* ("These students don't get this chance of learning these drawing skills anywhere else, some don't even work here seriously. Some students among these do very good drawing. They can even go in competitions. But they don't take drawing seriously. Still I keep saying and try that they learn something.") Some students use a compass to make a

drawing. The teacher tells them, *"Compass use karke nahi banaani. Aise to drawing kahaan rahegi, mathematics ki figure ho jaegi. Scale use karlo bhale hi, par koshish karo ki khud banaao."* ("Don't use the cmpass in making it. Otherwise it won't be drawing, it will be a mathematical figure. Use the scale if you wish to but try to make it on your own.") The students keep the compass inside and continue with the drawing.

As the teacher goes out of the classroom to talk to another teacher, the students start talking and moving from their places to the seats of other students. They show their drawings to each other and ask, *"Sahi banaaya hai na?"* ("Have I drawn it correctly?") They even laugh at each other's drawings and their mistakes. A student Harsh sees the drawing of his friend Farhan, laughs, and says, *"Abey, ye kya banaaya hai. Ye dekh(shows his drawing). Pehle figure bana, fir divide kar do parts me."* ("Ohh! What have you made. See this. First, draw the figure, then divide it in two parts.") Some students make excellent figures using the same technique and continue with the other pages of the book as well. The teacher enters the class and says, *"Ghar se ye practice karke aana. Or time dekh ke practice karna. Ye nahi ghanto bhar lage raho isi me. Exam me ek ghanta hi milega."* ("Practice this from home. And see the time while practicing it. You don't have to keep sitting with it for hours. You will only get an hour in the exam.") She picks up her books and leaves the class as the period has got over.

Mid-Day Meal (Observation I)

The teachers in this school were required to update information about the Mid-Day meal on the government's portal through their mobile phones. They were required to fill how many students took the meal, how much was left, which classes were served the meal, the name of the vegetables, their quality, and so on. Also, the next day they were required to count the number of students and fill in information about the present and absent students on the portal for the mid-day meal to reach the school according to the number of students. The mid-day meal in charge was supposed to perform all these duties. When asked about the quality of mid-day meal in the school, she said that most of the students didn't like the food and the milk being served in the school. She said that earlier, the food used to be cooked in the school but now, there is another private agency that supplies the food in the school. When the researcher enquired whether they told the agency about the quality of the food or the teachers checked whether the food was good or not, the in-charge said that though cooking in the school was better as the teachers could get the vegetables themselves, they could see how the cook is cooking the meals and serve it hot to the students, it required a lot of extra work for the teacher

which became a headache for the teacher. The teacher said that she was already overloaded with uploading the information about the mid-day meal every day on the Government's portal. She also added that the food served by the agency was not good, so some of the students got their lunch from home. She told the researcher that the milk being served was powdered milk with some flavor that if one tries it, one could vomit. The teacher said that some students used to take the warm milk and throw it in the washbasin or vomit it out. There were two breaks in the school, one for milk and one for lunch. For taking this milk, the students had to go to the last room in the school, take the milk, drink it, and wash the glasses. The teacher said that though the milk was not good which the students told the teachers, the teachers still insisted the students take it because they couldn't even afford this at their homes. She said that at least through this milk, they would get some nutrition which they were deprived of at home. The teacher also shared that sometimes, the students were also given iron tablets for health benefits.

Medical Check-up (Observation I)

The Haryana government in association with Wellness Path labs had organized a free medical check-up for the students and the teachers of the school. The laboratory people were given Direct-to-Home(DTH) television room and all the students were called on one by one to get their weight checked, their blood test was done and their blood pressure checked. The reports for the same would be given to the school authorities in a week after assessment along with the remedial measures suggested in the report. Though the students kept going class wise during the entire day, the teachers went whenever they got the time in the entire day.

Assembly (Observation I)

The morning assembly for classes VI-VIII was held separately. The morning assembly for classes IX-XII was held separately as these two wings were considered separate by the school. The school had won 1st prize in the science competition in the entire district and so, a special assembly was kept for classes IX-XII to give the prize to the student and the teachers. The assembly started with the teachers arranging the students class wise. The physical education teacher on the mike started with the exercises to warm up the students. He said, "Ready, Attention." He continued, "Left, Right, Left. Left, Right, Left. Move your hands when you are doing the exercises." He asks the students to maintain one arm distance as they do the exercises and after that. As he stops the exercises, he tells the students to fold their hands for the prayer. Some students on the stage recite Gayatri Mantra along with the poem- "*Itni shakti hume dena*

data." ("Give us that much strength, God.") All the students in the assembly are given the time to speak after them.

As the prayer ends, the teacher tells the students to sit for the assembly. It was class XI-B which had prepared the assembly that day and so, one student of the class speaks a general thought in Hindi. After that, some students explain a curricular topic "*Sandhi*" ("Noun"), and translate one sentence into various languages such as Bangla, Maithili, Bhojpuri, and so on. The class teacher of the class adds, "*Ab hume yaad rahega na sandhi kya hota hai. Kya kehte hain ise Maithili me? Abhi bataaya hai, aur abhi hi bhool gaye honge. Kyu Nisha, kya bataaya hai?"* ("Now we will remember what is a noun. What do we call it in Maithili? I have told you just now and you have forgotten. Why Nisha, What did I tell you?") Nisha smiles as she can't recall what has been taught to the students. The teacher repeats the same sentence in Maithili and says, *"Yaad hai na last week bhi Maithili bhasha ke baare me bataaya tha. Jo bhi yahaan bataate hain use yaad karne ki koshish kia karo."* ("Remember, last week too we told you about Maithili Language. Whatever we tell here, try to remember it.")

As the assembly ends, the principal takes the mike and greets the students. She asks the students, *"Ab next week se exams aane waale hain. Pat hai na sabko?"* ("Now from next week exams are going to start, you all know that?") The students shout yes in the chorus. She continues, *"Preparation to chal rahi hogi. Teachers bhi karwa rahi hongi or aapko bhi ghar pe khud se bhi karni hai. Ye exams ko final exams ki tayaari samajhna or iske marks to 5 me se add honge hi finals me. To kahin bhi koi kami nahi rehni chaiye. Agar koi doubts hain to isi week apne teachers se pooch lo. Abhi ache number laoge to aage jaake kuch banoge. Aapke parents Parents-Teacher Meeting(PTM) pe kehte hain na humaare bachhe kuch ban jaayein. Vo tumhaari mehnat se hi hoga. Ab dekho aaj assembly me Simar Bachhi ko award milna hai. Kuch bacche hote hi ache hain. Padaai me bhi bohot ache number laati hai. Or me announce kar du, ye poore Haryana district me humaare school ke liye first award lai hai science competition me."* ("Preparation would be going on. Teachers would be doing it, you would be doing it at home yourself too. Consider these exams as a preparation for final exams and these marks would be in any case added in the final exams out of 5. So, there shouldn't be any bit left from anywhere. If there are any doubts then ask your teachers this week itself. If you get good marks now, then you might become something. Your parents say during PTM that our children should become something. That would happen with your hard work. Now see today in the assembly, Simar child will get an award. Some students are very good. They get very

good marks in the studies too. And let me announce that she has got the first award in the entire Haryana district for our school in the science competition.") All the students start clapping and Simar goes to the stage. The principal hugs Simar and says, *"Shabaash. Aisa nahi hai aap log nahi kar sakte. Bas mehnat nahi karte or aalas karte ho."* ("It's not you guys can't do it. You just don't do hardwork and procrastinate.") She further says, *"Iski mehnat ke peeche humaari teachers ka bhi haath hai. Especially Seema ma'am, jinhone is ek mahine se itni achi tayaari karwayi. Humaari school ki saari teachers ki bohot achi hain, inki mehnat ki wajeh se humaara school number 1 hai poori district me. Ek baar teacher's ke liye bhi taaliyan bajaao."* ("Besides her hardwork, our teachers are also responsible. Especially Seema ma'am who worked hard for an entire month with her and prepared her well. All the teachers of our school are very good, due to their hardwork, our school is number 1 in the entire district. For once, clap for these teacher's too.") All the students and the teachers clap for the teachers. The principal says, *"Ab exams ke lie good luck to you all. Mujhe umeed hai ki aap mujhe niraash nahi karoge or bohot acha result laoge. Hai na?"* ("Now for exams, good luck to you all. I hope you will not disappoint me and get good result. Isn't it?") The students shout, "Yes ma'am." The Principal says, *"Ye simar ki tareh piche saal bhi vo abhishek ladka tha. Uski mummy kehti rahi ki uska school change karengi. Humne unhe convince kia ye bacha is school me acha karega or dekho uska result. Agar tum acha karoge to har school tumhe rakhna chahega. Now good luck to you all. Do well."* ("Like Simar, there was a boy named Abhishek last year. His mom kept saying that she will change his school. We convinced her that this child would be good in this school and see his result. If you do well, every school would want to keep you….") The physical education takes the mike, asks the students to stand up, starts with march pass with the students, and tells them to disperse one by one to their classes.

School Visits (Observation I)

During the course of the fieldwork, many teachers went for various refresher courses, competitions, and events related to the school, its students, and its progress. For two days, the IT teacher in the school along with the teacher who taught retail as a subject was sent to some other school in Haryana for a refresher course related to their subjects.

The science teacher was preparing the students for a month for a debate and quiz competition to be held in Rajasthan. The mathematics teacher accompanied her along with the students for the same for 10 days. The science teacher told the researcher that this trip was for an educational trip for which the school got funds from the Government. So, every year they

took students for one such trip. The teachers planned to make students participate in the event along with the site visit to various historical places in Rajasthan.

School Examinations (Observation I, Class VI-VIII)

During one of the weeks of the observation, the mid-year examinations for the entire school had started. The students for classes VI-VIII had two examinations in a day-one before lunch and one after lunch. The students of classes IX-XII had one examination in a day considering the difficulty of the course content. This was the time of December and therefore, chilling winter when the examinations had begun. The school received the question papers from the government department on the day of the examination. The teachers opened the seal, checked the serial number, and reported it to the Head of the Department for uploading on the government website. The teacher-student ratio in the school was around 1:50 students. So, for the purposes of examination, the teachers asked one student to sit on a desk and chose the other students to sit on the floor outside the classroom, along with the wall of the classroom. This was done so that there was no cheating by the students during the examinations. The students kept pushing each other as they sat on the floor. The girls of class VII sat with their legs close to their bodies to avoid the cold weather. A student Netan of class VII peeped out of the window of the classroom to see the students sitting on the floor close to the window and said, "*Inse pooch lenge."* ("We will ask them") He asked Shailja, *"Bata degi yaha se?"* (" Will you tell from here?") Shailja smiled and the teacher asked him to look inside and close the window.

As it was chilling cold, the researcher asked the teachers why were the students sitting on the floor? The HOD immediately ordered all the students to go back to their classes. The Head of the Department along with the other teachers planned to shuffle the students to avoid cheating. For instance, class VII students who had an English examination were made to sit with class VIII who had their mathematics examination, and so on. The Head of Department immediately went to all the classes and asked the students, *"Sab ne paper ke liye achhe se tayyari ki hai na?"* ("Have you all prepared well for the exam?") The students shouted, "Yes, Ma'am." She further said, "*Dhyaan se paper padna hai, fir jawaab likhna hai. Jaise Principal ma'am ne assembly me kaha tha, jiske Bohot ache number aayenge, use prize bhi milega. Good Luck"* ("Read the paper carefully, then write the answer. Like Principal ma'am said in the Assembly, whoever gets good marks will get the prize. Good Luck.") When the papers were distributed, the subject teachers went to the required classes appropriately to either explain the questions or identify any mistakes in the paper.

As the researcher was sitting in one of the classrooms during the examination, a mathematics teacher came and wrote all the questions on the blackboard as she announced the same. She told the researcher that though the school teaches mathematics in English, the entire district has Hindi medium schools and so, the examination paper was made in Hindi by the Government authorities and sent to all the schools. The teacher, then, had to translate the paper into English and dictate it to the students along with writing the same on the blackboard. The teacher said, *"Question number 3 me has given numbers ka ratio nikalna hai. Humne methods padhe the na ratio nikalne ke, unme se koi bhi ek method ko follow kar sakte ho."* ("In Question number 3, you have to take out the ratio of the given numbers. We had read the methods of finding out ratio, follow any one method amongst them.") She further added, *"Question number 4 to simple hai."* ("Question Number 4 is simple.") A student Yash said, *"Ma'am ye to division se hoga."* ("Ma'am, this will happen with the division.") The teacher continued, *"Question number 5 me aankadon ka matlab figures hai. To given figures ka area nikalna hai."* ("In Question number 5, aankadein means figures. You have to find the area of the given figures.") The teacher writes on the board as she continues with the explanation and the students copy the same in their paper.

As there was no teacher in the next room, so the researcher goes into another room to invigilate the examination. The students stop talking and focus silently on their paper. A Student Gaurav tells the researcher, *"Ma'am, mera ho gya."* ("Ma'am, mine is done.") The researcher goes to his seat and sees that he hasn't done all the questions. The researcher reads the unattempted questions, explains the same to him in Hindi, and asks him to write something in the space provided. Similarly, the researcher tells the other students to revise their paper before submitting it. Another student Urvashi asks the researcher, *"Ma'am, iska answer kya hoga*?" ("Ma'am, what will be the answer for this?") The researcher explains the meaning of the question in Hindi and says, *"Ye chapter kia hoga na tumne. Usme ye character tha? Ab batao us Character ke baare me jo bhi padha hai."* ("This chapter that you have done, it had this character? Now tell about that character whatever you have read about it.") She becomes excited, goes back to her seat to write the answers. The Head of the Department enters the room and tells the researcher to take a break since there was nothing substantial happening in the classrooms during the examinations.

The researcher moves to the next classroom to observe the students giving the examination. The students at the second last and last benches try to cheat from each other but

stop it as soon as the researcher reaches their place. A student Piyush asks Bishan, *"Yaar apni sheet idhar kar le."* ("Friend, move your sheet here.") Bishan gives his exam while he moves his sheet on the other side to make it visible for Piyush. The girls sitting on two separate rows sit quietly to attempt their examination with some of them thinking about what to write. Some of the students on the last benches even try to open their textbooks to see the answers. The art teacher enters the classroom and asks the student to quickly finish the paper and do it well because their marks will be added in the report book. The examination ends, the teachers collect the answer sheets and the students disperse to take their mid-day meal before they start with the next examination. Some of the students start revising for the second examination. The teacher shares with the researcher that since these students are small in an age in comparison to other classes in the school (class IX onwards), they are given rest and time to eat before they sit for the next examination.

Summary

The chapter demonstrates the discipline-specific interactions in the domain of ICT as well as a Non-ICT classroom. It furnishes examples from the two schools and their classrooms structured around the teaching of specific disciplines. It narrates the conversations between the teachers and the students, the accounts of the teacher's narration, the intervention of parents in the schools, the perspective of the principal, the outlook of the corporates entering the school systems on ICT and education. It enunciates the everydayness of ICT in the classrooms vis-à-vis the policy documents that celebrate ICT and the conflicts that emerge in between the two. The chapter weaves a story around discipline-specific narration of usage of ICT from two schools in Delhi-NCR and opens the field for the reader to implicate the same.

Chapter 5

The Ramifications of ICT in the School Systems

Introduction

The ICT has increasingly become indispensable to the education system across the world. As technology drives many of the domains of our life today, the students should be aware of the latest developments to become an important part of society. This is possible, according to Monica Kandhari, by introducing and teaching technology-oriented courses in education both in schools and institutions of higher learning (Kandhari, 2019). Although there are many other reasons for introducing technology in the education systems worldwide as have been mentioned in the previous chapters, it is vital to see the involvement of the students and the teachers on these digital platforms to understand its relevance. One of the ICT conferences held in the northern part of India has reinstated the increasing importance of ICT in the educational systems and a participant of the event stated that:

"*In Jakarta, if a student has a youtube channel with minimum 10,000 subscribers and 1 lakh views, he/she is offered a position/enrolled in the University"*.

One's popularity on social media platforms is seen as a guarantee for getting admission to the University. This would tell us that the importance that digital mediums have gained in our psyche very closely. This is a profound move, irrespective of the aims behind such a move, as it recognizes one's work on social media for educational grounds. Another example from the Qmark school depicts the number of students engaging with these digital media platforms, especially social network applications. The data from the students of Qmark school depicts that about 97.3% of the students know social networking profiles/apps and approximately 93.1% of the students use social networking profiles/apps, quite a huge number from the entire sample of students.

As digital mediums have already entered our lives, our minds, and the education system, it needs to be seen how are they imagined to be integrated with the education system for delivering better results. Though the pros and cons of the ICT in education have been discussed in the previous chapters, this chapter would elaborate upon the insights from the field and its analytical outcomes. These insights would further aid in developing an understanding

of how technology has entered the sphere of education, its implications, and its integration in the education system in the coming times. It would critically dwell upon the diverse issues that emerge as technology becomes an important part of the education systems and its ramifications for society as a whole.

ICT Infrastructure in School

It has been discussed earlier that there is a need for technology in the schools due to many factors such as the increase in presence of technology in other domains of our lives due to the prevalence of technocratic mindset in the society, the corporate nexus that promotes the use of more technology, the dominance of human resource model in the education systems that look upon humans as mere skill sets, the widespread usage of technology in the developed countries and its replication in the developing countries, the demand by parents to include ICT in the school and among many others. The first question of ICT in education is that whether schools have access to ICT infrastructure. The National Policy on Education 2020 (Ministry of Human Resource Development, 2020b) proposes that every school should equip devices such as desktop computers, classroom projectors, Wi-Fi routers, etc., and personal devices such as smartphones, laptops etc. Though some proponents argue that there is some minimum infrastructure required for the usage of ICT in the education systems, some others argue that the pre-existence of ICT is not an important tool for the facilitation of digitized learning. It is alleged that many schools continue to remain without electricity. Therefore, the policy priority should focus in first place on a regular supply of electricity to the schools, followed by ICT infrastructure for better pedagogical results[17]. The experiences of the ITE program[18] highlighted that in schools where there was a dearth of infrastructure, strategies such as BYOD (Bring Your Own Device), community wi-fi was used to enable the integration of ICT in the classrooms and the schools. Though there are different perspectives on the role of infrastructure in ICT classrooms, it can't be denied that ICT needs a certain kind of infrastructure for specific usages and purposes. Since ICT in itself is hardware, the changes visualized require the pre-existence of certain kinds of technological machinery in the classrooms and the schools. The National Policy on Education 2020 (Ministry of Human Resource Development, 2020b) puts

[17] At an ICT conference, a presenter shared a report of the implementation of ITE programme at The Tata Institute of Social Sciences, Mumbai

[18] ITE is the Integrated Approach to Technology in Education initiative of the Tata Trusts, that aims at integrating technology in the school curriculum and teaching plans of teachers and other learning centers, in eighteen mostly rural locations in Eastern and Northern India. (TISS)

the responsibility on the states to generate funds for the installation of institutional devices in Government schools. The importance of ICT infrastructure can be further substantiated by the fact that a lot of students in the Qmark school had access to such digital devices at the school and home. (See table 5.1, 5.2)

Table 5.1: Number of students of the Qmark School using ICT devices at home

At Home			
Variables	Yes	No	Total
Laptop	70 (77.7)	20 (22.2)	90 (100)
Tablet	58 (64.4)	32 (35.5)	90 (100)
Mobile phone	84 (93.3)	6 (6.66)	90 (100)

The values in parenthesis are in percentage

Table 5.2: Number of students of the Qmark School using ICT devices at school

At School			
Variables	Yes	No	Total
Laptop	22 (24.4)	68 (75.5)	90 (100)
Desktop	69 (76.6)	21 (23.3)	90 (100)
Smartboard	69 (76.6)	21 (23.3)	90 (100)

The values in parenthesis are in percentage

As has been mentioned in the last chapter, the Qmark school has its software for administrative work along with the installation of smartboards in the classroom. They had developed its software for administrative related functions such as attendance, parent's interaction, and so on. Though there are many startups in the market which develop software products for schools based on ERP software, the Qmark schools sought to develop their own with economic logic. The direct benefits of having the school's software are the control over the data produced, fixed one-time payment for the software, the freedom to use and update the software as per the needs and requirements of the schools, the flexibility in the installation and the usage of the content.

Technological devices have been created to reduce human labor and therefore, the invention of systems such as ERP software-based school solutions and so on. The debate on

the positive contributions of technology in our lives have been that it will reduce human labor and therefore, is beneficial for humans. The expanse of the startups in the market developing solutions for attendance marking marks uploading, teacher-parents interaction, and so on highlights the positive contributions of the technology in the education system. Van Braak et al (2004) describe various educational uses of the technology, out of which few are "differentiated activities" and "completing tasks on the computer". The technology roadmap (TIFAC, 2017, p. 138) highlights that one positive contribution of technology have been that it can help in the improvement of "administration, management, and governance". These software solutions aim to perform administrative tasks easy for the school and the related agencies. The table for companies (Appendix III) shows the expanse of companies providing school solutions based on ERP software. The following tables reveal the number of companies developing varying kinds of ICT solutions- productwise and levelwise categorization and therefore, the visualization of ICT for educational solutions by the corporate industry. (See table 5.3, 5.4)

Table 5.3: Number of companies developing varied ICT products for educational purposes

Product Categories	Number of companies
Equipments/Hardware	84 (52.5)
Software	84 (52.5)
Publications	26 (16.25)
Music, Play and Sports Materials	20 (12.5)
Content and Curriculum	62 (38.75)
Communication/ Connectivity	36 (22.5)
Special Needs	28 (17.5)
Allied and Supportive Products/Solutions	64 (40)
Total	160 (100)

The values in parenthesis are in percentage
Source: DIDAC INDIA, 2018

It is vital to see that about 38.75% of the companies developed curriculum and content for the education sector, quite high number if one visualizes the change they will bring about in the future of the education system through the means of the curriculum.

Table 5.4: Number of companies developing varied ICT products for different levels of education

Level Categories	Number of companies
Early Years/Foundation	93 (58.12)
School Education (ages 4-18)	132 (82.5)
Higher Education	108 (67.5)
Further Education	89 (55.62)
Adult and Community Education	75 (46.87)
Vocational Education and Training	99 (61.87)
Research Levels	68 (42.5)
Total	160 (100)

The values in parenthesis are in percentage
Source: DIDAC INDIA, 2018

The table shows that approximately 82.5% of the companies are making products for school education and about 67.5% for the higher education realm, the major levels where ICT is entering the education system. For academic purposes, there were smartboards installed in every classroom in the Qmark school along with access to 3-4 computer rooms for both the teachers and the students. Though this was a norm in the entire school, it was not fully functional all the time. The school principal revealed that though the school has invested a lot in the installation of these devices, there was no proper usage of these devices by the teachers or the students in comparison to the financial investment done for the same. The actual usage of these devices will be discussed in detail in further sections. As the educational benefits of the technology have already been recognized in the world trends, the same have been pushed both by the market and the state in recent times. The technology roadmap (TIFAC, 2017, p. 138) throws light upon the educational benefits of using such devices in the school system such as “integration of history, theory, data” and “new pedagogical possibilities”.

In the Beanbone school, there was a computer room, one DTH (Direct-to-home) television room, and one TV room for the use of technology for academic purposes. The DTH had stopped working due to an error in network and the computer room was used only for the teaching of IT as a vocational subject. The Beanbone schools, unlike the Qmark school, depended on the Government’s website for uploading information related to administrative

work. As has been mentioned in the last chapter, the teachers had to upload information related to the attendance, mid-day meal, assessment, and so on. The teachers in the Beanbone school used technology more for administrative purposes than academic purposes. There was one computer through which all the other administrative tasks were done if mobile phones couldn't be utilized for the same. The problem of access to ICT infrastructure was very different in a Beanbone school as the students could only get access to ICT devices placed in the school computer room or TV room. The physical distance creates a psychological distance and ICT was not a habituated part of the student's lives. This would create a digital divide of accessing ICT among the students.

The existence of ICT in a classroom can be an agency for varied kinds of changes. The existing infrastructure also acts as a motivating factor for the teachers in the school to use ICT devices for curricular activities in a better manner[19]. Similarly, it was seen that in the Qmark school, ICT was an additional requirement for the teachers besides the other curricular tasks they were asked to do. In the Beanbone school, since it was not a necessity to use ICT, the teachers used it at their own will, and therefore, it was a privilege that could be accessed sometimes and not a regular requirement in the Beanbone school.

One of the major problems with the installation of institutional devices is "the lack of know-how available locally for maintaining equipment." (Ministry of Human Resource Development, 2020) In every classroom in the Qmark school, two students were assigned as the in-charge of the ICT device. They were trained by the school's IT team in switching on-off the device, handling the keyboard and the mouse, looking for basic options if the device stops working, calling the IT person if he/she can't understand the reason for the non-functioning of the device, complain to the IT person in the school if the devices were not functioning and so on. Also, the teacher could directly call the IT wing if the device didn't function and the assigned person immediately came to resolve the issue. As the teachers are not fully aware of the operations and functions of these devices, the presence of such IT people in the school becomes a mandatory thing for managing the devices properly.

In the Beanbone school too, the students were asked by the teacher to switch off the devices, to check if all the computers are switched off, to complain to the principal if there was

[19] At an ICT conference, it was shared by Delhi government school teacher that the presence of ICT devices motivate the teacher to be creative in their pedagogy.

a problem with the computers, and so on. As the teacher was a trained IT person, she could resolve some of the basic issues but there was no technical support that the school got either from the Beanbone or the agency which had set up the IT lab in the school. It was reported by the teacher that earlier the agency people used to come once in a while to monitor the systems and their function but later they stopped coming.

In the Qmark school, there were mobile applications like snap homework, WhatsApp groups for every class and subject for communication between the teachers and the parents, the school and the teachers, the students and the teachers, e-mails for sharing and uploading the work apart from the smart devices installed in the school. This not only shows more usage and emphasis on technological platforms in the Qmark school but also, increased communication between the agencies involved in the school due to the presence of ICT. Also, virtual reality devices were being used for paid workshops for the students to enhance their academic know-how.

In the Beanbone school, the teachers mostly called the parents to communicate with them. There were WhatsApp groups among the teachers to communicate for school-related or other purposes. Though in the Beanbone School, there were Government initiatives to train the teachers and the students in the usage of ICT through various workshops, as of now, it was the IT lab that was used for the same. Though there can be many reasons attributed to the increase in the use of ICT devices in the Qmark school than the Beanbone school such as access, literacy, class difference among others, it needs to be said that the Government schools need to utilize some of these platforms more to facilitate communication between the concerned agencies.

The ICT Devices

The Smartboard

It is important to ponder upon the kind of infrastructure that the emerging startups are imagining in the domain of ICT in education. One kind of infrastructure that has been widely discussed is the smart classrooms. There are a number of companies concerned about this as the future technology after the textbooks such as Tata Classes, Extramarks and so on. The smart boards in the classroom become a better technological device than the textbook or as a supporting aid to the textbooks. No doubt, pedagogically, there can be a lot of innovative

techniques and methods that can be useful for the classroom with the use of smartboards. How it is used by the teachers is discussed in the further sections.

To discuss the implications of a smartboard, it is vital to know what is a smartboard and how has it become important in the classroom space? A smartboard is nothing but a blackboard equipped with computer-related functions. It has become more relevant in the classroom because it performs the functions of a blackboard along with many more additional functions that can't be done on a simple blackboard. In fact, in the Qmark school, the teachers used the same screen for writing as a blackboard and as a smartboard. It doesn't need a separate space physically but occupies the same space as that of a blackboard, so it is easy to introduce it in a classroom. There are many varieties of the smartboard available in the market depending upon the design, features, market, requirement, and so on. As the Qmark school had a smartboard, it is important to know the frequency of students who used the same at home and school and the time devoted to using the same. (See table 5.5, 5.6) It was noted that out of the total 90 students, about 52.2% of the male students said that they used ICT devices at the school in comparison to 47.7% of the female students.

Table 5.5: Number of students of the Qmark School using ICT devices at school

At Home			
Variables	Yes	No	Total
Smartboard	10 (10)	90 (90.2)	90 (100)
At School			
Smartboard	68 (75.5)	22 (24.4)	90 (100)

The values in parenthesis are in percentage

Table 5.6: Number of students of the Qmark school (standard wise) using ICT devices at school

Variables	VI std	VII std	VIII std	Total
Smartboard	34 (37.7)	20 (22.2)	36 (40)	90 (100)

The values in parenthesis are in percentage

The smartboard in the Qmark school was used to show various kinds of ICT material which consists of videos, audios, movies, IT software such as Microsoft word, excel etc. and power-point presentations. The power-point presentation was often used by the students as their homework which they had to e-mail to the teacher or for noting down question-answers from the presentation.

In the Beanbone school, there was no smartboard. But a television and a few computers were kept in the computer room.

Virtual Reality Devices

The Virtual reality device was used in the Qmark school to show curricular-related three-dimensional videos to the students such as on oceans, forests etc. These devices can provide an almost real experience to the students[20], something that the textbooks and the classroom teaching cannot make up for. A virtual reality device is usually a headset that provides an artificial three-dimensional environment for a person to interact with it in varied ways. It is a simulation generated by the computer and can have many features such as eye-tracking sensors etc. As has been mentioned in the last chapter, in the Qmark school, it was used for virtual experiences of a jungle, ocean, and so on to make the students learn curricular related topics and visit these places together. It was a part of the curriculum in the Qmark school, so almost all students used it in the school.

A vital point that needs to be considered here is that technologies such as virtual reality are seen as an alternative to the actual experiences one might have. For instance, a visit to a forest is replaced by a virtual experience of a forest on a virtual reality device. But virtual experience caters to only limited human senses such as eyes, ears whereas humans are holistic beings who experience by feeling, touching, smelling which is only possible in an experience. An experience involves interaction with a new physical, social, psychological setting and is liberating for the human mind and self. It is very different from a limiting experience of, for example, a few animals in a virtual forest setting, which would entail just listening to their recorded sounds and movements. A real experience to a forest might involve experiencing silence, solace, getting lost in the woods, sighting the surprise footsteps of animals and birds, sharing lunch with friends, playing and so much more. In times of the Covid-19 pandemic too, the teachers resorted to visiting online museums since actual visits were not possible. These platforms serve a good purpose in times when actual visits are not possible but it becomes debatable when actual visits are replaced by virtual visits and the students are made more dependent on such platforms. It is not difficult to visualize that in the coming times, the schools would save more money by shifting from actual field visits to online visits. It should be noted that replacing actual visits with virtual visits would mean barring students of meaningful

[20] Informed by the owner of the company who took Virtual Reality workshops in the school.

experiences and making them more dependent on technology, that would be dangerous for their physical and mental health in many ways. If we could replace technology for every real experience we had, people wouldn't have faced lots of problems sitting at home during the lockdown.

Also, the students go to the malls and see videos in virtual reality devices for a short while, it means to play in that context and not learning. Even if the videos are designed as per the curriculum, they need to be integrated into the curriculum for better results. The videos can't be shown in a vacuum and termed as learning. There has to be re-visualization of what learning means and how technologies like virtual reality can aid learning in the school context. Learning doesn't mean seeing a video on animals to cover the animals topic in the curriculum. It means knowing about animals, learning about their sounds, movements, their habitat, and so on. So, if such a video is shown in tandem with the curricular subjects and their planning, it would fulfill the curricular goals better.

