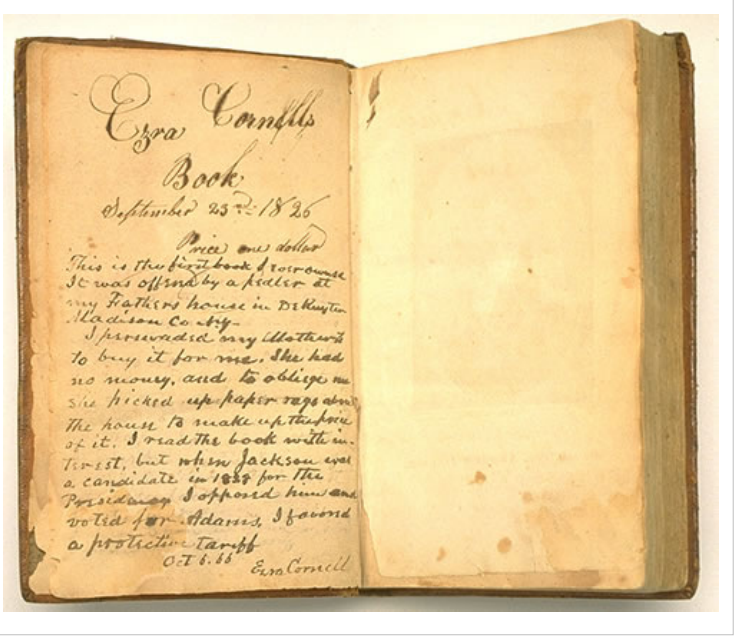
ICT teacher handbook/Print version



ICT teacher handbook

The current, editable version of this book is available at
http://teacher-network.in/OER/index.php/ICT_teacher_handbook

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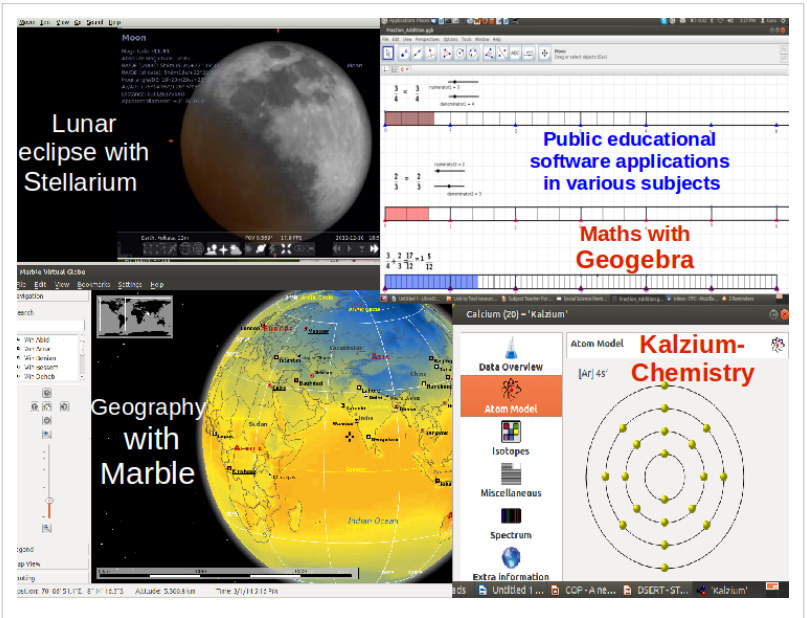

Preface

Information Communication Technologies are as old as humanity itself; yet, digital technologies have brought in major changes in the creating, processing, organizing and presentation of information, as well as in communication. All ICT bring significant changes not only to education and knowledge processes, but also to larger socio-cultural, political and economic structures and processes. The ease of creating and sharing information using digital technologies has caused an explosion of information in society, creating what is termed as an “information society” [1].

Development of digital literacy skills is required for all to navigate this ‘information society’. Teachers, student teachers and teacher educators need to be able to use ICTs for their professional development, through self learning, peer learning, in digital resources creation and in teaching-learning. They must develop a critical understanding of the larger positive and negative implications of the design and adoption of ICTs in society. Recent curricular (NCFTE [2], National ICT Curriculum [3]) and policy (National ICT Policy in School Education [4]) documents on education in India have recognized the importance of integrating ICT in school education. We also believe that an effective technology implementation can strengthen the government school system such that the vision of universal education of ‘equitable quality’ set out by the Indian Right to Education Act [5] is realised.

Recognising the transformatory nature of ICT in education, the state education department is aiming to integrate technology into teaching and learning in sustained and meaningful ways. The ICT implementation in school education is based on the four pillars of infrastructure, training, content and connectivity. The focus is on having a digital lab and a digital classroom. It is envisaged that technology is not to be seen as an end by itself, but rather as a process for creating a rich learning environment. The digital classroom would be a regular classroom enriched with digital content; the teacher will be empowered to transact in this classroom. In line with National ICT Policy, the state intends to use open content and free and open source software [6] to allow rich possibilities for creating, sharing, communicating and learning. The department has also undertaken the training of teachers in technology integration to build in house capabilities in the education system, the schools and teachers to manage an effective ICT program integrated with school processes.

It is in this context that the Telangana Department of School Education, along with SCERT, has developed an ICT syllabus and text book which will be used by the school teachers transacting the ICT classes from Class 6-10. The state syllabus and the textbook have been developed based on the National ICT curriculum developed by NCERT, which seeks to bring to school education the possibilities of ICTs for connecting and learning and creating and learning. The development of the ICT text book and the teacher hand book is in collaboration with IT for Change [7], under a MOU with Commonwealth Educational Media Centre for Asia [8] (CEMCA), an inter-governmental

organization, of the commonwealth countries.

Scope of the handbook

This teacher handbook is meant as an accompanying resource for teachers to help in the facilitation of the student ICT syllabus and provide meaningful linkages to curricular and co-curricular areas. The handbook also has a component of using ICT for Teacher Professional Development which will introduce the pedagogical framework for technology learning, the implications of technology and society and possibilities for advanced learning in digital methods and processes. The handbook also has a discussion on school level implementation guidelines.

It is hoped that the textbook and handbook will help support the teachers in meaningful technology integration in the direction of achieving digital classrooms as well as in their own journey of becoming self reflective professionals.

Overview

ICT have impacted education in terms of change in the processes of learning and even physical spaces of learning. Availability of a global digital library has meant that the focus of education now needs to move from content acquisition to analyzing and meaning making of content as well as use the information for decision making. The availability of new format of content representation also means that new forms of knowledge can be explored and understood. This means, of course, that new skills have to be developed - both in terms of skills in interacting with the ICT environment as well as in terms of meta cognitive skills like analyzing, meaning making and representing the information available. The rapid growth and dissemination of information means that we now live in a world which is organized very differently and the implications of ICT and societal processes and institutions also needs to be understood.

Approach and intent of the NCERT ICT curriculum

1. The NCERT ICT curriculum [10] has been based on the aspirations and guidelines set in the National ICT Policy which focuses on building the skills of computing, creating and collaborating through safe, ethical, legal means of using ICT.
2. Ability to handle ICT environment, creating original content, sharing and learning and focusing on educational and learning processes rather than on specific applications are the key principles of this curriculum.
3. The curriculum has been designed keeping in mind the various possibilities of creative expression possible through ICT applications and platforms available today and also seeks to build a mindset that will explore and such applications on an ongoing basis.
4. The curriculum does not take a conventional approach to building digital literacy on specific applications but rather emphasizes a thematic, project based approach to ICT learning. Such an approach will also enable integration of ICT with multiple school subjects.

