UNIT IV

Meaning & Definition ICT is technology that supports activities involving information. Such activities include gathering, processing, storing and presenting data. Increasingly these activities also involve collaboration and communication. Hence IT has become ICT: information and communication technology. Some underlying principles Technology does not exist in isolation ICT contributes at various points along a line of activity ICT is used in activities – the ICT use depends on the activities The key outputs of educational activities are context are knowledge, experience and products The output should be useful to the users (self and others)

What is a useful concept of ICT? It depends on the local culture and the particular ICT available and how it is configured and managed. The understanding, management and configuration of the available technology might vary the concept of ICT from a collection of tools and devices used for particular tasks, eg, publishing, course delivery, transaction processing... an organised set of equipment (like a 'workshop') for working on information and communication components of integrated arrangements of devices, tools, services and practices that enable information to be
collected, processed, stored and shared with others components in a comprehensive system of people, information and devices that enables learning, problem solving and higher order collaborative thinking, that is, ICT as key elements underpinning a (sharable) workspace

Let’s focus on the three words behind ICT: INFORMATION -COMMUNICATIONS -TECHNOLOGY A good way to think about ICT is to consider all the uses of digital technology that already exist to help individuals, businesses and organisations use information. ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email, robots.

**Information and communication technology (ICT)**

Information and communication technology, or ICT, is defined as the combination of informatics technology with other, related technologies, specifically communication technology. In this book, these three definitions have been collapsed into a single, all encompassing, definition of ICT. This definition implies that ICT will be used, applied, and integrated in activities of working and learning on the basis of conceptual understanding and methods of informatics.

**Aims & Objective**

Information and communication technology (ICT) has become, within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy. UNESCO aims to ensure that all countries, both developed and developing, have access to the best educational facilities necessary to prepare young people to play full roles in modern society and to contribute to a knowledge nation. Because of the fundamental importance of ICT in the task of schools today, UNESCO has previously published books in this area as a practical means of helping Member States: for example, *Informatics for Secondary Education: A Curriculum for Schools (1994)* and *Informatics for Primary Education (2000)*. Rapid developments in ICT now demand a completely new document in place of the first of these publications. This book has two key purposes. The first is to specify a curriculum in ICT for secondary schools that is in line with current international trends. The second purpose is to outline a programme of professional development for teachers necessary to implement the specified ICT curriculum successfully. All governments aim to provide the most comprehensive education possible for their citizens within the constraints of available finance. Because of the pivotal position of ICT in modern societies, its introduction into secondary schools will be high on any political agenda. This book gives a practical and realistic approach to curriculum and teacher
development that can be implemented quickly and cost effectively, according to available resources.

Implications:

**Student-Centered:** Cooperative activities pair students together or place them within groups, allowing each individual student more time and opportunities to participate in the classroom discourse.

Information and Communication Technology

**Thematic Instruction:** Students' interests are addressed through thematic planning, especially if they have a voice in deciding the theme, and further participate in the design of cooperative activities around the theme that allow them to co-construct knowledge in a social environment.

**Active Learning:** Cooperative activities naturally get students up and interacting with their environment.

**Cognitive Apprenticeship:** Paired and group activities offer excellent opportunities for teachers to model specific methods or behaviours for their students.

**Authentic Learning:** Students who engage in cooperative learning practice social skills that will help them to succeed in real-life situations that require group collaboration.

**Retention:** Students who have mastered some aspect of cooperative learning and are comfortable working with their peers experience the following benefits: Higher retention and achievement, development of interpersonal skills and responsibility, heightened self-esteem and creativity.

**Interaction:** Students in cooperative learning groups acquire the skills necessary to interact successfully with peers in an environment that rewards respectful...
The Promise of ICTs in Education

For developing countries ICTs have the potential for increasing access to and improving the relevance and quality of education. It thus represents a potentially equalizing strategy for developing countries. [ICTs] greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others who live in the poorest countries, is their sense of isolation. The new communications technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago. However, the reality of the Digital Divide—the gap between those who have access to and control of technology and those who do not—means that the introduction and integration of ICTs at different levels and in various types of education will be a most challenging undertaking. Failure to meet the challenge would mean a further widening of the knowledge gap and the deepening of existing economic and social inequalities.

How can ICTs help expand access to education?

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enrol on campus.

- **Anytime, anywhere.** One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, for example, may be accessed 24 hours a day, 7 days a week. ICT-based educational delivery (e.g., educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning).

- **Access to remote learning resources.** Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited
quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons—mentors, experts, researchers, professionals, business leaders, and peers—all over the world.

How does the use of ICTs help prepare individuals for the workplace?

One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market. Technological literacy, however, is not the only skill well-paying jobs in the new global economy will require. Engage of the North Central Regional Educational Laboratory (U.S.) has identified what it calls “21st Century Skills,” which includes digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reasoning, effective communication, and high productivity. The potential of ICTs to promote the acquisition of these skills is tied to its use as a tool for raising educational quality, including promoting the shift to a learner-centered environment.

How can the use of ICTs help improve the quality of education?

Improving the quality of education and training is a critical issue, particularly at a time of educational expansion. ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training. ICTs are also transformational tools which, when used appropriately, can promote the shift to a learner-centered environment.