Mobile Phones

Though India is still far from using mobile phones in schools, there have been various debates and proposals for the same which need to be discussed. The Policy (Ministry of Human Resource Development, 2020) states that personal devices such as smartphones need to be included in the schools as a medium of digital learning as they are accessible and can be useful in supporting other educational technology interventions in the school. There have been several debates around the inclusion of mobile phones as a tool for learning in schools. With the increasing penetration of smartphones in the lives of people in the 21st century[21], the use of smartphones as a viable tool for educational learning and output has been debated upon. Though some advocate that mobile phones can be a handy technology to be used in the classrooms, others highlight the risk of usage of mobile phones for non-learning purposes in the school. Mobile phones are used by the parents, teachers, and the students at home for academic and non-academic purposes daily. The results from the guided interview of the students highlight that almost all of them in the Qmark school used mobile phones daily whether it was for chatting, research, playing games, and so on. (See table 5.7)

[21] India has over 400 million smartphone users, making it the second largest mobile market in terms of number of users, after China. (Sharma, 2020)

Table 5.7: Number of students of the Qmark School using ICT devices at home and school

Variables	Yes	No	Total
At home			
Mobile phone	84 (93.3)	6 (6.66)	90 (100)
At School			
Mobile phone	9 (10)	81 (90)	90 (100)

The values in parenthesis are in percentage

About 27.7% of the students of class VI, 24.4% of the students of class VII, and 47.7% of the students of class VIII used mobile phones at home, out of a total of 90 students. Among them, about 59.2% of the male students and 41.1% of the female students used mobile phones at home. It is vital to see the time spent on using mobile phones by the students to understand the space it occupies in the life of the students. (See table 5.8, 5.9)

Table 5.8: Hours/day spent on using ICT device by the students of the Qmark School

Hours/day	(Minutes/Day)	Mobile phone users
0	(0 min)	5 (5.55)
0.02	(1 min)	1 (1.11)
0.05	(3 min)	8 (8.88)
0.07	(4 min)	7 (7.77)
0.08	(5 min)	7 (7.77)
0.1	(6 min)	9 (9.99)
0.12	(7 min)	5 (5.55)
0.15	(9 min)	1 (1.11)
0.16	(10 min)	9 (9.99)
0.25	(15 min.)	7 (7.77)
0.42	(25 min)	1 (1.11)
0.5	(30 min)	9 (9.99)

0.55	(33 min)	1 (1.11)
0.66	(40 min)	1 (1.11)
0.75	(45 min)	7 (7.77)
1	(60 min)	9 (9.99)
1.5	(90 min.)	1 (1.11)
3	(180 min)	1 (1.11)
8	(480 min)	1 (1.11)
Total		90 (100)

The values in parenthesis for mobile phone users are in percentage

Table 5.9: Hours/day spent on using ICT device by male and female students of the Qmark School

Variables	Male (Hours/day)(Minutes/day)	Female (Hours/day)(Minutes/day)	Total (Hours/day)(Minutes/day)
Mobile phone	18.06 (1084 min.) (41.69)	8.83 (530 min.) (26.5)	26.9 (1614min.) (35.09)

The values in parenthesis are mean values in minutes/day

In the Beanbone school too, the students of X-XII standard used mobile phones daily for both academic and non-academic purposes. With this acceptable hypothesis in mind, the central square foundation is trying to build solutions to turn this usage of mobile phones by the students every day into learning time for the students. As mobile phones gain stature as a tool for learning, the schools would accept them as a new tool for learning. Therefore, it is not difficult to imagine that as ICT becomes a norm in the schools, mobile phones too would be accepted as a learning technology, the dynamics of which are yet to be understood. In fact, since the market for mobile phones has been quite expansive across sociological groups, mobile phones would be the easiest device to build the bridge to the digital divide that exists in the private and government schools. Even in the times of the Covid-19 pandemic, the government schools have relied upon mobile phones to communicate with the students and the parents for all curricular and co-curricular activities.

Robotics

As has been shared in the last chapter, robotics was taught as a skill to the students in the schools, which was earlier a part of the curriculum of the colleges and has trickled down to the school curriculum. (shared by the robotics teacher) This was a separate subject where the students only learned about how to develop different robotic models using the given kits and the endpoint was to make them work. Though the teachers accompanied the students in the robotics lab, they either checked their notebooks or observed the students as a part of their duty to accompany the students when they move out of the class. In contrast to this, a professor from Ireland shared that there were Lego- Robotics laboratories set up for 7-16 year old students where the students were guided to solve real-life problems.[22] For instance, she shared that during one of the projects, the students developed an automatic motorized vehicle for solving the water problem in the vicinity and the students were also required to share the research behind the development of their project. This required combining robotics with the core curricular subjects and thinking of its applicability in the real life.

These curricular options were not a part of the Beanbone school. Instead, there was Retail being offered as a vocational subject along with IT as a subject. The difference in the vocational subjects offered at Beanbone and Qmark school highlights the difference in philosophy and approach for both the Beanbone and Qmark school system. It depicts the class segregation that exists at the curricular level in terms of the skills training provided to the students for varied kinds of professions. While the curriculum of a private school aims to prepare the students to take up professions related to statistics, mathematics, engineering etc., the government school curriculum aims to provide the skills for professions such as shop managers, customer executives, and so on. There is a difference in terms of stature, class, income for both these kinds of skill sets and professions. The schools should be the places to equalize the opportunities for the students and provide an expanse of skill-sets to nurture the talent of the students, rather than just providing skills that are more relevant and functional for a particular class group in the respective group.

[22] A professor from Ireland shared at an ICT conference.

The ICT and the Curriculum

The Content of the curriculum

The curriculum is the window through which all the changes at the policy level permeate down to the classroom level. So, the content, form, organization, and transaction of the curriculum are the main aspects that need to be analyzed for understanding the integration of ICT in the school system. In the Qmark school, it was mostly the videos, audios, or PowerPoint presentations that were used as the content for ICT-induced teaching-learning process. The videos, audios, or the PowerPoint presentations showed by the teacher were sourced mainly from free online sources, from whatever was available on youtube or google or other such platforms. It is important to understand that the market for ICT material has proliferated at a large scale and therefore, the ICT materials with all kinds of ideologies are available online, from which the choice can be made depending upon a host of factors such as teacher's ideology, school's ideology, the requirement of the curriculum and so on. The teacher's in the Qmark school used to find out ICT material individually for secondary grades, share and show it to the students. It, therefore, depended majorly on the teacher's pedagogy, attitude towards ICT materials etc. that facilitated the selection of these materials. Due to a host of factors such as offline examinations, teacher's perception of ICT as a support material, lack of appropriate training for usage of ICT in a creative manner, the availability of ICT materials, paucity of time for inclusion of ICT, overburdened teachers etc., the teacher's selected the best materials from the available content and fixed it in the classroom timetable appropriately. As would be revealed in the coming sections, the ICT has almost diluted the set patterns of the curriculum in the school system. When there is a plethora of information available on the ICT platforms (availability of information is a function of ICT) and the teacher is almost forced to use ICT platforms for various purposes, there are new facts that are justified in the name of using ICT. For instance, if a video shows a certain community selling pots, the teacher has to consider that while teaching about that community. This jostles the teacher as the secondary authority but the ICT device as the first medium to transact the curriculum in the classroom. So, the teacher's voice is silenced and becomes void in the first place in the classroom scenario. The entire perspective of education where the teacher-student relationship plays a central role in the learning process becomes nullified. It is now the ICT and its content that plays an important role in the learning process. This not only changes the process of education but also the meaning of education. Education doesn't mean the process of learning from each other but is

reduced to the delivery of content through ICT and therefore, routinized. The following table (See table 5.10) depicts teacher's attitudes regarding the usage of ICT devices for various purposes. It shows that the maximum percentage of teachers believe it is alright for the students to use ICT devices for academic purposes in comparison to usage for other purposes. So, the selection of ICT materials too was content-based such as a recitation of a poem in the textbook, a story for teaching a mathematical concept, and so on.

Table 5.10: Attitude/perception of agencies towards the usage of ICT devices for certain purposes by students (Qmark School)

Variables(Teacher's attitude of usage of ICT for following purposes)	Yes	No	No Answer	Total
For Shopping	23 (25.55)	6 (6.66)	61 (67.77)	90 (100)
For social networking	31 (34.44)	17 (18.88)	42 (46.66)	90 (100)
For browsing	41 (45.55)	8 (8.88)	41 (45.55)	90 (100)
For schoolwork	61 (67.77)	2 (2.22)	27 (30)	90 (100)
For learning/reading	55 (61.11)	3 (3.33)	32 (35.55)	90 (100)
For games	13 (14.44)	14 (15.55)	63 (70)	90 (100)
For e-mailing/printing	46 (51.11)	3 (3.33)	41 (45.55)	90 (100)
For storage of data	40 (44.44)	3 (3.33)	47 (52.22)	90 (100)

The values in parenthesis are in percentage

In the Beanbone school as well, it was through PowerPoint presentations and the videos being shown to the students for the teaching of various subjects, apart from the usage of the computers in the computer room.

Throughout the teaching of all subjects, the teachers used the textbook as the main source of reference for teaching in the Qmark and the Beanbone school. Whether they were done with the textbook teaching or had planned it after the reference of smartboard teaching, the textbook remained as the primary source of reference for the students as well. The videos, audios, or powerpoint presentations on the smartboard was seen as the support material for teaching any concept in the classroom. It was seen that the sanctity of the textbook as the bearer of ultimate knowledge that emerged during the colonial times due to the assessment based on

the textbook, as highlighted by Krishna Kumar, has widened with the emergence of ICT in the schools. (Kumar, 1991) Now, the same textbook is available on the screen along with a variety of materials to aid learning. So, the ICT might take the center stage as the main text to be used in the classroom in the coming times, although the pattern of offline examinations is one of the reasons that still make the teachers rely more on just textbooks than ICT for the present times. At a school observed in London[23], it was seen that since the examinations were held online, the teachers used digital content and material for a major part of the school activity than in the Indian context. Also, the content was more innovative as it included games, activities, instructions for offline work, chapter reading etc. along with a variety of other content. The entire lesson and its activities for the subjects were conducted with the aid of the smartboard. For instance, in an English classroom:

Teacher: We had done prepositions from the book too, now let me show you the video again for revision.

Students: Yes ma'am, start the video.

(The students sing the song in the video along with the video being played on the smartboard)

The textbook was perceived as the main source of knowledge for a long and continued to do so in many ways. The teacher was believed to be the primary authority through which the textbook knowledge was transmitted to the students. With the introduction of ICT devices in the classroom and the availability of varied ICT materials to the students beyond the contours of the classroom, the definition of the textbook as the text changes in the mind of the students, the teachers, and the parents. The students refer to varied websites before doing their work such as meritnation[24] etc. and so, flexibility in the notion of what is considered as knowledge has emerged with the proliferation of such materials. It is not only the textbook that has sacrosanct knowledge but there is information on the internet, mobile applications etc. too that has relevance for the students. In such a scenario, what is considered apt, relevant, and valuable for

[23] This school in London was a Khalsa School, run by a welfare organization and the major students studying in the school belonged to the Sikh community. The use of smartboards was a norm in the school as all the subjects were taught using the device.

[24]Meritnation is an online learning and assessment platform for the school students studying under various boards in the Indian school system. There is a proliferation of such corporates selling digital products in the Indian context.

the students is another question that needs to be pondered upon and will be discussed in the coming sections.

The Use of ICT in the school curriculum

There were a lot of times when the teacher used videos for recapitulation of the concepts that were already being covered by her in both the Qmark and the Beanbone school. It is important to note that placing the video as ICT material in the classroom only for revision or as a support tool, in addition to the teaching of the main concept, involves imagination of ICT as a certain kind of tool. This means that the teacher didn't view ICT as a main teaching-learning material for the classroom. Once the teacher has already explained the concept verbally to the students in the classroom, then what is the purpose and impact of showing the video as the same was held in the classroom? Though the students were glued to the video, what addition did the video do to the existing concepts of the student's needs to be seen? It meant that ICT is an important part of the classroom, although the purposes it serves in the regular day-day teaching was still not clear. The ICT devices were considered fruitful by all the agencies in the school curriculum but it was used as and when time permitted or to just justify its presence in the classroom.

The usage of ICT for the teaching of low-level skills such as using software etc. was more common than its usage for analytical purposes. For instance, although there were routine classes for IT subject every week, usage of smartboards in the classroom for the teaching of various subjects happened daily, the workshops to enable the mindful usage of ICT such as cyber-crime workshops, workshops on how to segregate important information on the internet etc. happened on a bi-annual or annual basis. This meant that ICT was hardly used to foster creativity, innovation in the schools, rather it was just another tool to complete the syllabus prescribed for the students.

Time allocation for ICT learning

The organization of ICT in the curricular and co-curricular activities of the school decides its role and importance in the school curriculum. Since the schools for fieldwork were chosen based on the usage of ICT, both the schools had already organized ICT in varied ways in their curriculum.

The students had two IT periods[25] in a week for computer as a subject in the Qmark school. Also, for other subjects, it was left to the discretion of the teacher to decide when she/he wanted to show an ICT content and when do they want to teach using textbooks or other traditional means. This can be interpreted as the non-obligatory nature of using ICT in the present education system for teaching other subjects though there is a realization of its benefits at the policy level. The time devoted to the usage of different devices by the students is mentioned in the tables below. (See table 5.11, 5.12, 5.13)

Table 5.11: Hours/day spent on using ICT (laptop) device by the students of the Qmark School

Hours/day (Minutes/day)	Laptop Users
0.01 (1 min)	5 (5.55)
0.05 (3 min)	4 (4.44)
0.06 (4 min)	6 (6.66)
0.08 (5 min)	4 (4.44)
0.1 (6 min)	12 (13.33)
0.15 (9 min)	5 (5.55)
0.16 (10 min)	13 (14.44)
0.3 (18 min)	5 (5.55)
0.41 (25 min)	5 (5.55)
0.5 (30 min)	8 (8.88)
0.65 (39 min)	5 (5.55)
0.75 (45 min)	11 (12.22)
1 (60 min)	7 (7.77)
Total	90 (100)

The values in parenthesis for laptop users are in percentage

[25] A Period in the Qmark school meant approximately 45 minutes devoted to the teaching of one discipline.

Table 5.12: Hours/day spent on using ICT (desktop) device by the students of the Qmark School

Hours/day (Minutes/day)	Desktop Users
0 (0 min)	6 (6.66)
0.02 (1 min)	6 (6.66)
0.05 (3 min)	17 (18.88)
0.06 (4 min)	11 (12.22)
0.08 (5 min)	10 (11.11)
0.1 (6 min)	5 (5.55)
0.16 (10 min)	10 (11.11)
0.25 (15 min)	10 (11.11)
0.5 (30 min)	10 (11.11)
1.5 (90 min)	5 (5.55)
Total	90 (100)

The values in parenthesis for desktop users are in percentage

Table 5.13: Hours/day spent on using ICT (tablet) device by the students of the Qmark School

Hours/day (Minutes/day)	Tablet users
0 (0 min)	5 (5.55)
0.12 (7.2 min)	6 (6.66)
0.05 (3 min)	9 (10)
0.06 (3.6 min)	5 (5.55)
0.08 (4.8 min)	5 (5.55)
0.1 (6 min)	7 (7.77)
0.15 (9 min)	5 (5.55)

0.16	(9.6 min)	6 (6.66)
0.25	(15 min)	6 (6.66)
0.3	(18 min)	5 (5.55)
0.33	(19.8 min)	5 (5.55)
0.5	(30 min)	7 (7.77)
0.75	(45 min)	6 (6.66)
1	(60 min)	8 (8.88)
1.5	(90 min)	5 (5.55)
Total		90 (100)

The values in parenthesis for tablet users are in percentage

It was noted that the total students of standard VI spent 26.29 minutes/day using a laptop, 25.71 minutes/day in using a desktop, 47.14 minutes/day in using a tablet, 40 minutes/day in using a mobile phone, 27 minutes/day in using the smartboard, 41.15 minutes in using television and 5 minutes/day in using other ICT devices. In comparison, the total students of standard VII spent 29.56 minutes/day in using a laptop, 27 minutes/day in using a desktop, 30.71 minutes/day in using a tablet, 82.92 minutes/day using a mobile phone, 20 minutes/day using a smartboard and 86.67 minutes/day in using television. Further, the total students of standard VIII spent 9.77 minutes/day in using a laptop, 3.43 minutes/day in using a desktop, 6.24 minutes/day in using a tablet, 9.13 minutes/day in using a mobile phone, 8 minutes/day in using the smartboard, 8.11 minutes/day in using television, 6 minutes/day in using PlayStation and 10.73 minutes/day in using any other ICT devices. Taking cognizance of the gender dynamics, it was seen that on average, male students of all grades spent 18.5 minutes/day in using a laptop, 12.62 minutes/day in using a desktop, 20.19 minutes/day in using a tablet, 41.69 minutes/day in using a mobile phone, 16.23 minutes/day in using the smartboard, 47.11 minutes/day in using television, 20 minutes/day in using PlayStation, 2 minutes/day on using a smartwatch and 12.11 minutes/day in using another ICT devices. In contrast to this, the total female students of all grades spent 15.79 minutes/day in using a laptop, 15.31 minutes/day in using a desktop, 21.87 minutes/day in using a tablet, 26.5 minutes/day in

using a mobile phone, 14.61 minutes/day in using the smartboard, 41.53 minutes/day in using television and 4.67 minutes/day in using any other ICT devices.

The Beanbone school had no ICT periods. Rather, it was left to the discretion of the teachers to use the available devices as and when required.

The Beanbone school system didn't make any such attempt to introduce the homework period as such decisions in the Beanbone school system are made by the Government departments who are considered responsible for implementing the policies in the school systems. In contrast, the Qmark school systems had to implement such decisions themselves beforehand to avoid questions posed by the government authority. After observing the usage of ICT in both the Qmark and the Beanbone school, it can be said that technology usage was at a very preliminary stage and therefore, the time allotted to its usage was bare minimum which would increase in the coming times.

ICT and the teaching-learning of various subjects

Every disciplinary domain has got its tradition and technique that would reflect in the classroom transaction. A conventional classroom would of a specific discipline follows a set pattern of interactions as per the requirements of the discipline. For instance, a History classroom would involve visualization of certain eras, their customs, traditions, and culture. ICT is although a homogenous entity negotiates the interaction between the teachers, the students, and the parents when it enters the contours of the classroom. How ICT puzzles the transactions inside the classroom and its entire structure is vital in recognizing the changes it ushers in the classroom and the teaching-learning process. The further sections reveal the changes that ICT initiates in learning of specific disciplines and the teaching-learning process thereon. The insights would reveal the teaching of these disciplines in a conventional classroom vis-à-vis an ICT classroom to realize the changes in the content and the pedagogy of the teaching-learning of these specific disciplines in the classroom. This section would also consider the changes in nature and the teaching-learning of these disciplines with the ushering of the digital means.

Teaching-learning the foreign language

The field observations revealed that ICT was used maximum for teaching-learning of the French language in the Qmark School. Though the ICT content for these languages came along

with the textbooks which made it easier to plan the lessons using ICT, the teachers were convinced that ICT usage for teaching-learning of the language makes it easier for the students to learn the language and for the teacher to explain the concept. The medium of technology serves as an effective tool for the teaching-learning of a non-native language to the students which would have otherwise become tiresome. Though there are many theories on how language is learned, the teachers in the Qmark school use translation and moved from grammar to literature as the major approaches for learning the language. This grammar-translation method has been critiqued for it views language as segregated elements that need to be learned and recalled for learning. Whereas language is a holistic entity that is better learned in contextual meaning-making settings. The holistic learning approach which could be efficiently combined with ICT for language learning was not even discussed in the school system. Also, communication in a language is not just about words but visuals, gestures, non-verbal communication, and so on. The teacher emphasized more on the literature and grammar as prescribed in the syllabus. In most of the classes, the teacher either used the literature topics or the grammatical texts that were prescribed in the syllabus. Although the use of ICT made learning of the third language a little more engaging than it was in the classrooms where ICT wasn't used for learning of the language due to the captivating impact of the digital medium. The videos, the exercises, the powerpoints made grammar learning visually more appealing and relatable than it was in a non- ICT classroom, especially to learn a language. Technology has the power to grasp our attention and engage our minds, which has been utilized by the market forces to normalize its presence in our lives.

The Beanbone School didn't offer any foreign language being taught to the students.

Teaching-learning the Sciences

The most common form of ICT teaching-learning material used for science teaching was videos. For instance, in a chemistry class, the teacher showed the video of the formation of coal to the students while explaining the same lesson. The audio in the same was based on a British accent and purely content-based. Though the teacher who showed this used to teach higher classes mostly and she showed this to class VIII students, the video moved from one process to another showing the content for the formation of coal, without any relevance such as child-friendly features for the audience. There were some difficult words for products and processes such as ammonical liquor, coke, distillation etc. which the students didn't understand. A student even laughingly asked the teacher about the coke if it is the same coke that we drink too, which

the teacher explained as a different product. This is a classic example of the teacher's pedagogy on choosing the ICT content.

It was observed that while a video was being played in the classroom, the main interaction happened between the video as the agent and the students listening to it passively. The teacher often acted as a mediator for explaining the difficult words, concepts, recapitulation, or reiteration, or anything that the students could not understand or wanted to clarify. For instance, while watching the video in the chemistry class, a student didn't understand what is meant by distillation and so, she explained the same to him after pausing the video. It is important to mention that while National Education Policy 2020 aims at facilitating innovation through ICT, the examples from the school show that it is reduced to another tool to finish the syllabus and not a creative medium for exploring scientific concepts. This means the purposes and the manner of usage of ICT in the school need to be visualized along with the installation of ICT infrastructure.

The second form of ICT material the science teachers used was Powerpoint Presentation(PPT) for writing the question-answers. The teacher prepared the question answers in a PPT form and the students had to note them down in their notebooks for future reference. It is not difficult to imagine that in the future, the students might not even note down the question-answers as the examinations would happen online. The teacher could either give the printout or email it to the students. Though the Qmark school still valued the importance of written work by the students, its relevance in an ICT classroom needs to be re-imagined and re-positioned. Technology re-adapts the human labor and skills required to operate it by making it more efficient at one level such as the homogenous forms of writing through ICT devices and the difference in skills required for writing a document in comparison to typing a document. But it has implications for human agency in a Marxian sense as it alienates the humans of their creative power to re-imagine writing, its purposes, and aesthetics. It, rather, reduces them to mere puppets who adapt the idea of typing and normalize it more and more. It rips humans of their choice and power to define the contours, styles of writing, and also, the personalized touch/language of a handwritten document.

In the Beanbone school as well, the teachers either used PowerPoint presentations or the videos inserted in the slides for teaching-learning of science. As the teachers didn't choose the material for ICT, ICT classes were more of an extra class to be covered for a better understanding of the concepts. The writing of question-answers from the slides served the

purpose of retaining more information for the students. The school had ICT material for only science and mathematics from an organization which showed the perception in the minds of people regarding these subjects. Why was ICT material being developed for only these subjects shows the primacy accorded to science and mathematics as a discipline in modern society and therefore, the education system? The modern society which values scientific developments, statistics, mathematics, and computers more than other disciplines such as social sciences reflects the same in its education system as well.

Another important factor that is highlighted in the field observations is the conception of science as a discipline by the school, the teachers, and therefore, the students. In the ICT as well as the Non-ICT classes, it was mostly the subject-specific concepts that were focused upon. The question that needs to be asked is that though there are subject-specific concepts that need to be taught for every subject, reducing the entire subject to just conceptual knowledge is adequate in teaching-learning of the subject? For that matter, is mathematics only about teaching certain formulas or questions that are given in the book? Any subject is about the importance of the specific discipline and understanding it in relation to our lives. The teachers never discussed or used ICT to make the discipline more relevant to the lives of the students. Education is a process of exploration of ourselves and our lives while exploring these disciplines. It means looking at science as not just some laboratory experiments but looking beyond that and seeing science in everyday existence such as science in our kitchens. Education is a means of learning from established disciplines such as history, sociology etc., engaging with them in our lives and then thinking beyond them. How schools limit the knowledge of these disciplines to packaged materials not just limits their understanding but the growth of the students as well. The agencies in the school, therefore, need to facilitate the transaction of these subjects creatively for better learning and understanding. (Pathak, 2020b)

Teaching-learning the Languages (English and Hindi)

For the English classes, most of the videos were played for grammar topics like a preposition, conjunction, alliteration, and so on. The fact that grammar topics are considered more terse and therefore, need ICT support in comparison to the literature topics is a pedagogical question that linguists have been exploring for more than a decade now. How grammar of a language is segregated from its literature portion is a methodology considered outdated in the innovative curriculum in the present context of education. As has been mentioned earlier, a language needs

to be taught in its context with the emphasis on meaning-making for a better grasp of the language than the tedious process of learning grammatical rules and then the language.

Also, the difference in which grammar is taught using ICT versus the teaching of grammar in a regular classroom too needs to be seen closely. In a Non-ICT class, the teacher explained the meaning of prepositions by highlighting their definition, then focused on three prepositions- "on, it, at" and their usage, and then asked the students to frame their examples. By the end of the class, the students got tired of learning the grammar from the class and asked the teacher:

Student: Ma'am, How much time is left?

Teacher: What do you have to do? I am here till 2.30…I will take the homework period too.

Student: The point is it would be homework time. Would you teach us in that period too?

Teacher: Yes, I am taking that period.

In the Non-ICT classroom where prepositions were explained, the students asked the teacher about how much time is left for the class to get over and why would the teacher use the homework period for teaching the same concept. Whereas in an ICT classroom while teaching English, the teacher showed a video to the students based on prepositions wherein two students discussed the usage of prepositions amongst each other through real-life situations, examples, and the song. The students recited the song along with the video, were more excited, and asked the teacher to replay the video again. As grammar is a very abstract concept that is difficult for the students to understand, ICT makes learning easy and fun for the students. Although the videos chosen by the teachers didn't combine teaching grammar with literature and were mostly based on didactic teaching of grammar concepts, the storyline combined with songs and pictures made it much more interesting than in a regular classroom. The other videos for teaching grammar were on metaphors and similes and alliterations. In the simile and metaphor video, the explanation was done only through the song, and in the alliteration video, the explanation is done via narration and pictures.

The videos used for the literary aspect of language learning were Cinderella movie, Malala documentary, and so on. Though, understandably, the content for the lessons in the course of the students might not be available but the Malala documentary was very heavy for

the students of these classes (VI-VIII) even though the teacher showed them to motivate the students with her journey.

In the Beanbone school, the teachers never showed videos for grammatical aspects. The teacher showed a supplementary video for explaining the planets of the Universe. The language of the video was British English and so, it was a little difficult for the students to understand it. The teacher used translation as a medium to make the content understandable to the students and highlighted the difficult words and their meaning to be remembered by the students. Is ICT a medium to enhance the subject knowledge of the students or teach them difficult words, are the purposes that need to be explored further? It needs to be mentioned that videos used in the Qmark school were still more engaging than the ones used in the Beanbone school.

The Hindi teachers in the Qmark school use ICT for both grammatical and literature portions. The videos for grammar topics were used more such as *Kriya, Sandhi,* and so on.

Developing vocabulary is an essential part of language learning and was a part of both English and Hindi classes. In a Hindi classroom, while the teacher was teaching a poem on Rani of Jhansi, she emphasized the important words as she said, "*Ye shabd jaise aag, junoon yaad rakhna, ye paper me likhne se ache number milenge*". (These words like fire, passion-remember them, you will get good marks if you write them in the examination) With the usage of ICT, the words can be related to the pictures and the sounds to make them more dominant and relatable for the students.

Teaching- learning the Mathematics

Most of the mathematics teachers thought that mathematics as a subject is based on solving the problems and practicing them, so ICT as a tool is not helpful as such for teaching mathematics as a subject. So, ICT was not used in the mathematics classroom, except noting down the solutions from the powerpoint presentation.

But one teacher tried to show certain videos based on the concept of proportions though she believed that this consumes a lot of time and students are not able to practice the problems if this becomes a continuous process. She showed a story-based video for understanding the concept of proportions. Due to the technical fault, the video couldn't be run properly and so, the students tell the teacher:

Student A: Ma'am, Please finish the video.

Student B: Ma'am, show this in homework time and let's continue with the notebook work.

It is important to note that the fact that even students consider ICT is less significant for a mathematics classroom is a vital perception that they have imbibed about mathematics as a subject. Even they have come to believe that mathematics is a subject that needs to be practiced and that is how they would be assessed in the examination of their learning of the problems done in the notebook. And usage of ICT is seen as a time-waste than rather a focus on actual learning of the mathematical concepts. It is because the assessment was based on concepts and ICT was utilized for additional tasks rather than the teaching of the concepts in the classroom.

Mathematics as a subject involves understanding the abstract concepts and formulas which are not directly visible or relatable. The ICT content can be used innovatively in a mathematics classroom such as a 3D view of the figures, real-life situations, and examples through stories, and so on. Due to the increase in the course and examination pressure in the secondary grades, the teachers did not use ICT and focused on teaching through traditional methods. In one of the classes where the teacher introduced a story to explain the concept of proportion, the students were able to make guesses and relate the concept with real-life situations. Also, approximation and guesswork is an important mathematical skill which is missing from the classrooms and ICT can be an important tool in developing the same in the students.

Teacher: What is the motive behind watching this video?

Student A: That we have two choices in life- ratio of milk/water and difference between liars and honest people

Student B: The ratio of taxes is less than the ratio of development.

Teacher: The quantity of water is greater than the quantity of milk, so comparison of two quantities.

Though there was less usage of ICT for these classes, there was an emphasis on hands-on activities involving graphs, compasses, and model work which was considered an important part of learning mathematics. The fact that the perception of the teachers for ICT was limited

to videos, audios, and Powerpoint presentations and the hands-on-activities were an important part of the assessment, the teachers never emphasized the usage of ICT in a mathematics classroom. For instance, the teacher asked the students to show the working of a mathematical model based on lines and figures to the researcher. She said that the students have developed this model for parent-teacher meetings as well as a competition to be held outside the school. The students revealed that how with the different placement of a rubber band on the model, the model could be used for showing different figures and angles.

If one tries to compare a mathematics classroom where ICT was used in the Qmark school with a classroom where ICT was not used, certain characteristics can be highlighted. In a non-ICT classroom, the teacher focused more on the explanation of the concepts and their practice, whereas in an ICT classroom, it more based on questions during the ICT content being played, followed by concept explanation and practice. So, it can be said that ICT can enhance the learning of mathematics if the resources are utilized appropriately.

In the Beanbone school, ICT was used for the recapitulation of the concepts/formulas already covered. It involved multiple question answers to be solved by the students as the teacher went ahead with the PowerPoint slides. As the teachers believed that mathematics as a subject couldn't be taught through ICT as such and required hands-on practice, the content received from the ICT-provider organization was covered as additional practice for the syllabus covered.

Teaching and learning the Social Sciences

Teaching social science as a subject in schools involved discussion on people, place, and communities, and so on. Visualization is an important skill to understand the communities in context, social sciences in general. In one of the history classes, the teacher used videos as an ICT tool to effectively teach about the communities such as Bhils, Gonds, Ahoms, and so on. Through the videos, the students could not just see the dresses, dances, living patterns, the geography of these communities, they could actively engage by asking questions about the communities and their present-day existence.

Student A: Ma'am, Where is Gadkatan? (A place referred to in the video where Gond tribes were found)

Teacher: It is a Mahoba now. It is not present.

Student A: Ma'am, is the land present?

Teacher: It is present in Madhya Pradesh and Chattisgarh.