The themes of The National ICT curriculum

1. **Connecting with the world**: Technology is providing new ways for us to access information and learn. Along with this, evaluating information and using it appropriately become skills to be developed. This theme will focus on accessing the internet, evaluating resources available and creating meaningful personal digital libraries for self learning.
2. **Connecting with each other**: A related dimension of connecting through ICT is in possibilities for learning in communities from each other. The focus of this theme will be on how to interact and learn in peer learning settings and through online, virtual forums. Collaborating an learning is a key learning expectation from this curriculum.
3. **Interacting with ICT**: Building skills and aptitudes in a technology environment is an important expectation of this curriculum. The theme will focus on building a more proactive approach to engaging with technology, evaluating appropriate technology choices, maintaining ICT infrastructure and becoming critical users of technology, being aware of the social and economic implications of technology.
4. **Creating with ICT**: This is a theme that focuses on building computing and creating skills in students and teachers using various ICT applications. These include data analysis and processing, creating graphics, creating audio visual communications, working with mapping applications, creating resources with specific school subject related applications and programming.
5. **Possibilities in education**: ICTs have changed how we learn, the processes of learning and even places for learning. Numerous applications have also been developed for subject learning. Along with this, it has become necessary to develop a critical perspective on technology in education, an understanding of how technology will alter learning processes, making appropriate choices of technology, media and content and evaluation of technology for various learning processes.
6. **Bridging digital divides**: Technology holds a lot of promise for development. Technology can also lead to exclusions and marginalizations. Understanding the social, economic and political impacts of technology as well as an understanding the various possibilities of platforms can help in making sure technology can be used for equitable opportunities. Another area of focus in the curriculum is in the use of technology for exploring inclusive education possibilities.

Teacher and Student curriculum

1. The teacher curriculum is expected to be completed over a 2 year time frame, resulting in a certification. While the 2 year time frame is for a comprehensive program, the curriculum has been designed in a modular manner to allow for need based learning. This can be structured as a course in both pre-service and in-service training, and specific subjects can be differentiated.
2. In the student curriculum, the focus is on bringing digital literacy for students as well as introducing the digital methods as a method of subject learning. Themes 1-4 will be a part of the student curriculum. The digital literacy will focus on building computing and creating skills and not merely office applications. Logical,this has been developed as a 3 year curriculum (from Classes 6-10) though individual states can structure it based on their requirements and constraints. The expectation is that this can be tested as a core subject area at the end of Class 10.

Approach of the student textbook and teacher handbook

Philosophy of the book

The National ICT Policy [4] articulated the vision for ICT in Education in terms building the skills of computing, creating and collaborating through safe, ethical, legal means of using ICT. The NCERT ICT curriculum has been designed keeping in mind the various possibilities of creative expression possible through ICT applications and platforms available today and also seeks to build a mindset that will explore and such applications on an ongoing basis. Such an exploration requires a technology environment that is free and open; this has been recommended both in the ICT Policy and NCERT [11] curriculum. The textbook has therefore introduced different digital processes predominantly through free and open source applications.

Curricular basis

1. The textbook has been designed based on the NCERT ICT curriculum – focusing on creating original content, sharing and learning and on educational and learning processes
2. Ability to handle an ICT environment for the above outcomes, rather than learn specific applications is the focus of this textbook
3. In line with the National ICT curriculum, the following dimensions of ICT knowledge have been taken up in this book
    1. Interacting with the ICT environment, including the internet and an understanding of the nature of ICT
    2. Data processing and representation
    3. Communication with graphics
    4. Audio visual communication
    5. Programming
    6. Working with different software applications

Each of these is organized as a chapter with graded objectives and activities in 3 levels to address the different levels of Class 6-8. The activities will be structured as small projects which will allow for an exploration of some topic/ issue is one/ more subject areas.

1. The 3-level curriculum has been split across two books – Book 1 (for class 6-8) and Book 2 (for class 9-10). Within Book 1, there are three levels proposed – based on the extent of digital skills anticipated and the academic levels expected
2. The focus is on learning skills of computing and developing competencies to interact with ICT, as envisaged in the National ICT Policy. Therefore, a wide variety of applications has been introduced. The choice of applications – both generic and subject specific – has been made in such a way as to introduce students to the possibilities of creating and learning with ICT.
3. Book 1 will has a student textbook and this is the accompanying teacher handbook. The teacher handbook will have two components - a component for Teacher Professional Development as well as a component to support the transaction of the student textbook.

Pedagogic approach

1. ICT allow for integrated multi-disciplinary learning methods to be developed. To explore and for enabling a holistic approach to learning, the textbook for the students has taken a project based approach. A project based approach offers several advantages in terms of student engagement, exploration, self-learning, peer learning, expression and self evaluation. By using ICT to explore an issue or a theme, students will be encouraged to make connections with different school subjects.

2. The textbook has been developed based on the Technological Pedagogical Content Knowledge [12] (TPACK) framework where technology is not introduced as a stand-alone, tool-based method but integrated within core academic processes relevant to school learning. Hence the activities have been described in terms of processes of learning rather than steps of using an application.
3. Another important emphasis in the textbook is on the possibilities of creation using ICT. Hence the book has been written as a set of activities that invoke several learning processes and integrating ICT meaningfully into the processes, allowing multiple possibilities for student creation. Steps of working with various tools and applications has been left as incidental learning.
4. Collaborating and learning is another important aspect of ICT. The activities in the textbook have been designed so as to allow for group work and adequate opportunities for peer learning. It is intended that different activities be taken up by different student groups to allow for a wide variety of creations; thus allowing for learning and sharing.
5. It is also intended that the activities be done in a cumulative manner, across different themes of the curriculum as well as across levels. It is possible to assess formatively the process of working through the projects with various digital methods and tools as well as evaluate the finished product, which will be in the form of a digital portfolio.
6. All activities need not be completed by all teachers. The teacher can assess the learning contexts, needs and transact the activities that will be most effective. Teacher is encouraged to introduce variations into the activities that may make them more useful for student learning.

Learning expectations

The learning expectations are two-fold, for students and for the teachers. It is expected that at the end of the completion of the ICT syllabus, the students would be able to reach the levels of competencies articulated in the National ICT Policy. The key expectations from the curriculum are listed below

1. Able to interact with various ICT devices and applications and handle ICT equipment safely
2. Able to use ICT for understanding information, analyzing and meaning making
3. Able to use ICT for creating and expressing in various forms - textual, graphical and audio visual
4. Able to use ICT for self learning through use of multiple ICT applications in various subject areas
5. Able to collaborate with one another and create and share work, as well as publish through web based methods
6. Understand the implications of ICT on society and adopt safe, ethical and legal practices of ICT use

In addition to these, the expectation from this curriculum is that teachers become a self-aware group of professionals who are able to collaborate and learn and adopt new pedagogical processes for facilitating a constructivist classroom using ICT.

Technology for teacher professional development

Reading material for teachers

1. Technological pedagogical content knowledge [12] framework
2. Pedagogical content knowledge [13]
3. Teacher_Education [14] resource portal

ICTs and Society

Information and Communication Technologies (ICTs) refer to the infrastructure and processes connected to creating information, organizing, processing and representation of the information, as well as communication of the information. ICTs have impacted the functioning of existing institutions in government, private sector, media and

civil society.

Understanding ICTs – a brief history

Information as well as the communication have been one of the defining characteristics of the human society. Historically, many societies and cultures have used different and multiple ways of organizing, representation and transmission of information. These differences exist in the manner of recording, the content recorded, ways of access and the scope of the transmission. Improved and easy access to information and knowledge significantly enhances people's overall life opportunities and has the potential to alter structures in society. Traditionally, difference in access and use of information by various sections of the society has led to marginalization and inequity.

ICTs are perhaps nearly as old as humanity itself, as human beings needed to communicate with one another, beginning with symbolic (non verbal) ways, before language was invented. Language could be seen as first 'ICT', it enabled (oral) communication amongst human beings. Yet oral communication had the limitation of space and time, meaning that the speaker and the listener had to be in the same space and time.

Script was the next ICT, invented around 5,000 years ago1, which enabled information to be held distinct from the communicator and be made available beyond the limitation of space and time that oral communication imposed. Writing also enabled easier recording of human history and thus the invention of script was a landmark in the history of ICTs. Invention of printing technologies scaled up the 'writing' process and enabled mass production of books. The invention of radio and television created the 'mass media' in which simultaneously the same message could be transmitted to thousands of people. Each ICT invention enabled the processes of information creation, sharing, storing and communicating to be easier, quicker, more efficient (reaching more people) etc. Each invention was a significant event in the evolution of human communication processes and in the explosion in the availability of information. Each step also resulted also in shifts in the way information became accessible to sections of society.