**Motivating to learn.** ICTs such as videos, television and multimedia computer software that combine text, sound, and colorful, moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise
makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students

**Digital Age Literacy**

Functional literacy Ability to decipher meaning and express ideas in a range of media; this includes the use of images, graphics, video, charts and graphs or visual literacy
Scientific literacy Understanding of both the theoretical and applied aspects of science and mathematics
Technological literacy Competence in the use of information and communication technologies
Information literacy Ability to find, evaluate and make appropriate use of information, including via the use of ICTs
Cultural literacy Appreciation of the diversity of cultures
Global awareness Understanding of how nations, corporations, and communities all over the world are interrelated

**Inventive Thinking**

Adaptability Ability to adapt and manage in a complex, interdependent world
Curiosity Desire to know
Creativity Ability to use imagination to create new things
Risk-taking Ability to take risks

**Higher-Order Thinking**

Creative problem-solving and logical thinking that result in sound judgments

**Effective Communication**

Teaming Ability to work in a team
Collaboration Ability to interact smoothly and work effectively with others
Personal and social Be accountable for the way they use ICTs and to learn to use ICTs responsibly for the public good
Interactive communication Competence in conveying, transmitting, accessing and understanding information
High Productivity Ability to prioritize, plan, and manage programs and projects to achieve the desired results

Facilitating the acquisition of basic skills. The transmission of basic skills and concepts that are the foundation of higher order thinking skills and creativity can be facilitated by ICTs through drill and practice. Educational television programs such as Sesame Street use repetition and
reinforcement to teach the alphabet, numbers, colors, shapes and other basic concepts. Most of
the early uses of computers were for computer-based learning (also called computer-assisted
instruction) that focused on mastery of skills and content through repetition and reinforcement.
(See section below on Computer- Based Learning.)

Enhancing teacher training. ICTs have also been used to improve access to and the quality of
teacher training. For example, institutions like the Cyber Teacher Training Center (CTTC) in South
Korea are taking advantage of the Internet to provide better teacher professional development
opportunities to inservice teachers. The government-funded CTTC, established in 1997, offers
self-directed, self-paced Web-based courses for primary and secondary school teachers. Courses
include “Computers in the Information Society,” “Education Reform,” and “Future Society and
Education.” Online tutorials are also offered, with some courses requiring occasional face-to-face
meetings.15 In China, large-scale radio and television-based teacher education has for many years
been conducted by the China Central Radio and TV University,16 the Shanghai Radio and TV
University and many other RTVUs in the country. At Indira Gandhi National Open University,
satellite-based one-way video- and two-way audio-conferencing was held in 1996, supplemented
by print-materials and recorded video, to train 910 primary school teachers and facilitators from
20 district training institutes in Karnataka State. The teachers interacted with remote lecturers by
telephone and fax.

Electronic Tutorials to Enhance Learner Support at Universitas Terbuka, Indonesia

Since its establishment in 1984 as the first distance and open learning institution in Indonesia, the
Universitas Terbuka (Indonesian Open Learning University) has made great strides in making
higher education available to Indonesians, having served more than 400,000 students nationwide
in its 14 years of existence. The mandate of Universitas Terbuka, however, is not only to expand
educational opportunity but also to “improv[e] the quality of education and make it more
relevant to national development needs.”18 In its effort to address issues of quality in instruction,
it has recently introduced the use of the Internet and a combination of facsimile and Internet
technologies for student tutorials in 40 of its more than 700 courses on offer. These electronic
tutorials are a supplement to more traditional tutorial models—including face-to-face, regular
mail, radio and television—already employed by the university.
Two electronic tutorial models are being used: tutorials via email lists, and tutorials via a combination of email and fax messages. In the latter, tutors send email messages to a “fax gateway” which are then received by students as fax messages while student’s messages are sent by fax and then converted to email messages to the tutors. While both models allow tutor-student and student-student interaction, the fax/Internet model is the more accessible of the two since fax services in Indonesia are cheaper than Internet access, and do not require students to have basic computing and emailing skills. These two models were initially piloted over a two-semester period and results revealed low participation rates for both students and tutors. This was due partly to the lack of familiarity and comfort with using the technology and partly to more basic confusion over the purpose of the tutorials. Tutors also claimed that the limited availability of computers, lack of time and low student participation dampened their initial interest in electronic tutorials. Thus, while Internet and fax technologies have the potential to enhance learning support at Universitas Terbuka, practical steps must be taken to improve tutor-to-computer ratios, upgrade the computing and emailing skills of both academic staff and students, more aggressively promote the electronic tutorial model, and not least, collaborate with external institutions to create more Internet access points throughout Indonesia.

How can ICTs help transform the learning environment into one that is learner-centered?

Research has shown that the appropriate use of ICTs can catalyze the paradigmatic shift in both content and pedagogy that is at the heart of education reform in the 21st century. If designed and implemented properly, ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning. When used appropriately, ICTs—especially computers and Internet technologies—enable new ways of teaching and learning rather than simply allow teachers and students to do what they have done before in a better way. These new ways of teaching and learning are underpinned by constructivist theories of learning and constitute a shift from a teacher-centered pedagogy—in its worst form characterized by memorization and rote learning—to one that is learner-centered.

• **Active learning.** ICT-enhanced learning mobilizes tools for examination, calculation and analysis of information, thus providing a platform for student inquiry, analysis and construction of new information. Learners therefore learn as they do and, whenever appropriate, work on real-life problems in-depth, making learning less abstract and more relevant to the learner’s life situation.
In this way, and in contrast to memorization-based or rote learning, ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning is also “just-in-time” learning in which learners can choose what to learn when they need to learn it.

**Collaborative learning.** ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners’ teaming and communicative skills as well as their global awareness. It models learning done throughout the learner’s lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields.