Mapping is another important tool that is used in the social science classroom. With the usage of ICT, the teachers could help the students visualize the geographies of the places in a colorful and better manner. The students too asked questions as they saw maps in between the videos in the history classroom while understanding the location of different tribes. For instance, while showing the video on Ahoms, a map showing their dominance in the western and northeastern part is shown. The students ask the teacher:

Student A: Are Ahoms still in our country?

Teacher: They are there but not very prominent.

The teachers at the Beanbone school have not yet used ICT for teaching-learning of social sciences in any of the classes.

Teaching-learning the Information Technology (IT)

IT as a subject matter in the schools involves students acquiring particular type of skills, sensibilities, and their application across all spheres of personal and social life. The Qmark school introduced IT as a subject to teach appropriate software, skills, and curricular content as early as class I. The Beanbone school too introduced computer-related learning for classes I-V though IT as a subject was formally introduced at class XI in the Beanbone school system. The differences in the introduction of IT at different grades highlight the class difference in the access and use of technology by the students of these schools. It shows the reproduction of inequality that the schools produce in terms of technological access and therefore, a stark variation in learning the subject at different age groups. It needs to be seen that IT has been considered a subject only in the present times in the school system and there are many reasons for the same such as importance placed on computer sciences in an increasingly 'modernist' society, expansion of technology markets, an increased presence of technology in our lives among many others. The skills being imparted in the early years in the school prepare the students for the roles they are expected to take as future citizens. It is vital to understand that though IT is considered an important skill to be taught in the school system, it almost invades every domain of our lives outside the school too. The transition of IT as a skill to IT as a means

of living life needs to be seen more critically by analyzing other domains of our lives where IT has been taking a prominent place. Also, it needs to be seen that the age appropriateness for the introduction of IT has to be critically analyzed and the factors behind this have to be understood more deeply. At lower grades, increased usage of technological devices not just rips the students of their outdoor play, impacts their physical and mental health in bad ways, it makes them hugely dependent on technology, and loosens the connection with their surroundings and self. The concept of 'screen time' is emerging in society because of the increased dependence of the students on these technologies. It has to be noted that young students are tender beings and susceptible to any influences in their environment and if they are routinized to use technology on an everyday basis, it may lead to long term negative consequences on their selves and minds.

The IT subject had been divided into one theory and one practical class. The competition for IT subject or IT week in the Qmark school (classes I-III) is in itself an example of emphasis laid upon the learning skills related to IT or computers for the upcoming generation. The environment of the students impacts their learning in many ways. In this case, learning IT skills in schools are encouraged and supported by the parents as it enables the new capability to use ICT products for daily purpose. Access to technological devices in the everyday environment such as mobiles, laptops, computers etc. increase its usage along and become an intrinsic part of our everyday lives. The students would learn these skills and make digital cards for other occasions too at other places in their lives such as festivals, birthdays etc.

Another important characteristic of the IT class in the Qmark school was that all the students worked separately on their computers and saved their work after the class got over so that the teachers and the students can refer to it again whenever required. As many classes and sections came to one computer room, the students saved their work in their class folders and continued with the same in the next class. Saving and storage of the previous works of the students signify the importance of the work students perform on the device as well as its relevance for the next class. This means that practical learning on the software is as important as the work done in the textbooks and needs to be done with due rigor. In the Beanbone school, the saving of work was not emphasized as much as in the Qmark school.

There was variability in the manner in which the students worked with the software. For instance, while using design software, the students practiced by making and coloring

different shapes to practice the software. In another class, while calculating percentages of marks, the students followed different steps such as some added all the marks and calculated holistic percentage, some calculated individual marks and calculated the percentage and some found out the average of each subject first and then calculated the percentage and so on. The teachers allowed flexibility while working with this software in the IT class as well as with examples formation in subjects such as English and so on. In the Beanbone school too, when the students worked on their computers as they were asked to make PowerPoint presentations, there was variability in how they made their slides. Some of them wrote the invitation in pointers, some focused on decorating the slide first, some others made all the slides first, and then wrote the content for the same. There are individual differences in the manner in which students express themselves while working with these software but the emphasis on homogenous results over-shadows these differences. Also, these differences can be facilitated in varying ways to make learning the software a fun activity for the students where individual answers are valued rather than homogeneity in the results.

Teaching-learning the Life-skills

In the Qmark school, there was a counselor appointed to teach life skills as a subject to students of all grades. It involved awareness of regular issues such as fighting, dealing with the human psyche and emotions, dealing with conflicts, and so on to prepare the students to face real-life situations. One of the days, the life skills teacher showed two videos to every class from class VI-VIII during the last period as a part of the life skills curriculum. The videos dealt with two topics from their life skills curriculum- anger management and how to show gratitude. The videos had cartoon characters explaining different ways and situations to manage anger and show gratitude. The students were in such a hurry to go back home that they saw the videos and quickly picked up their bags to go back home. The life skills teacher was not present to engage with it or talk about it any time later. It is important to understand that life skills was not considered an important part of the course and so, even ICT content in this class was not focused upon much. This subject didn't exist in the Beanbone school. This subject can be seen as a re-adaptation or a similar version of the moral values that used to be a part of the school curriculum. Although the subject could be made more innovative by pedagogical techniques that make it relevant for the lives of the students, it was reduced to counseling sessions and sometimes, didactic teaching of certain values. The role of ICT was limited to showing videos

for philanthropical purposes, moral lessons etc., although it could be used to make the subject more relevant and creative.

ICT and the Co-curricular activities

In the Qmark school, besides the time allocated for the games period, the students had to choose one co-curricular subject among various choices, the classes for which happened every Friday in the last two periods. The students were offered various options like photography, animation, robotics, astronomy, theatre, home science, and so on. For some of these courses, the students had to pay extra fees such as astronomy, photography etc. but not for home science etc. In the era of globalization, skills have become an important asset for the students to learn from in and outside the school. The schools too enterprise their brand of teaching and learning by introducing such courses to satisfy the parental demands. It is by inculcating diverse skills, students will stand ahead in the competitive world. Smith (1998: p. 371) highlights that globalization leads to more emphasis on the human capital resource model of education, producing workers for the new globalized markets. It is in this context learning more and more skills becomes important. It is in this world of competition that subjects like robotics and astronomy were taught in the school as the same used to be part of the college curriculum a few years back. This trickling down of subjects from college to school level and from school to pre-school level is a phenomenon that creeping into the education system.

In the astronomy class, the teacher showed a PowerPoint presentation to the students on Sun, its movement, parts, and environment. Through the usage of ICT, the teacher showed videos to the students explaining the Sun's surface and the movement. The concepts were abstract for the students to understand and the PowerPoint had too much content which the teacher was explaining, the students were interested in listening to it as it was a new concept. During my interaction with the teacher, he revealed that he even showed the space objects using a telescope to the students. Though there was no usage of ICT or the smartboard for the robotics class, the tools used were in itself a technology used to make robots, cars etc. It was based more on hands-on activities with support from texts, pictures, and guidance from the teacher. The students prepared their robots and practiced making them as per the advice of the teacher. It needs to be mentioned that these subjects are an intrinsic part of the technocratic world which values technology, science, statistics etc. and so, there is more emphasis on learning these subjects at an early age.

In the Beanbone school, IT as a subject and retail were offered as vocational subjects. Though the description of IT as a subject has been provided in the previous section, the retail subject focused more on outdoor activities and hands-on learning rather than the use of ICT. This is yet another example of how the education system reproduces inequality by providing curricular options to the students that prepare them for low-skilled jobs such as retail managers, customer executives etc. In the Marxian sense, this would be a superstructure that reflects how the society views government school students.

ICT and the Homework

The homework given to the students in the Qmark school often involved material related to ICT or usage of technological devices. For instance, in an English classroom, the teacher asked the students if they had taken a printout of the worksheet and pasted it in their notebooks. The students in the Beanbone school couldn't afford the same and homework comprised of the work teacher gave in class for practice or revision.

Earlier, there used to be student diaries that played an important medium of conversation between the students, the teachers, and the parents. The students used to note down their homework in it, the teachers and the parents conversed through it for any important notes or events related to curricular or co-curricular activities. Though the students in the Qmark school still carried alumnacs and noted down their homework in it along with the teachers' notes whenever was required, another medium added to this was the class WhatsApp groups, e-mail groups, and another software application called the smart homework. Every classwork was supposed to be clicked through one's phone and shared on the smart homework application. The teachers stated that though they were assigned to do this task, they asked students to do it as the former were already occupied with other types of works in the school. This was done so that if any student was absent or missed the work done in the class, he/she should not miss the work done in any class and get updated on the same. All the students, parents, and teachers were a part of this particular class group. Though in the Beanbone school, the communication with the parents was not aided by WhatsApp groups etc., the teachers often called the parents over a telephone to have a conversation if required. In most of the cases, the teachers called the parents if they had to ask about the reason for elongated leave of the child, health issues, concern for studies, information regarding the parent-teacher meet among many others.

The kind of conversations that take place around assigning homework and its completion between the teachers and the students in a regular classroom is very different from what might be the homework in future ICT classrooms. For instance, an English teacher checks the notebooks of the students and asks them the reason behind the non-completion of their homework. With ICT as a medium for uploading and recording of the homework in the classroom, the first accountability comes with the aid of a computer device and then, with the teacher checking the same. For instance, even during the covid-19 pandemic, it has been seen that sometimes, the students blame ICT for non-completion of their homework. This entails that there is a digital medium between the students and the teachers that changes the process of completion of homework and the discourse between the teachers and the students. Now, the communication between the teachers and the students involves a device that creates a psychological distance, creating indirect accountability of the teachers in the future among many other ramifications. Also, the process of completion of homework changes with the access to ICT as the student's research and do tasks, create PowerPoint presentations and e-mail them etc. This creates a dependence first on ICT and then the teacher, more independence and more flexibility masked by more regulation by the technology. This is different from the non-ICT setups where the students directly feel dependent on the teachers and the teachers feel directly responsible for the students. It can be seen that the teacher's role for transacting academic content would be replaced by these technological platforms.

ICT and Special Education

It is important to see and understand the usage, relevance, and importance of these ICT devices by the differently-abled students. While other students in class I-III in the Qmark school were able to use the software such as Microsoft Paint etc., the special students faced difficulty in using them and creating their drawings for the IT week competition. A student Aryan wanted to draw but that could be possible only when he could get some help. But teachers may not spare time with him to help as they keep busy due to the pressure of competition. These students, therefore, become the second priority of the teachers during the regular school hours. He looked at the drawing of the other students but couldn't help, just sat and talked to them. Though special students may pick up IT skills more easily, in this case, it was clear that the student needed help in comprehending the tools and couldn't work on them independently. The students with special needs were allowed to attend the normal classes but they had special periods for extra help and their examinations too were held separately.

There was a special education room with three teachers dedicated to the classes of the special students in the Qmark school. The special educator showed the researcher videos of NCERT texts which he showed these students to make them learn in a better manner. His teaching was based on these text-based videos though he could use other innovative materials too for making the concepts easy for these students. These videos just displayed the text in the video form and couldn't make learning easy or need-based for these students. Other than this, he used word cards, different scripts to make these students understand the concepts better. ICT can play an important role in making concepts understandable to these students. The lack of time and lack of innovation in finding better ICT content for these students made the burden of the chapters intact for the students. The teacher said that it was important to give them extra time so that they can read and write like the other students and so, in their special periods too, they made them practice the book reading and writing which they couldn't keep pace within the regular classroom. There are so many reading softwares, devices such as Dolphin screen reader for visually impaired etc. that cater to the needs of special students which were not suggested or used in the school for these students. Also, some websites develop content for specially-abled students to help them learn in an easy manner which was not mentioned or used in the school. ICT and developments in softwares for differently-abled students are a boon for the students with special needs as it has made learning easy for them but as these students were not prioritized by the school, they were always looked at as slow learners, with an eye of compassion that viewed them as lacking something. There can be an alternate vision that views them as equally capable learners and puts effort in their growth through the usage of the available softwares, that couldn't be seen in the school system. Even at the higher education levels, developments in technology have aided the differently-abled students to not just pursue their studies independently with access to hearing softwares, typing softwares, speak and write softwares among many others.

The Beanbone school had not offered admission to differently-abled students.

ICT and Assessment

The evaluation using ICT needs to be seen at two levels; the specific usage of ICT tools for assessing the student's work and the usage of ICT work by the students using ICT or non-ICT measures.

In the IT week competition organized by the Qmark school for class I-III, the teachers helped the students if they couldn't complete their drawings or couldn't figure out how to use a particular tool as the students were at their early age. Though the students made their drawings on the computer, it was evaluated at three levels by the IT teachers, then by academic heads, and finally by the writing heads. The criteria for assessment was objective based on certain factors such as diversity of tools, written message etc. For classes VI-VIII too, the IT subject was assessed at both theoretical and practical levels. For practical, the students were required to perform the operations using software on the computers. So, it was mostly an IT subject that was evaluated with the usage of ICT since it involved practical work and tests. In the Qmark school, the students were also assessed on how well are they able to use the ICT tools and present their work. For instance, in a History classroom, the whole class of students was required to develop a PowerPoint presentation on vermi-composting and present it before the school on a certain day. This was a part of the assessment and students were marked out of a total of 5 marks for this work in their grade sheet. ICT could be seen as a part of assessment although in limited ways. It needs to be mentioned that just like pedagogy, ICT can be used to make assessment innovative and creative by use of powerpoints, online tools etc., which was used just to finish the tasks assigned as per the school work and not for innovative purposes. For instance, the students were required to submit PowerPoint presentations on a science topic as holiday homework. The students had to present that in the class, were asked questions, and then they were marked on the same. This shows that although students are trained to use ICT in efficient ways, the academic content is not explored in innovative ways such as videography of water conservation in nearby areas, documenting photos of air pollution etc. The emphasis remains on using ICT skills to be able to use the various tools that it offers. This was reflected in the report cards that the teachers prepared at the end of every semester. The teachers were required to enter the marks on an online software sheet and then hand over the printouts to the parents. This too showed that the school emphasized the normalization of usage of ICT devices for routine tasks, to be able to make all the agencies adept in using the same. This adds to the school's brand name, culture, image, and the purpose of making it a technologically equipped school (a vision embraced in a technocratic society).

It is also important to look at the students' assessment through the usage of ICT. The students from classes I-III in the Qmark school had not developed the skills to assess their work. In the IT competition, the students have kept drawing, erasing, and re-drawing their work even though it was perfect from the teacher's viewpoint.

In the Beanbone school, it was only in the IT class that the students were assessed on their usage of ICT devices. Besides the theoretical examination, the students had to give a practical examination to display their ICT skills. The teacher, informally, checked the PowerPoint making skills of the students while making them practice the same. Since ICT was used very less in the Beanbone school, the assessment through ICT was far behind.

It was shared by a person representing the HCL foundation at an ICT conference that for ICT to take the main role in the classrooms, it is assessment through ICT which has to become a norm first. She shared that, in the schools run by her foundation, though the teachers have made use of ICT and created supporting factors to perpetuate the same, the students have gone through a stressful period at the time of examinations. It is almost like playing with the minds of the students where they are told that ICT is a new phenomenon and would help them learn in better ways. But during examinations the same teachers instruct students to prepare for writing answers in the answer sheet in the conventional mode, that is pen and paper. Learning through the digital means becomes irrelevant for writing examination doesn't happen through a digital mode. The assessment, therefore, defines the medium of learning in many ways and it needs to be digitized before ICT can be pushed at the other curricular levels for better results.

Another important factor that needs to be kept in mind is the assessment of ICT integration in the curriculum itself. The trajectory of the growth of the usage of ICT materials, both in terms of quality and quantity needs to be seen. And, how well the teachers and the students can make use of ICT over the period. It is a question of whether the teachers and the students have learned to use ICT devices and material creatively, whether the teachers and the students have developed their research proficiencies, among many other criteria. This study could not elaborate further as this domain requires long term engagement in the field, although the use of ICT in creative ways was missing in the field observations. Even during the times of the covid-19 pandemic, the students were required to give online examinations before the actual examinations so that they become used to the same. Online examinations might become the norm in the future, although their content such as subjective vs objective exams, book questions vs creative questions etc. are things that need to be pondered upon.

ICT and Pedagogy

ICT and the Teaching-learning process

How the technology in general and the ICT, in particular, change the course of the teaching-learning process in the school system has been one of the objectives of this study. Compared with conventional technologies such as textbooks and blackboards, we need to ask the question to what extent has ICT impacted the teaching-learning process.

The pedagogical techniques in the ICT class in the Qmark school usually involved asking questions related to the video, audio, or PowerPoint presentation being played on the smartboard. It was the device that remained at the center of the class and the teacher looked at the content of the device to ask questions. Although the ICT was considered important enough to acquire the center stage, its purpose was visualized as a support tool by the teachers and therefore, it was used accordingly. This can be seen as a part of the process of normalizing ICT in the schools like the developed nations, which might happen in the later stages in India. The main goal of the classroom transaction was to run the content on the device and end it. So, the questions asked by the teacher were limited to the content displayed on the device and around it. The questions or the brief explanations the teacher provided didn't go beyond the content shown through the device. The type of questions asked in the Qmark school were usually short questions invoking the concept already explained in the video or relating it with that concept or recapitulating to connect with the already covered concepts. As the content on the smartboard had to be played at one go, the teacher kept her intervention minimum to continue with the content on the smartboard.

For instance, while playing a video on proportions in a mathematic classroom, the teacher asked the students:

Teacher: What can be done (in the video situation) to realize that they are doing wrong? (Concept-based question)

The students look towards the smartboard and teacher in silence.

Teacher: They can have a bank, put the milk there, there are 200 jugs already there

In another History classroom, before showing the video on different tribes, the teacher asked:

Teacher: You remember we had learnt about the difference between tribes and nomads in class 6th? (Recapitulation Question)

The students nod in acceptance.

Teacher: So, what do you mean by tribes?

Student A: They live in hilly areas

Student B: They wear traditional dresses.

The teacher discusses different answers with the students to finally explain the meaning of tribes to the students.

In the Beanbone school too, the teachers focused on concept-based questions related with the curriculum or the questions involving recapitulation.

For instance, in a biology classroom, the teacher asked:

Teacher: The External structure of the leaf is called _____? (Concept-based question)

Students: Epidermis.

As has been mentioned in earlier sections, ICT was not utilized to make the teaching-learning process more innovative, rather acquaint the learners with its working and usage. This may be due to the early stages of the introduction of ICT in the school system. In a Non-ICT classroom too, as the teachers were the main medium through which the curriculum was transacted, the explanation of the concepts had acquired a major part of the teaching-learning process along with the questions, writing, and so on. The teacher could start and end the topic as per her pedagogical technique and method. He/ she could start with the exercise first, then chapter reading and question-answer or change this format as per his/her design. The kind of questions asked can be categorized into various categories such as inquiry-based questions, feedback-based questions, concept-based questions, and recapitulation-based questions among others. In a non-ICT classroom, the questions proceeded as per the design of the teacher's plan, whereas in an ICT classroom, it was the ICT device and its content that decided the procedure of the questions. This difference would negatively impact the teacher’s agency in future classrooms and need to be checked.

In the opinion of the students of the Qmark school too, the teachers encouraged them to use ICT for specific purposes and discouraged its usage for other purposes. These responses are vital to understand the perception of the students regarding the role and purpose of ICT the teachers visualize for them for educational purposes. About 96.23% of the students thought that the teachers encouraged them to use ICT for group work, 87.23% thought that the teacher's encouraged its usage for discussion, approximately 94.23% of the students thought that the teacher's encouraged them to use ICT to find out any information, 91.38% stated that the teacher's encouraged them to use ICT for general knowledge and 86.67% stated that the teacher's encouraged them to use ICT for playing music.

While doing Powerpoint presentations as an ICT tool in the classroom, it was observed that though the content in the slides remained the same, how teachers and students interacted with the tools had changed. For instance, in a History classroom, when the teacher was helping the students to prepare for the presentation, the content of the slides was the same but the language of the students engaging with it changed on repeated presentations. This suggests that while understanding ICT, the interaction between an ICT device or a tool and humans need to be seen more closely. Humans beings alter their behavior in the presence of an ICT device or a tool. ICT becomes an extension of our personality and we act as per the device subconsciously, without even being aware of the same.

Research on certain topics is an important part of the classrooms. With the availability of these devices and the internet with the students at home and school, research can happen within a fraction of minutes. Earlier, the only source for researching students at the school level was other publisher textbooks or libraries. So, the teachers resisted giving a lot of work that involved research for the students. It was during the break that the teacher asked the students to visit cyber cafes and search for some material. The research had become more frequent homework in the classrooms. The teachers ask the students every other day to look for some meaning/topic on the internet for discussion in the next class. For instance, in a history classroom, the following conversation took place between the teacher and the students:

Student A: Ma'am, are Ahoms present today?

Teacher: When you do activity of research on tribes, you would know whether they are present today or not.

At an ICT conference, this emerging concept of research by the students was discussed as a positive contribution of the technology in the education system but it raises a lot of questions about the kind of research that students do. The question that needs to be asked is that does research only mean culling out small bits of information from the internet or it means learning about a specific topic? Though the internet aids in the development of research skills, what does it meant for the students? Though research as a term has become more rampant and widely used in the classrooms, the internet composes of a plethora of information. It is also important to make the students aware about what are the correct sources of information, which kind of information is correct, which information is not valid, and so on. The students have access to all kinds of information but the analytical skills to look at this information critically should be emphasized in the schools. Though this forms a part of the IT subject, the teachers who teach other subjects too need to be cautious about it. Education is a means of socialization and it is socializing the humans to adopt technology in their lives without any conscious thought about its impact and influences, that needs to be dwelled upon.

This research was not an acceptable phenomenon in the Beanbone school. Neither the teachers gave homework to the students to find out any topic on the web, nor they considered these devices as an important part of the student's learning. The given content on the smartboard was the only content used by the teachers for teaching. Even in the IT class, the teacher never asked the students to practice the concept at home or search about some topic.

The ICT content was placed at a specific time and position in the ICT classroom. The teacher in the Qmark school, mostly, either played the content before the beginning of the chapter or after the chapter had ended. The ICT content was never played while a chapter was continuing in the classroom. So, the main text was still the textbook in the Qmark school with ICT material as a support text to be shown to the students to add to their understanding of the concept. For instance, in the Qmark school, the teacher showed videos related to the preposition, alliteration etc. as a recapitulation after the textbook chapter related to the same was over with the students.

In the Beanbone school too, there was very little usage of the ICT devices, and that too, only when the concept had been covered with the textbook and notebook discussion with the students. The ICT material was extra content that the teachers sometimes referred to whenever they had the time or they thought it could add to the student's understanding of the concept or they thought that it was an easy way to clarify the concept in the minds of the students and so

on. For instance, in the Beanbone school, in the English class, the teacher showed the video related to the chapter after she had finished the chapter reading with the students.

As has been discussed in the previous chapters, the learning theories in the realm of education have evolved from behaviorism to child-centric learning over the period. These changes have been informed by the trends in different disciplinary traditions. In educational philosophy and practice, it is the notion of child-centric learning which is an acceptable phenomenon in the present times. One technique that promotes this form of learning is project-based learning. At one of the conferences (learners as constructors of their knowledge), the student-groups from different parts of the country had displayed projects they had made using ICT resources. Some students had used online software to develop games, blogs, and websites. Another group of students had used wires, connections, and software applications to develop a model to test the purity of air in the system. The important question to be thought about, in this context, is the relationship between the constructivist approach to the teaching-learning process and the importance of ICT in fostering the same. Is ICT an important technology that can aid in fulfilling this goal of student-based learning in a better manner? Or is it that the importance of adoption of technology in the present times makes it necessary to be linked to the prevalent learning theories? This brings one to the question of the nature of learning with ICT and the need for theoretical developments along with new pedagogies around the same.

The domain of new pedagogies and ICT as a pedagogy needs to dwell further in the discussion of ICT as a learning tool. A teacher at an ICT conference shared how she used PowerPoint presentations in her class to narrate digital stories to the students. She, then, encouraged the students to do the same but the important skill students need to know for this is how to make PowerPoint presentations. Another teacher from Shantiniketan school shared that he helped the students in making a local history project by synthesizing the website material. Though it took a long time, with the use of ICT, the students were able to research material, develop questionnaires and develop their blog for local people to read their work too. It needs to be said that although constructivism as a pedagogy can be encouraged with and without the use of ICT, ICT as a medium can be used to facilitate the adoption of constructivism in the schools. ICT is clubbed with the prevalent pedagogy to facilitate the adoption of ICT and constructivism in the schools.

The rewards and punishments are a part of the hidden culture of the school and depend on the value system a school and its agencies embrace. In an ICT classroom, giving the right

answer on watching the ICT content was seen as a rewarding opportunity, and not paying attention to the ICT content was seen as a point to providing punishment to the students. This is how students were trained/disciplined to view ICT as an important part of the classroom. Even ICT was seen as a reward when the students had done their work and were free. This thought process is even adopted by the parents these days to hand over technological devices such as mobile phones to their children when they are free and are done with their work. This means that ICT is even seen as a distraction and can be used for pleasure as it doesn't need any usage of mind or hard work by its audience. So, if ICT has these qualities of distracting the mind, how will its usage be justified in a classroom where the teacher aims to shape the learners into active learners who need more deliberation before its introduction in the classrooms.

In a Non-ICT classroom, the teachers in the Qmark school often instructed the students to study well, else they would be called for the extra class. There was an understanding that extra class is a punishment that the students would get if they don't do their work properly. For instance, in an English classroom, the following conversation took place:

Teacher: Is anyone left with the notebook checking?

Students (Prompt): Ma'am, Manu.

Teacher (angrily): Manu will stay for the extra class today.

Often, the teachers either scolded the students or asked them to keep quiet when they saw them talking amongst each other in the classroom. This is a kind of ritual which any teacher in any school, teaching any classroom would be seen doing. Though while teaching, the student's talk might be a distraction for the students, to shun it completely and not view it as a pedagogical asset for the classroom is a loss for the teacher and the teaching-learning process as well.

ICT as a language

The body language of the humans, in this context, the teachers and the students, too changed with the presence of the ICT device in the school, especially classroom. In an ICT classroom in the Qmark school, the teachers usually remained on one side of the classroom as the smartboard was in the center on which the ICT content was being shown to the students. He/ she either saw the content from one side or back of the class. He/ she moved in between the

rows if the teacher had to pause and explain something related to the content or ask some questions and so on. The teacher usually looked at the content first on the smartboard and then, looked at the students to add his/her inputs if required. In the Beanbone school too, the teacher stood at the side of the smart device as he/she pointed at the content when it was being played on the device. In contrast, in a Non-ICT classroom, the teacher took to the centerstage and usually remained at the front center of the class with movement throughout the class as and when required. The teacher referred to the textbook but he/she was the main transactor in the classroom. It was his/her role to deliver the content to the students by using varied pedagogical techniques. It can be observed that although the teachers in the Qmark school used ICT as a support material, its position in the classrooms is very dominant and can be used as a replacement for the teachers in the coming times (as has been discussed in the other sections). The teachers need to create their own creative spaces in the classroom to emphasize their roles and agency irrespective of the use of ICT.

The students too had a specific body language in an ICT classroom in comparison to a Non-ICT classroom. In the Qmark school, not only the students moved less out of their desks in an ICT classroom, they too learned the body language they had to follow while using an ICT device or a tool.

For instance, while the students preparing for the PowerPoint presentation to be presented in front of the school, a boy was moving his hands to explain the concepts written on the slides.

Teacher: Hands at the back, Rishabh.

Rishabh moves his hands at the back and continues with the PowerPoint presentation and explanation.

The example states that students are trained to show a certain kind of body language when they interact with the ICT devices. The disciplining of the body with the usage of the ICT device or around its presence are the subtle ways in which ICT creates its culture to make the agencies around it adapt to the same. This can be interpreted in Foucault's terms as “disciplining” the body by the structures in the society. (Foucault, 1977) He says the technologies that keep changing with the times lead to the production of “docile bodies” by “normalizing judgment, hierarchal observation, and examination”. This produces knowledge that is “invisible” and “coercive”. If it was prisons that asserted power through normalizing the

criminals in the earlier times, the digital technologies assert power in hidden ways as the reasons behind the emergence of certain kind of content, the emphasis on certain algorithms, the purpose of creation of certain kind of devices and tools and use of data is not known. This shapes individuals in learning the same language and content, without which they won't be considered a "normal" part of the system. (Krasmann, 2017, p. 15) Also, while watching ICT content in the classroom, the students were usually passive with their hands on their chin or desks and eyes glued to the device.

It is obvious and apparent that when we use a particular device, we start talking in that language revolving around that device. For instance, if we use a laptop, we automatically start talking about the keys, related functions, tools, and so on. So, when an ICT device is used in the school or classroom in the Qmark school, the entire gamut of the language used in the school/classroom changes. The students of classes I-III could use words such as 'clipart', 'design tool', 'modify by borders', and so on, which shows that vocabulary of the students encapsulated terms related to ICT devices. This is the literal language of the device that becomes a part of the classroom culture upon its introduction in the classroom. Learning a language is a part of building the culture of ICT, thereby making it a part of the classroom culture. For instance, in a History classroom in the Qmark school, when the teacher was helping the students prepare the PowerPoint presentation for the assessment, she guided the students in making the best presentation. This is guided by the perception that PowerPoint have texts, pictures, videos and they need to be aptly placed with borders and lines for it to look better. There is a way in which PowerPoint is explained and the students were guided in doing the same.

Student A: (Explains the slide) Each child is supposed to do vermin composting. It helps in the collection of waste from the kitchen.

Teacher: Highlight that point.

Because the smartboards were a part of the classrooms in the Qmark school, the language revolving around the device was more prominent here. In the Beanbone school, there were few rooms dedicated to the use of computers and digital devices, so this language was restricted to these rooms.

Because of the rampant expansion of the mobile industry, the boys of class XI and XII in the Beanbone school too had mobile phones but their usage for academic purposes was never

discussed by the teachers or the students. The students of class VIII onwards had some idea about what was the meaning of "Bluetooth", "Network Connection", other means of connecting mobile to the computer such as "Wi-fi", "data sharing" and so on. For instance, in one of the English classes, the mobile phone couldn't be connected to the smart device, so the students started prompting:

Student A: Ma'am, hotspot se share kar lo. (Ma'am, share it through hotspot)

Student B: Ma'am, wi-fi on karke dekho, shayad usse ho jaye. (Ma'am, switch on the wi-fi, maybe that can help do it)

Student C: Ma'am, agli baar Bluetooth device leke aayenge, use jaldi connect ho jaega. (Ma'am, next time, we will get the Bluetooth device, that will connect quickly)

The teacher calls one of the students near the board to help her connect the mobile with the smartboard to start playing the video.

The literal language of the ICT materials too has been a matter of discussion at many forums and conferences. At an ICT conference, it was shared that most of the websites that are being accessed by the teachers and students for educational purposes are in English in the Indian context. Since the schools seen as a part of this study were English medium schools, this issue didn't come at the forefront but nonetheless, it is an important issue in a multilingual country like India. If there is minimal content in Hindi language, one can imagine the paucity of content in other state languages, local languages, or dialects. Although in metropolitan cities with English as the language of communication, the digital content in English is comprehensible and so, it can be easily be furthered and used in the schools. In places with languages other than English as the dominant language, the problem of content availability would emerge first and a lot of work needs to be done in advance before the introduction of digitization of school systems. A lot of startups are emerging by making educational content available in local languages to be able to increase the accessibility of the digital content and make the digital world more equitable.