The digital paradigm

Information and communication have historically been drivers of social processes and systems. What makes the new framework different is the advancement in the digital technologies surrounding information and communications. We are now perhaps in the middle of the next epochal movement in the history of ICTs, the use of digital methods of accessing, creating, modifying sharing, storing information as well as for communication.

The digital format of resources has caused such an explosion of information since creation, storage and dissemination of information has become much easier and cheaper than before. Increasingly, production and consumption of information becoming increasingly important, not only from economic but even more so from social and cultural perspectives. This digital knowledge society is developing new structures and adjusting existing structures, along the lines of information flow. These pathways of information flow can also create more marginalization and exclusion if all the participants in society are not equipped with the skills to function in this society.

Another key aspect of ICTs is in the possibilities of connecting and their impact on communities and organization. By their very nature, ICTs allow new possibilities for network structures of organizing and communicating information.

Movement of ICTs

Knowledge model / Basis	Method	Storage	Sharing	Publishing (mass sharing)	Features
Oral / Language	Oral	Human memory; Speaking - Hearing	Not possible	Requires synchronicity of space and time	
Written / Script	Text	Books	Physical	Not possible	Share knowledge across space and time, but in limited manner
Print / Printing	Text	Books	Physical	Books	Explosion
Mass Media/ Radio, TV	Analogue -Audio, video	Cassettes and similar analog devices	Physical	Over broadcast media	Mass reach across space and time
Digital (ICT)	Digital methods (text / audio / video editors)	Digital storage like hard disks	Email	Websites, blogs, Wikis – 'desktop publishing'	Information spreads fast and wide1. Much easier construction and much Wider possibilities – text, audio, video

Like the ICTs invented earlier, the invention and mass use of digital ICTs is having significant implications for society across various spheres of polity, economy, governance, media etc. We will explore these implications briefly in the next section.

ICTs and implications for polity, society and economy

Political

The political processes in most countries have been impacted by digital ICTs. Many political leaders now participate on virtual platforms that allow them to communicate with people directly. For e.g. Twitter which is a 'micro blogging' platform, is used by many political leaders, as well as government departments to communicate its work and information. Mass movements have also used digital networking tools to collaborate and support action. It is believed that during the recent Egypt struggle for democracy, protests were coordinated using social networking platforms/tools, which made them more effective. The counting of votes has now become a fraction of time, used earlier, through 'electronic voting machines' and in a large country like India with a large voter base, counting for an entire constituency can be completed in a matter of hours.

Think and talk it over with your students

The use of Internet by people mobilising in Egypt during the 'arab spring' is discussed in detail in 'Internet Activism and the Egyptian uprisings : transforming on-line activism into the off-line world' by Tim Eaton, see article [15]). Read this article and discuss the concept of 'mediated mobilisation'. Can a variation of such a strategy be used for instance by women, to protest against liquor shops in villages? Can you create a group of your colleagues in your Mandal, using a tool like 'whatsapp' to discuss ways/methods of raising awareness against domestic violence?
The listed article was sourced using 'Google Scholar' a search engine that provides links to scholarly / academic articles. Can you search Google Scholar for articles of interest to you.

Digital technologies also allow unauthorised access (even spying). Emails and documents can be 'hacked' and accessed. A large part of our ICT infrastructure is privately owned, and the companies which often provide it 'free' (of cost) to users, may be using the information users feed, to monetise the same as well as share it with others. The sharing of such information both authorised by us (when we agree to the 'terms of use' of the software/tool), as well unauthorised, can be for the commercial gains of the company (they can sell or hire this information to advertisers

for example), or for political purposes (to enable governments or other agencies to spy on us). ICTs make such tapping much simpler and easier, since the data passing over the global networks can be easily 'hacked' and a copy of the information shared with the people conducting such espionage.
Thus the digital nature of ICTs can be both greatly beneficial as well as greatly harmful for furthering human rights and development. Hence a critical perspective is essential, and as teachers we need to be cautious against the hype that surrounds ICTs, as a panacea for all problems, and instead keep a balanced and critical perspective.

Socio-cultural

Since communication is the essence of social processes, the introduction of ICTs has dramatically impacted most of our socio-cultural activities and processes. With the mass use of the cell phone, we now assume that we can reach anyone any time. This kind of access enables us to plan interactions / activities in much more efficient ways. Even twenty years back, the best of possible communication situations, one was not sure, if one could reach another person using a land-line / fixed line phone. In the absence of email, the formal communication method of a letter sent over postal services meant a gap of several days before communication could be established. The reduction in communication time, has opened up numerous more possibilities for each of us (who are part of this digital world). Social networking platforms are connecting millions of people to create 'virtual communities' or groups. Such interactions with large number of people who may not be physically proximate, opens new possibilities for friendships and learning. Of course, we also hear several anecdotes of how people can be naively trusting of 'friends' on such networks and get exploited or fooled. It is extremely necessary to exercise diligence and caution in making friends on such platforms. We also need to guide our students on safe and careful use of social media platforms.
The mass sharing of information through the digital networks is also perhaps accentuating and speeding up the assimilation of dominant cultures, which began with the advent of mass media. Wherever one travels, we can see the popular brands and symbols and the shopping malls across cities look familiar with the similar brands available on sale. There is research to suggest that this process is negatively affecting local contexts and cultures. UNESCO study has documented the decline of local cultures and languages and that many languages have become extinct and many dying. As teachers, your role would be to promote digital avenues for storing and sharing local cultures as well. For instance, the Wikipedia encyclopedia has more than 5 million articles in English but less than 1% of that in Telugu [16]. Documenting local cultures, resources, literature and sharing it in digital formats on public digital platforms, such as Telugu Wikipedia [16] is an important priority for our society, one in which teachers would need to have an important role.

Think and talk it over with your students

BBC study - source - http://www.bbc.co.uk/news/technology-12419672

1. In 2000, 75% of stored information in the world in analogue format such as video cassettes, but by 2007, 94% of it was digital"
2. Email has become the primary communication tool for a significant number of people
3. 1.88 billion – The number of email users worldwide.
4. 294 billion – Average number of email messages per day. (42 emails for every human being)
5. Web 2.0 world – blog / wiki as collaborating and publishing knowledge
6. 255 million – The number of websites as of December 2010.
7. 21.4 million – Added websites in 2010.
8. Population of the world 6.89 billion, India - 1.17 billion
9. Amazon, the worlds largest book seller sells more e-books than books (http://news.bbc.co.uk/2/hi/technology/8443804.stm)

Economic

For several centuries, society was agrarian, meaning most people worked in agriculture, food (and related items) production was the most significant part of the gross domestic product (GDP). With the industrial revolution in the 18th century, industry / manufacturing sector became very important and its contribution to a nations GDP crossed that of agriculture. Think and talk it over with your students Society is changing, moving from an Agricultural society → Industrial society → Knowledge society. The table below lists highlights relating to the processes of production.

Kind of society	Basic production	Basic material	India in 1950 (2010)
Agricultural society	Food	Land	70.00% (15)
Industrial society	Goods	Capital	20.00% (28)
Knowledge society	Services / knowledge	Knowledge / Information	10.00% (57)

ICTs have affected the nature/shape of many industries and occupations. Typewriters, "film" based cameras have become extinct. Information based 'service' industries such as travel and tourism, financial services, insurance, have been significantly impacted. Many 'digital' occupations have also begun, such as software engineering, digital photography, system administration, desk top publishing etc. The possibilities of establishing information networks which can facilitate rapid communications and decision making has led to the creation of very large scale transnational corporations. They are able to support decentralised working, yet retain overall control through by better ICT based 'Management Information Systems. Such networks are also on the other hand, supporting decentralised production and collaborative production projects, such as FOSS or Wikipedia.

