CHAPTER - 6

METHODS SUGGESTED FOR IMPLEMENTATION OF ICT IN EDUCATION

INFRASTRUCTURE REQUIREMENT FOR BETTER ICT IMPLEMENTATION

Infrastructure and software requirements for successful implementation of ICT are related to computer science technologies. There are many ways to describe different infrastructure needs and computer system configuration options and strategies as per the resources available in different schools in Rajasthan. In this chapter, we use four organizing themes:

- Networking technology
- Internet access
- Software and operating systems
- Open source softwares

NETWORKING TECHNOLOGY

Connecting computers together form a network, and connecting school, lab, and classroom networks to the Internet can multiply the educational value and impact of computers in schools. There are a variety of options for creating class-room, lab, and school computer LANs. These are:

- Peer to peer Networking
- Client/Server Networking
- Thin Client-Server Networking

Peer to Peer networking is a distributed application architecture that partitions tasks or workloads between peers. Two computers are considered peers if they are communicating with each other and playing similar roles. In peer to peer networking there is no central server that can manage the whole task of
managing other systems. Peers are both suppliers and consumers of resources, in contrast to the traditional client server model in which the consumption and supply of resources is divided. One or more of the computers in a peer-to-peer network can provide centralized services such as printing and access to the Internet. Most desktop operating systems come with software that can enable peer-to-peer networking once the computers are connected by some cable or through wireless networking infrastructure.

Peer-to-peer networking is good for small networks where a centralized file server is not needed and network security is not a major issue. The advantage of peer to peer network is that it is less expensive to set up since the only additional expense is in the cables and networking hardware (one or two hubs). Most common computer operating systems (Mac OS and Windows 95/92/Me/2000/XP) come with software to establish a peer-to-peer network, so it may not be necessary to purchase, install, and configure special network operating system soft-ware such as Windows NT, Novell Netware, or Linux. Schools that need to be set with less financial budgets can use this form of architecture to set up the lab infrastructure.

Client Server Architecture - As a computer network grows in size and complexity, it becomes necessary to shift to a client/server style of network using more advanced network operating software. In these networks, one computer acts as a central computer that functions as storing common files, e-
mail delivery, and providing access to applications and peripherals such as printers.

One of the advantages of client/server networks is that they are scalable: more clients and servers can be added to the system without changing the network. These centralized networks are easier to manage, administer, and secure than peer-to-peer networks. But there are some disadvantages also like there has to be a central “dedicated” server, whose initial costs are higher. Also, they are more complex to set up and maintain than stand-alone computers and peer-to-peer networks, often requiring schools to hire a technician to oversee the network. Also, with client server architecture there is single point of failure i.e. if the server fails, all network functions fail.

**Thin Client Server Architecture**

A thin-client/server network is similar to a traditional client/server network except that the client is not a free-standing computer capable of operating on its own. Thin clients are desktop appliances or network devices that link the keyboard, monitor, and mouse to a server where all applications and data are stored, maintained, and processed. The server, often called an application server, is built to provide all networking services and computer calculations. Since all network and computer services are centralized, all maintenance and upgrading is done at the server; there is no need to service the clients. The initial purchase costs of thin client server configuration is higher than that with traditional Client/server networks, but long term costs or total cost of ownership can be significantly less. Thin-client/server networks are also easier to install than traditional client/server networks. The chance of theft is reduced with thin client/server architecture because client machines cannot work without server machines. Thin-client systems are very efficient at providing access to the Internet, and, because the client appliances have few moving parts and limited functions, thin-client/server networks are more reliable and stable than traditional network systems.
Problem with thin-client/server networks are based on a type of UNIX operating system, skills with UNIX are needed to set up and administer. However, if schools have no staff with these skills, but do have access to the Internet, it is possible to have a technician at some remote site administer and maintain the network. This enables a school district to have one highly skilled technician manage thin-client/server networks in several schools, thus reducing management costs further.