ICT and Skills

The major argument behind the agenda of the importance of ICT in the school system is the acquaintance of the students and the teachers with the requisite skills for the 21st century. ICT

has increasingly become important in education around the world. There has been a recognition of the importance of ICT in education and India cannot but take the same road as the emphasis in National Policy 2020 (Ministry of Human Resource Development, 2020) suggests. The skills required to revolve from technical skills such as using Microsoft Word, Microsoft Powerpoint etc., use of available softwares, development of computer resources and become acquainted with the skills required to survive such as computing, using safe cyber resources, and so on. It is a widely recognized fact that the agencies involved need to develop certain skills while using ICT such as research, engaged parents, the authenticity of data, student-centric projects, networking, solving real-life problems practically, and so on.[26] Although the Qmark school held some workshops on cybersecurity and related topics, it was bi-annually or annually which meant that the school focused less on developing these aspects of technological usage. Also, certain higher-order skills such as creativity, reflecting etc. can only be facilitated with the use of ICT and the teacher but can't develop on its own by the device itself. This is because ICT is just a device programmed to perform certain tasks and skills like critical thinking, analytical thinking, creativity etc. involve the human mind that has capabilities beyond a device and therefore, needs human intervention.

As the information explosion circulates around us through the means of varying technologies, mass media, internet penetration, the prevalence of fake information too is expanding rapidly. So, the authenticity of the data is difficult to acknowledge. For the system of education, with the expansion of web-based education platforms and the increasing reliance of the students and teachers on such platforms for educational materials, the users should know the authenticity of the data that is available on such platforms. Then, it is not integrating technology in the education sector but also facilitating digital citizenship among the teachers and the students. It was highlighted that digital citizenship is the need of the hour and the students and the teachers need to be trained to use ICT cautiously along with the push for increased use of ICT.[27]

The Qmark school teachers insisted on written work by the students in their notebooks. The teachers sometimes dictated the question-answers, sometimes they displayed them as

[26] In a paper presented at an ICT conference, a professor from Ireland shared that her team had used mobile phones with the students to make interesting projects such as water conservation in the neighborhood, marking area for the same and so on.
[27] At an ICT conference, it was highlighted by the program co-ordinators of a program known as ITE by TISS

PowerPoint presentation on the smartboard. The teachers often said that the reason behind this is because the students are required to give the examination in the written format. Writing is an important skill that students learn in school. Though it has been replaced by typing in many domains of our lives such as higher education institutions, administrative purposes, less paperwork, and so on, it has still not happened in the context of schooling in India, even though this might be the future of Indian schools too. The changing relationship with the body(hands) and the loss of a skill in the future needs to be thought about in-depth. Also, writing is not just a skill but entails a discipline along with it- a style, an approach, and a manner in which it is done. For instance, in an English classroom, the teacher asked a student to write the date in the page first and then start writing from the left margin. Also, while the teachers used ICT, they insisted that the students write the content in their notebooks alongside for them to remember it. In an English classroom, the teacher asked the students to write down the examples of conjunctions from the video as she played it and explained the concept alongside. In this case, writing makes the students register the concept in their mind and see it as important, as opposed to just watching the video and not recording it anywhere. The notion of clean work in the notebook which holds certain minimum marks in the assessment holds relevance today but might not be an important factor as the students will be required to do their homework fully with the ICT device in the coming times. The format of writing which involves date on the left-hand side and certain other important factors might not be the same with ICT because the students would use software for writing which would have automatic systems to be followed by them. As ICT would have it's language, it might change the way the world would view writing in the future. Also, handwriting is cherished for its personal touch whereas typed written text is homogenous and lacks the same. So, in a world where typed texts might become the norm, we must learn to embrace the handwritten texts as well for their reflection of a person's self in so many ways.

Technology is developed to ease human work in many forms. One such skill was translation which was done by translators in the earlier days and now, all the softwares including google, Microsoft have online translators to make translation easier. If not a direct medium in the classroom, these softwares are more or less familiar to the students and others outside the contours of the classroom. It is easy for the students to learn the skills of translation online using these softwares. Also, because translation can be easily done using these softwares, the requirement to learn many languages has evaded as students can translate directly from these softwares. This further leads to increased dependency on technological

devices and less emphasis on the development of skills to be able to do the translation or learn the languages on one's own. This is how technology made us forget phone numbers, names etc. and weakening our memories by making us rely on available numbers and names on our phones. These things need to be seen critically for these processes are involved in the shaping of humans and society. In one of the English classroom, the teacher gave the students an example- "Can you translate____Spanish?" She further asks:

Teacher: How many of you can actually translate from Spanish?

Students: We can use google. It actually depends on the passage of translation.

Sociological Insights in the world of ICT

The fact that students were told 15 days before the IT week competition to prepare for the same at home showed that it is an acceptable fact that these students had access to devices such as laptops, mobiles etc. at home and they would have used the same for practice. This exists as a part of the shared conscience among the teachers, the students, and the parents. Within this rhetoric, an interlinkage between the class of the students and the subjects they are taught at the school can be seen. In the Beanbone school, the usage of ICT for learning all these skills were not even visualized because the students of the Beanbone school did not have access to these devices and it was an acceptable fact among the agencies involved. Moreover, class positions of the students' families were constrained to normalize IT as a part of their lives due to the financial crunches.

The class dynamics impacted the curriculum and its aspects in many ways. The Beanbone school offered retail and IT as an extra subject to develop the vocational skills of the students whereas the Qmark school offered robotics, photography, astronomy among many others. The difference in the subjects offered for vocational skill development highlights the difference in the perception of the Beanbone and the market for the students belonging to different classes. For instance, if the students in the Beanbone school are being prepared for lower-level jobs such as customer executive, a sales executive in shops, malls etc., the students in the Qmark school are equipped with skills such as photography etc. to enhance their skillset and choose what they want to pursue. As a part of the extra-curricular activities, there was also philanthropic collections that were done by the students of the Qmark school every year for a Non-Governmental Organization called Sparsh which catered to the needs of visually impaired students. To collect the funds, the students from classes XI, class XII came to classes to

elaborate the PowerPoint presentations to the students, and a competing environment was set between the students to collect maximum funds from their parents and neighborhood. Another very stark observation that depicted the class difference was that IT as a subject started at the primary level in the Qmark school whereas, in the Beanbone school, it began at the upper primary level. The number of years students of the Beanbone school missed learning the ICT impacted their overall growth and development. So, ICT was also a medium to be used for class-based events and transactions.

The class dynamics were also visible in the interactions between the teachers and the students. The students of the Qmark school were very vocal about their needs, rights and expressed the same without any hesitation. For instance, in a mathematics classroom, the teacher played the video based on percentage. As the video stopped twice in between due to some error, a student asked the teacher to just stop the video and begin with the notebook work. In another instance, the students asked the English teacher to stop teaching as the period was over and it was homework period that couldn't be used for teaching. In the Beanbone school, however, the students of class VI-VIII usually obeyed whatever the teacher decided for the class. Although the students of class XI-XII sometimes asked the teacher to cancel the class as they had an exam or they were busy with other subjects or activities in the school. Therefore, class dynamics leads to a different kind of interaction between the students and the teachers. While using ICT, there were many instances when the teachers referred to certain events that highlighted the class biasness among them. For instance, in a History class, when the teacher was showing videos of tribes and nomads, it was being highlighted in the video that 39% of the Bhil community was found in Rajasthan. The teacher herself belonged to Rajasthan and she immediately stopped the video and said, "Do not think I am a Bhil". This instance, seemed to suggest that tribes belonged to a low class of the society and the teacher likes to disassociate associated with them. There is a stratification of the society based on class, this example suggested the reading of history as "them". These are few ways in which the teacher-student interaction was impacted by the class consciousness.

The digital divide could be seen more starkly during the covid-19 times when more than half of the student population studying in the Government schools couldn't continue their education due to non-accessibility of the digital devices whereas the students of the private schools continued their education through online mediums. The proliferation of ICT is in itself

a class phenomenon as its access is inequitable to a major part of the population and therefore, its impact varies in different contextual settings.

ICT and Gender

In the Qmark school, in an English classroom, the teacher played a lot of videos in a continuum and asked the students regarding which video she should be playing on the smartboard. A girl student asked the teacher to play the Cinderella movie and the teacher said that she always wanted to see that movie. Females are socialized to like characters like Cinderella at home and in school and therefore, the girl liked seeing that again and again. This is how humans are socialized through stories and the values they inculcate, that lead to deeper beliefs in their subconscious mind. The way humans are socialized, then, impacts the choices they make when an opportunity arises.

In the Beanbone school, the girls and the boys were made to sit separately in the classroom as well as the TV room or the projector room. Though the girls and the boys sat separately in the classrooms in the Qmark school as well, the arrangement of the ICT lab was W-shaped which made the segregation less distinct. So, for instance, in a Qmark school, if two girls were sitting next to each other on the computer, they could be accompanied by the boys on either side. Since the Beanbone school had the same desk arrangement in the TV room or the projector room as in the classroom, the boys and girls sat in separate rows as they did in their classrooms. The kind of devices, therefore, changes the quality of the interactions that take place among the students and the teachers. ICT infrastructure could be used to promote gender-friendly physical spaces in the school set up which could hardly be seen.

In the Qmark school, the work allocation related to ICT too was gendered. For instance, it was the boys who were assigned the duty of maintenance of the device most of the time. Maintenance requires physical and mental work and therefore, it is men who are considered more fit for it. These things need to be challenged to break gender stereotypes in the mind of the agencies involved in the school system. The difference in male and female students in using ICT devices for varied purposes needs considerable attention as it depicts the difference in socialization and orientation towards usage of ICT devices for specific purposes. (See Appendix I) Also, it is important to mention that ICT is just one medium to challenge gender dynamics, it majorly depends on the agencies using it to critically think about it and plan it in appropriate ways.

ICT for Democratic Process

One of the important aspects of a democratic society is providing equal opportunity for all. The National Policy on Education 2020 (Ministry of Human Resource Development, 2020) is aimed at promoting equity through the means of ICT. It aims at making education reach the masses through the digital means that ICT provides. A vital transformation that is taking place in the field of education has been the increasing access to the technologies and their related platforms. It implicitly suggests that the growing trend of ICT based education informs the democratic nature of ICT. It is believed that ICT can equalize opportunities by making the educational material available to people belonging to all classes, castes, regions, religions, and ethnicities. For instance, Pratham, a non-profit organization in Delhi has utilized the concept of open licensing on the web to make their books available to people in many countries. Although technology can promote education in marginalized settings where there is a problem of lack of teachers, lack of physical school spaces etc., whether it can make up for those differences through technology is a much vital question that needs to be asked. It was quoted at an ICT conference that technology can't do what couldn't be done otherwise. ICT has a democratized presence as it is readily available and accessible but if the other structural issues in the education system are not addressed, it won't be able to resolve the problem of equity and thereby, democracy. The question that needs to be asked is whether technology is democratic or divisive? Although the accessibility of the technology makes it democratic, its presence is not the same across various castes, classes, gender groups, and so on. For instance, if one observes facebook algorithms, it feeds the data to an individual based on analysis of what the person searches/looks for and is interested in over a while. So, it replicates what a person already knows and keeps feeding him/her with more of that. It doesn't provide for what one is not aware of. In that sense, it replicates inequality that already exists in the society by providing what a person already knows again and again. The democratic aspect of the technology needs to be critically seen across these dimensions.

ICT can help in developing connections among the people the world over. Nowadays, schools have started utilizing forums where students from U.S.A/other countries can discuss and debate over a lesson with the students sitting in India over the web platform and share knowledge. When we talk to people across boundaries, we become global beings and ICT is a medium that promotes these processes of globalization. These processes that promote the culture of technologism and globalization shape the students and their selves in varied ways.

For instance, the global world would become more accessible to the students and therefore, this might aid processes like global academics, global citizenship, global curriculum among many other processes. This trans-national, trans-boundaries characteristic of ICT enables us to communicate across borders but it also limits the vitality of physical space in our lives. Human beings are holistic individuals with physical and mental presence. Traversing to new physical spaces impacts our minds and selves and that's the role physical spaces play in our lives. With the glorification of ICT as the medium that can overcome the boundaries of physical spaces, humans are being controlled to stay in controlled settings and algorithms created by the digital mediums, which will harm the human mind and physicality in many ways in the coming times. For instance, influenced by the possibilities of the digital mediums, the departments may cut funding for seminars/workshops at different places and instead, organize it online. This may be limiting as it would cut meeting new people, seeing new places, and learning from new settings and new life opportunities itself. UNESCO and various other organizations have developed such platforms that promote trans-space interactions but they shouldn't be seen as an alternative for learning outside the classrooms, from new settings and environment. Even during the times of covid-19, many schools resorted to online visits to museums which was a necessity but it shouldn't be equated with a visit to the museum that involves physical, mental experience and thereby, having a holistic experience.

Limitations of ICT

With the increasing usage of ICT, the Qmark school held workshops for the students to make them aware of the threats they may encounter while using these devices or the internet. Even the teachers were not allowed to upload videos or any other content from any other place but the school's computer room or IT room to resist the virus. The susceptibility to data loss, virus attack, data theft etc. are inherent in digital devices and it is important to train the students, the teachers, and the parents on the same while facilitating the usage of these devices in the school systems. A lot of new corporates are focusing on developing tools, training modules to challenge these threats.

Many times, the smartboard and the internet system didn't work in the classroom due to which the teacher had to change the lesson planned or switch off the system and work with the textbook and the notebook. For that matter, any kind of technology is susceptible to such vagaries and may leave the education system disrupted if there is complete dependence on such technologies. For instance, in a German language class in the Qmark School, the teacher had

planned to show a video to the students and the smartboard system couldn't be connected to the online database. The teacher called the other teacher from the next class, asked some students to help but it couldn't be resolved. She, then, started with the chapter from the book. These are the threats with the usage of digital devices and need adequate attention as technology becomes an intrinsic part of the school systems.

The nature of content that the students see on the smartboard or any other ICT device needs to be appropriate as per the age, relevance for the students, the curricular content and has to be qualitatively appealing as well. In one of the mathematics classrooms, the animated video had characters which moved in unrealistic ways, their eyes popped up when they were surprised, the drummers in the video played the drum even without touching the drum which seemed very unrealistic and humorous to the students of this age group (classes VI-VIII). The students laughed a lot while watching the video and even pointed out these traits of the characters in the video.

Student A: Ma'am, he has not even touched the drum and the music is being played.

Student B (laughs): Ye ankhein kaise ghuma raha hai. (See, how is he rolling his eyes)

It is quite possible that the students of this age group (11-14 years) can't relate with the characters which are animated unrealistically as they can differentiate between the animistic world and real-world characters, as Piaget suggests. (Berk, 2013) The teachers need to keep these factors in mind while choosing any content for their classrooms and the developers too need to be aware of the same. ICT also makes the students passive in the classrooms as noted in the earlier sections, which should be challenged by the teachers while using the ICT content to increase the student's involvement in the classrooms. As has been mentioned in the earlier sections, ICT and its forms can be seen as a facile replacement for the human presence in the schools and the classrooms, which can be limiting for the mind and the body. Out of the total 90 students, about 69.23% students thought that ICT can lead to health issues, about 57.14% of the students thought that ICT has no limitation when used for entertainment purposes, about 66.67% of the students thought that ICT has a limitation when used for knowledge-based purposes and 63.64% of the students thought that ICT has limitations when used for purposes other than these.

ICT and Human relations

It is well known that an important aspect of the teaching-learning process is human relations, that is the subconscious of learning from each other. This is beyond the content that is transacted at the outset and performs the salient function of personality formation, value building, and so on. This forms the binding means for the social and pedagogical relations in the classroom. As the ICT enters the classroom, there is a new culture that re-defines those relations. For instance, as has been mentioned, in an ICT classroom, the teacher always speaks to re-affirm what has already been covered through the ICT medium. Many such changes in the social and pedagogical relations between the teachers, the students, and the parents mean that the entire structure of the classroom as imagined in the education systems is broken. The teacher no longer remains the key person to learn from and the students value online learning as swift and reliable. As this longs for a considerable amount of time, one can visualize the entire classroom as broken and therefore, a substantial change in the meaning of the education systems in the coming times. In the times of covid-19, there has been an absence of physical interaction between the teachers, the students, and the teachers. This means the aggravation of learning through ICT platforms and therefore, limiting the learning process to just the content of the disciplines. The further sub-sections would reveal how these repercussions would play out in the sphere of relationships in the education system and a coercive shift towards its almost breakdown in the coming times.

ICT and Self

When any new devices or tools being introduced and used by the teachers and the students in the classroom continuously, then it eventually becomes a part of the classroom culture. The devices do not exist in a vacuum, but integral to the representation of one's self as the very existence of the devices fundamentally involves human interaction in one form or another while they were in use. For instance, in a History classroom, when the students were preparing the PowerPoint presentation to be presented in front of the school for assessment, the students and the teacher presented the slides as a part of what they were speaking. There were certain parts of the slides, collated with certain parts of the speech, which together formed the whole presentation. So, the device represented the extended self of the speakers and displayed the parts they were speaking about. How ICT impacts our self and our interactions will be discussed in the following sections:

ICT and the Students

Though there are varied learning theories such as behaviorism, constructivism on how students learn, as has been said, it is important to understand the learning patterns and styles of students while using ICT devices. Not only students, but we as humans have a habit of adapting to our environment and learning from each other. The students in the IT class saw what their partner had drawn and started copying from each other. Once, the student sitting next had drawn rain and the other student copied it, sometimes they removed clouds to copy their partner. A student showed her classmate that she had written- "We will do pooja on Diwali" and asked her partner not to write the same sentence but something just like that. This can be seen as behaviorist pattern of learning which happens in a non-ICT classroom as well. Although there are many other ways in which students learn such as experiment, observe etc., learning with ICT too involves the use of the same patterns that the human mind has adopted in the other conditions, with variations of course. The variation majorly would derive from the agency of the digital mediums to shape the classroom interactions. For instance, a student working on a computer would have to learn the language and follow the commands of the digital device while working with it. This would impact the student's psyche and learning behavior in many ways.

The teachers and students were engaged on the screen whenever the ICT device was switched on. If the content on the ICT device was interesting for the students, the students didn't feel the need of a teacher to make them sit or not talk or behave well in the classroom. For instance, in an English classroom, the students were watching an English movie for developing their listening skills and not a single student moved out of the class even during lunchtime. They kept seeing it in silence until the next teacher came to start the class. Visual images have a lasting impression on our minds. The power of ICT on our minds, therefore, cannot be valued less though its apt usage is still a question of discussion and debate.

The imagery and the rhythm of the audio, video, or the PowerPoint presentations showed to the students created a lasting impact on the minds of the students. For instance, in a Hindi classroom, the teacher showed audio narrating the textbook poem of Rani ki Jhansi and the students sang the same along with the video while noting the words and phrases in their textbook.

The students felt very passive while watching any ICT content because it didn't involve any active engagement from the students besides listening to the content being played. So, it

was seen that it was very difficult for the students to come back to notebook writing after they had seen any content on the smartboard. It is because they went into the receptive mode while watching any content on the smartboard and it was very difficult to return to the active mode to write or perform any other action which didn't involve the smartboard.

How the students use ICT impacts them, their usage of ICT, and their conception and role of ICT in the school system. In the Qmark school, the students were mostly at the receiving end of the technology as the smartboard was the main device to be used by the teachers in the classroom. It was only in the computer room that the students experimented with drawings, tables, and cards etc. while using the computers. Other than this, there was no active usage of the technology by the students to solve real-life problems or relate them with other parts of the curriculum. In the Beanbone school too, the students received the content from these devices in the ways decided by the teacher since it was only Television and projector being installed in two rooms other than the computer room. The Beanbone school students too experimented with PowerPoint presentations, cards etc. only in the computer room. They didn't have the curricular space to link ICT with other subjects, create ICT related materials or use it actively to solve real-life problems.

The students too believed that ICT was an extra tool and insisted the teachers to carry on with the main task of the classroom. In a mathematics classroom, when a video couldn't be played properly, a student asked the teacher to stop it and continue with the main work in the notebook.

In an English classroom, the teacher was called by the headmistress for some work in the staffroom. Now, to engage the students, the teacher asked the students to switch in the smartboard and watch any video. The students take permission from the teacher and start watching Avengers on the smartboard. They close the door and the lights and watch the movie as if sitting in a theatre. It is not problematic to see such movies once in a while, but the dominant notion of the screen has been associated with movies, games, and other fun activities. So, as soon as the students are free from school work, their minds take them to the fun mode of usage of screen. In this context and the widening EdTech startups and other endeavors, it is important to see the role of screens in schools in changing such conceptions or creating new spaces for its usage.

The student's own schemas impact the things students notice in an ICT material or emphasize the same. Because there are many occasions in the school when the students are told to walk in a line, the students automatically point to such things while watching a video. For instance, while watching a video in a mathematics classroom, a student points out:

Student: Ma'am, they are so responsible, they are standing in a line.

(The teacher looks at him, smiles, and asks him to concentrate on the video)

The kind of videos showed to the students as a part of the curriculum invoked different reactions from the students and the teachers. For instance, in a history classroom, the teacher showed three videos to the students on different tribal communities such as Gonds, Bhils, and Ahoms. The video on Gonds stated information about Gonds through a conversation between a father and a son, the Bhils video included dance and music to explain about them and the video on Ahoms was an explanatory video stating information about their geography, kingdom, and so on. The teacher asked the students which video they enjoyed the most and the students replied to the video on Bhils. The researcher also observed that because the video on Ahoms was based on the format of direct explanation and involved too much explanation, the students became restless while watching the same while the students were very interested in watching the video on Gonds and Bhils.

ICT and the Teachers

The teachers in both the Qmark school and the Beanbone school perceived technology as good and could help learn in many ways. But it was seen as additional work by the teachers due to examinations held offline and paucity of time to finish the main syllabus. The teachers s viewed ICT as a support device to their teaching and not the main tool to be used in the classroom. How any educational tool is perceived by the education system including the school agencies such as the teachers and the school impacts the usage of the same in the school system. A Hindi teacher told the researcher that though the students enjoyed watching ICT, she can't use it daily as it consumes a lot of time. Most of the teachers in the school used it as a device to be used to aid learning or for free time or for substantiating the concept/argument. In a conference held on ICT in the education system in India, a professor shared her experiences of working on the STEM program with the school students in Ireland. She argued that the teachers in Ireland too felt that there was hardly any time to incorporate ICT in the curriculum due to the paucity of time in finishing the syllabus. Besides having no time, the teaching profession is very hectic

and hardly leaves any space for the teachers to imagine the use of ICT creatively in a limited time.

Because ICT was never seen as a main pedagogical tool or material, the content chosen by the teachers was not aptly placed in their lesson planning. The teachers chose content as per the topic based on certain factors such as the difficulty of the topic, mandatory requirement of ICT material, and so on. The videos, audios, or powerpoints were never decided according to the specific purpose for the requirement of a topic but on the availability of the material for the topic and the requirement for a topic. Since ICT learning was never put to test, it was used just as an addition or for the sake of it. For instance, if a teacher had to show a video on Rani ki Jhansi's poem in the textbook, she would search for some material online and choose the best out of that as per her wisdom. He/ she wouldn't think about the purpose and the objective for which ICT content is required, then give it a specific place in the lesson plan and see its impact and choose the next ICT content accordingly.

Sometimes, watching videos on the smartboard was seen as a sign of reward for the students when they were done with their work. For instance, in an English classroom, the teacher had nothing to teach after the students were done with their work and so, she played a video of a movie on the smartboard so that the students can be engaged and she can focus on her work. Similarly, stopping the video was a punishment for the students if they disturbed the class or kept talking. In a mathematics classroom, the students kept prompting in between when the video was being played and so, the teacher says:

Teacher: Since you are not co-operating, we should stop. *(The teacher stops the video to play it again)*

Student: Arey yaar, kitna mazedaar tha. (Oops, it was so much fun) (The students regret the fact that the video has been stopped)

ICT and the Teacher-Student relationship

The relationship between the teachers and the students was hierarchal in the classrooms of the Qmark school. Often, the teacher held authority over the students in terms of choosing the content, the position of the teacher, the authority in the classroom, and the autonomy of the students. Although the teacher's have a position of hierarchy in almost all the classrooms, with the ICT coming in the classrooms, this gets fused between the teacher and the device. For

instance, in an ICT classroom, when the teacher plays the ICT content and silently observes the same, he/she is giving equal power to the ICT device and its content to play a role in the teaching-learning process, though she still has agency in shaping the content. The agency teacher enjoys in placing and presenting the ICT content can be easily challenged by the power enjoyed by the corporates and school administrations in diminishing the teacher's role in the classrooms, once it is believed that the teacher's role is limited to delivering the content that can be easily done by the ICT as well. The 'hidden agenda' behind the content would have to be looked at critically since it would be more driven by the corporates, the administrators and less by the concerns of the students and the teachers. In an IT class although, it is the teacher who enjoys authority over the device and the students as he/she dictates what and how the work has to be done. The type of activities for which teachers encouraged the students to use ICT devices has an important place in understanding the changes in their relationship as well. (See Appendix I)

In an ICT and Non-ICT classroom, the content for the lessons to be delivered in the classroom was chosen by the teacher and the academic heads. In an ICT classroom, the teacher herself searched the videos online as per the content at the beginning of the year, wrote that in the planner, and showed that whenever was required. Although it was the teacher who was responsible for what content she presented in the classroom, the companies made universal content to be utilized differently in different contexts. So, besides looking at the development of certain content, the choice to use it in the classroom and how it is used becomes important as well. For the Non-ICT classrooms, the school decided the textbooks and support books including the principal, the academic heads, and the teacher.

In an ICT classroom, the role of the teacher was to substantiate the concepts and the arguments from the video. So, the position of the teacher was not as the main person but as a person who had to connect the video with the concepts taught in the classroom and the students. The teacher often stood on one side of the classroom looking at the video along with the students, sat with one of the students or kept walking in the classroom as the content was being played on the smartboard. For instance, in a Hindi class, the teacher started with the poem of Rani ki Jhansi. She stopped in between to ask a few questions from the students.

Teacher: Jhansi ki Rani ko kyu yaad kia jaata hai?(Why is Rani of Jhansi remembered?)

Student: Kyunki vo bohot Bahadur thi. (Because she was very brave)

In a Non-ICT classroom, the teacher was the main person explaining the concept directly to the students. It is the teacher who held the task of explaining the concept, answering the questions, the exercises, and the help-book questions in a non-ICT classroom. But, in an ICT classroom, the role of the students was reduced to the level of an audience as opposed to the learners in a Non-ICT classroom. The students mostly heard what was being said as opposed to working actively on the concept being taught. Even during the times of covid-19, the teachers and the students missed being in each other's company, learning from each other because learning is not restricted to content but involves human interaction that can't be replaced through digital devices. As humans, we are deeply connected, we survive by sharing, interacting, being together and technology (not even artificial intelligence devices) can replace that connection, they might try to replicate it at a facile level. Also, the students belonging to smaller age groups had problems learning through ICT during the covid-19 times as they need personal attention which is difficult to provide at a physical distance that was created due to learning through ICT.

ICT and the Parents

The engagement of the parents in the school system has increased as a result of the ICT inclusion in the school system. In the Qmark school, the teachers often shared their displeasure at parents worrying about every aspect of their child's involvement in the school from the organization of the curricular material to examinations to their child missing a class and so on. The relationship between the teachers and the parents has changed due to the accessibility of these digital platforms, networks, and thereby, easy accessibility of the teachers. The parents enjoyed more control over the teachers by calling them at odd hours, sharing their anxieties, and therefore, blurring the space between professional and personal space and time of the teachers. This leads to further degradation in the status of the teacher's profession and related ramifications. Also, it is important to see the kind of activities for which parents encouraged their children to use ICT devices and its implications. (See Appendix I)

ICT and Surveillance

As has been said in the last chapter, the teachers in the Beanbone school were required to update information about the number of students present to take the meal, the amount of meal required in the school, the food left after being distributed, and so on. They were required to do this daily as a part of the surveillance by the Beanbone authorities for the food that the Beanbone

was providing to the students in the school. With the increase in accessibility of such devices and ease of communication, not just the administrative work involving such reporting becomes easier, the surveillance has become more pronounced. Now, the people working in Qmark and Beanbone organizations can be tracked every then and there either during teaching or in the office and questioned for any deviations from the prescribed rules.

One of the food and ICT startups in a conference revealed that they have developed a unique product for the school students. Their product was a card which the students could redeem for buying any food item at the school canteen and could be recharged only by the parents. This way the parents can avoid giving cash to their children and keep track of what are their children buying for eating in the school. Also, the card could serve as an entry ID card for the school. The parents could also see if their children are attending the school at the proper time or bunking it without letting them know. This can be seen as another type of surveillance of the students where the parents do not trust the students with the money or attending the school.

The Qmark school had installed CCTV cameras in the classrooms, in the corridors, in the lift, and all the other required places in the school premises.

Summary

The chapter analyses the data from the last chapter by devising themes around the education system and draws implications from the same. It canvasses the impact of using ICT for administrative purposes such as preparing report-card, uploading attendance etc. along with the usage for academic purposes such as for teaching-learning of specific disciplines, discipline and punishment/rewards, for homework among other aspects. The chapter elaborates upon the entire process of education as it integrates with ICT including pedagogy, assessment, teaching-learning, personality formation, and so on. It can be identified that ICT is although considered useful in many aspects of the school curriculum, its uncritical and coercive application in the school curriculum can almost breakdown the course of the curriculum and the education system. ICT, therefore, needs to be viewed as just another technology that has entered the contours of education like books, pencils etc. and so its functions need to be seen in the context of its development and usage. If there is a non-thoughtful push for the integration of ICT's in the school curriculum, the consequences can range from impact on the personalities of the involved agencies to education as a whole.

Chapter 6

Summary and Conclusion

Glimpses of the previous chapters

This study begins with mapping the place of technology in the field of education and its evolution as educational technology with the advancement of information technology. Then onwards, it marches towards the educational progress, how technological development has contributed to the structural and cultural changes of the educational system we see today. Expansion and qualitative transformation of education, by and large, depends on the technological adaptation into the education system in the fast-changing world. It is in this context that the present study becomes significant to make sense of the complex matrix of education in the changing world of technology, especially Information and Communication Technology (ICT). While discussing the problem of research, the first chapter highlights the brief history of the emergence of educational technology in general and its progress in India particularly to focus on the questions of the education-technology matrix and elaborate objectives of the research study. As the problem is to understand the impact of educational technology in schools through changing communication patterns, the chapter deployed certain key concepts such as technology and communication. This chapter also discusses the methodology and the proposed methods, techniques, and tools of data collection. At last, it summarizes some of the insights gained from conversations with the students about the usage of the technology and its effect on the learning process. The theoretical developments on these terms and terminologies have been discussed in the last chapter.

While placing technology at the center of the discourse, the second chapter debates and elaborates on the function, structure, elements, and meaning of the technology in conditioning human lives and progress. Other than defining the etymology of technology, various disciplinary perspectives are sought to interpret its complicated relationship with other structures and elements of society. Given the nature of multiple usages of technology, this chapter focuses on its impact and challenges in the field of education in the present and the future. Bringing theoretical insights from sociology, psychology, and educational theories, this chapter illuminates how technology and its operation can be effective in the educational processes. Furthermore, it elaborates on the varied sociological theories on communication and

sociological perspectives of media technologies. An attempt has been made to develop a conceptual linkage between technology, communication, and education using advanced research in this field. Further, the chapter draws insights from the learning theories in education and their interaction with the different kinds and usages of technologies in the educational context. Lastly, the chapter sheds light on the technological apparatuses developed for education and their implications for teaching and learning in the present and the future.