Governance

Democratic Governments have in the past had difficulties in sharing information transparently with citizens and also support citizen/ community participation in their activities. This is partly been to the large volumes of information being generated and stored across thousands of paper files which has made sharing difficult if not impossible. Slow modes of communication also lead to delayed communication with the public. However, increasingly, governments are using ICTs to improve information processing and sharing, leading to greater transparency. India has passed the Right to Information Act [17], 2005 and the use of 'pro-active' disclosure through the Internet is seen as a very important way of meeting RTI needs. Apart from information transparency, transaction processing too has been simplified in many areas. Booking of travel tickets has become simple, and in case of education, admission, examination administration etc. has also become quicker and more efficient.

ICT_in_Education

Students must develop ICT competencies and skills through their school years, to fully participate in the knowledge society. If the students must develop ICT skills, it goes without saying that the teachers must be equipped to facilitate them to acquire these skills. The scope for ICT in Education has three broad strands – in the school and the teaching-learning process, in teacher-education and in strengthening the administrative and academic support structures.

Principles for ICT in education

Digital Natives

While considering ICTs in Education, we need to consider that the generation of children entering schools are digital natives [18]. They are born into an age where rapid changes are taking place in digital technologies, and learning to navigate the digital world is an essential skill. An important point to keep in mind here, however, is that these conditions of nativity are not uniform. Socio-economic disparities are mirrored in disparity of access to the digital world and many economically deprived children are deprived of this aspect of education too. It is also important that teachers acquire and internalise technological and pedagogical skills to the extend that they can facilitate the classroom process while working with digital natives and non-natives.

ICTs in education as Public Resources

An important principle in public education, is that curricular resources and the tools for creating such resources need to be publicly owned, so that they are freely available to teacher educators, teachers and students without restrictions. In the same manner, digital tools and resources used in public education, should be publicly owned. Use of free and digital tools/resources can provide a rich and diverse public digital environment. Digital resources are non-rivalrous (sharing does not reduce availability) and hence promoting public creation and sharing of digital resources (both e-content and software) is an important step to ensure systemic benefit from ICTs in education. The National Policy on ICT in school education therefore recommends the use of free and open source software applications. Use of proprietary products can create vendor 'lock-in' which could be detrimental to education.
A free and open source operating system such as GNU/Linux is widely used. This can save public funds on license fees on procuring proprietary software and upgrade fees at later dates. There are a large number of freely shareable educational tools on GNU/Linux, pertaining to mathematics, science, social sciences etc which can be used in schools. There are large number of additional freely shareable tools , such as IBUS which supports word processing in more than 50 languages, including most languages used in India or the ORCA screen reader necessary for the visually handicapped or Scribus for desktop publishing. All these tools can be pre-installed in a 'custom distribution' of GNU/Linux for a one-time installation.

Integration of ICT in education

ICT In school education

There are three ways in which ICTs can be introduced in schools– ICT Literacy, instruction in ICT-related subjects and use of ICTs to as a resource tool to teach various subjects as a regular part classroom teaching-learning-assessment process. Primary ICT literacy requires the acquiring of sufficient working knowledge and proficiencies that are needed to work in an ICT enabled system. This proficiency refers to competencies of navigating an existing ICT ecosystem without changing or modifying the system.

ICT In teacher education

There are three components to use of ICT for teacher education - **Digital literacy** - It is essential for student-teachers to learn to use ICT tools like radio, audio-cassettes, audio-video (AV) tools, computers etc. as well as methods such as information access, review, classification, communication and net-working. ICTs to create and share digital resources. Teachers and teacher educators can use ICTs to develop **networks for peer learning and sharing**. Thirdly, digital tools can be used to **access, create and revise educational resources**. Open Distance learning is also being changed by integrating ICTs, to allow for greater interactions between the educators and learners and amongst the learners.

ICT In education administration

ICTs can be used for planning and implementing training programmes through Training Management Systems.

Open Educational Resources

The National Curriculum Framework 2005 speaks of contextual, inclusive and meaningful education. For these ideas to come true, relevant learning resources must be available for the students (teachers) and teachers (teacher-educator). These resources must be contextual, easily available, allow for learners to modify and adapt for their requirements. Right now, in many cases, the textbook tends to be the most important resource for teachers, if not the only resource. This resource is limited, made once in a year and represent on set of thoughts. These resources are largely text based, have very audio visual resources and may not address multiple learning needs. External resources, though available, are also largely non-digital, expensive and cannot easily be adapted for local needs and contexts.

For critical and diverse perspectives to develop, multiple resources must be available and it must be possible for knowledge to be constructed and shared from multiple contexts. Otherwise, it is possible that only some forms of knowledge will remain important and other will die out. For knowledge sharing to freely happen, educational resources must become freely available, freely shareable and freely changeable to adapt to local contexts and needs. Open Educational Resources (OERs), as they are called are such learning resources. Open Educational Resources are digital resources that are available freely, in multiple formats – text, audio, video – to allow for multiple learner needs.

This is a global phenomenon, Wikipedia (www.wikipedia.org) was launched in 2001, this is an encyclopedia on the Internet, where knowledge is created and shared by many many people and not restricted to one person. Following this, Massachussetts Institute of Technology, a leading university in the United States of America, released many of its course materials for free called Open Courseware (2001). In teacher education also, educational resources were developed collaboratively by a programme for Teacher Education in Sub Saharan Africa and published on-line [19]. These are some of the early initiatives in OERs; now many more OERs are available across the world teaching and learning. In India, National Programme on Technology Enhanced Learning (NPTEL) (http://nptel.iitk.ac.in) and IGNOU have offered many of the courses as Open Educational Resources. Kinds of OERs

Principles of OERs

Open Educational Resources are those resources that allow the following four kinds of freedoms to learners/ users. These “Freedoms” are as follows:

1. Resources can be accessed for free, used and 're-used'
2. Resources can be revised/ adapted to make it relevant
3. Resources can be re-mixed / combined to make a new resource
4. Resources can be redistributed - the revised/ remixed resource can be shared back. These are called the 4 Rs (re-use, re-vise, re-mix and re-distribute)

Licensing and copyright

These resources are shared under copyright which are less restrictive than the usual 'all rights reserved' and allow for some or all of the four R's. One popular copyright used for such resources is the “Creative Commons”. Creative Commons is a type of copy right (sometimes called Copy Left) that will allow you to use the resources, modify them, combine them and also redistribute. When you are accessing/ sharing something as OERs, you can share it under Creative Commons License, by explicitly mentioning that 'Copyright – Creative Commons' in your text. If nothing is mentioned, the default copyright is 'all rights reserved', which will mean others cannot modify or share your resources.

OERs – A national priority

At the national level, the is maintaining a National Repository of Open Educational Resources. For more information on NROER, click http://nroer.gov.in/home Karnataka Open Educational Resources [20], is a resource repository collaboratively created by the teachers of Karnataka. It is organized on the same principles of OERs and is built on a Mediawiki platform like Wikipedia [21].

Basic digital literacy

The ICT environment today

Introduction to the ICT environment Having an overview of ICTs and their larger societal implications, we will now learn how to navigate / use ICTs. Any technology has a skill component and an ICT is something all of us can practise for our own use. In the next section we will learn how to use a computer and various software applications for our professional activities. You should diligently work on this practice component, by integrating it into all your learning across the other course as well, as relevant and useful. The more you use, the more you would learn and become comfortable. We will explore the basics of computer hardware and software and learn Internet browsing, concept mapping as well as text and number editing applications in this section. At all times, we will try to see how ICTs are relevant to your primary purpose of teaching-learning. Hence we will provide a pedagogical perspective on the learning and use of applications.