**METHODS OF INTERNET ACCESS**

The Internet is a network of computers, designed to receive and send data in the form of e-mails, blogs, webcasts, etc. Internet is a very important means of enhancing knowledge and information. The Internet has helped bring the world closer. Receiving news from across the world and accessing knowledge resources are the most frequent uses of Internet.

Different methods of Internet connections are:

- Simulated Internet - If direct connection to the Internet is not possible, for economic or technical reasons, students and teachers can still gain simulated
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access to a selection of Internet resources by copying valuable Websites to CD-ROMs. Then they can use the CDs to access these sites, thus simulating the Internet. The CDs, which are updated periodically, use the same browsers that are used with the Internet, so that when Internet access becomes available, teachers and students will have no difficulty using this technology. The “Internet” CDs also can make it easier for teachers to prepare structured educational activities using Websites since they can preview the resources quickly before the class session. In addition, this approach can focus student inquiry because students can explore the CD’s resources but cannot surf freely beyond the scope of the activity or become distracted by non educational Websites. Also, since these Internet resources are stored locally, no time is spent waiting for Websites to load. Even if Internet access is available, a CD with copied Websites can make it easier for students to access Internet resources rather than relying on a slow, congested connection.

A dial-up connection- With a dial-up connection, the Internet user can connect to the Internet via his or telephone line and an Internet service provider. This method of connecting to the Internet is generally considered the cheapest, but it is also provides the user with the slowest overall connection speeds. However, it may suit the purposes of the occasional Internet user without a need for a fast or consistent connection.

Dial up connection can provide Internet access to a single computer (for example, in a lab, classroom, teachers’ room, or library) or, by using software on a server, networked computers can share this single connection. However, with a shared connection, access can become very slow, since the total available bandwidth (the total amount of data that can be moved through the net-work per unit of time) is divided among all the computers sharing the same Internet connection. This is the slowest common form that is used for connecting to the Internet. This is where a computer is connected to the internet via a modem that connects to an ordinary voice telephone line. Because such telephone
service was originally designed for 'voice only' - which is very 'narrow band' -
dial up is the slowest common form of internet connection.

If two or three phone lines are available, these lines can be combined using an
analog router to enable multiple phone line access to an ISP, thus increasing
available bandwidth. For the dedicated Broadband Connection - The term
'broadband internet connection' refers to a number of different means or
methods for obtaining higher data transmission speeds than is possible using
dial-up connection. Schools can get faster and more reliable Internet access by
using permanent “dedicated” high-speed connections where they are available
and affordable. A variety of dedicated high-bandwidth options may be
available to schools, including integrated services digital network (ISDN),
digital sub-scriber line (DSL), terrestrial wireless, digital cable, radio modem,
and satellite access:

- ISDN (Integrated Services Digital Network or Isolated Subscriber Digital
  Network) - a system that is similar to and generally slower than DSL in
  that it uses a special telephone connection. Not commonly used today was more common at one time.

- DSL (Digital Subscriber Line) – a special high speed telephone line
  internet service – you can only get DSL if you are within about 18000
  feet of a ‘switch’ – which is about 3 miles. In other words, folks out in
  the country cannot usually get DSL. (A ‘switch’ is a telephone company
  terminal device that costs a lot of money and they are therefore generally
  only installed in high density population areas).

- Broadband Mobile – An internet connection that works through a
  cellular telephone provider, such as Sprint, AT&T, Verizon, etc. This is
  similar to but faster than a dial-up connection. It is essentially 'dial-up'
  on a cell phone network. Since the cell phone networks are newer than
  ordinary telephone lines and by their nature operate with broader
  bandwidth specification, broadband mobile is faster than dial up. The
actual speed varies and is dependent upon the actual network and other factors.

- **Wireless Internet** - This is a system whereby the user connects to the internet via a radio link - also known as 'wireless'. This is very similar to 'broadband mobile' but does not take place on a cellular telephone network. The radio number link is usually UHF (Ultra High Number) and is capable of higher bandwidth and therefore faster connection speeds than dial-up, ISDN and DSL. A wireless internet connection will require an antenna at the user's home or office that is aimed at the service provider's antenna, which is usually located on a water tower or other tower structure. Wireless internet generally requires a direct and unobstructed line-of-sight between the user and the provider.