The third chapter engages in policy issues and recommendations on educational technology in the Indian context. Since the policy perspectives play an important role in driving the initiatives on the field, it is important to know the progress of India on this issue vis-à-vis the states and the world economies. This chapter, other than defining ICT and related terminologies, provided detailed explanations on the relationship between IT and the ICT industry in the Indian context. In the backdrop of ICT development, the chapter dissects the emergence of educational technology in India since the colonial era. It was the print technology and circulation of texts in the forms of textbooks that were seen as a technological aid for education during and after the colonial period. From the 5th five-year plan onwards, Independent India began to discuss the inclusion of educational technology programs in the schools. There were several initiatives like the CLASS program, the formation of the Central Institute of Educational Technology (NCERT), EDUSAT among many others. Then, it was in National Policy on Education 1986 that the role and importance of educational technology were highlighted the first time. This chapter highlights the importance of educational technology in the National Curricular framework 2005 (Ministry of Human Resource Development, 2005) and the National policy on Educational technology in 2012 (Ministry of Human Resource Development, 2012). These policies are discussed to understand the socio-economic-political context in which the discourses on educational technologies become significant. It further elaborates on the recommendations on educational technology in the National policy on Education 2020 (National Policy on Education, 2020) and its importance in the present times. This chapter in general provides a critical perspective of the policy discourses on educational technology, its scope, and relevance in reforming India's educational system.

The next chapter is carved out from the field observations, interviews, and conversations with the stakeholders in the education of selected sample schools in Delhi. It provides a detailed account of discipline-wise classroom observations with and without the usage of educational technology in the classroom such as humanities, sciences, languages, and

co-curricular activities. A comparative method becomes significant to understand and differentiate the conventional models, the adaptation of technology at different stages, and its effect on teaching and learning and overall structural changes in the educational system in the sample schools. Keeping in view these broad outlines, the narrative collected from the field observation enabled to describe the practical usage of the educational technology in the school system. The accounts give voice to the teachers, the students, the administrators as they have the first-hand experience of adapting and using educational technology in teaching and learning in the first place.

In continuation of the previous chapter, the fifth chapter analyses the data in light of the theoretical framework and recent researches using segregated data grouped into three sub-themes. The chapter starts with a discussion on the ICT infrastructure in the schools followed by its usage for administrative and academic purposes. Besides discussing the primary issues of pedagogy and ICT and assessment using ICT, the chapter explored the dynamics of changing relationships of ICT with other sociological variables such as class, caste, etc. Given the complex nature of society and its implication on educational inequality, this chapter informs the major shortcomings of ICT in dealing with larger questions of social inequality.

ICT and society

Technology has encapsulated our lives in all domains. We are becoming highly dependent on technology for all tasks of our lives. New devices are being launched every day that make us increasingly reliant on these technologies. In such a societal system, the role of technology in our lives needs to be clearly defined. The debates on technology-human interaction aim to locate the place of technology in our lives. This chapter would reflect on these issues, especially the role of technology in the education system.

Education is a part of society. Any changes in the societal structure influence the education system in multiple ways. The expansion of technologies in all spheres of society, therefore, determines the course of education as well. The heavy penetration of communication technologies such as computers, mobiles, and smartphones, the digital platforms for movies/soaps, the technology-oriented games, etc. have intensified our everyday interaction across time and space. Adapting and integrating technology into the educational system is realized as a part of the greater role of technology in shaping our lives. The invention of smart boards, robotics, virtual reality workshops, etc. can be seen as a part of this endeavor. The

further sections will further explore how is technology becoming a part of the education system and its future implications.

ICT at Home

The family has a long-lasting impact on the overall development of the child. Sociological theories and their different perspectives such as functionalism, conflict, symbolic interactionism take into account family as the first and the foremost means of socialization. For functionalists, the family performs the basic role of socialization of the individuals in learning of social norms and values to become a member of society. On the contrary, the conflict theory views family as a means of socialization in maintaining the status quo and reproducing the existing inequalities in terms of the material positions held by its members in society. For Symbolic interactionists, it is through the shared understandings of each other in the family that members get socialized to be in certain ways (Ritzer, 2011). It is the socio-cultural-political-economic environment of the family that plays a crucial role in defining the identity of the child. So, the use and impact of ICT in the school environment need to be situated in the context of the family and society for better understanding. If there is an increase in the acceptance of technological devices in the education system, schools in this context, it is also because there is a proliferation of the usage of these devices in the society too. The students have increased access to many of these devices at home. The data for an increase in usage of the internet by persons and the increase in usage of computers in the subsequent years in India has been provided in table 3.2 and table 3.3 in chapter 3 depicting increasing their usage in the familial and societal settings. Somekh (2007, p. 110) cites a study among a sample of 2000 students aged 10-16 in secondary schools in England, "In the evaluation study, the access to the internet at home rose from 59% in June 2000 to 73% in June 2001. This led to an increase in the ownership of the computer in these student's homes from 83% to 90% in the same period. This further leads to student's exploration of the world of the computer for varied purposes as shown through image-based concept maps".

The more these technological devices are used in settings other than school, the more students began to view them as a part of their lives and hence the norm. for instance, smartphones have become a norm in the lives of people today. Facer (2011) highlights that access to technologies at home poses new questions for the processes of schooling and education in the future since it changes the entire dynamics of 'informal learning' at home. The access to information technologies varies on grounds of "family cultures, peer cultures, access

to material and economic resources" and various other socio-economic-political factors. So, the participation by the student's in 'informal learning' through these devices is shaped by these dynamics more than the inter-generational differences which form an important part of formal learning at school. These factors and their impact on the process of learning need to emphasized while proposing formal learning through digital devices in the school context. (Facer, 2011, p. 19) For instance, in chapter 4 and chapter 5, it has been highlighted that since both the schools (where fieldwork was done) were placed in different strata of society, the experiences of the students in the usage of digital spaces vary differently. The students of the Qmark school were not only adept at using virtual reality devices, laptops, tablets, etc. due to accessibility, but the families also imbibed a culture of screen time for the children, using educational applications for learning, gaming, and so on. On the other side, the students of the Beanbone school could only access mobile phones at home due to limited resources and the digital culture involving gaming, WhatsApp, etc., keeping it confined to mobile phones. Facer (2011) further states that how the students learn from these digital devices informally is very different from the processes of formal learning at the schools. The students learn through "trial and error, messing about, fiddling around" in informal settings, the learning is driven by self-interests, peers, repetitions, "exploring different identities" and is not the same as learning in the school. The student's in the school are divided according to different age groups and they learn through fixed patterns decided by the teacher and a fixed curriculum. With the increase in the reach of digital technology, the intensity of the impact of informal learning might increase among the students and they might move towards independent learning. But there are certain skills which the students might not be able to learn independently such as "critical literacies", "development of mathematical and scientific understanding" etc., and would need the support of a teacher for the same. In this context, the challenges for schooling and the usage of digital spaces in the schools would take into consideration the different "informal learning cultures" developed through accessibility and use of digital devices outside the school. (Facer, 2011) Now, the question arises whether schools take into cognizance the accessibility and the informal learning student acquires outside schools while fostering usage of ICT in the school system? It was observed that class operates as a part of the hidden curriculum in schools, the teachers of the Qmark school knew that the students can access and prepare a PowerPoint presentation at homework, but it was not possible for the students of the Beanbone school due to inaccessibility of the computers at home. But the informal learning by the students outside the schools using digital devices was hardly recognized in the school system. For instance, the games students played, the educational applications students used were not known to the

teachers of both the schools to facilitate classroom learning in the school system. To conclude, when IT culture exists at home, it becomes an obligation for the school to cater to the demand of the students.

The Philosophy behind ICT in Education

The nation-state's project and the nation-building processes have always central to the welfare of its citizens. Since the industrial revolution, education has aimed to create a labor force that can serve the nation at different levels. At present, through the diffusion of ICT and related devices in the field of education, a particular group of the citizenry is created as ICT literate useful for post-industrial development. It is the extension of the human capital model that drives the education systems to an extent. This model views humans as a skilled workforce, so the more skills humans possess, the better they are for the nation's progress. Technologies such as ICT add new skills and capabilities for the citizens, thereby, integrating into the labor market demands. It is, therefore, imperative to adopt ICT in the school curriculum, for the integration of the humans, the market, and the nation-states/world.

The ICT in school education was aimed to solve the educational challenges and issues better than the available technologies. These new genres were believed to be making progress in the life of human existence and hence the significance of ICT in education. For instance, in the present times, Artificial Intelligence opens up new avenues of the market as well as new opportunities without direct human intervention. Therefore, the schools in developed countries like the USA have been training the students the artificial intelligence to adopt in a new style of working conditions.

Some critiques of the technology also highlight that it will bring slavery back into our lives. As the advertisement of Amazon's Alexa puts forth the perspective that everything can be done even without humans moving from one place to another, they just need simulation. This brings one to the question that if technology can perform all functions which humans do and earn their living from too, how does one differentiate between these technological devices and humans then? How would the future of humans, their work, their living, and their purpose and existence on Earth be defined in the presence of technologies taking over major human tasks? Will humans become slaves to technology and its existence around or will technology solve our problems? Though there has been constant overtaking of tasks by new kinds of technologies in the present times and future too, will technology be our aid or overwhelm us

by its presence in all domains of human existence in the future? As we see a coercive adoption of technology in our lives and the education systems, it makes humans a secondary agency in matters of what we see, how we spend our time, what we learn. Therefore, ICT might lead to socio-economic development as has been visualized, but its overregulation undermines the place of human agency and their faculty on the critical decision in everyday life.

Technology for Education

As one begins to think about the role of technology in education, the first question that one asks is- Why is there a need for technology, ICT in this context, in education? There are many theories and propositions to the usage of technology for education. One of the claims is that it improves the quality of the teaching-learning process. For instance, at an ICT conference, a corporate from an educational technology startup shared that with the use of technology, there can be several modulations that can become a classroom reality for teaching subjects such as science, mathematics, etc. which is not possible otherwise. Also, there have been several other examples that have been quoted in the previous chapters that show the positive usage of ICT for classroom education undoubtedly. Historically, technology was used in education for administrative purposes to ease the workload. Then, the computer teachers started using it for the discipline of computer studies to make it more effective. This involved "programmed instruction" wherein a set of targets were visualized and achieved by providing information and then tested on the same. The basic premise was to make "instruction" more effective. It was after this that the computers were used to deliver 'content' for other subject areas as well (Kurland, 1987). So, the introduction and usage of computers in the schools were aimed at improving the teaching-learning process.

This leads to schools making an increased investment in ICT devices. Though there was a difference in the quantity and the quality of the usage of technological devices in the Beanbone and Qmark School, generally it is sought to the betterment of the teaching-learning process. The Principal of the Qmark School said that though the school has invested a lot in the ICT infrastructure, the returns in terms of the improvement in academic learning were quite low. This has been the case with many such endeavors in other settings. For Instance, Somekh (2007) highlights that in the United Kingdom, despite considerable investment made by the Government for ICT in school education since the 1980s, it was hardly being used for academic purposes.

Another important point here is the claims that technology would make lives easier and therefore, the educational process too easier and better. From where does this logic begin, how does it encapsulate the minds of the general public, and then by what means does ICT become a norm in our lives are questions that need to be reflected upon deeply. As the penetration of technologies is vast in society, it is being visualized even in the National Education Policy 2020 (Ministry of Human Resource Development, 2020) that technology can aid in increasing access to education. But the fallacy of this argument could be seen during the covid-19 era when the entire Government school students couldn't access their education due to non-accessibility to the technological devices and the networks. So, whether technology can aid in promoting equity and equality are questions that need to be discussed in detail.

It is equally important to mention the other end of the argument that with less investment in technology, we can improve other aspects of the teaching-learning process such as better training of the teachers, better pedagogy among many others. Although these changes would add to the efficiency of the education system, equating them with technology would be a misnomer. The reasons for technological integration in the education system are different and therefore, other qualitative changes need to be clubbed with the technological integration for better results.

Although there can be arguments from both ends on the advantages and the limits of the technology, it can be seen that online learning has been a rescue in today's crisis times of covid-19. The ICT and related platforms have been able to derive the educational processes when the possibility of schooling has been closed. In the entire world, it is due to the availability of ICT that education has been continuing even in times of crisis. So, this means that in the future, ICT will become an essential part of the education system. How ICT should be adopted and integrated into the education system, both in terms of quality and expansion, need to be balanced with improvement in other aspects of the education system such as the quality of teaching, time management, limited time for ICT among many others.

The ICT and the School

An important question that arises how can ICT be best integrated into the school system and who can integrate it best in the school system? Is it the school administration, the teachers, the curriculum developers, the EdTech startups, the Principal, or the students who have a major role in the integration of ICT in the school system? Are the agencies working in the school

system trained to use ICT themselves as a part of their professional training? This question would converge ICT in the schools with other domains of the education system such as higher education institutes, administration, teacher training institutes, policy institutes among many others. If ICT is being visualized as an important tool for learning, it needs to integrate from a network of the school education system to train the agencies involved in the usage of ICT.

The role of the school administration can't be discounted in facilitating and implementing ICT in the school curriculum. If the school administration believes in the benefits of ICT, they will invest in ICT resources in the school. Further, the administration will not only make the infrastructure available but facilitate processes such as teacher groups, centralized school software, etc. Although the administration of the Qmark school set up such processes- WhatsApp groups for teachers, students, and parents, school e-mail id's for teachers and parents, centralized software to upload the ICT content and other infrastructure, its utilization by the agencies involved in the school system were not up to the mark, according to its principal. In the Beanbone school, the administration facilitated teaching through smart TV, use of computers for teaching but the availability of infrastructure and the processes facilitating ICT are decided by the government and were limited in many ways.

In the school system, the teachers play a vital role in introducing ICT in the classroom and acquainting the learners. It is vital to note and observe that only if the teachers understood the relevance of 21st-century skills for the learners which can be facilitated through ICT, they would use ICT tools and techniques themselves and propagate it among others too. Though there was recognition among the teachers in the Qmark school that ICT can make certain things easier such as presentations, conceptual clarity of difficult concepts such as chemistry, the teachers didn't feel it was something mandatory that had to be used in the classroom to acquaint the learners with the skills required in the 21st century. In contrast, the policy statements and the discourses have been furthering the agenda of ICT based on the same premise that the learners and the teachers need to be acquainted. Also, the teachers themselves need to be acquainted with this ICT using skills to impart it among the learners. Though in the Qmark school the teachers knew how to use these devices, in the Beanbone school, they had to struggle with it and ask the students to operate the device for them in most of the instances. The teacher professional development courses, then, have to consider these variables in mind while training the teachers. For instance, a certificate course (ITE) by Tata Institute for Social Sciences trains

the teachers in the usage of ICT and related technological tools in their classrooms for better outcomes and learning.

The student's usage of ICT in the school system plays an important role in the integration of ICT in the school system. The student's acquaintance with the ICT devices, their perception of integration of ICT with the school content, their experience in the usage of ICT for learning purposes is critical for the effective usage of ICT in education. Although there are varied indicators such as learning outcomes, various kinds of tests can be explored. It is the student's engagement with ICT that forms the most important part of the effective utilization of ICT in the school system. It was seen in both the Qmark and the Beanbone school that ICT plays an important role in grabbing the attention and interest of the students. The students not only saw it as a break from the monotonous regular classes, but they were also more engaged in exploring the devices and learning from them. So, if ICT devices have this power of keeping the students engaged, how can be they effectively used for educational purposes that need to be thought about.

The role of corporates in devising ICT products for educational purposes can't be undermined. It is the market that drives the purposes of integration of ICT in the school curriculum. The kind of products devised for educational purposes, the content transacted through these products, the market and educational value of these products and their relevance in the societal and educational context defines the vitality of the product. For instance, the virtual reality devices-based workshops held by a corporate in the Qmark school relied on the instant delight and involvement that the students experienced while viewing the content of the videos. The company owner, then, sold the product on showing this involvement for a short span as meaningful learning which is questionable on the grounds of learning we want to promote among the students. Although it is known that such products are developed in the context of developed Nations before coming in the Indian context, the skills these products aim to develop in all the contexts need to be critically viewed in terms of targeting effective and quality education. While technology becomes an unavoidable part of the everyday reality of the agencies involved in the school system, its repercussions for the lives of these agencies too need to be viewed critically. The limiting factors in terms of its over-imposition on the curriculum, diminishing the role of the teachers in the classroom, the students getting access to too much information among others need to be viewed critically as technology enters the contours of the school system.

The Curriculum

As has been mentioned in the previous chapters, ICT comprises the hardware, the software, and the processes involved in the facilitation of the same. In terms of hardware, it is important to ask what kind of devices are being promoted to integrate ICT in the school curriculum? It is the smart board or the smart TV that becomes part of the school classroom. The Qmark school had smart boards, projectors installed on the wall of every classroom as an ICT device for effective curriculum transaction. Besides this, there were computer rooms, a robotics room with equipment required for robotics, virtual reality room with virtual reality devices among many others. In the Beanbone school, there were computers in the computer lab, a smart TV room, a DTH room along with the other labs in the school. The important questions that need to be asked are- Why are devices like smartboards and virtual reality devices looked upon as more apt for educational purposes than a plethora of other devices in the market? There are debates on introducing mobile phones in schools for educational purposes. It can bring forth positive aspects for learning such as flexibility of carrying the device, easy accessibility among others. It can also be challenging in many ways such as restricting the usage for learning purposes, reducing screen time, and so on. The implications of introducing such devices in the school curriculum are still being explored worldwide.

ICT includes the software component of the devices as well. One is the software that the students learn while using devices such as Microsoft word, google drive, etc. The other part is the training of the students in specific software such as Artificial intelligence-based software, coding, etc. Every day new software is being developed in the market and the training of the students in that is considered apt to develop the new workforce. So, the kind of human force that this software will be and have been creating shortly needs to be pondered about? The software is the products mainly developed and distributed by the corporates worldwide, so the intention to facilitate certain kinds of skills needs to be seen critically.

Another important part of the ICT curriculum is the content of the devices. An issue with the content of ICT's is- Who is the most suitable person to develop the content for these devices? EdTech startups hire freelancers to develop this content. Sometimes, the schools have their teams to develop the ICT content. It is also being proposed by some institutes that students should be allowed to develop their content. For instance, at an ICT conference, it was shared by a person working with Homi Bhabha Centre for Science education that in one of the STEM (Science, Technology, Engineering, and Mathematics) projects, when students were allowed

to develop content using OLPC (One laptop per child) software, the students could develop their textbooks in one week using free laptops along with that software. Now, whether it is the corporates/startups, academicians in schools or universities, or the students who develop the content, it entails a vast majority of questions that need to be considered while deciding the same. The level of qualification of the content developer, the purposes behind the content development, the relevance of the content developed and the usage of the content to be considered before deciding the agencies involved in content development. As has been mentioned, with the introduction of ICT in the school system, the entire curriculum is being diluted. The vast information that becomes accessible with the availability of ICT dilutes the sanctity of chosen content and therefore, the curriculum for the school system. The new processes and content create space for new facts and relationships by trampling upon the existing structures and raises questions over the integration of ICT in the school curriculum.

ICT and Learner Centric Pedagogy

One of the important and main goals for the school education system is the overall growth and development of the learners. The recent approach towards teaching-learning which has been furthering this goal is that of constructivism which places importance on learners as producers of knowledge. Whether ICT would be an important technological innovation aiding in the fulfillment of the goal of child-centric learning or it can be the driving technology for the fulfillment of the same is yet to be seen. It was observed during the fieldwork that most of the ICT devices are used for replicating the same things by the students such as practicing worksheets and learning software etc. Especially in the Government school, the students were seen becoming victims of more content as they had to cover the ICT content which their school had received along with the textbooks. How ICT's can be used as tools to facilitate learners as producers merit further investigation. To integrate the introduction of ICT in the school system with the constructivist pedagogy without any reasonable logic is to ignore other important aspects of the teaching-learning process and therefore, the implications of ICT on the same. This would be problematic in the coming times as it would be inculcating functional aspects in the curriculum such as ICT's without looking at their impact on the agencies involved in the school system.

The ICT's and other existing technologies in the school system

As has been mentioned in the review of literature that the adoption of digital technologies in the school system is a recent phenomenon that needs to be situated historically because the technologies have already in place in the field of education. From blackboards/chalks to textbooks to ICT's, there have been different ways and means in which systemic adoption of these technologies happen and then, how they re-define the school system. As per the simple definition, technology is anything that eases the human workload. In the context of education, blackboards and textbooks not only aided the teachers, but also brought about a new dynamic of engaging with the students, the teachers, and the teaching-learning process.

Furthermore, this study has tried to understand how ICT's interact with other conventional modes of technologies in the school system such as the use of textbooks, blackboards, and so on. When ICT device such as smartboard becomes an essential part of the classroom, it acquires a dominant physical space and brings in more content in addition to the textbooks. Since textbooks are means to access the content, ICT fast replacing the textbooks in the future as they are more interactional along with providing the content. It is not difficult to see the new ICT devices in the market and educational spaces which are a combination of the whiteboard, online textbook, and digital material installed all in one device. The industry and the education system, therefore, still recognizes the role and importance of textbooks and teachers in the education system, the future of which is yet to be imagined. Will ICT devices replace the human workforce, especially the teaching profession involved in the school system are questions that need in-depth deliberation.

The larger question that emerges is the future of ICT's in re-defining the space of these existing technologies such as textbooks and blackboards. While the content is being replaced from textbooks to ICT, it is also important to compare the change in the other dynamics in the classroom with this change such as the relationships, the learning among many others. Whether these technologies will be used for the development of lower-level skills such as the use of video-based tutorials, websites, and facts for research by the students, for examination spreadsheets, showing graphs, and so on or used as a tool for enhancement of higher-order thinking are the questions that need to dwell in more detail.

Combining the curricular and co-curricular through ICT

As has been observed and analyzed, there has been a stark difference between the usage of ICT in the computer room and the classroom. Moreover, there was a difference in the perception of the usage of ICT in the computer room and classroom. If the usage of ICT in the computer room was related to computers as a discipline, in the classroom, ICT was a part of the academic subjects. The question that needs to be thought about is the relevance of ICT for academic and non-academic subjects. It was seen that although there has been teaching of computers as a discipline for quite some time as the infrastructure for it existed in both the Qmark and the Beanbone school. The integration of ICT with other academic disciplines is a recent phenomenon in Indian schools and therefore, partial attempts could be seen in the Qmark and the Beanbone school. It was observed in the Qmark school that ICT was not only used for academic and computers/IT as a school subject but other extra-curricular disciplines as well such as astronomy, photography, virtual reality workshops, etc. With the expansion and the proliferation of the technology, every domain bases its growth upon the adoption and integration of the technology and so, these extra-curricular disciplines[28] are no different. Undoubtedly, technology will play a major role in the education system in the coming times. What place will the education system and its related agencies hold in the coming times needs to be discussed in-depth?

The Teacher and the ICT

Goodman (1972, p. 51) reinforces the notion that although "tools technology" has always been present in the educational spheres, what is required is a "systems-technology". This means that there have been different tools/aids to be used for the educational process, it is equally important to have a system including the agencies involved in education to supplement and support the usage of those devices in an adequate manner. Because human is a social being and the "technology is a social activity", it is the role of the teacher to guide the usage of such technological tools towards desired objectives for effective pedagogical outcomes.

This study examined the changing role and position of teachers in the school systems due to the adoption of ICT in the classrooms. In a Non-ICT classroom, it is the teacher who acquires a central position responsible for content delivery, pedagogical engagement,

[28] The extra-curricular disciplines mean the extra subjects offered by the school as a choice to the students to enhance their passion, skills etc.

classroom management among many such roles. With the arrival of the smartboard (ICT device) in the classroom, the teacher's position gets delineated and shared with the device as both perform the task of instruction and management of the classroom. Although the teacher decides the content of the device, when will it be used etc., the device plays a vital role in transacting the curriculum. The interaction becomes centered in between the device and the students, with the teacher adding inputs in between. The kind of relationship that will exist between the device, the teacher, and the students will be important for the future role of ICT integration in the school systems. It can be visualized that the teacher's authority and autonomy are in question as ICT takes the central place in the classroom. The teacher's role is reduced to justifying the ICT content, repeat the same content, and therefore, manage the pedagogical process and time accordingly. The teacher is, therefore, diminished to a secondary agency whose position in the classroom becomes questionable as the ICT's take a key role in the classroom scenario. This reduces the entire process of education to just content delivery, devoid of any personal and pedagogical relationships.

An important debate that has been the center of these changes is the replacement of the teachers with technological devices. Will the ICT's replace the teachers or will it be a supporting aid in the technology-driven classrooms? These are some of the questions that need to be pondered upon while the agenda for incentives through technology-driven education is being pushed in the public as well as private school systems. There are certain issues with the increasing penetration of technology in the lives of the students and their parents. Will the learners completely depend upon technology for learning or will they be able to develop other skills (other than 21st-century digital skills) required for using technology constructively for learning.

Technology and the Future of Education

The market for educational technology has been on the rise and will increase at a rapid pace in the coming years. ICT and future technologies will become a major part of the education system in the future. What technologies will be useful for education and how to integrate them into the education system are pertinent questions to be thought about? Although both the sample schools in this study had done some investment in enabling ICT infrastructure in the schools, the manner and how it was utilized in many ways as has been elaborated in the last chapters.

Education is a process of socialization of individuals. It aims at preparing the younger generations for the future. Facer (2011) highlights that 'this future incorporates certain assumptions about the nature of the economy and the society that has been visualized by society at large'. While understanding the relationship between education and socio-technical change in the future, Facer highlights two perspectives that have been accepted in the last two decades:

1. "With the massive increase in computing power, the emergence of global digital networks,…we have to adapt to a high-tech, globally, competitive world or risk economic and social oblivion." The role of education in this vision is to adapt the learners to the new technological and social changes for the betterment of the economy". (Facer 2011, p. 2)

2. The second narrative has been that 'education has failed to respond to the needs of the technologically advanced contemporary world'.

These perspectives emerge from a "one-dimensional" understanding of society which views economic growth as central and technology playing a huge role in that growth and development. Here, education too is conceived as "instrumental" and 'concerned with raising individuals to serve the formal economy'. Facer (2011) is of the view that the role of technology in education is limited as it doesn't take into account the diversities of the interaction of technologies in society such as the "social context in which technologies are taken up", 'the alternative uses of technology', 'the selective choices on the promotion of certain technologies' and 'different ways in which technologies are appropriated in the society'. So, it is important to take into account these varied factors while visualizing the larger role of technology in society and education. Facer (2011) argues that the role of education is to not only prepare the younger generations for a technocratic society but "as a reciprocal dialogue of anticipation, adaptation, and creation".

Education as a process

Although various facets of ICT and teaching-learning have been discussed earlier such as online courses, use of digital mediums such as videos in the classrooms, digitizing textbooks, and so on, it is vital to keep in mind the meaning and process of education while discussing the role of technology in education. Education is a process of socialization of humans and so, it comprises both the content and the process of learning. Most of the policy recommendations, the practices in the schools reduce the entire process to the content of education while

mentioning/using ICT in education. For instance, the teachers in the Qmark school chose the ICT content and used it in the classroom alone without any consideration of the process of the teaching-learning, that is, where can a particular content be best placed for better outcomes. Although the ICT content might help in quick learning, there is a difference between the human-human interaction and human-computer interaction. These technologies appeal to only visual and audio senses but there are other human senses which play an important role in human learning. With new technologies such as Artificial Intelligence and so on, there have been claims that computers would be as good as humans and would almost be able to do anything, there is still much more to humans than a software-based technology can do. This is a wider debate of humans versus computers which needs time and in-depth understanding. Imparting knowledge in the school consists of the content, the skills to be developed along with the character. Most of the time, education is being equated with imparting the content as it is easy to measure the same and therefore, technological solutions are given more importance in doing the same as content can be easily imparted through technological aids. But acquiring skills and shaping human character fundamentally require human interaction. Such processes cannot be measured easily. The adoption of technological solutions for the entire educational purposes undermines the very foundational meaning of education.

Although many theorists have highlighted the difference between knowledge and learning, Vygotsky refers to learning as an internal process through which an individual learns, although it might or might not happen in collaboration whereas knowledge is constructed in collaboration with others in a social environment (Churcher et al., 2014). So, education is not an individual process based on learning only the concepts and the content of the discipline, it is a holistic experience of collaborating with others, sharing, discussing concepts among others. A technological device can facilitate learning but whether it can enable the construction of knowledge and the entire educational process are questions that still need more deliberation.

UNESCO has reported that due to increased online learning, there has been a drop in the quality of education. There have been many reasons for the same such as boredom, focus on only content, lack of guidance, and so on. Although there will be an increase in online learning and technology-based learning, how can it be used to effectively improve the quality of learning? It needs to be understood that education isn't only about the content transacted through online platforms but a process of the transaction involving learning socio-emotional skills.

Convergence of Technology, market, and education

Recently, in the Indian context, there have been grave talks of privatization of education. The recent policy recommendations 2020 (Ministry of Human Resource Development, 2020) states that entrepreneurship must be encouraged among the faculty members. Beyond doubt, these are the suggestions for the acceptance and promotion of a market model of education.

As has been seen participating in the conferences and conducting fieldwork, it is mainly observed that the private enterprises hold command of technological solutions in the field of education. Though there are few government initiatives such as SWAYAM Prabha, Diksha, e-Pathshala, etc.[29], the market for educational technology is much bigger and has the potential to expand multiple times. Especially in India, the market for educational technology initiatives has got great scope as many reports state. In the wake of the acceptance of privatization of education, what do these market models of educational technology mean for the education system? As these models reach the educational systems, how will they be assessed, and on what parameters? Will there be agencies to check the quality of these models, their efficiency, and their impact on the education system? What place would the government initiatives hold in such a scenario? These are the bigger questions that need to be addressed in the backdrop of the expansion of educational technology initiatives in the country.

Conclusion

To conclude, it can be stated that a school system needs to be understood as a network of agencies and processes in and around the school while pushing the scope for ICT's as another process in the school system. To understand the importance of ICT in the school system, the aims of education by use of ICT's along with the installation of infrastructure for ICT enabled schools and related dynamics need to be seen closely. Besides this, the content of the curriculum around ICT's, the implementation of assessment tasks by the usage of ICT's and

[29] 1) SWAYAM Prabha- It is an initiative of the Ministry of Human Resources Development to facilitate 32 DTH channels throughout the country on 24*7 basis. The channels will telecast curriculum based on course content of different disciplines and levels of education. (SWAYAM Prabha)
2) Diksha- It is an initiative of Ministry of Human Resources Development to provide digital resources for teachers for enabling effective learning. It enables the teachers to create content and use digital resources at all levels and times. (India.gov.in, National Portal of India, 2018)
3)E-Pathshala- It is an application developed by CIET, NCERT, under the aegis of Ministry of Human Resources Development, to provide educational resources for teachers, students, parents, researchers and educators. (NCERT, 2020b)

the preparation of agencies involved in using ICT's and related material through appropriate training form the core in understanding the impact of ICT in the educational settings, especially school in this context. Finally, the use of ICT's for administrative uses in the school and forging relationships outside the school such as between the parents and the school system including its agencies help in presenting a picture of the ICT ecosystem and its impact on the education system. All these factors need to be considered holistically while understanding the importance of ICT and the role in the school system, as has been suggested through this study.