Computer Hardware and Software

A computer is a device which takes input, processes it and gives output which can be stored and shared. When you enter data into your computer, it is called as input. An input can be data like text or picture or an instruction (what to do with the data). This data is processed (process means to perform a series of operations on a set of data) and you will get the output. The software is what makes the computer and mobile so powerful. Learn more about the history of computers [22]

1. Scanner (nowadays this is in mobile itself, hence it not very much used)	2. CPU – This is the processing unit. Many “chips” are there which determine the speed of computer. For example Intel core is a chip.
3. Main Memory: RAM: This determines how fast the computer works	4. Expansion cards
5. Power supply unit	6. CD Drive – External storage device
7. Hard disk: This determines how much storage capacity	8. Motherboard: This is where all instructions are wired together and helps the computer work
9. Speakers	10. Monitor
11. Operating System	12. Application Software
13. Keyboard	14. Mouse
15. External Hard Disk	16. Printer

Hardware: Parts 2-8, 10, 13 and 14 constitute basic hardware and are parts of all computing devices. These have now all been combined into one unit in a laptop or mobile. Largely, the hardware is divided into input, storage and output functions.

Internet connectivity devices: A modem is used for connecting the computer- laptop or mobile to the internet through a broadband connection. In a networked environment, this modem will be used together with a Local Area Network (LAN).

Peripherals: Speakers, external hard disk and printers are important peripherals that are used for storing and output and these can be connected to the computer or laptop. An important peripheral is a modem for connecting to the internet.

Learning to input with keyboard

Most of the instructions / input to the computer is through the keyboard and hence it is important that teachers should be able to type in the correct manner, using all their fingers. Typing using the right finger for each key on the keyboard will help improve the speed of input enormously. Learning the Keyboard will enable the teacher to type without seeing the keyboard, seeing the monitor will enable spotting of any typing mistakes immediately.

Earlier to learn typing, one had to go to a typing class, but now the computer has software that you can use to learn typing, visit Learn Tux Typing

Brief information about the keyboard

The keys on the keyboard can be divided into several groups based on function:

1. Typing (alphabets and numbers) keys: These keys are arranged as in a traditional 'QWERTY' typewriter
2. Special purpose keys: These keys are used alone or in combination with other keys to perform certain actions, such as CTRL, ALT, ESC, Function keys etc.
3. Navigation keys: These keys are used for moving around in documents / editing text. They include the arrow keys, HOME, END, PAGE UP, PAGE DOWN, DELETE and INSERT.
4. Numeric keypad: The numeric keypad is handy for entering numbers quickly. The keys are grouped together in a block like a conventional calculator or adding machine.

Learning to input with the mouse

Initially, the keyboard was the only device for providing instructions to the computer, but with the invention of the 'graphic user interface' (GUI in short), the mouse became an important input device. The mouse makes giving instructions much simpler by point the cursor at a place on the screen and clicking to select an instruction. You can become comfortable in using the mouse through Learn Tux Paint. Tux Paint features a simple interface and a fixed drawing area with access to previously made images using icons. Tux Paint is equipped with a lot of tools such as cartoon mascots which can encourage students to learn to use the mouse.

Operating System

We need a special computer program to explain our instructions to the computer, this is called the **Operating system** or system software. Every computer must have an operating system to run other computer programmes. Even your mobile phones have an operating system. Operating systems start automatically when you turn on the computer, this process is termed **booting.** All the other computer programmes like programmes to paint, type, listen to music, learn maths etc., are called **application software** or 'Apps' which work with the system software. People who write programmes are called computer programmers or software developers. On any computer you will have software to paint, to type letters, to watch movies, to find something on the Internet, to learn maths.

The operating system is like the Foundation of a building. By itself it may seem to be very useful, but it is the basis for all other applications (other floors of the building, which are used by us)

ICT for connecting and learning

What is internet and web

One of the most powerful things about a computer is its power to connect to another computer. The transfer of information through digital methods allows devices to be connected across time and space. It is not difficult to see the possibilities that this has for the way knowledge can be accessed and shared. The by-line of Sun Microsystems, a IT company was "The network is the computer". ICT have the power to connect people to one another, allow sharing of knowledge with each other and allow collaborative work and creation.

The emergence of the internet and the web has changed the way we are accessing information. Getting data about something is not so difficult any more. Emergence of email has changed the way we think of communication, on-line communities are emerging on various interest areas. All of these have a great impact on the way we learn. However, making meaning depends on our skills to evaluate and organize these resources. The resources available on the internet can be organized into a meaningful personal digital library thus enabling self learning.

Internet

If you want information about some book available in your library, you can connect to the library's computer from home and get the information that you want. There are many such computers in different organisations giving us different types of information. These computers are all connected to one another. This is called the Internet. So, for sharing or getting information from another computer on the Internet, you need a connection to the Internet. The Internet is a physical network of millions of computers across the world, each of which has a unique identifier. Some of these computers act as 'servers', they store data which can be accessed by other computers. The millions of computers which are part of the Internet, is like a huge library with information on almost any issue. These computers communicate or share data with one another using the protocol called the TCP-IP [23], (transmission control protocol/internet protocol). As the name suggests, TCP/IP is the combination of TCP and IP protocols working together. Under TCP/IP each file being transported across the Internet is broken into smaller parts called "packets" by the server. Each packet is assigned an IP (Internet protocol) address of the computer it has to travel to.

As the packet moves through the global network it is "switched" by a number of servers toward its destination, the requesting computer or "client" computer. These packets do not usually travel together on the Internet. Packets from the same file may travel via different paths through different servers, but toward the same destination. This “splitting into packets” technology allows us to use Internet most efficiently. It means parts of a file can be shared across a number of phone lines instead of having to find one phone line to put a large file into. It is also hard to break the network, as the data will be routed around the trouble spot. In this respect TCP/IP can be likened to a group of cars which need to go to the same destination, but instead of all of them going on one road (which may be busy), each car can select a different road out of thousands of roads available (thus picking the roads with least traffic), hence all cars can reach the destination in overall least time. The TCP/IP protocol, which is the heart of the Internet was invented by Vincent Van Cerf [24], Robert Kahn [25] and Louis Pouzin [26].

World wide web

Web is an application on the Internet (www). This was invented by Tim Berners Lee [27], to allow computers to access the Internet in the form of a web page, using an application called the Web Browser. There are millions of pages of shared information on the computers in the network, created by many people and organizations, in the form of 'web pages' accessed using a software application called a 'web browser'. This information network is called the World Wide Web. The source of information is called the web site. A web site is a collection of related web pages of information. Initially this was only for downloading, and this was called Web 1.0; when more people wanted to create their own materials and publish on the Internet, the second generation of www was evolved, called Web 2.0. We have moved further along now to collaborative creation of web pages, through online collaboration platforms. Now more and more processing can be done on the Internet, where the data, results and analysis is stored the Internet and we can operate/ add/ access through various web based applications. This is called Cloud Computing.

Professional learning communities

Every profession has its own professional association for learning and sharing – like doctors, lawyers, accountants, IAS officers and so on. These associations are a method of continuous interactions with fellow practitioners (peers) and allow methods of learning beyond the college or university. You have also learnt earlier about social constructivism and how we learn from each other and how conceptual learning and contextual understanding are equally important. Teachers, as professionals too need to connect regularly to their peers, for sharing their experiences, practices as well as insights and learnings. They also need to be able to contact peers as well as mentors for seeking support. However, in the large school system in India, we find that teachers are often isolated in their practice and they have no way of sharing their experiences, reflecting and sharing understanding or seeking solutions for their specific challenges. In the traditional in-service teacher training programmes, the learning is usually at a point in time; teachers learn in workshops, and there is limited opportunity for interactions after that. They largely do not have any formal, organized methods of being in touch with their trainers or with each other to extend the learning after the workshop. Hence field-level problems are difficult to solve and also teachers are not able to share their experiences, ideas and resources with one another. After the training workshops, teacher interactions is very limited and physical meetings at the cluster, block or district levels are often not enough to meet these needs.

While professional communities and associations have been there for a long time, ICTs have made possible ways of connecting and communicating with each other simpler and more accessible. Online communities are often a good way of continuing interactions beyond the restrictions of meetings of physical time and space. Online communities can be mailing forums or discussion groups and can be accessed either through your phone or the computer. The [http:// ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf National Curriculum Framework for Teacher Education] (NCF-TE, 2010) talks about a pioneering model of teacher education with the following key components - (i) integrating technology tools for teaching learning, (ii) collaborative networks for learning and sharing, (iii)

continuous learning models that allow for different paths and spaces for learning. Peer learning is regarded as a key component of Teacher Professional Development.