**SOFTWARE AND OPERATING SYSTEM CONSIDERATIONS**

Along with the hardware software is also an equally important requirement for the use and implementation of ICT in schools for the purpose of teaching and learning. Software, an essential component of computer systems, enables the user to implement its task more easily and fastly. The following four types of software’s are required for educational programs in schools:

- Operating system (OS) software for client and server computers;
- Basic computer application software, including software for word processing, spreadsheets, presentations, and graphics;
- Educational software applications; and
- Internet-related softwares like browsers, Java applications, and interactive tools on Websites.

**Operating System Software**

Decisions about what operating system software to use on client or end-user computers are usually based on the type of hardware purchased. If Apple
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Computers are purchased, then Apple’s OS, which comes with the computer, will be used on client computers. If computers with Intel or Intel-compatible CPUs are purchased, the computers will come with a version of the Microsoft Windows OS. Basic Apple and Windows operating system software comes with the capability to enable computers to be connected together to manage small networks. However, larger and more robust networks that may need to be managed securely will require special network operating system software installed on the network’s server to manage the functions of the network, including links to printers and other peripherals, e-mail, file sharing, security functions, and communication among linked computers. There are different options for network operating system software. For Apple computer systems, two main options are available: Apple’s own network operating system and Linux. For Intel-based computers, the three main options are Microsoft NT, Novell Netware, and Linux.

Several points that should be kept in mind before opting operating system software are:

- What types of operating systems were used already?
- Which operating system will best satisfy the needs of a school?
- Is technical support available for that OS?
- What is the cost of maintenance?
- How much money is available in project and school budgets to cover the costs of installing, maintaining, and upgrading network operating system software?
- Is the network operating system software available in a language version to match languages commonly spoken by technicians and users?

Computer Application Software

Computers in school should be enriched with good Application software which can help aid computer literacy programs and can make possible to integrate
computer into routine education programs. These applications generally include software for word processing, spreadsheets, presentation software, and graphics software, and the increasingly important software to create Websites and HTML documents. As with operating system software, commercial and public domain options are available.

Where funding is a constraint, schools have the option of using Sun Microsystems public domain software application suite, called Open Office. It includes an integrated graphical interface similar to MS-Office and WordPerfect and comprises word processing, spreadsheet, and presentation applications. StarOffice also has support for AutoPilot Web page design software, 3D graphics, diagrams, HTML editing, and calendar, newsgroup, browser, e-mail and scheduler, photo editing, and other applications. This software is also available in a variety of languages and can be downloaded for free from the Internet. There are versions of StarOffice for Windows and Linux operating systems.

**Educational Software Applications**

Thousands of software applications have been developed over the years, many for free, to meet specific educational objectives, including:

- strengthening subject matter competence;
- providing drill and practice activities for different subjects;
- enhancing logical thinking and problem-solving skills;
- enriching research and writing activities;
- simulating complex or dangerous processes that enable students to change variables and visualize how processes are changed; and
- providing opportunities for students to extend learning beyond the scope of classroom activities.
As with all uses of computers to enhance and improve teaching and learning, the key to success is not the type of educational software that is used, but how teachers use the software and integrate it into their teaching programs. Significant benefits to teaching and learning can be achieved without using any specialized educational software only if teachers can make the best possible use. However, when used effectively by teachers, many excellent educational software applications can enhance the use of computers in education. Publishers can provide evaluation copies of software that teachers can use to test the products before the school decides to purchase them. When evaluating educational software, teachers and schools need to develop evaluation criteria so that purchase decisions are based on objective and subjective measures of educational quality.