**Overview of Pedagogy in the Industrial versus the Information Society More Less (‘emerging pedagogy’ Aspect (‘traditional pedagogy’) for the information society)**

- Activities prescribed by teacher
- Activities determined by learners
- Whole class instruction
- Small groups
- Little variation in activities
- Many different activities
- Pace determined by the programme
- Pace determined by learners

**Collaborative • Individual**

- Working in teams
- Homogenous groups • Heterogeneous groups
- Everyone for him/herself • Supporting each other

**Creative • Reproductive learning • Productive learning**

- Apply known solutions to problems • Find new solutions to problems
The Uses of ICTs in Education

Education policymakers and planners must first of all be clear about what educational outcomes (as discussed above) are being targeted. These broad goals should guide the choice of technologies to be used and their modalities of use. The potential of each technology varies according to how it is used. Haddad and Draxler identify at least five levels of technology use in education: presentation, demonstration, drill and practice, interaction, and collaboration. Each of the different ICTs—print, audio/video cassettes, radio and TV broadcasts, computers or the Internet—may be used for presentation and demonstration, the most basic of the five levels. Except for video technologies, drill and practice may likewise be performed using the whole range of technologies. On the other hand, networked computers and the Internet are the ICTs that enable interactive and collaborative learning best; their full potential as educational tools will remain unrealized if they are used merely for presentation or demonstration.

How have radio and TV broadcasting been used in education?

Radio and television have been used widely as educational tools since the 1920s and the 1950s, respectively. There are three general approaches to the use of radio and TV broadcasting in education:21

1) **direct class teaching**, where broadcast programming substitutes for teachers on a temporary basis;
2) **school broadcasting**, where broadcast programming provides complementary teaching and learning resources not otherwise available; and

3) **general educational programming over community**, national and international stations which provide general and informal educational opportunities.

The most notable and best documented example of the direct class teaching approach is Interactive Radio Instruction (IRI). This consists of “ready-made 20-30 minute direct teaching and learning exercises to the classroom on a daily basis. The radio lessons, developed around specific learning objectives at particular levels of maths, science, health and languages in national curricula, are intended to improve the quality of classroom teaching and to act as a regular, structured aid to poorly trained classroom teachers in under-resourced schools. IRI projects have been implemented in Latin America and Africa. In Asia, IRI was first implemented in Thailand in 1980; Indonesia, Pakistan, Bangladesh and Nepal rolled out their own IRI projects in the 1990s. What differentiates IRI from most other distance education programs is that its primary objective is to raise the quality of learning—and not merely to expand educational access—and it has had much success in both formal and non-formal settings. Extensive research around the world has shown that many IRI projects have had a positive impact on learning outcomes and on educational equity. And with its economies of scale, it has proven to be a cost-effective strategy relative to other interventions. Mexico’s Telesecundaria is another notable example of direct class teaching, this time using broadcast television. The programme was launched in Mexico in 1968 as a cost-effective strategy for expanding lower secondary schooling in small and remote communities. Perraton describes the programme thus: Centrally produced television programs are beamed via satellite throughout the country on a scheduled basis (8 am to 2 pm and 2 pm to 8 pm) to Telesecundaria schools, covering the same secondary curriculum as that offered in ordinary schools. Each hour focuses on a different subject area and typically follows the same routine—15 minutes of television, then book-led and teacher-led activities. Students are exposed to a variety of teachers on television but have one home teacher at the school for all disciplines in each grade. The design of the programme has undergone many changes through the years, shifting from a “talking heads” approach to more interactive and dynamic programming that “link[s] the community to the programme around the teaching method. The
strategy meant combining community issues into the programs, offering children an integrated education, involving the community at large in the organization and management of the school and stimulating students to carry out community activities. Assessments of Telesecundaria have been encouraging: drop out rates are slightly better than those of general secondary schools and significantly better than in technical schools. In Asia, the 44 radio and TV universities in China (including the China Central Radio and Television University), Universitas Terbuka in Indonesia, and Indira Ghandi National Open University have made extensive use of radio and television, both for direct class teaching and for school broadcasting, to reach more of their respective large populations. For these institutions, broadcasts are often accompanied by printed materials and audio cassettes. Japan’s University of the Air was broadcasting 160 television and 160 radio courses in 2000. Each course consists of 15 45-minute lectures broadcast nationwide once a week for 15 weeks. Courses are aired over University-owned stations from 6 am to 12 noon. Students are also given supplemental print materials, face-to-face instruction, and online tutorials. Often deployed with print materials, cassettes and CD-ROMS, school broadcasting, like direct class teaching, is geared to national curricula and developed for a range of subject areas. But unlike direct class instruction, school broadcasting is not intended to substitute for the teacher but merely as an enrichment of traditional classroom instruction. School broadcasting is more flexible than IRI since teachers decide how they will integrate the broadcast materials into their classes. Large broadcasting corporations that provide school broadcasts include the British Broadcasting Corporation Education Radio TV in the United Kingdom and the NHK Japanese Broadcasting Station. In developing countries, school broadcasts are often a result of a partnership between the Ministry of Education and the Ministry of Information. General educational programming consists of a broad range of programme types—news programs, documentary programs, quiz shows, educational cartoons, etc.—that afford non-formal educational opportunities for all types of learners. In a sense, any radio or TV programming with informational and educational value can be considered under this type. Some notable examples that have a global reach are the United States-based television show Sesame Street, the all-information television channels National Geographic and Discovery, and the radio programme Voice of America. The Farm Radio Forum, which began in Canada in the 1940s and which has since served as a model for radio discussion programs worldwide, is another example of non-formal educational programming.
What is teleconferencing and what have been its educational uses?