Mailing forums are a good way to keep the teacher community in contact with one another and serve as a complement for the physical communities and interactions and provide for learning beyond the workshops. Teacher use the mailing forum to share their experiences, share resources, ask for clarifications, share question papers, share activities and ideas for CCE, issues in school administration and for general information sharing as well. Over 20,000 teachers are members of these mailing forums in Karnataka.

Professional Learning Communities is a recent method for continuing professional development and by providing teachers with peer support, it can be a sustainable method of development. You should also try to form such a community in your school, with your colleagues. You can also initiate a PLC with your colleague subject teachers in your Mandal or district. The steps to form such a PLC are explained here [28].

Building a personal digital library

The Internet has enormous possibilities of accessing information. This changes the way we can think of learning and the skills of learning. Skills of accessing information, organizing, evaluating information are very important. While the Internet is a continuous learning resource and there is a lot of content you can access, to make the resources effective, you need to organize it well, and have a clear unit plan on how to integrate multiple resources for teaching. While there are many tools for teaching learning, no single tool will be fully adequate for learning; we have to use a library of tools, materials and resources.

Information can be accessed in multiple ways from the Internet and we need to know how to search for information on the Internet. Sources of information, even if freely available on the Internet, needs to be acknowledged. There are different formats of resources available on the Internet - images, videos, audio files and each of these files have different formats. We must be aware of Internet safety while accessing images, videos and other information on the Internet. We already saw that each website is a page on the Internet and has an address. We can either copy and paste the link directly in the address bar of the browser (shown above). Another way of finding information on the Internet is through the use of a search engine.

Objectives of a personal digital library

You can build a resource library is on the following :

1. identify, classify and organizing learning resources (for self) and for classrooms
2. build personal resource libraries for classroom ideas
3. do curriculum analysis identify appropriate ICT resources for various learning needs - analyzing and abstracting, evaluating and problem solving
4. develop a concept map of learning outcomes and map to resources

How to access information on internet - Accessing video

1. Go to the website where the video is
2. If the video is downloadable, you will always see a download button'; right click will give download option
3. Youtube downloads - search for the videos
4. Click on the download button when the video is playing
5. When you search on you tube all videos listed. Right click on any link and click on "download as"
6. It will save in downloads folder; you can copy and paste into your folder
7. When you search on you tube all videos listed. Right click on any link and click on "copy link location"
8. This link can be put in text document. Do not insert videos in text document

How to evaluate an Internet resource

There are a few things you must check when we look at the usefulness of the information on any website.

1. Source of the website. It is important to know about the source of the information. This will help us have an idea of many ways of looking at things.
2. Use of multiple websites: Only one website will give us only one kind of information. Using more than one website will give multiple perspectives. We can also cross check and identify errors if any.
3. Relevance: Often when we search, one page will come up and often time we share with others also. But it is important to really read (at least quickly) the contents of the page. This is because of the way a search engine works. Any web page will have key words (called tags) and sometimes, keywords will be added even if the word (and associated issue) is discussed very very briefly. So, sorting for relevance is important. Information use is very contextual. A web page written about rainfall and look at lifestyle and crops will be different for different places. So we need to look at how it will be useful for us. Information also has to be valid for a given time. If the information is very old, we need to test for accuracy.
4. Features of a website: How useful a website is depends on how many different ways we can access the information and use it and view it. Can it be used by teachers, students, general public? The understanding of this will also help us determine how much we can use the content.

How to search for information

The second aspect of using a website relates to how we search for information. What words we use, how we phrase the question for search are all important features in deciding the quality of search results. For example try these different searches - Giraffe, Evolution and Evolution of giraffe You will notice that the pages that come up are all different. What we also need to keep in mind is who is the user, what is the use etc. How we use the search terms determines what results see and how relevant they are.

Checklist for evaluating a website

1. Whose website? 2. What kind of web site - commercial, educational, etc. 3. What kind of resources? Is the information reliable - always check more than one website 4. Does it allow for a discussion 5. Does it have transaction - like e-commerce websites 6. Is it easy to navigate? 7. Free/ Paid/ Subscription 8. Copyright 9. Navigation - Internal and External web links 10. How to contact the website?

For teaching-learning resources - In addition to the above

1. What is the website about? 2. Is the information reliable - always check more than one website 3. Who made it? 4. What it has? 5. Is it for teachers or for children? 6. How to use in class?

Steps in creating a personal resource folder

There are several steps in creating a resource folder. The specific technology actions for each of these steps, is available under the relevant application in the Explore_an_application page

1. Make a folder on the computer by topic
2. Create a 'meta' document which will provide your thoughts on the topic and link the resources you have collected to these thoughts
3. Access relevant resources from Internet
4. Save pages, images, videos
5. Insert into document
6. Copy and paste links
7. Insert links into document
8. Format document

Personal Digital Library

The set of resources downloaded in your folders for the given topic, along with your 'meta document' constitutes your personal digital library for the topic. You can build such libraries on any topic you are interested in, and build your own knowledge in a structured manner. Since the internet has resources on almost all topics, you have an opportunity to keep learning, that too on topics of your interest. The topic or area need not be only one of theoretical interest or only to build your knowledge. You can also work on building skills since there are likely to be videos available for helping you learn a new language, or even a skill like swimming. You can also share this library with your colleagues so that they can also benefit.

Contributing to the Global Digital Library

You can register on Wikipedia. Create articles in Telugu (http://kn.wikipedia.org) and add to existing articles. This will be a valuable contribution to OERs in your language. (You can also do this for Urdu, Telugu, Hindi or any of the Indian languages).

ICT for generic resource creation

The power of ICT is in possibility of creating resources in multiple formats, revising them and recombining them to create newer resources. In the earlier era of non-digital ICTs, creation was limited mostly to textual resource creation; the digital has made us reimagine the idea of information to include non-textual methods including audio, images and videos. The possibilities of using and combining generic resource creation applications to produce

multiple resources is simply mind boggling. The ability of digital technologies to represent all data as binary bits has made it possible to imagine a wide variety of formats of resources.

Some examples of generic resource creation are:

1. Using a text document and combining with images to create a communication
2. Using a concept map to organize ideas and present
3. Using a spreadsheet to create data analysis and representations
4. Using presentation software to make slide shows
5. Using pictures and combining with text to communicate
6. Audio communications (recordings) using different devices
    1. Audio visual communication
    2. Simple videos with pictures stitched with text added using screen cast methods
    3. Creating videos with pictures, text inserts, video clips and audio
7. Digital Story Telling

Each of this resource formats have their own advantages in communicating ideas. A picture can provide a clear idea of an idea or concept, a video can be even more powerful in enabling understanding. Text format can be used to communicate creative, subtle ideas and combining text, animation, audio and video in well designed manner can make the resource useful and this can be tailored to the context and the learning need.

Digital story telling

WORK IN PROCESS

The focus of this activity is to develop a digital story for a teaching-learning situation - examples, creating a photo essay for documenting an event or a place, comic strips to tell a story (graphic novels) and an audio recording for sharing understanding. The focus on all of these activities is to demonstrate possibilities of using digital stories to express understanding and learning without focusing exclusively on text based methods.

Objectives

1. Capturing information in multiple (non-only-textual) ways;
2. Combining text, graphic and audio visual methods, developing a story and scripting by combining multiple digital methods; digital stories can be story books; audio or video or a combination of these
3. Digital stories for communication in classrooms; in the case of language teaching-learning how this can be used for learning and assessment. It can be used to document community institutions for social science topics. It can be used to document nature / natural events for science topics.
4. Evaluation of digital stories (for teachers for assessment)
5. Possibilities for inclusion using digital story telling (for teachers for children with different learning needs and abilities)

Understanding digital stories

Take a given multimedia communication and discuss with the students the overall message and the role and effectiveness of each of the pieces of the digital story in communicating the idea. For example, with a sequence story or animation film, ask the children to tell the story.