ICT and the fieldwork experience in School

Although this study is comprehensive in understanding the changes triggered by the introduction of ICT's in the school systems, it has certain limitations due to varied reasons. This study approaches the problem of ICT and education through the institution of school systems and their related dimensions. It doesn't take into account the detailed account of the usage of ICT devices and systems outside the contours of the school system such as home, cyber cafés etc. This aspect couldn't be elaborated upon as the objective of the study was to view the actual implementation of ICT usage in the school system and its impact on the education system through the means of interactions in the classroom. Also, the nature of the study limited its scope in the school system, especially the classroom. It is unique in its approach at viewing the everyday changes that are lead by ICT in the school systems as it analyses the actual impact of ICT vis-à-vis the policy objectives of usage of ICT for education systems. The observations and interviews with the students showed that there is a substantial amount of usage of ICT devices by the students at home, at malls, and other settings outside the school. However, the study has further scope for elaboration and expansion by approaching the problem through the institution of family/community and the changes brought about through ICT in the familial/community domain. This would provide a holistic perspective to the study and co-relate the findings with the proliferation and usage of ICT at home and other settings with the school, thereby visualize its impact comprehensively.

Since ICT is a recent phenomenon (late arrival) in the Indian context, the researcher couldn't ponder/plan the course of fieldwork in advance and it had to be decided after looking at the utilization of ICT in the contexts of the schools. The researcher, therefore, had to plan observations/interviews as per the utilization of ICT in the school contexts and not according to the requirements of the plans for the field visit. This was helpful as the researcher could schedule the observations flexibly as per the context of the school and the participating

agencies. Also, the grades for which fieldwork was done in both the schools along with the disciplines for which ICT was used depended on the context of the schools. In the future course of research as well, it is advisable to plan the course of research based upon the level of integration of ICT in the school system, that is, derive theoretical perspective from the ground. Unless ICT becomes normalized in the school system, it would be difficult to plan researches focused on highly specific outcomes.

Due to the same reason, this study doesn't take into account the impact of ICT on the learning outcomes in the school contexts as the usage of ICT is still in the preliminary stages and the assessment is done through offline examinations. This means that there was the usage of ICT along with the offline teaching-learning processes and since examinations happened in an offline mode, the ICT wasn't viewed as important to be able to impact the earning outcomes of the students. To be able to measure learning outcomes, ICT has to be used for examinations and more often in classroom settings. The studies in the context of developed Nations can be utilized to understand the impact of ICT on learning outcomes and then planned in the Indian context for a longitudinal study when ICT becomes a normal phenomenon in Indian schools.

There were some personal struggles of the researcher while doing fieldwork that need to be highlighted here. It requires no mention that since there have been hardly such works in the Indian context that have explored the usage of ICT devices in the school contexts and their impact, it was tedious to review related literature along with searching the schools for the same. On the field, the researcher was always an outsider trying to gauge the perspectives of the insiders. One among such issues was the pretence of appropriating perfect pedagogies to be presented before the researcher. On many occasions when the researcher was invited by the teachers to observe their classes, the teachers tried to be perfect while delivering their lessons. In that perfection, the teachers tried to present an ideal image of how a classroom should be, and the same got reflected in their teaching as well. In an English classroom, the teacher was explaining prepositions and after giving one example for each of the prepositions explained, she asked the students to write their examples. No doubt, the students framed sentences and discussed them with the teacher, it was quite visible that providing independence to the learners to work on their own was a sign of the recent and innovative pedagogy, that the learners might not be familiar with. Since the researcher's image was of an outsider, she had limited scope for discussion about various pedagogies and had to accept as it was presented although there were few moments for deliberations. On the other side, being immersed in the field for a long period

was helpful in becoming one with the school systems and agencies and therefore, ascertain the insider's view and usage of ICT. This research is a reflection of a perspective from outside and inside and thereby, a holistic viewpoint.

As the researcher engaged in a semi-ethnographic work inside the schools, the researcher realized that although technology has become an acceptable phenomenon inside the school system, its usage wasn't a main part of the curriculum and therefore, was a medium to be used at specific times. This meant that although ICT has an important and evolving position in the school curriculum, its overall socio-economic-political impact wasn't much of a botheration among the participating agencies.

Since the ICT lessons were not separately scheduled in the curriculum, the researcher had to sometimes pick random classes where ICT was being used and sometimes plan a week in discussion with the teachers on when would ICT be used in the school hours. This was a hassle instead of the already busy school hours and the related agencies in the beginning and then, became quite adaptable as per the existing context.

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Appendices

Appendix I

Data Tables

Table A1.1: Encouragement/discouragement to use ICT devices for various purposes

Variables	Yes	No	Total
For groupwork by teachers	51 (96.23)	2 (3.77)	53 (100)
For groupwork by parents	46 (95.83)	2 (4.17)	48 (100)
For groupwork by friends	44 (95.65)	2 (4.35)	46 (100)
For discussion by teachers	41 (87.23)	6 (12.77)	47 (100)
For discussion by parents	43 (87.76)	6 (12.24)	49 (100)
For discussion by friends	34 (85)	6 (15)	40 (100)
Any other by teachers	20 (54.05)	17 (45.95)	37 (100)
Any other by parents	27 (61.36)	17 (38.64)	44 (100)
Any other by friends	25 (59.52)	17 (40.48)	42 (100)
Find out information by teachers	49 (94.23)	3 (5.77)	52 (100)
Find out information by parents	56 (94.92)	3 (5.08)	59 (100)
Find out information by friends	37 (92.5)	3 (7.5)	40 (100)
For General knowledge by teachers	53 (91.38)	5 (8.62)	58 (100)
For General knowledge by parents	51 (91.07)	5 (8.93)	56 (100)
For General knowledge by friends	33 (86.84)	5 (13.16)	38 (100)
Any other by teachers	24 (55.81)	19 (44.19)	43 (100)
Any other by parents	26 (57.78)	19 (42.22)	45 (100)
Any other by friends	21 (52.5)	19 (47.5)	40 (100)

For playing games by teachers	17 (80.95)	4 (19.05)	21 (100)
For playing games by parents	31 (88.57)	4 (11.43)	35 (100)
For playing games by friends	50 (92.59)	4 (7.41)	54 (100)
For playing music by teachers	26 (86.67)	4 (13.33)	30 (100)
For playing music by parents	45 (91.84)	4 (8.16)	49 (100)
For playing music by friends	46 (92)	4 (8)	50 (100)
For playing movies by teachers	19 (82.61)	4 (17.39)	23 (100)
For playing movies by parents	50 (92.59)	4 (7.41)	54 (100)
For playing movies by friends	48 (92.31)	4 (7.69)	52 (100)

The values in parenthesis are in percentage

Table A1.2: Factors for encouragement/discouragement of use of ICT devices

Variables	Yes	No	Total
For learning subjects by teachers	60 (98.36)	1 (1.64)	61 (100)
For learning subjects by parents	54 (98.18)	1 (1.82)	55 (100)
For learning subjects by friends	33 (97.06)	1 (2.94)	34 (100)
For performing work quick by teachers	47 (90.38)	5 (9.62)	52 (100)
For performing work quick by parents	53 (92.98)	4 (7.02)	57 (100)
For performing work quick by friends	38 (90.48)	4 (9.52)	42 (100)
For information search by teachers	54 (98.18)	1 (1.82)	55 (100)
For information search by parents	53 (98.15)	1 (1.85)	54 (100)
For information search by friends	38 (97.44)	1 (2.56)	39 (100)
For general knowledge enhancement by teachers	52 (94.55)	3 (5.45)	55 (100)
For general knowledge enhancement by parents	55 (94.83)	3 (5.17)	58 (100)
For general knowledge enhancement by friends	35 (92.11)	3 (7.89)	38 (100)

For gaining extra knowledge by teachers	55 (93.22)	4 (6.78)	59 (100)
For gaining extra knowledge by parents	50 (92.59)	4 (7.41)	54 (100)
For gaining extra knowledge by friends	37 (90.24)	4 (9.76)	41 (100)
For problem solving by teachers	44 (89.8)	5 (10.2)	49 (100)
For problem solving by parents	48 (92.31)	4 (7.69)	52 (100)
For problem solving by friends	40 (90.91)	4 (9.09)	44 (100)
For playing games by teachers	12 (70.59)	5 (29.41)	17 (100)
For playing games by parents	25 (89.29)	3 (10.71)	28 (100)
For playing games by friends	57 (95)	3 (5)	60 (100)
For watching movies by teachers	15 (78.95)	4 (21.05)	19 (100)
For watching movies by parents	42 (91.3)	4 (8.7)	46 (100)
For watching movies by friends	57 (93.44)	4 (6.56)	61 (100)
For listening to songs by teachers	19 (82.61)	4 (17.39)	23 (100)
For listening to songs by parents	42 (93.33)	3 (6.67)	45 (100)
For listening to songs by friends	55 (94.83)	3 (5.17)	58 (100)
For religious purposes by teachers	18 (58.06)	13 (41.94)	31 (100)
For religious purposes by parents	43 (81.13)	10 (18.87)	53 (100)
For religious purposes by friends	28 (73.68)	10 (26.32)	38 (100)
For quick/fast communication by teachers	42 (100)	0 (0)	42 (100)
For quick/fast communication by parents	53 (100)	0 (0)	53 (100)

For quick/fast communication by friends	46 (100)	0 (0)	46 (100)
For easy communication by teachers	40 (97.56)	1 (2.44)	41 (100)
For easy communication by parents	54 (100)	0 (0)	54 (100)
For easy communication by friends	53 (100)	0 (0)	53 (100)

The values in parenthesis are in percentage

Table A1.3: ICT devices used with the peer group

Variables	Yes	No	Total
Mobile	59 (96.72)	2 (3.28)	61 (100)
Laptop	18 (90)	2 (10)	20 (100)
Computer	13 (86.67)	2 (13.33)	15 (100)
Play station	10 (83.33)	2 (16.67)	12 (100)
Tablet	11 (84.62)	2 (15.38)	13 (100)
Smartboard	1 (33.33)	2 (66.67)	3 (100)
TV	1 (33.33)	2 (66.67)	3 (100)

The values in parenthesis are in percentage

Gender Wise Data

Table A1.4: Encouragement/discouragement to use ICT devices for various purposes

Variables	male frequency (male mean)	female frequency (female mean)	Total frequency (Total mean)
For groupwork by teachers	29 (0.94)	22 (1)	51 (0.96)
For groupwork by parents	28 (0.93)	18 (1)	46 (0.96)
For groupwork by friends	28 (0.93)	16 (1)	44 (0.96)

For discussion by teachers	25 (0.83)	16 (0.94)	41 (0.87)
For discussion by parents	27 (0.84)	16 (0.94)	43 (0.88)
For discussion by friends	22 (0.82)	12 (0.92)	34 (0.85)
Any other by teachers	13 (0.5)	7 (0.64)	20 (0.54)
Any other by parents	16 (0.56)	11 (0.73)	27 (0.61)
Any other by friends	16 (0.55)	9 (0.69)	25 (0.60)
Find out information by teachers	30 (0.91)	19 (1)	49 (0.94)
Find out information by parents	35 (0.92)	21 (1)	56 (0.95)
Find out information by friends	22 (0.88)	15 (1)	37 (0.93)
For General knowledge by teachers	32 (0.87)	21 (1)	53 (0.91)
For General knowledge by parents	30 (0.86)	21 (1)	51 (0.91)
For General knowledge by friends	21 (0.81)	12 (1)	33 (0.87)
Any other by teachers	17 (0.55)	7 (0.58)	24 (0.56)
Any other by parents	17 (0.55)	9 (0.64)	26 (0.58)
Any other by friends	16 (0.53)	5 (0.5)	21 (0.53)
For playing games by teachers	12 (0.86)	5 (0.71)	17 (0.81)
For playing games by parents	21 (0.91)	10 (0.83)	31 (0.89)
For playing games by friends	33 (0.94)	17 (0.90)	50 (0.93)
For playing music by teachers	18 (0.82)	8 (1)	26 (0.87)
For playing music by parents	28 (0.88)	17 (1)	45 (0.92)
For playing music by friends	28 (0.88)	18 (1)	46 (0.92)
For playing movies by teachers	10 (0.71)	9 (1)	19 (0.83)

For playing movies by parents	32 (0.89)	18 (1)	50 (0.93)
For playing movies by friends	29 (0.88)	19 (1)	48 (0.92)

The values in parenthesis are mean values

Table A1.5: Purpose of ICT devices used with the peer group by male and female students

Variables	male frequency (male mean)	female frequency (female mean)	Total frequency (Total mean)
Communication purposes	12 (0.86)	16 (1)	28 (0.93)
Gaming	27 (0.93)	8 (1)	35 (0.95)
Learning	17 (0.90)	13 (1)	30 (0.94)
Entertainment/music/photograph	14 (0.88)	7 (1)	21 (0.91)
Stalking	12 (0.86)	10 (1)	22 (0.92)
Any other	0 (0)	1 (1)	1 (0.33)

The values in parenthesis are mean values

Appendix II

Interview Schedule

For Teachers/ School Administration

Objectives of the research

- To study the changing communication patterns in the present context with advent of technologies of communication and its effect on the school system, its system and agencies.

- The research explores the production and reproduction of communication patterns and processes due to technologies of communication in school context and find out its ideological underpinnings.

1. Profile of the principal/teachers/school administration

1.1	Name	
1.2	Name of the school	
1.3	Age	
1.4	Gender	
1.5	Address	
1.6	Marital status	
1.7	Educational Background	
1.8	Total work experience	
1.8.1	Work experience in this school	
1.8.2	Work experience before joining this school (teacher/ other, specify)	
1.9	Subject being taught	

2. Why is ICT important for school education?
3. Channels of communication

Applications/channels of communication with the parents, teachers, students that the school uses.				
Teaching/learning/Governance		Yes/No	How facilitate communication?	Different from the past?
3.1	*Teachers-Students*			
3.2	*Teachers-Parents*			
3.3	*School-Parents*			

3.4	*School-teachers*			
3.5	*School student*			

4. ICT Device ad its usage

4.1 Access to ICT device				
4.1.1	At Home		Yes	No
	If yes, Which devices?	Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		
4.1.2	At School		Yes	No
		Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		
	At Other Places		Yes	No
	Learning, classes/Tuition Centre Cyber Café Any Other	Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		

4.2 How often do you use ICT devices?			
4.2.1	At Home	In a day (number of hours)	In a week (number of days)
4.2.2	At School	In a day (number of hours)	In a week (number of days)
4.2.3	At Other Places	In a day (number of hours)	In a week (number of days)

5. Familiarity with the ICT device

5.1	Familiarity with the following companies and their programs which you might use/heard of?		
		Yes	No
	Microsoft		

	Google						
	Yahoo						
	Ubuntu						
	Any other						
5.2	Can you perform the below mentioned tasks with the ICT device?						
5.2.1		Offline Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does it help in academic learning? (Yes/No)	Can you create this	Can you download/ upload/search this program? (Yes/No)
	As a User	a. Work with Microsoft word, google docs, Ubuntu word etc					
		b. Work with Microsoft Paint etc.					
		c. Work with Microsoft excel etc.					
		d. Use Microsoft office etc					
		e. Use Microsoft powerpoint etc					
		f. Use Microsoft onenote etc					
		g. Use google drive etc					
		h. Play games such as PS4 etc					
		i. Any other					
5.2.2		Online Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does it help in academic learning? (Yes/No)	Can you create this	Can you download /upload/search this program? (Yes/No)
	As a User	a. Protection softwares such as Mcafee, avast antivirus etc					
		b. Games such as racing games etc					
		c. Browsing with google chrome, Mozilla firefox etc					
		d. E-mail with gmail, yahoo mail, Hotmail etc					
		e. Social networking profiles/apps such as facebook, whatsapp etc					

6. ICT in the school

6.1	Whether this school makes use of service of any ICT product?	Yes	No
6.2	Which company provides the ICT product to the school?		
6.3	Does the same company takes care of the maintenance and service of the product too?	Yes	No
6.4	What was the reason behind choosing this company?		
6.5	Training for the ICT device		
6.5.1	Was there any training provided by the school/ company to use the ICT device?	Yes	No
	If yes, what kind of training was provided? Specify (keeping in mind the hardware, software and the content of the ICT device)		
	Was the training provided by the same company who installed the device?	Yes	No

7. Experience of using ICT in the school

7.1	How has the experience been using such technologies?				
	Excellent	Good	Bad	Worst	Neutral

8. Identification of the ICT device and comprehension of its function

8	Asking the teachers the details about the device and how do they visualize the design, hardware, software and the content of the device?				
8.1.	Do you know the name of the device?	Yes		No	
	• In Computer lab • In the classroom				
8.2	Name the visible parts of the device?				
	• In Computer lab				
	• In the classroom				
8.3	Have these parts of the device remained the same over the period of time?				
8.4	Name the internal parts of the device and their function?				
	• In Computer lab				
	• In the classroom				
8.5	How did you come to know about the external and internal parts of the device?				
8.5.1	Formal Training				
	• Formal training in the school, if yes, explain				

	• Formal training outside the school, if yes, explain	
8.5.2	Informal training	
	• Parents	
	• Teachers	
	• Friends	
	• Any Other	
8.6	Highlight the differences between a computer lab and an ICT classroom in terms of: • Name • Goals • Teaching-Learning process	

9. Encouragement/discouragement to use the ICT device

9.1	Do you encourage/discourage the students to use ICT for the following purposes?	Yes	No	Time
	Interactive			
	a. For group work/homework with friends/teacher			
	b. For discussion with parents/peers/colleagues			
	c. Any other			
	Informative			
	a. To find out about people, things, places, ideas etc			
	b. For general knowledge			
	c. Any other			
	Entertainment			
	d. Playing games			
	e. Playing music			
	f. Playing movies			

9.2	Rank your priority for encouragement of ICT device			
Very satisfied	Satisfied	Unsatisfied	Very unsatisfied	Not sure

9.3	On what factors do you encourage/discourage the students to use the ICT device?	Yes	No
	As a tool to enhance learning		
	Helps in study of various subjects		
	Helps in performing the work quickly		
	Aid in providing lots of information		
	Helps in general knowledge enhancement		
	Helps in gaining extra knowledge, other than the textbook		
	Enhances problem solving		
	Entertainment		
	Fun to play games		
	Fun to watch movies		

	Fun to listen to songs		
	Religious Purposes		
	Listen/watch songs/kirtan/movies		
	Communication		
	Quick/Fast communication		
	Easy Communication		

10. Do you think ICT leads to certain benefits?

Yes/No	Benefits • For knowledge base • For Entertainment base • Material/ economic benefit • Any other

11. Do you think there some limitations in using ICT?

Yes/No	Limitations • For knowledge base • For Entertainment base • For health issues • Any other

On ICT, curriculum and co-curricular activities

12. Pedagogy with ICT (for computer and subject teachers)

12.1	What is the nature of pedagogy used in the ICT lab?	
12.2	What is the subject matter for learning ICT in the lab?	
12.3	ICT in the classroom to teach academic subjects	
	Mathematics	
	• What is the pedagogy followed? • What is the subject matter for the same?	
	Science	
	• What is the pedagogy followed? • What is the subject matter for the same?	
	Social Science	
	• What is the pedagogy followed? • What is the subject matter for the same?	
	Language	
	• What is the pedagogy followed?	

	• What is the subject matter for the same?	
	Arts	
	• What is the pedagogy followed?	
	• What is the subject matter for the same?	
	Any other	
	• What is the pedagogy followed?	
	• What is the subject matter for the same?	
12.4	Which subject matter can be best and easily learnt using ICT?	
	Mathematics	
	Science	
	Social science	
	Language	
	Arts	
	Any other	

13. Change in teaching-learning due to ICT in comparison to conventional mode.

13.1	How has the usage of ICT changed the way one learns in comparison to the conventional mode of learning?			
	Teaching-learning Process	Conventional mode of learning	Learning with ICT	
			Learning Computers in a computer lab	Learning academic subjects using ICT devices
	a. Pedagogy			
	b. Subject matter			
	c. Curriculum			
13.2	Learning outcomes with respect to subjects	Conventional mode of learning	Learning with ICT	
	a. Mathematics			
	b. Science			
	c. Social Studies			
	d. Languages			
	e. Arts			
	Any Other			

13.3	Does school use any ICT product for evaluation of students?	Yes		No	
	If yes, which tools school use?				
13.3.1	How are they used?				

13.3.2	How is the introduction of ICT changing the assessment procedures?	

14. What is the basic text for the students in the classroom? Has it changed with the introduction of ICT devices and how?

15. You as a teacher has seen both ways of teaching in the classroom. So do you think ICT supplements, replaces or extends the conventional mode of teaching-learning?

16. ICT to address the conventional education problems

16.1	Do you think ICT can overcome the problems of conventional education system?	
	Yes/No	How ?
16.2	Do you think ICT is creating new problems? Yes/no	
16.2.1	What are the problems? • Pedagogy • Subject matter • Curriculum	
16.2.2	How can they be solved?	
16.2.4	Do you face any problem using online materials? How do you handle that?	

17. When this school introduced ICT? How is your experience of using it? (changes in personality and pedagogy?

18. Attitude and perception towards usage of ICT device.

18.1	What is the attitude and perception of these people towards usage of ICT devices?		
	I teacher/student use the ICT device for the these purposes		
		Teacher	Student
	Shopping		
	Social networking		
	Browsing		
	School Work/academic work		
	Learning/reading		
	Business		
	Bank details		
	Games		
	Music/movies/dance		
	Designing		
	Stalking		
	E-mailing/ printing		
	Any other		

18.2	Are you familiar with the peer group of your students?	Yes		No	

18.2.2	How does peer group impact the students in usage of ICT for various purposes and vice-versa.	

19. What is it that you love and hate the most while working with a ICT device?

20. Describe your relationship with the ICT in a few words/picture/drawing.

21. What is the vision of the school? And what is the role of ICT in that vision?

Interview Schedule

For Students

Objectives of the research

- To study the changing communication patterns in the present context with advent of technologies of communication and its effect on the school system, its system and agencies.
- The research explores the production and reproduction of communication patterns and processes due to technologies of communication in school context and find out its ideological underpinnings.

1. Profile of the principal/teachers/school administration

1.1	Name	
1.2	Standard studying	
1.3	Name of the school	
1.4	Age	
1.5	Gender	
1.6	Place of stay	
1.7	If studied at other schools earlier, which school?	
1.8	Occupation of parents	
1.8.1	Father's occupation	
1.8.2	Mother's occupation	
1.9	Hobbies	

2. Why is ICT important for school education?
3.
4. ICT Device ad its usage

4.1 Access to ICT device				
4.1.1	At Home		Yes	No
	If yes, Which devices?	Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		
4.1.2	At School		Yes	No
		Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		
	At Other Places		Yes	No
		Laptop		

	Learning , classes/Tuition Centre Cyber Café Any Other	Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		

4.2	How often do you use ICT devices?		
4.2.1	At Home	In a day (number of hours)	In a week (number of days)
4.2.2	At School	In a day (number of hours)	In a week (number of days)
4.2.3	At Other Places	In a day (number of hours)	In a week (number of days)

5. Familiarity with the ICT device

5.1	Familiarity with the following companies and their programs which you might use/heard of?		
		Yes	No
	Microsoft		
	Google		
	Yahoo		
	Ubuntu		
	Any other		

5.2	Can you perform the below mentioned tasks with the ICT device?						
5.2.1		Offline Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does this program help in academic learning? (Yes/No)	Can you create this program?	Can you download/upload/search this program? (Yes/No)
	As a User	a. Work with Microsoft word, google docs, Ubuntu word etc					
		b. Work with Microsoft Paint etc.					
		c. Work with Microsoft excel etc.					
		d. Use Microsoft office etc					
		e. Use Microsoft powerpoint etc					

		f. Use Microsoft onenote etc					
		g. Use google drive etc					
		h. Play games such as PS4 etc					
		i. Any other					
5.2.2		Online Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does this program help in academic learning? (Yes/No)	Can you create this?	Can you download/upload/search this program? (Yes/No)
	As a User	a. Protection softwares such as Mcafee, avast antivirus etc					
		b. Games such as racing games etc					
		c. Browsing with google chrome, Mozilla firefox etc					
		d. E-mail with gmail, yahoo mail, Hotmail etc					
		e. Social networking profiles/apps such as facebook, whatsapp etc					

6. ICT in the school

6.1	Training for the ICT device		
6.1.1	Were you provided any training by an ICT professional to use the ICT device?	Yes	No
	If yes, what kind of training was provided? Specify (keeping in mind the hardware, software and the content of the ICT device)		
	Was the training useful for you in learning about the ICT device?		

7. Experience of using ICT in the school

7.1	How has the experience been using such technologies?				
	Excellent	Good	Bad	Worst	Neutral

8. Identification of the ICT device and comprehension of its function

8	Asking the teachers the details about the device and how do they visualize the design, hardware, software and the content of the device?				
8.1.	Do you know the name of the device?	Yes		No	
	• In Computer lab • In the classroom				
8.2	Name the visible parts of the device?				
	• In Computer lab				
	• In the classroom				
8.3	Have these parts of the device remained the same over the period of time?				
8.4	Name the internal parts of the device and their function?				
	• In Computer lab				
	• In the classroom				
8.5	How did you come to know about the external and internal parts of the device?				
	• Formal training outside the school, if yes, explain				
8.5.2	Informal training				
	• Parents • Teachers • Friends • Any Other				
8.6	Highlight the differences between a computer lab and an ICT classroom in terms of: • Name • Goals • Teaching-Learning process				

9. Encouragement/discouragement to use the ICT device

9.1	Do these agencies encourage/discourage to use ICT for the following purposes?	Teachers	Parents	Friends	Time
	Interactive				
	b. For group work/homework with friends/teacher				
	b. For discussion with parents/peers/colleagues				
	d. Any other				
	Informative				
	g. To find out about people, things, places, ideas etc				
	h. For general knowledge				
	i. Any other				
	Entertainment				
	j. Playing games				

	k. Playing music				
	l. Playing movies				

9.2	Rank your priority for encouragement of ICT device			
Very satisfied	Satisfied	Unsatisfied	Very unsatisfied	Not sure

9.3	On what factors do these agencies encourage/discourage you to use the ICT device?	Teachers	Parents	Friends
	As a tool to enhance learning			
	Helps in study of various subjects			
	Helps in performing the work quickly			
	Aid in providing lots of information			
	Helps in general knowledge enhancement			
	Helps in gaining extra knowledge, other than the textbook			
	Enhances problem solving			
	Entertainment			
	Fun to play games			
	Fun to watch movies			
	Fun to listen to songs			
	Religious Purposes			
	Listen/watch songs/kirtan/movies			
	Communication			
	Quick/Fast communication			
	Easy Communication			

10. Do you think ICT leads to certain benefits?

Yes/No	Benefits • For knowledge base • For Entertainment base • Material/ economic benefit • Any other

11. Do you think there some limitations in using ICT?

Yes/No	Limitations • For knowledge base • For Entertainment base • For health issues • Any other

On ICT, curriculum and co-curricular activities

12.

13.

14. What is the basic text for you in the classroom? Has it changed with the introduction of ICT devices and how?

15.

16. ICT to address the conventional education problems

16.1	Do you think ICT is creating new problems? Yes/no	
16.1.1	What are the problems? • Pedagogy • Subject matter • Curriculum	
16.1.2	How can they be solved?	
16.1.4	Do you face any problem using online materials? How do you handle that?	

17.

18. Attitude and perception towards usage of ICT device.

18.1	What is the attitude and perception of these people towards usage of ICT devices?		
	I teacher/student use the ICT device for the these purposes		
		Teacher	Parent
	Shopping		
	Social networking		
	Browsing		
	School Work/academic work		
	Learning/reading		
	Business		
	Banking		
	Games		
	Music/movies/dance		
	Designing		
	Stalking		
	E-mailing/ printing		
	Storage of data		
	Any other		

18.2	Can you identify your peer group?	Yes		No	
18.2.1	What devices you use the most with your friends?				
18.2.2	For what purposes do you use these devices?				
18.2.3	How does peer group impact your usage of ICT for various purposes and vice-versa.				

19. What is it that you love and hate the most while working with a ICT device?

20. Describe your relationship with ICT in a few words/picture/drawing.

Interview schedule

For Parents

Objectives of the research

- To study the changing communication patterns in the present context with advent of technologies of communication and its effect on the school system, its system and agencies.
- The research explores the production and reproduction of communication patterns and processes due to technologies of communication in school context and find out its ideological underpinnings.

1. Profile of the parents

1.1	Name	
1.2	Age	
1.3	Place of stay	
1.4	Married/Single	
1.5	Educational Background	
1.5.1	Schooling (name and number of years)	
1.5.2	College (name and number of years)	
1.6	Total experience	

2. Why is ICT important for school education?

3. Channels of communication

Applications/channels of communication with the parents, teachers, students that the school uses.				
Teaching/learning/Governance		Yes/No	How facilitate communication?	Different from the past?
3.1	*Teachers-Students*			
3.2	*Teachers-Parents*			
3.3	*School-Parents*			
3.4	*School-teachers*			
3.5	*School student*			

4. ICT Device ad its usage

4.1 Access to ICT device				
4.1.1	At Home		Yes	No
	If yes, Which devices?	Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		

4.1.2	At School		Yes	No
		Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		
	At Other Places		Yes	No
	Learning, mclasses/Tuition Centre Cyber Café Any Other	Laptop		
		Desktop		
		Tablet		
		Mobile Phone		
		Smart board		
		Any Other		

4.2	How often do you use ICT devices?		
4.2.1	At Home	In a day (number of hours)	In a week (number of days)
4.2.2	At School	In a day (number of hours)	In a week (number of days)
4.2.3	At Other Places	In a day (number of hours)	In a week (number of days)

5. Familiarity with the ICT device

5.1	Familiarity with the following companies and their programs which you might use/heard of?						
		Yes	No				
	Microsoft						
	Google						
	Yahoo						
	Ubuntu						
	Any other						
5.2	Can you perform the below mentioned tasks with the ICT device?						
5.2.1		Offline Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does this help in academic learning? (Yes/No)	Can you create this program?	Can you download/upload/search this program? (Yes/No)
	As a User	a. Work with Microsoft word, google docs, Ubuntu word etc.					

		b. Work with Microsoft Paint etc.					
		c. Work with Microsoft excel etc.					
		d. Use Microsoft office etc.					
		e. Use Microsoft powerpoint etc.					
		f. Use Microsoft onenote etc.					
		g. Use google drive etc.					
		h. Play games such as PS4 etc.					
		i. Any other					
5.2.2		Online Programs	Do you know this program? (Yes/No)	Can you use this program? (Yes/No)	Does it help in academic learning? (Yes/No)	Can you create this	Can you download/ upload/search this program? (Yes/No)
	As a User	a. Protection softwares such as Mcafee, avast antivirus etc.					
		b. Games such as racing games etc.					
		c. Browsing with google chrome, Mozilla firefox etc.					
		d. E-mail with gmail, yahoo mail, Hotmail etc.					
		e. Social networking profiles/apps such as facebook, whatsapp etc.					

6. ICT in the school

6.1	Training for the ICT device		
6.1.1	Was there any training provided to your child by the school/ company to use the ICT device?	Yes	No
	If yes, what kind of training was provided? Specify (keeping in mind the hardware, software and the content of the ICT device)		

7.