Teleconferencing refers to “interactive electronic communication among people located at two or more different places.” There are four types of teleconferencing based on the nature and extent of interactivity and the sophistication of the technology: 1) audioconferencing; 2) audiographic conferencing, 3) videoconferencing; and 4) Web-based conferencing. Audioconferencing involves the live (real-time) exchange of voice messages over a telephone network. When low-bandwidth text and still images such as graphs, diagrams or pictures can also be exchanged along with voice messages, then this type of conferencing is called audiographic. Non-moving visuals are added using a computer keyboard or by drawing/writing on a graphics tablet or whiteboard. Videoconferencing allows the exchange not just of voice and graphics but also of moving images. Videoconferencing technology does not use telephone lines but either a satellite link or television network (broadcast/cable). Web-based conferencing, as the name implies, involves the transmission of text, and graphic, audio and visual media via the Internet; it requires the use of a computer with a browser and communication can be both synchronous and asynchronous. Teleconferencing is used in both formal and non-formal learning contexts to facilitate teacher-learner and learner-learner discussions, as well as to access experts and other resource persons remotely. In open and distance learning, teleconferencing is a useful tool for providing direct instruction and learner support, minimizing learner isolation. For instance, an audiographic teleconferencing network between Tianjin Medical University in China and four outlying Tianjin municipalities was piloted in 1999 as part of a multi-year collaboration between Tianjin Medical University and the University of Ottawa School of Nursing funded by the Canadian International Development Agency. The audiographic teleconferencing network aims to provide continuing education and academic upgrading to nurses in parts of Tianjin municipality where access to nursing education has been extremely limited. Other higher education institutions using teleconferencing in their online learning programs include the Open University of the United Kingdom, Unitar (Universiti Tun Abdul Ruzak) in Malaysia, Open University of Hong Kong, and Indira Gandhi National Open University.

How have computers and the Internet been used for teaching and learning?

There are three general approaches to the instructional use of computers and the Internet, namely:
1) Learning about computers and the Internet, in which technological literacy is the end goal;

2) Learning with computers and the Internet, in which the technology facilitates learning across the curriculum; and

3) Learning through computers and the Internet, integrating technological skills development with curriculum applications.

What does it mean to learn about computers and the Internet?

Learning about computers and the Internet focuses on developing technological literacy. It typically includes:

- Fundamentals: basic terms, concepts and operations
- Use of the keyboard and mouse
- Use of productivity tools such as word processing, spreadsheets, data base and graphics programs
- Use of research and collaboration tools such as search engines and email
- Basic skills in using programming and authoring applications such as Logo or HyperStudio
- Developing an awareness of the social impact of technological change.

Issues in the Use of ICTs in Education

Effectiveness, cost, equity, and sustainability are four broad intertwined issues which must be addressed when considering the overall impact of the use of ICTs in education.

Does ICT-enhanced learning really work?

The educational effectiveness of ICTs depends on how they are used and for what purpose. And like any other educational tool or mode of educational delivery, ICTs do not work for everyone, everywhere in the same way.
Enhancing access. It is difficult to quantify the degree to which ICTs have helped expand access to basic education since most of the interventions for this purpose have been small-scale and under-reported. One exception is the television-based project Telesecundaria (discussed in a previous section), which in 1997-98 was serving over 750,000 junior secondary students in 12,000 centres in Mexico. In Asia and Africa, assessments of distance learning projects at the junior secondary level using a combination of print, taped, and broadcast technologies have been less conclusive, while at the primary level there is little evidence that ICT-based models have thrived.45 In higher education and adult training, there is some evidence that educational opportunities are being opened to individuals and groups who are constrained from attending traditional universities. Each of the 11 so-called mega-universities, the biggest and most well-established open and distance institutions in the world (which include the Open University of the United Kingdom, the Indira Gandhi National Open University of India, the China TV University System, the Universitas Terbuka of Indonesia, and the University of South Africa, among others) has an annual enrollment of more than 100,000, and together they serve approximately 2.8 million. Compare that with the 14 million combined enrollment of the 3,500 colleges and universities in the United States.

Raising quality. The impact of educational radio and television broadcasts on the quality of basic education remains an under-researched area, but what little research there is suggests that these interventions are as effective as traditional classroom instruction. Of the many educational broadcast projects, the Interactive Radio Instruction project has been the most comprehensively analyzed. Findings provide strong evidence of the project’s effectiveness in raising the quality of education as demonstrated by increased scores on standardized tests as well as improved attendance. In contrast, assessments of the use of computers, the Internet and related technologies for distance learning have been equivocal. Russell, in his comprehensive review of research, claims that there is “no significant difference” between the test scores of learners taking ICT-based distance learning courses and those receiving face-to-face instruction. However, others claim that such generalizations are inconclusive, pointing out that the large number of articles on ICT-based distance learning does not include original experimental research or case studies. Other critics argue that dropout rates are much higher when instruction is delivered at a distance via ICTs. There have also been many studies that seem to support the claim that the use of computers enhances and amplifies existing curricula, as measured through standardized testing.
Specifically, research shows that the use of computers as tutors, for drill and practice, and for instructional delivery, combined with traditional instruction, results in increases in learning in the traditional curriculum and basic skills areas, as well as higher test scores in some subjects compared to traditional instruction alone. Students also learn more quickly, demonstrate greater retention, and are better motivated to learn when they work with computers. But there are those who claim that these represent modest gains and, in any case, much of the research on which these claims are based are methodologically flawed. Research likewise suggests that the use of computers, the Internet, and related technologies, given adequate teacher training and support, can indeed facilitate the transformation of the learning environment into a learner-centered one. But these studies are criticized for being mostly exploratory and descriptive in nature and lacking in empirical rigor. There is as yet no strong evidence that this new learning environment fosters improved learning outcomes. What does exist are qualitative data based on observations and analysis of student and teacher perceptions that suggest a positive impact on learning. One of the most critical problems in trying to assess the effectiveness of computers and the Internet as transformational tools is that standardized tests cannot capture the kinds of benefits that are expected to be gained in a learner-centered environment. Moreover, since technology use is fully integrated into the larger learning system, it is very difficult to isolate the technology variable and determine whether any observed gains are due to technology use or to some other factor or combination of factors.