**Internet-Related softwares**

One of the most important benefits of Internet- and Web-related software is that most of it can be used regardless of the hardware and software installed at schools. The “platform independence” of the Internet reduces the costs involved in using the Internet in education and enhances its benefits. One key area of Internet use is access to a variety of Internet and Web-based software applications, much of it freely available in different languages that can be used by teachers and students in a variety of ways, including:

- browser and search software that enables students to carry out research on the Internet and engage enquiry-based learning activities using the millions of Websites on the Internet
- e-mail software that allows users to send and receive communication from other learners and Websites;
- listserv or e-mail distribution software that allows groups of users to form and communicate easily by e-mail;
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- Web-based discussion forum software that allows users to engage in ongoing dialogues in which the topics or themes are linked to form discussion threads;

- Interactive Web-based publishing tools that allow students and teachers to publish their thoughts, comments, experiences, pictures, suggestions, etc., instantly on Web pages;

- Internet- and Web-based chat and instant messaging software that allows users to engage in live text-based discussions;

- easy-to-use Web page construction and publishing tools;

- voice and video software applications that allow teachers and students to participate in synchronous audio- and videoconferencing, if sufficient bandwidth is available; and

- file storage and retrieval software that allows users to share digital files easily, including documents, presentations, images, data, and music, with other users.

The existence of these online or Web-based software applications that enable users to communicate at a distance has given rise to opportunities for collaborative and project-based learning that were not possible before the Internet. Since learning is very much a social activity, the ability to link students and teachers together to form learning communities can significantly enhance learning outcomes and opportunities to develop lifelong learning skills.

Another important category of Internet-related software includes applications, many of which are freely available, that enable teachers and students to construct and publish Web pages and HTML documents on the Internet. Due to the Internet’s “platform independence” nature it can be used for a variety of software applications, including JAVA and FLASH, which can be used to create learning applications. These programming languages can be used by
teachers and students to accelerate understanding of complex concepts and demonstrate scientific activities that normally would need to be carried out in expensive labs.

**OPEN SOURCE SOFTWARES (OSS)**

One of the most hotly debated topics in educational technology today is the question of whether it is better for school systems to use open source software (OSS) or commercial software products for client and server operating systems. The needs of teachers and students basically decides what software should be used and implemented. Similarly, educational uses and needs for computers are often quite different from corporate needs hence a decision has to be made about technology choices for schools.

Linux, part of the family of UNIX-based operating systems, is one of the most popular open source software products used for computer operating system software. Linux has become popular primarily because it is available free of charge and has a large development and user community. Linux is also the first or second most popular operating system software for Internet servers—accounting for about 30% of all Web servers in the world today. It is used only rarely as a client operating system (on the end terminal or PC at the user’s desk), however, mainly because few software applications, such as word processing, can be used on computers running Linux. The exception is WordPerfect’s and Sun’s StarOffice’s application suite (the latter is now called OpenOffice, since it was released as an OSS application).

When selecting a particular operating system the following points are to be kept in mind reliability, scalability, performance, security and cost. Various studies have shown that Linux which is an open source software is more secure and crashes less often and performs better as compared to other OSS softwares. Linux and other open source software usually have significantly lower initial costs than commercial operating system software.
Suggestions:

The following suggestion may be proposed on the basis of above findings:

• Government schools particularly of rural region should be facilitated more towards the implementation of ICT.

• A large number of computer teachers needs to be appointed for successful implementation of ICT in education.

• High quality training of teachers is required regularly because technologies are invented every day.

• Facilities of hardware and software must be enhanced in government schools of Rajasthan.

• ICT must be made a part of course curriculum as a subject in lower classes as well in government schools.

• Computers in school should be used as a tool for playing as well as for learning, thereby increasing pupils' pleasure and familiarity with their use.

• Increased encouragement should be provided for teachers who are willing to use computers in their subjects.

• Educational games should be encouraged and used in schools by pupils at least in their free time; for the time being ICT is used in some subjects of the school curriculum and by some teachers. There is supposed to be a move towards using ICT in all subjects.

• Teachers should consider using ICT facilities in their subjects More teachers should become computer competent so they can demonstrate the use of the teaching in every subject area and become natural part of the teaching and life; if ICT facilities are used competently in school, then there would be no need for separate ICT.

• Each subject teacher must not only be competent in using the equipment but must also be proficient in using it in her/his teaching.