8.

9. Encouragement/discouragement to use the ICT device

9.1	Do you encourage/discourage your student's/children to use ICT for the following purposes?	Yes	No	Time

	Interactive			
	c. For group work/homework with friends/teacher			
	b. For discussion with teachers/peers/colleagues/parents of friends			
	e. Any other			
	Informative			
	m. To find out about people, things, places, ideas etc.			
	n. For general knowledge			
	o. Any other			
	Entertainment			
	p. Playing games			
	q. Playing music			
	r. Playing movies			

9.2	Rank your priority for encouragement of ICT device			
Very satisfied	Satisfied	Unsatisfied	Very unsatisfied	Not sure

9.3	On what factors do you encourage/discourage the students to use the ICT device?	Yes	No
	As a tool to enhance learning		
	Helps in study of various subjects		
	Helps in performing the work quickly		
	Aid in providing lots of information		
	Helps in general knowledge enhancement		
	Helps in gaining extra knowledge, other than the textbook		
	Enhances problem solving		
	Entertainment		
	Fun to play games		
	Fun to watch movies		
	Fun to listen to songs		
	Religious Purposes		
	Listen/watch songs/kirtan/movies		
	Communication		
	Quick/Fast communication		
	Easy Communication		

10. Do you think ICT leads to certain benefits?

Yes/No	Benefits • For knowledge base • For Entertainment base • Material/ economic benefit • Any other

11. Do you think there some limitations in using ICT?

Yes/No	Limitations • For knowledge base • For Entertainment base • For health issues • Any other

On ICT, curriculum and co-curricular activities

12.

13. Change in teaching-learning due to ICT in comparison to conventional mode.

13.1	How has the usage of ICT changed the way one learns in comparison to the conventional mode of learning?			
	Teaching-learning Process	Conventional mode of learning	Learning with ICT	
			Learning Computers in a computer lab	Learning academic subjects using ICT devices
	d. Pedagogy			
	e. Subject matter			
	f. Curriculum			
13.2	Learning outcomes with respect to subjects	Conventional mode of learning	Learning with ICT	
	f. Mathematics			
	g. Science			
	h. Social Studies			
	i. Languages			
	j. Arts			
	Any Other			

13.3	Does school use any ICT product for evaluation of students?	Yes		No	
	If yes, which tools school use?				
13.3.1	How are they used?				
13.3.2	How is the introduction of ICT changing the assessment procedures?				

14. What is the basic text for the students in the classroom? Has it changed with the introduction of ICT devices and how?

15.

16. ICT to address the conventional education problems

16.1	Do you think ICT can overcome the problems of conventional education system?

	Yes/No	How?
16.2	Do you think ICT is creating new problems? Yes/no	
16.2.1	What are the problems? • Pedagogy • Subject matter • Curriculum	
16.2.2	How can they be solved?	
16.2.4	Do you face any problem using online materials? How do you handle that?	

17.

18. Attitude and perception towards usage of ICT device.

18.1	What is the attitude and perception of these people towards usage of ICT devices?		
	I parent/child use the ICT device for the these purposes		
		Parent	Student's/Children
	Shopping		
	Social networking		
	Browsing		
	School Work/academic work		
	Learning/reading		
	Business		
	Bank details		
	Games		
	Music/movies/dance		
	Designing		
	Stalking		
	E-mailing/ printing		
	Any other		

18.2	Are you familiar with the peer group of your student's/children?	Yes		No	
18.2.1	How does peer group impact your student's/children in usage of ICT for various purposes and vice-versa.				

19. What is it that you love and hate the most while working with a ICT device?

20. Describe your relationship with the technology in a few words/picture/drawing.

21. What can be done to increase the benefits/decrease the negative consequences of using technology?

22. When the ICT device is not available at home, how is the homework done?

23. If the child is not well equipped with the ICT device, who does the homework using ICT?

Interview Schedule

For Industry

Objectives of the research

- To study the changing communication patterns in the present context with advent of technologies of communication and its effect on the school system, its system and agencies.
- The research explores the production and reproduction of communication patterns and processes due to technologies of communication in school context and find out its ideological underpinnings.

1. Profile

1.1	Name	
1.2	Name of the school	
1.3	Age	
1.4	Gender	
1.5	Place of stay	
1.6	Married/Single	
1.7	Educational Background	
1.8	Total experience	
1.8.1	How long in this company	
1.8.2	Work profile in this company	
1.8.2	Before joining this company (teacher/ other, specify)	

2. Why is ICT important for school education?

3.
4. ICT device

4.1	What are the devices/programs that this company has developed?		
4.2	What is the type of device that your company sells to schools? How is it designed?		
4.2.1	Is the device exclusively designed for school education?	Yes/No	Details
4.3	Do you use any existing devices for the product you sell?		
4.4	Are there any special packages for schools/other consumers?		
4.5	Are there any special educational softwares that you sell/make?		

5.
6. ICT in the school

6.1	Does your company go to schools to sell your products?
6.2	How many schools do you sell your device to? (Details of school and package)

	School Name	Address	Number of students	Type of school (Primary/Secondary/Higher Secondary)	School Management(private/government/aided/unaided)	Year of introduction of the device	Continued /discontinued	If discontinued, reason

6.2	What is your criteria for the selection of the schools?		
6.3	Do you change your program/package for different schools?	Yes	No
6.4	What are the strategies that you adopt for the same?		

Training for ICT device

6.5	Do you train the teachers/school staff in usage of this device?	
	Yes/No	Please share the details of your training module(duration, timing, type of training)
6.6	What are the problems that you encounter while training of the teachers?	

7.
8.
9. Encouragement/discouragement to use the ICT device

9.1	How is your program perceived by these agencies?	Teachers	Parents	Friends
	Content of the device			
	Interactive			
	Informative			
	Entertainment			
	Purpose of the device			
	Special Package			

10. Do you think ICT leads to certain benefits?

Yes/No	Benefits • For knowledge base • For Entertainment base • Material/ economic benefit • Any other

11. Do you think there some limitations in using ICT?

Yes/No	Limitations • For knowledge base • For Entertainment base

	• For health issues • Any other

12. Pedagogy with ICT (for computer and subject teachers)

12.1	What is the nature of pedagogy used in the computer lab?			
12.2	What is the subject matter for learning ICT in the lab?			
12.3	Does your program enables the teaching-learning of academic subjects?	Yes	No	
12.3.1	If yes, what are those subjects?			
12.3.2	Is there any specific pedagogy for specific subjects? Explain	Yes	No	Details
12.4	Which subject matter can be best and easily learnt using ICT?			
	Mathematics			
	Science			
	Social science			
	Language			
	Arts			
	Any other			

13. Change in teaching-learning due to ICT in comparison to conventional mode.

13.1	How is the education system changing due to ICT?		
13.2	What are the changes happening due to introduction of ICT?		
	g. Pedagogy		
	h. Subject matter		
	i. Curriculum		
13.3	Do you anticipate any learning outcomes with the introduction of your device?	Yes	No
13.3.1	What are those outcomes?		
13.3.2	How do you measure them?		

13.3	Whether you make any product/package for the evaluation of the students?	Yes	No
	If yes, which products/programs do you make?		
13.3.1	How are they used?		
13.3.2	How is the introduction of ICT changing the assessment procedures?		

14.

15. Contrast your experience as a student vis-à-vis professional working in the domain of ICT.

So do you think ICT supplements, replaces or extends the conventional mode of teaching-learning?

16. ICT to address the conventional education problems

16.1	Do you think ICT can overcome the problems of conventional education system?	
	Yes/No	How?
16.2	Do you think ICT is creating new problems? Yes/no	
16.2.1	What are the problems? • Pedagogy • Subject matter • Curriculum	
16.2.2	How can they be solved?	
16.2.4	Do you face any problem using online materials? How do you handle that?	

17. When were you first introduced to educational technology? How has your experience of using it changed?
18.
19. What is it that you love and hate the most while working with a ICT device?

20. Describe your relationship with the ICT in a few words/picture/drawing.
21. Product and the market

21.1	Do you think your product is unique in the market?	Yes/No	Why?	
21.2	How do you come to know the demand of your product?			
21.3	Do you conduct any market research before designing the product?	Yes /No	Details	
21.4	What factors do you keep in mind while designing your product? (based on market research)			
21.5	Are there any such models available globally in any other part of the world?		Yes/No	Details

22. Profile of the people in the industry

22.1	How many people work in your company? (approx.)			
22.2	What kind of work profiles do you have for people working in the domain of educational technology?			
22.3	What kind of specializations do you look for these profiles?			
22.4	Do you hire people full time, part time or consultants?	Yes	No	Details

ICT, Pedagogy and curriculum

23. What is the future of the technology in education according to you? Likewise, where do you see your company in five years from now?
24. Being a parent, would you allow your children to use ICT? What would you allow them and what you don't while using such devices? And for how long?

Checklist for observation

1. The name, design, hardware and software components of the device used and the meaning attributed to it by the students, teachers and school administrators.

Name of the ICT device used
• In ICT lab
• In the classroom
Design of the ICT device, its hardware components
• In ICT lab
• In the classroom
Software of the ICT device
• In ICT lab
• In the classroom
The Content of the ICT device/any special educational package (represented through text, symbol, images etc.)
• In ICT lab
• In the classroom

2. The purpose and use of ICT in the classroom for curricular and co-curricular activities.

• The difference between ICT use for computer literacy and as a part of the curriculum
• The use of ICT in the classroom for different subjects and different purposes.
• The difference in the way ICT is used for different subjects.
• The pedagogical place and the role which ICT is attributed- supplement the existing curriculum, substitute the existing curriculum or has a major role in the curriculum
• The difference between the conventional mode of teaching and learning and the new mode of teaching-learning with the use of ICT.

3. The place of ICT in the classroom interaction, its impact on the role of the students and the teachers.

• The role of teachers and students in the use of ICT in the classroom.
• The meaning of ICT learning for students and the teachers in comparison to learning without ICT.

4. The psychological factors behind the usage of ICT in the classroom.

• The impact of teacher's personality on the use of ICT in the classroom
• The motivating factors for the students and the teachers to use ICT in the classroom.

5. The change in the communication patterns due to usage of ICT in the classroom

• The impact of varied devices on the curricular transaction and the communication patterns.
• The change in communication patterns while use of ICT in the classroom.

6. The difference in the school's philosophy and the implementation of ICT in the classroom scenario.
7. The impact of ICT usage at home/other arenas in the classroom scenario and vice-versa.

   The motivating factors for the students and the teachers to use ICT in the classroom.

Appendix III

Product Wise Categorization

Table A3.1: Product wise categorization for companies making varied ICT products for schools

	1	2	3	4	5	6	7	8
Product Categories	**Equipments/Hardware**	**Software**	**Publications**	**Music, Play and Sports Materials**	**Content and Curriculum**	**Comm./ Connectivity**	**Special Needs**	**Allied and Supportive Products/Solution**
NoNoBATE7 SOFTWARE PRIVATE LIMITED	Yes	Yes	No	No	Yes	No	No	No
3D KIDS	Yes	Yes	No	No	Yes	No	Yes	Yes
ACADEMY FOR CREATIVE TEACHING	No	No	No	No	Yes	No	No	No
ACER INDIA PVT. LTD.	Yes	No	No	No	No	No	No	No
ADROIT CONTROL ENGINEERS PVT. LTD.	Yes	Yes	No	No	Yes	No	No	Yes
AiSOLVE	No	Yes	No	No	No	No	No	No
AKIRA	Yes	Yes	No	No	No	Yes	No	Yes
ALL INDIA COUNCIL OF TECHNICAL EDUCATION(AICTE)	No	No	No	No	No	No	No	No
ALPHA CINEMA	Yes	No	No	No	No	No	No	No
APAR TECHNOLOGIES PVT. LTD.	No	Yes	No	No	Yes	No	Yes	Yes
ARIGOLD	No	No	No	Yes	No	No	No	No
B INSPIRED	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
BENQ INDIA PRIVATE LIMITED	Yes	No	No	No	No	Yes	No	Yes
BONTON TECHNOMAKE (P) LTD.	Yes	No	No	No	No	No	No	No

BRIO INTERACTIVE TECHNOLOGIES PVT. LTD.	Yes	Yes	No	No	No	No	No	No
BRITISH COUNCIL	No	No	No	No	Yes	No	No	No
BRITISH EDUCATIONAL SUPPLIERS ASSOCIATION (BESA)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
BRITNET GmbH	Yes	Yes	No	No	No	Yes	No	No
BUTTERFLY EDUFIELDS PVT. LTD.	No	No	Yes	No	Yes	No	No	Yes
CAMBRIDGE	No	No	Yes	No	Yes	No	No	Yes
CAMPUSMALL PVT. LTD.	No	No	No	Yes	No	No	No	No
CERTIZO INFOSYSTEMS PRIVATE LIMITED	No	Yes	No	No	No	Yes	No	Yes
CHRISTIANI SHARPLINE TECHNICAL TRAINING PVT. LTD.	Yes	Yes	Yes	No	Yes	No	No	Yes
CIVOM	Yes	No	No	No	No	No	No	Yes
CLASSPLASH GmbH	No	Yes	No	Yes	Yes	No	No	Yes
CLOUDWALKER STREAMING TECHNOLOGIES PVT. LTD.	Yes	No	No	No	No	No	No	No
CRETILE-WORLDCLASS STEM TOOL	Yes	Yes	No	No	Yes	No	No	No
DAC's INC	No	No	No	No	No	No	No	Yes
DEVELOPING EXPERTS	No	Yes	No	No	Yes	No	No	No
DIDACTA INTERNATIONAL	No	No	No	No	No	No	No	No
DR. -ING PAUL CHRISTIANI GmbH & CO. KG	Yes	Yes	Yes	No	Yes	No	No	Yes
DTi LABZ	Yes	Yes	No	No	Yes	No	No	No
DUSYMA KINDERGARTEN BEDARF GmbH	Yes	No	No	No	No	No	Yes	No

E INK HOLIDAYS INC.	Yes	No	No	No	No	No	No	No
EDISON AND TARGETPLUS EDUCATION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ED-IT.IN	No	Yes	Yes	Yes	Yes	Yes	No	No
EDLOUNGE LTD.	No	Yes	No	Yes	Yes	No	Yes	No
EDUCATION DESIGN ARCHITECTS (I) PVT. LTD.	No	No	No	No	No	No	No	No
EDUCATION INITIATIVES PVT. LTD.	No	Yes	No	No	No	No	No	Yes
EDUCATION QUALITY FOUNDATION OF INDIA (EQFI)	No	No	No	No	No	No	No	No
EDUNEXT TECHNOLOGIES PVT. LTD.	No	Yes	No	No	No	No	No	No
EDUPREC	No	Yes	No	No	Yes	Yes	No	No
EDUSWITCH SOLUTIONS PRIVATE LIMITED	No	Yes	No	No	No	No	No	No
EDUTECH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELMO CO., LTD.	Yes	No	No	No	No	Yes	No	Yes
ENFOLD PROACTIVE HEALTH TRUST	No	No	No	No	No	No	No	Yes
EPSON INDIA PVT. LTD.	Yes	No	No	No	No	No	No	Yes
EXPERT SCHOOL LLP	No	Yes	No	No	Yes	Yes	No	Yes
EXTRAAEDGE TECHNOLOGY SOLUTIONS PVT. LTD.	No	Yes	No	No	No	No	No	No
FAMIC TECHNOLOGIES	No	Yes	No	No	No	No	No	No
FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND ENERGY (BMWi)	No	No	No	No	No	No	No	No
FESTO INDIA PVT. LTD.	Yes	Yes	Yes	No	Yes	No	No	No

FILEX SYSTEMS PVT. LTD.	No	No	No	No	No	No	No	Yes
FLINTO LEARNING SOLUTIONS PVT. LTD.	No	No	No	No	Yes	No	No	No
FRANCISCAN SOLUTIONS PVT. LTD.	Yes	Yes	No	No	Yes	Yes	No	Yes
FRONTLINE TECHNOLOGIES	Yes	Yes	No	No	No	No	No	No
GALLANT SPORTS AND INFRA PVT. LTD.	No	No	No	Yes	No	No	No	No
GLOBAL SOUND MANAGEMENT	No	No	No	No	No	No	No	Yes
GOLDEN PATH	No	No	No	No	No	No	No	No
GURU ANGAD DEV TEACHING LEARNING CENTRE OF MHRD	No	No	No	No	Yes	No	No	No
HOHENLOHER	Yes	No	No	No	No	No	No	No
IBT-DESIGNED FOR EVERYONE	Yes	Yes	No	No	No	No	No	No
IMPERO SOFTWARE	No	Yes	No	No	No	No	No	No
INDIA DIDACTICS ASSOCIATION	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
INFRALAB-SMART CLASSROOM INDIA	Yes	No	No	No	No	No	No	No
INTERNATIONAL BACCALAUREAT E ORGANIZATION	No	No	No	No	Yes	No	No	No
INVENTIONS AND PATENTS	Yes	Yes	Yes	No	Yes	No	Yes	Yes
IQ KEY	Yes	Yes	Yes	No	Yes	No	No	No
iSAMS	No	Yes	No	No	No	No	No	No
IVY EVERYTHING FOR SCHOOL	No	No	No	No	No	No	No	Yes
JANATICS INDIA PRIVATE LIMITED	Yes	No	No	No	No	No	No	No

JIL INFORMATION TECHNOLOGY LTD.	Yes	Yes	No	No	Yes	No	No	No
JUPSOFT TECHNOLOGIES PVT. LTD.	No	Yes	No	No	No	No	No	No
KOGNITY	No	Yes	Yes	No	Yes	No	No	No
KOMPAN-LET'S PLAY	No	No	No	Yes	No	No	No	No
LEXSOLAR GmbH	Yes	No	No	No	Yes	No	No	No
LUCAS NUELLE GmbH	Yes	No	No	No	Yes	No	No	No
LUXURY PERSONIFIED LLP	Yes	No	No	Yes	No	No	No	No
LXL IDEAS PVT. LTD.	Yes	No	Yes	No	Yes	No	No	Yes
M&B FOOTWEAR PVT. LTD.	No	No	No	No	No	No	No	Yes
MAGNUM SADOSHIMA ISPAT PVT. LTD.	Yes	No	No	No	No	No	No	No
MAKEBLOCK CO. LTD.	Yes	No	No	No	No	No	No	No
MANGAHIGH	No	Yes	No	No	Yes	No	No	No
MANGO INSTITUTIONAL FURNITURE	No	No	No	No	No	No	No	Yes
MAPMYSTUDY BY PAC ASIA	No	No	No	No	No	No	No	No
MATH BUDDY	No	Yes	No	No	Yes	No	No	Yes
MICROSOFT CORPORATION (INDIA) PVT. LTD.	Yes	Yes	No	No	Yes	No	No	Yes
MILAN SALES CORPORATION INDIA	Yes	Yes	No	No	No	Yes	Yes	Yes
MILGRASP	Yes	Yes	No	No	No	Yes	No	Yes
MINDSCAN EDUCATION	No	No	No	No	No	No	No	No
MKT SOFTWARES (P) LTD.	No	Yes	No	No	Yes	Yes	No	No
MS KOREA CO., LTD.	No	Yes	No	No	No	No	No	No

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING(NCERT)	No	No	Yes	No	No	No	No	No
NATIONAL INSTITUTE OF OPEN SCHOOLING(NIOS)	No	No	Yes	No	Yes	No	No	No
NATURENURTURE	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
NILKAMAL LIMITED	No	No	No	No	No	No	No	Yes
NIVIA	No	No	No	Yes	No	No	No	Yes
NOPAPERFORMS	No	Yes	No	No	No	Yes	No	No
NOVABEANS	Yes	Yes	No	No	No	Yes	Yes	Yes
OMRSCAN CO., LTD.	No	Yes	No	No	No	No	No	No
ONVU LEARNING	Yes	Yes	No	No	No	Yes	No	Yes
OXFORD UNIVERSITY PRESS	No	Yes	Yes	No	Yes	No	No	Yes
PALLIUM MARKETING	No	No	No	No	No	No	Yes	No
PENSAR SOLUTIONS PVT. LTD.	Yes	Yes	No	No	Yes	Yes	No	Yes
PETALS PRE SCHOOL	No	No	No	No	Yes	No	No	No
PHILLIPS MACHINE TOOLS INDIA PVT. LTD.	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
POPCORN FURNITURE & LIFESTYLE PVT. LTD.	Yes	No	No	No	No	No	No	Yes
PRISMART	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
PRODIGY MATH GAME INDIA	No	Yes	No	No	Yes	Yes	Yes	No
PUMA SPORTS (I) PVT. LTD.	Yes	No	No	Yes	No	No	No	No
QUICK CLEAN PVT. LTD.	No	No	No	No	No	No	No	Yes
REMI	No	No	No	No	No	Yes	Yes	Yes
REMOTEDRISHTEE.COM	Yes	Yes	No	No	No	Yes	No	No

ROBOMATE EDUTECH PVT. LTD.	Yes	Yes	No	No	Yes	No	No	Yes
S CHAND EDUTECH PVT. LTD.	Yes	No	No	Yes	Yes	Yes	No	Yes
SCANNING PENS	Yes	No	No	No	No	No	Yes	No
SCHNEIDER ELECTRIC INDIA PVT. LTD.	Yes	Yes	Yes	No	Yes	No	No	Yes
SCHOLASTIC AND SCHOOL EDUCATION	No	No	Yes	No	Yes	No	No	No
SENSES ELECTRONICS PVT. LTD.	Yes	Yes	No	No	No	No	No	No
SEROSOFT	No	Yes	No	No	No	Yes	Yes	Yes
SKOOLSMART-CHILD SAFETY FIRST	Yes	Yes	No	No	No	No	No	No
SMC INTERNATIONAL TRAINING	Yes	Yes	No	No	No	No	No	No
SMC PNEUMATICS (INDIA) PVT. LTD.	Yes	Yes	Yes	No	Yes	No	Yes	Yes
SOFTBANK ROBOTICS	Yes	No	No	No	No	No	No	No
SOUND FOR LIFE	Yes	No	No	Yes	No	No	Yes	No
SRJNA 'LEARNING BY DOING'	Yes	Yes	No	No	Yes	No	No	Yes
SSC MANAGEMENT GmbH	No	No	No	No	No	No	No	No
STUDENT RESPONSE SYSTEM	Yes	Yes	No	No	No	Yes	Yes	Yes
SUFDI-SHANTI UPENDRA FOUNDATION FOR DEVELOPMENT INITIATIVES	No	No	No	No	No	No	No	Yes
TEST OUTLOOK SOLUTIONS LLP	No	Yes	No	No	Yes	Yes	No	No
TEXTHELP	No	Yes	No	No	No	No	No	No

THE HINDU STEP	No	Yes	No	No	Yes	No	No	No
THE ULTIMATE KNOWLEDGE	No	Yes	No	No	Yes	No	No	No
THINKCUTIEFUL	No	No	No	No	No	No	No	No
TOPSUN ENTERPRISES	Yes	No	No	No	No	No	No	No
TORRINS - SCHOOL MUSIC PROGRAM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
TRANQUIL	Yes	No	No	No	No	No	No	Yes
TREVI FURNITURE CORP PRIVATE LIMITED	Yes	No	No	No	No	No	No	No
UNIPRO EDUCATION PVT. LTD.	No	No	No	No	No	No	No	No
UNITED INDUSTRIES	Yes	No	No	No	No	No	No	No
VARDHAMAN IQ TOYS PVT. LTD.	No	No	No	No	No	No	No	No
VENDIMAN PRIVATE LIMITED	Yes	No	No	No	No	No	No	Yes
VGYAAN	Yes	Yes	No	No	No	No	No	No
VIDWATH INNOVATIVE SOLUTIONS PVT. LTD.	Yes	Yes	No	No	Yes	No	No	No
VINCO EDUCATIONAL GmbH	No	No	No	Yes	No	No	No	No
VIR SOFTECH PVT. LTD.	No	Yes	No	No	No	No	No	No
WACOM INDIA PVT. LTD.	Yes	No	No	No	No	No	No	No
WOODWISE PENCILS TM	No	No	No	No	No	No	No	Yes
WORLDDIDAC ASSOCIATION	No	No	Yes	No	No	No	No	No
WUEKRO GmbH	Yes	Yes	No	No	Yes	No	Yes	No
www.DIGITALEVALUATION.com	Yes	Yes	No	No	No	No	No	No
YARUKEY (A PRODUCT OF TOPPAN PRINTING CO. LTD.)	Yes	Yes	No	No	Yes	Yes	No	Yes

YOUFIRST VENTURES PVT. LTD.	Yes	Yes	No	No	No	Yes	Yes	Yes
YOUNG INDIA FILMS	Yes	Yes	No	Yes	No	Yes	Yes	No
ALMOE DIGITAL SOLUTIONS (P) LTD.	Yes	No	No	No	No	Yes	No	Yes
AMARDEEP DESIGNS INDIA P LTD.	No	No	No	No	No	No	No	Yes
BUSINESS OCTANE SOLUTIONS PVT. LTD.	Yes	Yes	No	No	No	Yes	No	Yes
I SOLUTIONS TECHNOLOGIES PVT. LTD.	Yes	Yes	No	No	Yes	Yes	No	Yes
QTPI PRIVATE LIMITED	Yes	Yes	No	No	Yes	No	No	No
ROBOMAX- A ROBOTIC LAB FOR SCHOOLS	Yes	Yes	No	No	No	No	Yes	Yes

Source: DIDAC INDIA, 2018

Level wise categorization

Table A 3.2**:** Level wise categorization for companies making varied ICT products for schools

	1	2	3	4	5	6	7
Level Categories	**Early Years/Foundation**	**Schpol Education (ages 4 to 8)**	**Higher Education**	**Further Education**	**Adult and Community Education**	**Vocational Education and Training**	**Research Levels**
NoNoBATE7 SOFTWARE PRIVATE LIMITED	No	Yes	No	No	Yes	Yes	No
3D KIDS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ACADEMY FOR CREATIVE TEACHING	No	No	Yes	No	No	Yes	No
ACER INDIA PVT. LTD.	No	Yes	Yes	Yes	No	Yes	Yes
ADROIT CONTROL ENGINEERS PVT. LTD.	No	No	No	Yes	Yes	Yes	No
AiSOLVE	No	No	No	No	No	Yes	Yes
AKIRA	No	No	Yes	Yes	No	Yes	No
ALL INDIA COUNCIL OF TECHNICAL EDUCATION(AICTE)	No	No	Yes	No	No	Yes	Yes
ALPHA CINEMA	No	Yes	Yes	Yes	Yes	No	Yes
APAR TECHNOLOGIES PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ARIGOLD	Yes	Yes	Yes	No	No	No	No
B INSPIRED	Yes	Yes	No	Yes	No	Yes	No
BENQ INDIA PRIVATE LIMITED	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BONTON TECHNOMAKE (P) LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BRIO INTERACTIVE TECHNOLOGIES PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BRITISH COUNCIL	Yes	No	Yes	No	No	Yes	Yes
BRITISH EDUCATIONAL SUPPLIERS ASSOCIATION (BESA)	Yes	Yes	No	No	No	Yes	No
BRITNET GmbH	No	Yes	Yes	Yes	Yes	No	No

BUTTERFLY EDUFIELDS PVT. LTD.	Yes	Yes	No	No	No	Yes	No
CAMBRIDGE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CAMPUSMALL PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CERTIZO INFOSYSTEMS PRIVATE LIMITED	No	No	Yes	Yes	Yes	Yes	Yes
CHRISTIANI SHARPLINE TECHNICAL TRAINING PVT. LTD.	Yes	Yes	Yes	Yes	No	Yes	No
CIVOM	Yes	Yes	Yes	No	No	No	No
CLASSPLASH GmbH	Yes	Yes	No	No	No	No	No
CLOUDWALKER STREAMING TECHNOLOGIES PVT. LTD.	No	Yes	Yes	No	Yes	Yes	Yes
CRETILE-WORLDCLASS STEM TOOL	No	Yes	Yes	No	No	No	No
DAC's INC	Yes	Yes	Yes	Yes	Yes	Yes	No
DEVELOPING EXPERTS	Yes	Yes	No	No	No	No	No
DIDACTA INTERNATIONAL	No	No	No	No	No	No	No
DR. -ING PAUL CHRISTIANI GmbH & CO. KG	No	Yes	Yes	Yes	Yes	Yes	Yes
DTi LABZ	No	Yes	No	No	No	No	No
DUSYMA KINDERGARTENBEDARF GmbH	Yes	Yes	No	No	No	No	No
E INK HOLIDAYS INC.	No	Yes	Yes	Yes	Yes	Yes	No
EDISON AND TARGETPLUS EDUCATION	Yes	Yes	No	No	Yes	No	Yes
ED-IT.IN	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EDLOUNGE LTD.	No	Yes	Yes	Yes	Yes	Yes	No
EDUCATION DESIGN ARCHITECTS (I) PVT. LTD.	Yes	Yes	No	No	No	No	No
EDUCATION INITIATIVES PVT. LTD.	No	Yes	Yes	Yes	No	No	No
EDUCATION QUALITY	Yes	Yes	No	No	No	Yes	No

FOUNDATION OF INDIA (EQFI)							
EDUNEXT TECHNOLOGIES PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EDUPREC	Yes	No	Yes	Yes	No	No	Yes
EDUSWITCH SOLUTIONS PRIVATE LIMITED	No	No	Yes	Yes	Yes	Yes	Yes
EDUTECH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ELMO CO., LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ENFOLD PROACTIVE HEALTH TRUST	No	Yes	No	No	No	No	No
EPSON INDIA PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EXPERT SCHOOL LLP	No	Yes	Yes	No	No	Yes	Yes
EXTRAAEDGE TECHNOLOGY SOLUTIONS PVT. LTD.	Yes	Yes	Yes	Yes	No	Yes	No
FAMIC TECHNOLOGIES	No	Yes	Yes	Yes	No	Yes	Yes
FEDERAL MINISTRY FOR ECONOMIC AFFAIRS AND ENERGY (BMWi)	No	No	No	No	No	No	Yes
FESTO INDIA PVT. LTD.	No	No	Yes	Yes	No	Yes	Yes
FILEX SYSTEMS PVT. LTD.	No	Yes	Yes	Yes	Yes	Yes	No
FLINTO LEARNING SOLUTIONS PVT. LTD.	Yes	No	No	No	No	No	No
FRANCISCAN SOLUTIONS PVT. LTD.	Yes	Yes	Yes	Yes	No	No	No
FRONTLINE TECHNOLOGIES	No	No	Yes	No	No	Yes	No
GALLANT SPORTS AND INFRA PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GLOBAL SOUND MANAGEMENT	Yes	Yes	Yes	No	No	No	No
GOLDEN PATH	No	Yes	Yes	Yes	No	No	No
GURU ANGAD DEV TEACHING	No	No	Yes	No	No	No	No