How much does it cost?

Broadly speaking, educational television broadcasts and computer-based and online learning are more expensive than radio broadcasts. There is disagreement, however, over whether television broadcasts are cheaper than computer-based and online learning. That said, categorical assessments of cost-effectiveness are difficult to make because of lack of data, differences in programs, problems of generalization, and problems of quantification of educational outcomes and opportunity costs. Speaking specifically of computers and the Internet, Blurton argues that “[w]hen considering whether ICT is “cost-effective” in educational settings, a definitive conclusion may not be possible for a variety of reasons. However, when considering the alternative of building more physical infrastructure, the cost savings to be realized from sharing resources, and the societal price of not providing access, ICT as a means of enabling teaching and learning appears to be an attractive and necessary alternative.” A common mistake in estimating the cost
of a particular ICT educational application is to focus too much on initial fixed costs—purchase of equipment, construction or retrofitting of physical facilities, initial materials production, and the like. But studies of the use of computers in classrooms, for example, show that installation of hardware and retrofitting of physical facilities account for only between 40% to 60% of the full cost of using the computers over their lifetime, or its total cost of ownership. In fact, while at first glance it may seem that the initial purchase of hardware and software is the costliest part of the process, the bulk of the total cost of ownership is spread out over time, with annual maintenance and support costs (known as variable or recurrent costs) constituting between 30% to 50% of the total cost of hardware and software. The cost of professional development, another variable cost, also accumulates over time. For computer-based approaches the total cost of ownership therefore includes:

**FIXED COSTS**

- Retrofitting of physical facilities
- Hardware and networking
- Software
- Upgrades and replacement (in about five years)

**VARIABLE OR RECURRENT COSTS**

- Professional development
- Connectivity, including Internet access and telephone time
- Maintenance and support, including utilities and supplies In order to determine cost efficiencies, fixed costs must be distinguished from variable costs, and the balance between the two understood. If the fixed costs of a technology project are high and its variable costs are low, then there will be cost advantages to scaling up. This is the case with general educational radio and television broadcasting. Programs such as Sesame Street and Discovery are more cost-efficient the larger their audience since the high cost of production is distributed over a larger viewer base while no staff expenditures are made for learner support. On the other hand, the case of Telesecundaria in Mexico demonstrates that the impact of higher variable costs related to learner support may be offset if the scale of the project is sufficiently large to the point where per
student costs compare favorably with those of traditional schools. Similarly, with the Interactive Radio Instruction project annual cost per student is estimated to fall from US$8.25 with 100,000 students to US$3.12 with 1,000,000. Obviously, these economies of scale may be achieved only in countries with large populations. Open and distance learning institutions have also achieved cost-effectiveness through economies of scale. Per student costs of the 11 mega-universities range from only 5% to 50% of the average of the traditional universities in their respective countries. The introduction of computers represents additional costs for schools but without short-term cost advantages. Data on cost of computer use per student in both primary and secondary schools in fact suggest cost-ineffectiveness. In Chile, for example, cost per primary school student is between US$22 and US$83, with expenditures for computer use requiring 10% to 37% of the national primary school budget. In the U.S., computer investments accounted for 1.3% of total expenditure on schools, with annual cost per student at US$70. Perraton and Creed suggest that these levels of cost support the argument against putting computers in every classroom, particularly in primary schools where there are no strong curricular arguments for investment in computers. In secondary schools, spending money on computers may be justified by the curriculum but this will come with significant increases in total school expenditure. Another dimension of cost is location, or who will pay for what. In projects that involve computers connected to the Internet, either the school or student or both bear the variable costs related to operations such as maintenance, Internet service charges, and telephone line charges. In contrast, with radio programming the learner has to pay only for a radio and a set of batteries.

Is there equity of access to ICTs in education?