Notes for the teacher

1. Why has a video been used for a particular message or could it have been captured (better) by a photograph? 2. What pictures/ images have been captured? How are they important? 3. How different media (audio, video, image) are different? 4. When to use what?

Student Outcomes

1. Comprehension, verbal (oral) expression from a given story/ resource 2. Making a story line for a given idea 3. Identify key ideas for getting photos / images/ drawing pictures

Making a story – Photo Image Essay

Here, we have to create a photo / image essay. This could be either be a documentation of an event or a set of images that can be tied to tell a story or an explanation of a process. These photographs could either be downloaded from the internet or taken by the participants (either through a camera, web camera, or a scanner) or created using MyPaint. For different processes, this will be different.

1. We can take photographs, add downloaded pictures and tell a story. Stitch the photographs in a slide show.
2. When we work for language lessons, we have to help create the story line using related pictures – related to a lesson/ idea/ author that we want to explore. It can be linked to the textbook chapter/ lesson; it need not be.
3. Even a mind map with images, notes is a story only!!

In language teaching-learning we have discussed two parts – one is the language itself (the grammar, figures of speech, the comprehension, vocabulary, etc); the second is the culture/ ideas that a particular lesson can be used to talk about.

Student Outcomes

1. Students must coherently tell a story 2. Making a story line for a given idea 3. Images and photos 4. Add descriptive text 5. Technical skills of combining images and text (mind map, text document or presentation) 6. Are students able to document details well? Meta knowledge of source of information, permissions, disclaimers, etc

Making a story with created images

Creating an image using paint/ drawing applications. Take a created digital art and combine with photographs. Together, tell a story with captions/ text. This can be fully written text or comic strip like phrases, etc

Student Outcomes

More methods of digital image creation (photograph, mypaint, scanner, etc)

Editing Images and Adding text

1. Editing the image for size, format, scaling and cropping, inserting into a document. Adding a caption to an image and placing it with text. Editing images to improve image quality.
2. Inserting text into images. Adding descriptive texts and labels to an image; sequencing and telling a story.

Student Outcomes

1. Image editing skills
2. How to combining images with documents
3. Vocabulary and writing skills
4. Combining text and non-textual methods for communicating
5. Sequencing images to tell a story
6. Ability to tell a story

Again this will differ for different purposes.

For a language lesson, you will assess the following: 1. Coherence and the flow of story 2. Language style 3. Vocabulary 4. Richness of ideas and extensions presented 5. Linking of ideas

For a social science/ project work, we can assess the following: 1. Coherence and the flow of story 2. Richness of ideas and extensions presented 3. How critical questions are asked and expressed 4. Linking of ideas

Other (picture/image) activities

1. Create a process flow (science) diagram and label it. (Using draw tools, scan from hand drawn process charts and take a screenshot from an existing image of a diagram/ process chart. 2. Even a Geogebra file is one such image / text story. 3. Explaining an experiment using screenshots from simulations is an example.

Video narrations

1. Shoot a video clip (of around 1 minute) to document any process or event. 2. Using a voice recorder, narrate the explanation, description or commentary of the process or event to create an audio clip.

Student Outcomes

1. Learn how to make a short video clip
2. Story telling and narration
3. Combining images and audio/ video to make a film
4. Developing a script, and tell a story

Assessment of digital stories

Digital stories can be used for assessment of student learning.

1. How well story is developed?
2. The quality of the material.
3. The quality of the language

4. Analysing information presented in multiple formats
5. How well ideas are connected?
6. Accuracy
7. How can we use this for children with different needs?

ICT for subject specific resource creation

Subject based free and open educational applications

The Free and Open Source Software community has developed hundreds of educational applications, which teachers can use to teach their subjects. These tools complement and supplement the traditional teaching methods that teachers use, such as lecture, chalk and talk, group discussions, projects etc. These tools have a few potential advantages:

1. Many of them are interactive and allow for the learner to provide inputs and get feedback/responses and create resources / digital artefacts. This can support a constructivist approach. (One of Piaget's contemporaries, Seymour Papert conceptualised this process as 'Constructionism'
2. Resources created by the learner can be assessed by the teacher for conceptual understanding
3. Peer learning possibilities amongst learners can be supported by encouraging group learning (this can take advantage of the limited ICT resources that may be available in the school, due to which a 2:1 or even 3:1 learner:computer ratio may be required)
4. Sometimes intangible or abstract concepts (such as an atomic model, algebraic equations) can be demonstrated through simulations, which can aid conceptual understanding

Free and Open Source educational applications bundled with GNU/Linux operating system

The Free and Open Source (FOSS) GNU/Linux operating system can be configured to add other FOSS applications also, this is not possible to do with proprietary operating system software. The Ubuntu GNU/Linux operating system has been customised to create distributions containing thousands of free and open source software packages, with educational tools for almost all subjects, including Mathematics, Science, Social Science, Language, Art, Music etc. See image below for the applications available in the Education menu sub bar.

Content and Pedagogy

The Technological Pedagogical Content Knowledge [29] framework provides a useful basis to understand the integration of ICTs in education. Elliot W. Eisner [30] declared in 1991 that “Like the systole and diastole of the beating heart, curriculum (content) and teaching (pedagogy) are the most fundamental aspects. ...No curriculum teaches itself, it always must be mediated, and teaching is the fundamental mediator". Yet, at times in pre-service teacher education (BEd or DEd), it is believed that the student teachers 'already know content' having studied these topics in their own schooling experience, and need to learn 'method' (pedagogy) only. In-service teacher training program is also sometimes seen to be only for 'content' or only for 'pedagogy', as if these are two distinct items.
(The NCFTE [31] document says "Most teacher education courses focus exclusively on the methodology of teaching individual school subjects. It is assumed that the teacher trainees have the subject-content knowledge which they would draw upon when required. Hence, teacher education curricula do not engage teacher trainees with subject-content. However, if we want to prepare teachers to present subject-content in developmentally appropriate ways and with critical perspectives it is essential that several theoretical concepts learnt during general education in school and college be revisited and reconstructed.

PCK

Shullman [13] disagreed with the thinking that teachers' subject (content) knowledge and pedagogy were mutually exclusive. He believed that teacher education programs should combine the two knowledge fields. He introduced the notion of pedagogical content knowledge (PCK) that includes pedagogical knowledge and content knowledge, (and also curriculum knowledge, knowledge of educational contexts etc). PCK has two parts:

1. Content: Which includes all that the teacher needs to know to teach. This includes actual content (not just facts and definitions but key concept learnings, the ethics of the subject, the social justification/ social implication for the subject and the philosophy of the subject). Content knowledge will make you a scientist, mathematician, or a poet.
2. Pedagogy : Which includes all the methods, strategies and techniques that are used to teaching. This includes various technologies, use of various resources, materials, etc. This can be called the “how” of teaching.

Integrating Content knowledge with pedagogical knowledge will make a better teacher, than seeing the two as distinct.

TPACK

ICTs have significantly impacted content/ learning resource possibilities for teachers. Earlier, the main resource was the text book, with ICTs, text resources can be complemented and supplemented with image, audio, video, semantic map, simulations and various kinds of digital resources. ICTs have also impacted pedagogy, by providing many more options for teachers. Earlier, we could only have a candle, and a ball to demonstrate eclipse. Now, with a desktop planetarium tool like Stellarium, the sun, moon and earth can be shown as moving in the screen, due to which actual classroom strategies can be different. Thus digital technology has altered/ presented new ways of representing content which makes it possible for new learning strategies to be developed. New areas of learning can also emerge.
Punya Mishra [32], professor, and Matthew J. Koehler [33], professor, both at Michigan State University, have done extensive work in extending PCK to the TPACK [34] framework

Concept Map

The TPACK framework provides a perspective on how technology impacts content and pedagogy, the two main components of the teaching learning process. This framework can help us understand the integration of ICTs into teaching-learning. The Subject Teacher Forum program design is informed by this framework. In recent workshops with Telangana maths and science teachers, this framework was discussed, and the concept maps exploring TPACK in these subjects was created, which is provided below.