LEARNING CENTRE OF MHRD							
HOHENLOHER	No	Yes	Yes	Yes	Yes	Yes	Yes
IBT-DESIGNED FOR EVERYONE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IMPERO SOFTWARE	No	Yes	Yes	Yes	Yes	Yes	No
INDIA DIDACTICS ASSOCIATION	Yes	Yes	Yes	Yes	Yes	Yes	Yes
INFRALAB-SMART CLASSROOM INDIA	No	Yes	Yes	Yes	No	Yes	Yes
INTERNATIONAL BACCALAUREATE ORGANIZATION	Yes	Yes	No	No	No	No	No
INVENTIONS AND PATENTS	No	No	No	No	No	No	Yes
IQ KEY	Yes	Yes	No	No	No	No	No
iSAMS	No	Yes	No	No	No	No	No
IVY EVERYTHING FOR SCHOOL	Yes	No	No	No	No	No	No
JANATICS INDIA PRIVATE LIMITED	No	No	Yes	No	No	Yes	No
JIL INFORMATION TECHNOLOGY LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JUPSOFT TECHNOLOGIES PVT. LTD.	No	Yes	Yes	Yes	No	Yes	No
KOGNITY	No	Yes	No	No	No	No	No
KOMPAN-LET'S PLAY	No	Yes	No	No	No	No	No
LEXSOLAR GmbH	No	Yes	Yes	No	Yes	Yes	No
LUCAS NUELLE GmbH	No	No	Yes	Yes	No	Yes	No
LUXURY PERSONIFIED LLP	Yes	Yes	Yes	Yes	Yes	Yes	No
LXL IDEAS PVT. LTD.	Yes	Yes	No	No	No	No	No
M&B FOOTWEAR PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MAGNUM SADOSHIMA ISPAT PVT. LTD.	No	Yes	Yes	No	No	No	No
MAKEBLOCK CO. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MANGAHIGH	No	Yes	No	No	No	No	No
MANGO INSTITUTIONAL FURNITURE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MAPMYSTUDY BY PAC ASIA	No	Yes	Yes	No	No	No	No
MATH BUDDY	No	Yes	No	No	No	No	No

MICROSOFT CORPORATION (INDIA) PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MILAN SALES CORPORATION INDIA	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MILGRASP	Yes	Yes	No	No	No	No	Yes
MINDSCAN EDUCATION	No	Yes	Yes	No	No	No	No
MKT SOFTWARES (P) LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MS KOREA CO., LTD.	No	Yes	Yes	Yes	Yes	Yes	No
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING(NCERT)	No	Yes	Yes	Yes	Yes	Yes	Yes
NATIONAL INSTITUTE OF OPEN SCHOOLING(NIOS)	No	Yes	No	No	No	Yes	No
NATURENURTURE	Yes	Yes	No	No	No	No	Yes
NILKAMAL LIMITED	Yes	Yes	Yes	Yes	No	No	No
NIVIA	Yes	Yes	Yes	Yes	No	No	No
NOPAPERFORMS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NOVABEANS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OMRSCAN CO., LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ONVU LEARNING	Yes	Yes	Yes	Yes	Yes	Yes	No
OXFORD UNIVERSITY PRESS	Yes	Yes	Yes	No	Yes	Yes	No
PALLIUM MARKETING	Yes	Yes	Yes	Yes	Yes	Yes	No
PENSAR SOLUTIONS PVT. LTD.	Yes	Yes	No	No	No	No	No
PETALS PRE SCHOOL	Yes	No	No	No	No	No	No
PHILLIPS MACHINE TOOLS INDIA PVT. LTD.	No	No	No	No	No	Yes	No
POPCORN FURNITURE & LIFESTYLE PVT. LTD.	Yes	Yes	Yes	Yes	No	No	No
PRISMART	Yes	Yes	No	No	No	Yes	No
PRODIGY MATH GAME INDIA	No	Yes	No	No	No	No	No
PUMA SPORTS (I) PVT. LTD.	No	Yes	No	No	No	No	No
QUICK CLEAN PVT. LTD.	No	Yes	Yes	Yes	No	Yes	No
REMI	Yes	Yes	No	No	No	No	No
REMOTEDRISHTEE.COM	Yes	Yes	Yes	Yes	No	No	No

ROBOMATE EDUTECH PVT. LTD.	No	Yes	Yes	No	No	No	No
S CHAND EDUTECH PVT. LTD.	Yes	No	No	No	No	No	No
SCANNING PENS	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SCHNEIDER ELECTRIC INDIA PVT. LTD.	No	No	No	Yes	Yes	Yes	No
SCHOLASTIC AND SCHOOL EDUCATION	Yes	Yes	No	Yes	Yes	Yes	Yes
SENSES ELECTRONICS PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SEROSOFT	Yes	Yes	Yes	Yes	Yes	Yes	No
SKOOLSMART-CHILD SAFETY FIRST	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SMC INTERNATIONAL TRAINING	No	No	Yes	No	No	Yes	No
SMC PNEUMATICS (INDIA) PVT. LTD.	No	No	Yes	Yes	No	Yes	No
SOFTBANK ROBOTICS	No	Yes	Yes	Yes	Yes	No	No
SOUND FOR LIFE	Yes	Yes	Yes	Yes	Yes	No	No
SRJNA 'LEARNING BY DOING'	No	Yes	No	No	No	No	No
SSC MANAGEMENT GmbH	Yes	Yes	Yes	Yes	Yes	Yes	Yes
STUDENT RESPONSE SYSTEM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SUFDI-SHANTI UPENDRA FOUNDATION FOR DEVELOPMENT INITIATIVES	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TEST OUTLOOK SOLUTIONS LLP	No	Yes	No	No	No	No	No
TEXTHELP	No	Yes	Yes	Yes	Yes	Yes	Yes
THE HINDU STEP	No	Yes	Yes	Yes	Yes	Yes	No
THE ULTIMATE KNOWLEDGE	No	Yes	No	No	No	No	No
THINKCUTIEFUL	Yes	No	No	No	No	No	No
TOPSUN ENTERPRISES	Yes	Yes	No	No	No	Yes	Yes
TORRINS -SCHOOL MUSIC PROGRAM	No	Yes	No	No	Yes	Yes	No
TRANQUIL	Yes	Yes	Yes	Yes	Yes	Yes	Yes

TREVI FURNITURE CORP PRIVATE LIMITED	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UNIPRO EDUCATION PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UNITED INDUSTRIES	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VARDHAMAN IQ TOYS PVT. LTD.	Yes	Yes	No	No	No	No	No
VENDIMAN PRIVATE LIMITED	No	No	Yes	Yes	Yes	Yes	Yes
VGYAAN	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VIDWATH INNOVATIVE SOLUTIONS PVT. LTD.	Yes	Yes	Yes	No	No	No	No
VINCO EDUCATIONAL GmbH	Yes	Yes	No	No	Yes	No	No
VIR SOFTECH PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WACOM INDIA PVT. LTD.	Yes	Yes	Yes	No	No	No	No
WOODWISE PENCILS TM	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WORLDDIDAC ASSOCIATION	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WUEKRO GmbH	No	No	No	No	No	Yes	No
www.DIGITALEVALUATION.com	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YARUKEY (A PRODUCT OF TOPPAN PRINTING CO. LTD.)	No	Yes	No	No	No	No	No
YOUFIRST VENTURES PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	No
YOUNG INDIA FILMS	Yes	Yes	Yes	No	No	No	No
ALMOE DIGITAL SOLUTIONS (P) LTD.	Yes	Yes	Yes	No	No	Yes	No
AMARDEEP DESIGNS INDIA P LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BUSINESS OCTANE SOLUTIONS PVT. LTD.	No	Yes	Yes	Yes	No	Yes	Yes
I SOLUTIONS TECHNOLOGIES PVT. LTD.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
QTPI PRIVATE LIMITED	No	Yes	No	No	No	No	No

ROBOMAX- A ROBOTIC LAB FOR SCHOOLS	Yes	Yes	No	No	No	No	No

Source: DIDAC INDIA, 2018

Appendix IV

Table A 4.1: States of India and ICT in School Education

S. No.	State/UT	National Initiatives for ICT in School Education and the implementation	State/UT led initiatives for ICT in school education
1.	Jammu and Kashmir	The ICT@School scheme has been extended to the state education department for schools under the aegis of Rashtriya Madhyamik Shiksha Abhiyan (Government of Jammu and Kashmir, 2009) The state government had signed an MOU with the National Institute of Electronics and Information Technology (NIELIT) to make 220 schools ICT enabled in the first phase. NIELIT had been co-opted as a knowledge partner under RMSA. (Sharma, 2015)	This had been backed up with other initiatives such as the pre-training of teachers in ICT and related subjects such as the Department of information and communication Technology, Government college of education, Jammu which aims to make the teachers 'critical' and 'reflective' users of ICT through various teacher training courses. (Government College of Education, Jammu and Kashmir, 2015)
2.	Uttarakhand		The project 'Aarohi' by the Uttrakhand government aimed to make 5-6 computers available in all the 1720 schools of the state and making the students and the teachers ICT proficient. The program was meant for classes 6^{th} to 12^{th}. Besides this, providing connectivity in all the schools is a vital issue too. (Government of Uttrakhand, 2021) The government also aims to train the teachers to use ICT devices through public-private partnerships with corporates such as Microsoft and Intel. These trainings are provided in DIETs and Microsoft academy with the help of public and private institutions. The government has also developed a teacher students portal for facilitating interaction between the 'teachers, students, parents and officials of the education department.' It is a platform for not just interaction but sharing resources for effective teaching-learning process. (Government of Uttrakhand, 2021)

			The government aims to develop 'e-class projects' which comprises of 'IT-enabled course and curriculum' for the classes 9th to 12th in subjects such as physics, chemistry, mathematics, and biology. This content would help in the integration of ICT with the teaching-learning process. (Government of Uttrakhand, 2021)
3.	Punjab		The government formed the Punjab ICT Education Society in 2004-05 with an "aim to impart compulsory computer education to all students of class 6th to 12th." The society, formed under the aegis of SSA, makes sure the smooth installation of the 'computer hardware' in the schools along with the provision of 'broadband connectivity' to these schools. (Government of Punjab Department of School Education, n.d.) In 2017, the Punjab government extended the plan to make computers accessible for primary classrooms too. The government utilized the old computers from upper primary levels, repaired them for the primary level to acquaint the student's with computers and their usage. (Chaba, 2017)
4.	Himachal Pradesh	The ICT@School scheme has been implemented in the state with the approval for the provision of computers in 2078 government schools out of the total 2162 government secondary and higher secondary schools in the state. The scheme aims at bridging the gap between "various socio-economic and other geographical barriers." Also, model smart schools have been developed in Himachal Pradesh under the scheme. (Government of Himachal Pradesh, n.d.)	The NIELIT, Shimla has signed an MOU with the Directorate of higher education, Himachal Pradesh to 'impart IT education and training' to the students of secondary and senior secondary schools, Himachal Pradesh. (Government of India, 2015)
5.	Delhi		For the management of around 1000 schools, the Delhi Government had launched 'a web-based MIS' to initiate reforms in 'personnel, office and

			finance management of the schools.' It has been a successful program and has invited acclaims from all corners. (Government of NCT of Delhi, n.d.) After that, the government introduced programs to facilitate reforms in the academic realm-the two of which are Computer-aided learning and Computer education projects. Computer-aided learning is "a method of the interactive learning-teaching process in which resources of the computer are used to impart learning to the children." The computer education project is a program under which the Delhi government has "introduced computer education in all the Delhi government and government-aided schools from class 6^{th} to class 12^{th}." This is further supported by 'setting up 10-20 computer labs in each school, the appointment of 2-3 computer teachers in each school, the introduction of computer science, informative practices and multimedia as elective subjects and functional literacy from class 6^{th} to 10^{th}. (Government of NCT of Delhi, n.d.) Besides these, the government has launched other facilities like 'online student management system', 'online student feedback', 'online computerized student I-card facility', 'e-service book' for personnel work records, 'MIS mail' among many other such initiatives for administrative purposes. (Government of NCT of Delhi. n.d.)
6.	Haryana	The ICT@School scheme had been implemented in the state in 2007-08 for 500 government senior secondary schools, 1000 schools in 2009-10 and 1617 schools in 2010-11.	In 2011, the department entered into an agreement with M/S Core Education & Technologies Ltd., Mumbai for 5 years to set up computer labs in 2622 schools. (Government of Haryana, 2018) Further, the government planned to recruit 5000 computer teachers in the year 2017 to boost the already installed infrastructure in the schools. (Malik, 2017)

7.	Uttar Pradesh	The state government of Uttar Pradesh has implemented a national ICT@School scheme since 2009, through the BOOT model, with the coverage of 2500 secondary and higher secondary schools in the first phase and 1500 schools in the second phase. (NCERT, n.d.)	
8.	Bihar	For the implementation of ICT@School scheme (2nd phase) across the state of Bihar, the government has planned the imparting of the scheme in 1000 senior secondary and higher secondary schools. This task has been assigned to three agencies such as IL$FS Education and Technology Services Ltd., Compucom Software Ltd. and Pearson Education Private Ltd. A software named SCAN (School Computer Access Network) has been developed for integrating the 'information of schools regarding computer lab work and work duration' at the headquarters. (Bihar State Educational Infrastructure Development Corporation, 2013)	The e-textbooks are available for accessibility on the government of Bihar education department website. (Government of Bihar, n.d.b) The government has undertaken these initiatives under the name of 'Bihar Education Initiative (BEI)' to 'improve the delivery of educational services at the school level.' The program uses public-private partnerships for facilitating the use of ICT in school education. The MIS portal provides details regarding all the schools in the districts to integrate and assess the quality of education in an effective manner. (Government of Bihar, n.d.a)
9.	Madhya Pradesh		The government of Madhya Pradesh started the 'computer-enabled education program' for the school students called the "Headstart" program in the year 2000 under the tutelage of Sarva Shiksha Abhiyaan. The CAL-Headstart program has various components such as 'establishment of new ICT labs', 'EDUSAT classrooms', 'Training of teachers in CAL', 'internet facility' and so on. Headstart is an online portal to facilitate CAL as an initiative of the school education department of the government of Madhya Pradesh in

			upper primary schools.[i] It facilitates the teaching-learning process by using computers as a tool at the elementary level. Along with that, 'interactive multi-media rich lessons (IMMRLs) and video films' are developed by 'Rajya Shiksha Kendra' to facilitate the teaching-learning process. The provision of computer labs in upper primary schools has been made for facilitating the teaching-learning process and interaction among peers. (Government of Madhya Pradesh, n.d.) The satellite channels beamed through the national agencies such as CIET-NCERT and RGPEEE would be made accessible to the schools as per the provision based on 'better infrastructure, availability of teachers and proper security.' This facility of 'EDUSAT classrooms is available to both headstart and non-headstart schools. The provision to provide ROTs to the schools is under consideration too. The 'in-service training of teachers' is a part of the Headstart program and trains the teachers on the components such as 'CAL', 'operating software', 'pedagogy of CAL' and 'management of computer centers.' These training courses are provided at district and block levels. (Government of Madhya Pradesh, n.d.) The 'internet facility' has been provided to '800 schools' in 2009-2010 which has been extended to 'headstart schools where broadband facilities are available from BSNL.' (Government of Madhya Pradesh, n.d.)
10.	Rajasthan	The state government had also implemented ICT@School schemes in 4500 schools with a partnership with companies such as Microsoft for facilitating the use of ICT's in government schools. (Indo-Asian News Service, 2018)	The government of Rajasthan had started project 'Utkarsh' to bring about the "qualitative change in mass school education through technology." Though technology is available in government schools, this project aimed at facilitating its usage and

		The state department of education has also partnered with Tata Institute of Social Sciences and Centre for Education Research and Practice to implement Connected learning Initiative (Clix) in the state for giving a boost to the implementation of ICT in school education, now under the aegis of Rashtriya Madhyamik Shiksha Abhiyan. (Government of Rajasthan, 2018)	implementation. (Digital Learning Network, 2017) Another project called 'e-Gyan Kendra' is meant to "facilitate and empower the community through e-learning and e-governance." This is done by making available technological platforms as solutions such as 'open educational resources' and connect the community of teachers, students around it for community building. (Digital Learning Network, 2017)
11.	Gujarat	The Gujarat government has implemented the national ICT@School scheme and the CAL program in the state. The 'smart schools' project under the ICT@School scheme aims to "not only to build 'Technologically advanced schools' but also to use the entire environment of learning by integrating the concepts of Pragna- Activity Based Learning (ABL), Computer-Aided Learning (CAL) and Building as Learning Aid (Bala) using the infrastructure of the school in proper manner for teaching-learning process." (Government of Gujarat, 2017a) The CAL program is introduced from classes 1 to 8 to "improve the quality of education through animated multimedia-based educational content." (Government of Gujarat, 2017a)	The Gujarat Council of Educational Research and Training is a body involved with the implementation of ICT in primary education. It also oversees the improvement in the quality of education through other means and programs. The body has enabled ICT integration through various means such as 'video conferencing with the DIET's', 'teleconferencing', 'websites of DIET's', connecting 'DIET's through internet and e-mail', 'EDUSAT' at GCERT office for collaborating with the national-level programs. (Government of Gujarat, 2017b) The government has tied up with organizations such as IL&FS to install computer labs in the schools, provide tablets to the students and train the teachers at DIET's to use ICT effectively. (Express News Service, 2017)
12.	Chattisgarh	The government of Chattisgarh has successfully implemented the ICT@Schools Scheme(now submerged under Rashtriya Madhyamik Shiksha Abhiyan). The scheme covers "both government and	The government also plans to set up "Centre of Excellence on Innovation and Technology in Education to manage the execution of Virtual Education Scheme with funding support from MEITY, Government of India." The center would cater to school education, higher education,

		government-aided secondary and higher secondary schools". The scheme has been implemented under the PPP model. (RMSA, n.d.a)	technical education, and vocational education. "The project envisages leveraging technology to improve student-learning outcomes, assisting teachers through ICT enabled classrooms, building teachers capacity using online and offline platforms for teacher training, creating and providing digital content for the entire education system and support the District-State administration with relevant, accurate and timely data to make informed policy decisions." The Chattisgarh Infotech society will be the nodal agency in managing and implementing the project. The government also plans to launch an "Online Learning Platform" (OLP), a software for imparting virtual education in the state. Besides this, a software named Software empowerment through Technology Utilization (SETU) has been decided to be launched by the state higher education department in collaboration with the Chattisgarh Infotech Society for online admission in colleges. (Reporter, 2017)
13.	Jharkhand	The government of Jharkhand had implemented 'Computer literacy and Computer-aided learning' scheme(ICT scheme) which is now subsumed under Rashtriya Madhyamik Shiksha Abhiyan to cover 1036 schools in the state. The Jharkhand Education Project Council(JEPC) and Jharkhand Agency for Promotion of Information Technology(JAPIT) were the core agencies planning to implement the project along with the technical support from Core Projects and Technologies Ltd. (Digital Learning Network, 2006)	Not only the government has implemented SMART classes in KGBV's, but also the devices such as tablets, wi-fi's have been provided to all the KGBV's. The government has introduced 'e-Shiksha' through 'satellite-based video conferencing' in some schools. 'E-Madhyan', the SMS based monitoring system for attendance and mid-may meal monitoring too has been implemented. The government is planning to implement the SMS based MIS system as well. (Akash, 2016)
14.	West Bengal	The ICT@Schools Scheme has been implemented in the	Apart from this, the department of education, West Bengal has formed a

		state in both 'government and government-aided secondary and higher secondary schools.' (Infodev, 2010b)	committee with the director of SCERT, West Bengal to 'utilize resources like TV and media to educate the teachers and the students.' The DIET's and SCERT's are also involved in creating e-textbooks for the students. SCERT's had also developed 'radio scripts' for the use of teachers and students. (Infodev, 2010b) There have been many initiatives by the private organizations in the state of West Bengal. An innovative project named KYAN- 'a digital multimedia device' has been installed in almost all the districts with the aid of state government. "Double click is an initiative of UNICEF in collaboration with IETS Kolkata to develop and test run a capacity-building initiative in computer literacy among the tribal student's of Kasturba Gandhi Balika Vidhyalaya (KGBV) centers in Purulia." Another program for the 'rural and semi-urban youth' for facilitating spoken English has been initiated by IETS in partnership with Webel Informatics Ltd.(a 'nodal agency for 'developing Information Technology' and 'e-governance' in West Bengal). (Infodev, 2010b) The 'Computer Literacy and Training Program' had started in 2002 as a collaborative project between Intel and the Government of West Bengal. The aim of the project was to foster computer literacy among the schools by providing "standardized Intel processor-based PCs and servers running the Linux operating system." The other organizations providing computer systems in the state are IBM, NIIT among many others. (Infodev, 2010b) The e-textbooks in Bengali are available across grades and subjects on the website of the Department of Education, Government of West Bengal. (Government of West Bengal, Department of School Education, n.d.)

15.	Odisha		In order to implement the national ICT@School scheme, the government of Odisha has started 'e-Vidyalaya' program in all the government aided and government schools in the state. It "proposed to establish computer hardware, software infrastructure and provide education services in the government schools." The Odisha Knowledge Corporation Limited is the technical partner in the integration and implementation of the project. The program covers domains such as 'e-content', 'teacher's training' and the installation of 'ICT labs.'(Government of Odisha, 2014)
16.	Andhra Pradesh	Though the installation of computers in the Andhra Pradesh schools was done much earlier, the government has planned to introduce ICT in 1647 schools as a part of their curriculum last year under the national ICT@School scheme. The curriculum focusses on integrating ICT with the pedagogy instead of introducing the computers as a separate subject. (IANS, 2017)	
17.	Maharashtra	The government of Maharashtra implemented the national ICT@School scheme from 2007-2008 in collaboration with companies such as IL&FS Education, Core Education and Technologies and Birla Shloka Edutech under the BOOT model. (Government of Maharashtra, 2005) (Charlie, 2017)	The Maharashtra State Council of Educational Research had also planned to make an online admission process for the D.ed course and has implemented the same. (Digital Learning Network, 2008)
18.	Tamil Nadu		The 'Computer-Aided Learning' program aims at integrating computer learning in the upper primary schools for building a strong future. Besides providing computers to the schools, the program provides CDs and DVDs to the schools for 'interactive

			sessions.' Also, the 'Rashtriya Avishkar Abhiyan' activities under the CAL program include 'project-based learning', 'techno-club competition for students', 'Science exhibition and science kit for upper primary schools.' There are competitions being held for students on the assessment of the integration of information and communication technology and awards given for the same. (Government of Tamil Nadu, n.d.) In collaboration with Microsoft Corporation Ltd, the pieces of training are being provided to the teachers for learning ICT and ICT enabled teaching. (Government of Tamil Nadu, n.d.)
19.	Karnataka	Later, the state adopted the Kerela government model of ICT in the school education as a part of ICT@School Scheme. The teachers and the principals of the school were trained and focus was on developing capabilities in the school system. the model of outsourcing was changed and (Moudgal, 2017) The CLASS project too has been implemented in the state in collaboration with MHRD and Electronics department. The revised CLASS program was implemented in selected 150 schools in the state to facilitate computer-based learning. (Government of Karnataka, 2018)	The government of Karnataka had started 'Mahithi Sindhu Project' in 2001 for providing 'computer education and computer-aided education' to class 8th, 9^{th} and 10^{th} standard students to the students of government schools, especially those who belong to the weaker section such as ST, ST, backward sections, girls and students belonging to rural areas. Besides computer literacy, the academic subjects too were integrated with computer-based learning. The program was outsourced to the private vendors to run the same in the schools till 2010. (Government of Karnataka, 2018)
20.	Kerela		The government of Kerela started the IT@School Project in 2001 under the department of General Education for classes 5^{th}-12^{th}, for implementing technology-based projects in the state education system. Under the project, Information technology was introduced as a compulsory subject in class X in 2005. Also, over the years, EDUSAT operations were launched

			and schools were provided with broadband connectivity. The VICTERS was the 'first complete educational channel' launched under the project. (PTI, 2017) In 2017, this project was promoted as a government company called KITE, Kerela Infrastructure and Technology Company. Besides assuring provision in the school education, KITE aims to make provisions of ICT to higher education such as colleges and universities. (PTI, 2017) There are various projects under KITE program such as "Hi-Tech School Programme which all Classes from Std 8 to 10 in the Government and Aided schools in the State would be upgraded international standards" including 'academic excellence', 'learning environment', 'extra-curricular activities', 'lab', 'library' and 'infrastructure up-gradation.' (Government of Kerela, Department of General Education, n.d.) Also, there is provision for ICT labs, teacher training, free and open software and hi-tech school plan of action under the project. (Government of Kerela, Department of General Education, n.d.) 'Hi-School Kuttikootam' is a unique program under KITE which "aims at facilitating an in-depth ICT learning environment for students, to provide students with an experience of group learning as well as collaborative learning, to improve the efficiency of ICT enabled education in schools, to ensure students participation in resolving the technical issues in schools, safe usage of internet and building awareness on cybercrimes, etc." (Government of Kerela, Department of General Education, n.d.)
21.	Assam	The national ICT@Schools scheme was implemented in the state in 2007 until 2017 and has not been further	The Rajiv Gandhi Computer Literacy Programme (RGCLP) was started in 2003 to "Build a Computer Literate Assam." It aimed at providing free of

		extended. A total of 2850 schools have been covered under the scheme in two phases. (Government of Assam, 2020)	cost computer education to the students of government schools of Assam. The project was implemented by the 'Planning and Development Department', Government of Assam and AMTRON along with tie-ups with other organizations such as M/S NIIT Ltd., M/S Educomp Solutions Ltd. and so on. (Government of Assam, 2020) The government of Assam has a proposal for an "electronic platform for the creation of a repository of educational records of students for easy maintenance and instant access to all stakeholders with due permission." The proposal for the project has been prepared by AEDC Ltd. (AMTRON) for high and higher secondary schools. (Government of Assam, 2021) In order to make education accessible for backward areas, the government has introduced "tele-education through virtual classrooms" in order to "inculcate concept-based learning by way of interaction through Satellite System covering the core subjects of English, Science, & Mathematics from Class-VI- X." (Government of Assam, 2021) The PPP model for collaboration has been furthered by collaboration between Tata Trusts and Rashtriya Madhyamik Siksha Abhijan (RMSA) and the partner for implementation, Gramya Vikas Mancha to introduce Integrated Approach to Technology (ITE) in 80 schools. The program aims at "improving teaching and learning processes through technology." (Government of Assam, 2020) Another collaborative project has been initiated between UNICEF and RMSA for the "integration of ICT into teacher education." "The program aims to provide an opportunity for teachers to engage in discussions related to the disciplines (mathematics, science, and social science), participate in an online community of learning and create and

			share open digital resources." (Government of Assam, 2020)
22.	Manipur	The ICT@School scheme has been implemented in the state under which 26741 schools have already been covered and 22426 schools are yet to be covered. The scheme is now under the aegis of Rashtriya Madhyamik Shiksha Abhiyan. (RMSA, n.d.b)	The government of Manipur has an educational channel called 'E-Pao' for all concerns and issues related to the education sector such as educational announcements, open sources, etc. (E-pao, 2018)
23.	Nagaland	Under the aegis of Sarva Shiksha Abhiyan, Computer-aided learning (CAL) and Computer Learning Programme(CLP) had been introduced to increase computer literacy, integrate computer learning with academic subjects and enhancing 'learning and retention' capability of the middle school students. (Shodhganga, n.d.) The national ICT@School scheme was implemented in the state in 2005-2006 with SCERT as the implementing agency. The project identifies two schools from both the government and the private sector for the implementation. (Government of Nagaland, n.d.)	The department of school education, Nagaland had an educational technology cell for "writing scripts, recording, and monitoring of educational broadcast and rural programs for schools." (Shodhganga, n.d.) Besides having an educational technology cell, SCERT, Nagaland had implemented the Computer Education Plan in 2005 to provide "video coverage to state-level function and aired school broadcasts on AIR." (Shodhganga, n.d.) Also, the CLASS project was started in 17 schools in the state in 1999-2000. The SCERT, Nagaland has also launched EDUSAT website to improve the quality of teaching of the teachers and the students. (Shodhganga, n.d.)
24.	Mizoram		The department of Information and communication technology, Mizoram along with a partnership with IL&FS education services Ltd. has introduced K-Yan in 50 government girls middle schools. K-Yan is a "digital teaching-learning device, which integrates the capability of a high-end computer, an ultra-large screen television & a projector preloaded with curriculum-based multimedia teaching aids." (Government of Mizoram, 2016) Also, the Tata Institute of Social Sciences along with the department of school education, Mizoram and Mizoram University has implemented

			the project called CLIx in government schools that have already implemented ICT@School scheme. "CLIx intends to build a networked ecosystem of partners, communities, individuals, institutions, teachers, and resources in collaboration with local implementation partners." (Government of Mizoram, 2018) The department of information and communication technology, Mizoram also has an IT Education program to assist the "department of school education through NEC fund to assume its leadership role in ICT of school education." (Government of Mizoram, 2016) The program has various objectives such as 'computer literacy' for students, 'integration of computers in the curriculum', 'teacher training' for ICT, installation and awareness regarding the usage of computers". (Government of Mizoram, 2016) The state had also implemented EDUSAT equipment for better implementation of ICT related schemes. (Government of Mizoram, 2017)
25.	Arunachal Pradesh		The government of Arunachal Pradesh decided to introduce smart classes n 264 government-run secondary and higher secondary schools for students of class 9^{th} and 10^{th} in 2017. This project was conceived in partnership with IL&FS Education Services Ltd. with the introduction of 'K-Yan' kit in the schools. (Express Web Desk, 2017)
26.	Tripura	The ICT@School Scheme, now under the aegis of Rashtriya Madhyamik Shiksha Abhiyan was started in the state in 2008. Under the scheme, ICT hardware has been implemented in government schools. (RMSA, (n.d.c)	
27.	Sikkim	The ICT scheme was launched in 2002 in the state with the	Under the computer-aided program, "40 upper primary schools were

		coverage of 29 senior secondary schools in 2002-05. Later, when the scheme was re-launched as ICT@School scheme, the coverage was expanded for 103 senior secondary and secondary schools and is still continuing. (Government of Sikkim, 2008)	provided with 10 computer sets and a 29" color television" along with the training of the teachers for 60 days. (Government of Sikkim, 2008)
28.	Goa	The computer education plan was launched in the state in 2005 under the aegis of ICT@School Scheme to "develop computer labs in high schools and higher secondary schools, make computer education a compulsory school assessment subject for classes 8^{th} to 12^{th}, provision of hardware, quality teaching services and unlimited internet connectivity in the schools." (Government of Goa, 2016b)	Along with this, the computer literacy in the schools for classes 5^{th} to 7^{th} has been prioritized in the budget since 2005 by separate budgetary allocation. (Government of Goa, 2016a) The state has also introduced the EDUNET scheme to "provide support to the students for their further studies and to enable them to use computers and information technology as a tool to enhance not only learning but also to empower them towards earning." To fulfill these purposes, the students are provided with the ink-jet printers, UPS and software. (Government of Goa, 2016a)
29.	Telangana	The ICT@School scheme has been implemented in 2694 high schools across the state. (Government of Telangana, 2018)	The state education department along with the Tata Institute of social sciences and SCERT, Telangana has implemented the connected learning initiative (Clix) in the state to facilitate the use of ICT in school education. (Government of Telangana, 2018) Besides facilitating ICT in other domains such as administration, the government emphasizes on three-pointers for boosting ICT in school education- "digital literacy, instruction in ICT related subjects and use of ICT as a tool to teach various subjects." (Government of Telangana, n.d.)
30.	Puducherry	The ICT@School Scheme was started in 2006-07 and continued in 2016 with the responsibility for supply of hardware given to IL&FS Education and Technology Services Limited. (Prasad, 2016)	The state also has initiatives such as Shagun, UDISE+ to enhance digitalization of school education. (Government of Puducherry, n.d.) The initiative 'Operation Digital Board' in secondary schools will enhance digital education. (Government of Puducherry, n.d.)