Given the wide disparities in access to ICTs between rich and poor countries and between different groups within countries, there are serious concerns that the use of ICTs in education will widen existing divisions drawn along economic, social, cultural, geographic, and gender lines. Ideally, one wishes for equal opportunity to participate. But access for different actors—both as users and producers—is weighted by their resources. Hence, initial differences are often reproduced, reinforced, and even magnified....A formidable challenge, therefore, continues to face planners of international education: how to define the problem and provide assistance for development. The introduction of ICTs in education, when done without careful deliberation, can result in the further marginalization of those who are already underserved and/or disadvantaged.
For example, women have less access to ICTs and fewer opportunities for ICT-related training compared to men because of illiteracy and lack of education, lack of time, lack of mobility, and poverty. Boys are more likely than girls to have access to computers in school and at home. Not surprisingly, boys tend to enjoy working with computers more than girls. As the American Association of University Women reports, “Girls have narrowed some significant gender gaps, but technology is now the new ‘boys’ club’ in our nation’s public schools. While boys programme and problem solve with computers, girls use computers for word processing…” In an evaluation of its programme in four African countries, Worldlinks, an organization that promotes project-based, international telecollaboration activities among secondary school teachers and students from developing countries, it was found that despite efforts to make the programme gender neutral, gender inequalities in access persist in Uganda and Ghana. Furthermore, while girls benefited more from the programme in terms of improved academic performance and communication skills, boys were able to hone their technological skills more. A complex of economic, organizational, and sociocultural factors account for these differences: “High student-to-computer ratios and first come first serve policies do not favour girls (typically heavily outnumbered by boys at the secondary level), girls have earlier curfew hours and domestic chore responsibilities which limit their access time, and local patriarchal beliefs tend to allow boys to dominate the computer lab environment.” Measures proposed to address this gender bias include encouraging schools to develop “fair use” policies in computer labs, conducting gender sensitivity sessions, and advocating for reducing the after-school duties of girls to give them more time to use the computer lab. Girls also need to have female role models to inspire them to participate in technology-related activities. Providing access to ICTs is only one facet of efforts to address equity issues. Equal attention must be paid to ensuring that the technology is actually being used by the target learners and in ways that truly serve their needs. An ICT-supported educational programme that illustrates this wholistic approach is the Enlace Quiché: Bilingual Education in Guatemala Through Teacher Training programme. The programme seeks to establish and maintain bilingual education technology centres for educators, students, teachers, parents, and community members in Quiché and neighboring areas. The technical teams for each centre are composed of three students, two teachers, and the centre administrator, with at least one female student and one female teacher. Another objective of Enlace Quiché is the creation of multimedia bilingual educational materials that are anchored on the Mayan culture and that reflect a constructivist approach to learning. As the project website notes, this “demonstrate[s]
that the technology can be used to know, to conserve, to disclose and to value local knowledge.” The project thus illustrates a model for bridging the digital divide arising from the monopoly in Internet content provision by Western and English-speaking groups and from uneven capacities to make purposeful, relevant and critical use of digital resources (see section on language and content below). Another example of a wholistic approach to ICT integration in education is a radio instruction project in Mongolia called the Gobi Women’s Project. It seeks to provide literacy and numeracy instruction built around lessons of interest to around 15,000 nomadic women, and to create income opportunities for them. Among the programme topics are livestock rearing techniques; family care (family planning, health, nutrition and hygiene); income generation using locally available raw materials; and basic business skills for a new market economy.

Are ICT-enhanced educational projects sustainable?

One aspect of development programs that is often neglected is sustainability. The long history of development aid has shown that too many projects and programs start with a bang but all too soon fade out with a whimper, to be quickly forgotten. This is true for many ICT-based educational projects as well. In many instances, these projects are initiated by third party donors—such as international aid agencies or corporations—and not enough attention is paid to establishing a mechanism by which the educational institution or community involved can pursue the project on its own or in partnership with other stakeholders after the initiating donor exits. But cost and financing are not the only barriers to sustainability. According to Cisler, the sustainability of ICT-enabled programs has four components: social, political, technological, and economic.

**Economic sustainability** refers to the ability of a school and community to finance an ICT-enabled programme over the long term. Cost-effectiveness is key, as technology investments typically run high and in many cases divert funds from other equally pressing needs. Planners should look to the total cost of ownership (see preceding discussion on cost) and build lucrative partnerships with the community to be able to defray all expenses over the long term. The need to develop multiple channels of financing through community participation ties economic sustainability closely to social and political sustainability.

**Social sustainability** is a function of community involvement. The school does not exist in a vacuum, and for an ICT-enabled project to succeed the buy-in of parents, political leaders,
business leaders and other stakeholders is essential. Innovation can happen only when all those who will be affected by it, whether directly or indirectly, know exactly why such an innovation is being introduced, what the implications are on their lives, and what part they can play in ensuring its success. ICT-enabled programs must ultimately serve the needs of the community. Thus community-wide consultation and mobilization are processes critical to sustainability. In short, a sense of ownership for the project must be developed among all stakeholders for sustainability to be achieved.

**Political sustainability** refers to issues of policy and leadership. One of the biggest threats to ICT enabled projects is resistance to change. If, for instance, teachers refuse to use ICTs in their classrooms, then use of ICTs can hardly take off, much less be sustained over the long term. Because of the innovative nature of ICT-enabled projects, leaders must have a keen understanding of the innovation process, identify the corresponding requirements for successful adoption, and harmonize plans and actions accordingly.

**Technological sustainability** involves choosing technology that will be effective over the long term. In a rapidly changing technology environment, this becomes a particularly tricky issue as planners must contend with the threat of technological obsolescence. At the same time, there is the tendency to acquire only the latest technologies (which is understandable in part because these are the models which vendors are likely to push aggressively) Generally, however, planners should go with tried and tested systems; stability issues plague many of the latest technologies. Again, the rule of thumb is to let the learning objectives drive the technology choice and not vice versa—the latest technologies may not be the most appropriate tools for achieving the desired educational goals. When making technology decisions, planners should also factor in not just costs but also the availability of spare parts and technical support.

**Key Challenges in Integrating ICTs in Education**

Although valuable lessons may be learned from best practices around the world, there is no one formula for determining the optimal level of ICT integration in the educational system. Significant challenges that policymakers and planners, educators, education administrators, and other stakeholders need to consider include educational policy and planning, infrastructure, language and content, capacity building, and financing.
What are the implications of ICT-enhanced education for educational policy and planning?

Attempts to enhance and reform education through ICTs require clear and specific objectives, guidelines and time-bound targets, the mobilization of required resources, and the political commitment at all levels to see the initiative through. Some essential elements of planning for ICT are listed below.

a. A rigorous analysis of the present state of the educational system. ICT-based interventions must take into account current institutional practices and arrangements. Specifically, drivers and barriers to ICT use need to be identified, including those related to curriculum and pedagogy, infrastructure, capacity-building, language and content, and financing.

b. The specification of educational goals at different education and training levels as well as the different modalities of use of ICTs that can best be employed in pursuit of these goals. This requires of the policymaker an understanding of the potentials of different ICTs when applied in different contexts for different purposes, and an awareness of priority education needs and financial and human resource capacity and constraints within the country or locality, as well as best practices around the world and how these practices can be adapted for specific country requirements.

c. The identification of stakeholders and the harmonizing of efforts across different interest groups.

d. The piloting of the chosen ICT-based model. Even the best designed models or those that have already been proven to work in other contexts need to be tested on a small scale. Such pilots are essential to identify, and correct, potential glitches in instructional design, implementability, effectiveness, and the like.

e. The specification of existing sources of financing and the development of strategies for generating financial resources to support ICT use over the long term.