Mathematics teachers

<mm>Flash</mm>

Science teachers

<mm>Flash</mm>

Language teaching

<mm>Flash</mm>

Explore an application

This page is intended to be a navigator for technology learning. Technology learning can be broadly classified into four strands:

1. Basic digital literacy
2. ICT for connecting and learning
3. ICT for resource creation - these can be further divided into the following:
    1. ICT for generic resource creation
    2. ICT for subject specific resource creation
    3. ICT for resource publishing
4. ICT for teaching learning

Each of the mind map nodes will link to a strand of technology learning. "Click to Learn" node will help navigate to the pages for specific applications.

School level implementation guidelines

This requires a discussion with the SCERT and Textbook Committee before finalization

The mind map below gives some parameters.

Chapter Objectives

1. Introduction to the idea of computing
2. What makes the computer special
3. The computer communicates with data
4. Data is of different kinds and can be edited, processed, combined in multiple formats which is what makes it possible to do many things with ICT
5. Different devices can be different for reading, representing data
6. Data can be organized in files and folders

7. Computers can connect with one another

Additional Resources

1. History of Charles Babbage, who is considered the Father of Computing [35]
2. What is an operating system [36]
3. Internet of things [37]
4. How has the desk changed [38]

Transaction notes for activities

Each activity has the following components.

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Subject integration
6. Assessment

How is a computer different from a fridge

1. This activity requires 40 minutes -1 period
2. It will be useful to go through the additional links given for this discussion; the classroom must have a projection enabled for this session. The labs should have sufficient computers for students to practise switching on and off.
3. In small groups ask students to come up why a computer is different from a fridge and this can be compiled digitally.
4. Introduce to the children that computer understands data and applications communicate data; distinguish between an operating system and application software
5. In small groups let the students talk about any application they are familiar with and list out the steps involved (this can be a flow chart). This can be used to introduce the idea of computing - the ability to describe a process to get to an outcome.
6. Student created mind maps can be digitized and added to their cumulative portfolio.

What all can a computer do

1. This activity requires 80 minutes - 2 periods
2. Prior to this the teacher must keep ready the following files/ applications:
    1. Images
    2. Videos
    3. Geogebra files
    4. Simulation
    5. Marble
    6. Text document
    7. Games
    8. Wikipedia page on Tigers, or Godavari
3. It may be an interesting idea to start the class with this video "How has the desk changed [38]". The video shows as a timeline how different applications came into the computer. Ask students to watch and make their comments. Encourage them to talk about any applications that they see on the video that are familiar to them.

4. Demonstrate the folder structure and show how you have organized the resources for the class.
5. When opening each file ask students to focus on the following:
    1. What is the file name and file extension
    2. How the application was opened (from a menu or right click)
    3. What all did they see on the application
    4. What input had to be given (for example, opening a browser and typing an URL)
    5. What controls are available (increase in size, volume, etc)
6. The files and applications chosen can be reflective of multiple subjects
7. Show the students the Applications Menu on the computer and ask them to explore multiple applications
8. On student computers, create a folder with an image, video, text document, concept map stored.
9. Students must open the folder on the computers and each of the files.

Introduction to the internet

1. The time required for this activity is 40 minutes.
2. During the previous session, you would have opened an internet page. You could start the discussion with introducing students to the idea that it is possible to access date not stored on your computer also. Discuss with the students if they have accessed information like that. Introduce the students to of the internet and also the idea of the web.
3. It is important to introduce them to the idea of the browser and how to use it to navigate the internet.

Historical perspective of ICT

1. The teacher must introduce ICT as a process of interaction with society
2. It is important to understand that technology is not neutral

Internet for learning

1. Introduce students to the possibilities of self learning
2. Build skills of collaboration

Transaction notes for activities

Activity Name

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Subject integration
6. Assessment

Reading Data

1. This activity will take 80 minutes
2. Data sets have to be prepared (in sets of 2 or 3) for each computer/ group of students. A data folder must be created on each computer and the data sets copied.
3. Copy the data folder on the computers. For each data set, make a set of questions for the students to answer after a study of the graph. After the students complete the analysis, encourage them to express the summary of the analysis in the form of a mind map. The following questions can be given to the students for discussion
    1. What are the data elements captured?
    2. Is the data giving your exact numbers or only relative estimation?
    3. What can you conclude from the data?
    4. What are the advantages in each kind of representation? When do you think each method is suited?
    5. What further information on the topic would you like to find out?
4. The data sets can be drawn so as to represent different subjects
5. Rubrics for assessment
    1. Ability to navigate the folder and open the graph/ image
    2. Creating a text document and saving with an appropriate file name

How to make data meaningful

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Subject integration
6. Assessment

Chapter Objectives

1. Understanding story telling as communication
2. Pictures can tell a story
3. Text can be added to pictues to tell a story
4. Combining text and pictures
5. Images are formats of data that can be edited and combined with other formats
6. Using digital art creations to tell a story
7. Making communication outputs with tools
8. Communicating about processes and events
9. Critical perspective on communication for community

Additional Resources

1. Storytelling - how to tell a story
2. How to make an animation

Transaction notes for activities

The transaction notes will include the following components. The activities are expected to be cumulative.

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Instructions for student led activities
6. Subject integration
7. Assessment (portfolio as evidence of digital skills)
8. Student portfolio as learning resources for other students
9. Teacher reflections

Photo and Image essays

1. This activity will take 80 minutes
2. Keep ready pictures/ images/ slide shows for demonstrating how to tell a story. Alternatively prepare the students in advance for them to collect images
3. In addition to image in the activity, use the computer timeline slideshow, picture gallery of microscope and the timeline of communication technology to talk about how pictures, combinations of pictures and text can be used to communicate. Important areas to focus can be on (i)what is the key idea(s), (ii) how to structure it, (iii) determining when is text useful, (iv) evaluation of the method of graphic communication
4. For each one of these, let the students collectively share their ideas about story line and they could do so either with a mind map or text document
5. In small groups, students should pick up topics both for individual image essays and collective digital essays.. Emphasize to the students that they will build upon this in future units.
6. Any image that can be used will reflect a subject area. In addition to demonstrating the students' grasp of the subject, the teacher can also use this discussion to build learning skills needed. These can be the rubrics for assessment also.

Tell a story

1. This activity will take 80 minutes.
2. Students must add narratives to the image and picture essays

Stories and songs come alive with pictures

1. This activity could take 80 - 120 minutes
2. The teacher has the choice of doing the illustrations by hand and digitizing or using a digital art creation tool; this could be a group activity
3. It will be useful for students to make a concept map of ideas being communicated in the song/ story and abstract the important story line items for illustrating. The teacher can facilitate this discussion, encouraging students to express their understanding using multilingual expressions.

Making communication outputs

1. This can be in the nature of a cumulative project
2. The students should be able to build critical perspectives and narratives on social processes and events, being able to see the issues, argue out multiple perspectives (using comic strips) or make an infographic. Digital image creations are to be encouraged.

Transaction notes for activities

Activity Name

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Subject integration
6. Assessment

Activity Name

1. Time estimate
2. Prior preparation
3. Methodology
4. Discussion questions
5. Subject integration
6. Assessment

Combining images and texts

1. Students must coherently tell a story
2. Making a story line for a given idea
3. Images and photos
4. Add descriptive text
5. Technical skills of combining images and text (mind map, text document or presentation)
6. Are students able to document details well? Meta knowledge of source of information, permissions, disclaimers, etc

Assessment of digital stories

1. Digital stories can be used for assessment of student learning.
    1. How well story is developed?
    2. The quality of the material.
    3. The quality of the language
    4. Analysing information presented in multiple formats
    5. How well ideas are connected?
    6. Accuracy
    7. How can we use this for children with different needs?

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ICT teacher handbook/References

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