What are the infrastructure-related challenges in ICT-enhanced education?

A country’s educational technology infrastructure sits on top of the national telecommunications and information infrastructure. Before any ICT-based programme is launched, policymakers and planners must carefully consider the following:
• In the first place, are appropriate rooms or buildings available to house the technology? In countries where there are many old school buildings, extensive retrofitting to ensure proper electrical wiring, heating/cooling and ventilation, and safety and security would be needed.

• Another basic requirement is the availability of electricity and telephony. In developing countries large areas are still without a reliable supply of electricity and the nearest telephones are miles away. Experience in some countries in Africa point to wireless technologies (such as VSAT or Very Small Aperture Terminal) as possible levers for leapfrogging. Although this is currently an extremely costly approach, other developing countries with very poor telecommunications infrastructure should study this option.

• Policymakers should also look at the ubiquity of different types of ICT in the country in general, and in the educational system (at all levels) in particular. For instance, a basic requirement for computer-based or online learning is access to computers in schools, communities, and households, as well as affordable Internet service. In general, ICT use in education should follow use in society, not lead it. Education programs that use cutting-edge technologies rarely achieve long term success: It is cheaper, and easier, to introduce a form of technology into education, and keep it working, where education is riding on the back of large-scale developments by governments or the private sector. Television works for education when it follows rather than precedes television for entertainment; computers in schools can be maintained once commercial and private use has expanded to the point where there is an established service industry.

What are the challenges with respect to capacity-building?

Various competencies must be developed throughout the educational system for ICT integration to be successful.

**Teachers.** Teacher professional development should have five foci:

1) skills with particular applications;

2) integration into existing curricula

3) curricular changes related to the use of IT (including changes in instructional design);

4) changes in teacher role; and 5) underpinning educational theories.
Ideally, these should be addressed in pre-service teacher training and built on and enhanced in-service. In some countries, like Singapore, Malaysia, and the United Kingdom, teaching accreditation requirements include training in ICT use. ICTs are swiftly evolved.

Will ICTs Replace the Teacher?

The answer is a resounding NO! In fact, with the introduction of ICTs in the classroom, the teacher’s role in the learning process becomes even more critical. What can and should change is the kind of role that the teacher plays. The role of students, in turn, also expands. And since ICTs can open up the classroom to the outside world, the community can also play a new role in the classroom. As learning shifts from the “teacher-centered model” to a “learner-centered model”, the teacher becomes less the sole voice of authority and more the facilitator, mentor and coach—from “sage on stage” to “guide on the side”. The teacher’s primary task becomes to teach the students how to ask questions and pose problems, formulate hypotheses, locate information and then critically assess the information found in relation to the problems posed. And since ICT-enhanced learning is a new experience even for the teachers, the teachers become co-learners and discover new things along with their students. Additionally, it is not uncommon to see students in an ICT-enabled classroom assume both formal and informal roles as teachers of their peers and younger students, sometimes even of their own teachers. Teachers and students from different schools, subject-matter experts, parents, community and business leaders, politicians, and other interested parties also become involved in the learning process—as resource persons, critics, mentors, and cheerleaders. They also comprise a public, and hopefully critical, audience for students’ work published on the Web or through other media. Yet many teachers are reluctant to use ICTs, especially computers and the Internet. Hannafin and Savenye identify some of the reasons for this reluctance: poor software design, skepticism about the effectiveness of computers in improving learning outcomes, lack of administrative support, increased time and effort needed to learn the technology and how to use it for teaching, and the fear of losing their authority in the classroom as it becomes more learner-centered. These are all issues that must be addressed by both pre-service teacher education and in-service teacher professional development programs if schools and other educational institutions are to fully exploit the potential of computers and the Internet as educational tools. At the in-service level, ICT teacher professional development (TPD) should be long-term, teacher-directed, and as flexible as possible. For many under-qualified, overworked, and underpaid teachers in developing countries,
Effective adoption of ICTs hinges on being given continuous opportunities to learn what they need to learn based on their specific circumstances and experience, when they have the time to learn it. Institutionalized incentives and support for teachers to pursue ICT TPD are also critical. This may take the form of promotions for teachers who innovate with (as opposed to merely using) ICTs in the classroom, or simply making sure that teachers have adequate access to technology after training.

Effective learning is possible by five sensory means. According to psychological study human can grasp 80% knowledge visually, 15% through hearing & 5% with the rest of the sensory items. So it becomes necessary to present the content by attractive means. Computer technology helps us to provide rich presentation. To provide rich presentation, it is necessary to use the various components like:-
1. Text matter presentation
2. Animation presentation
3. Graphic presentation
4. Audio presentation
5. Video presentation

Computer Aided Teaching has become popular now-a-days. The notes, printed text books can be digitized with the help of computer technology. Many e-books are available on websites developed by different publishers. Encyclopedia is also available on internet.

6. Online Results tests Feedback
7. Software Progress reports
8. Search engines
9. Libraries
10. Internet
12. Employees
INTRODUCTION TO PROJECT BASED LEARNING

PBL can help you as a teacher create a high performing classroom in which you and your students form a powerful learning community focused on achievement, self-mastery, and contribution to the community. Gathered over the past ten years, PBL appears to be an equivalent or slightly better model for producing gains in academic achievement, although results vary with the quality of the project and the level of student engagement. Also, PBL is not appropriate as a method for teaching certain basic skills such as reading or computation; however, it does provide an environment for the application of those skills.

More important, evidence shows that PBL enhances the quality of learning and leads to higher-level cognitive development through students’ engagement with complex, novel problems. It is also clear that PBL teaches students complex processes and procedures such as planning and communicating. Accomplishing these goals, however, requires time for both teachers and students to master the behaviors and strategies necessary for successful PBL. In addition to research, convincing reports have come from teachers that PBL is a rigorous, relevant, and engaging instructional model that supports authentic inquiry and autonomous learning for students. Along with encouraging academic proficiency and meeting the traditional goals of education, PBL has important benefits for today’s students.

**Definition:** A systematic teaching method that engages students in learning essential knowledge and life-enhancing through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks.

**Characteristics of project-based learning:**
- Students making decisions within a framework
- A problem or challenge to be solved;
- Students designing the process for reaching a solution
- Students gathering and managing information
- Continuous evaluation
- Students regularly reflecting on the process
- A final product to be evaluated for quality
- An atmosphere that tolerates error and change
The key elements and processes:

1. Learning objectives: Learning objectives are laid out in the rubric, and students should be able to tell which ones they’re covering in any given project.
2. Peer review: Honest feedback and ongoing adjustments help projects to continually improve. Both students and instructors participate in a peer review protocol.
3. Entry event: Instructors introduce each project with an entry event to hook the students and get them engaged in the content, to provide an exemplar of the instructors’ expectations, and to introduce key vocabulary.
4. “Need-to-know” list: Keywords in the entry event should prompt students to identify new concepts they’ll need to learn and help them make connections to related content they already know.
5. Rubric: Instructors carefully design rubrics to define the desired learning outcomes for a project, including which learning objectives students are expected to master and how performance will be measured for each outcome.
6. Group contract: Students use group contracts to document expectations for each team member to enhance individual accountability. Each project team writes a contract that clearly defines everyone’s roles, responsibilities, and contributions to the project, and students are held to it.
7. Research and collaboration: It is up to the students to work together to figure out what their final product is going to be and how they will acquire the knowledge they need to complete it.
8. Assessment and adjustment: Throughout the process, instructors and students give and receive feedback and make adjustments accordingly.
9. Presentations: Some form of presentations are the common element to project-based projects.
10. Final assessment: Because instructors take pains to observe student progress throughout the process, the final assessments tend to be relatively easy. The work up front on creating a clearly defined rubric that identifies multiple learning outcomes and criteria also helps considerably.
Additional resources

1. Criteria for effective assessment in project-based learning:
• When designing, use R.A.F.T. as a way to ensure an authentic culminating product: Students are
  given a topic (T); they choose a role (R) that they will take on individually and as a group, such as
  marketer, author, blogger, campaign manager, etc.; and they choose an Audience (A) obviously
  related to the role. Students also choose the format (F) that they will use, such as webpage, press
  release, letter, museum exhibit, or podcast.
• Target select power objectives.
• Select 21st Century skills to teach and assess.
• Formative assess only for purpose of revision and improvement.

2. Types of assessment for project-based learning:
• Written examinations
• Practical examinations
• Concept maps
• Peer assessment
• Self-assessment
• Instructor assessment
• Oral presentations
• Reports
• Student portfolios

3. Top ten tips for assessing project-based learning:
• Keep it real with authentic products.
• Don’t overlook soft skills.
• Learn from big thinkers.
• Use formative strategies to keep projects on track.
• Gather Feedback fast.
• Focus on teamwork.
• Track progress with digital tools.
• Grow your audience.
• Do-It-Yourself professional development.
• Assess better together.

THE BENEFITS OF PBL
As a field, PBL is still in the developmental stage. For example, there is not sufficient research or empirical
data to state that PBL is a proven alternative to other forms of instruction. Based on evidence
In standards-based PBL, students are pulled through the curriculum by a Driving Question or authentic
problem that creates a need to know the material.

Teachers report that PBL:
• Overcomes the dichotomy between knowledge and thinking, helping students to both “know” and “do.”
• Supports students in learning and practicing skills in problem solving, communication, and self
management.
• Encourages the development of habits of mind associated with lifelong learning, civic responsibility, and
personal or career success.
• Integrates curriculum areas, thematic instruction, and community issues.
• Assesses performance on content and skills using criteria similar to those in the work world, thus
encouraging accountability, goal setting, and improved performance.
• Creates positive communication and collaborative relationships among diverse groups of students.
• Meets the needs of learners with varying skill levels and learning styles.
• Engages and motivates bored or indifferent students.
As with any teaching method, PBL can be used effectively or ineffectively. At its best, PBL can help you as a teacher create a high performing classroom in which you and your students form a powerful learning community focused on achievement, self-mastery, and contribution to the community. It allows you to focus on central ideas and salient issues in your curriculum, create engaging and challenging activities in the classroom, and support self-directed learning among your students.

PBL IN YOUR CLASSROOM
Planning for a project must take into account what is possible in your classroom. The scope of a project will be affected by the bell schedule, the time of year, standardized testing, and the other myriad factors that impact your work. Perhaps the first question that usually arises is: do I have time to do this project? To answer that question, it is helpful not to think of PBL as taking time away from the regular curriculum. Instead, consider a standards-focused project as a central method of teaching and learning that replaces conventional instruction for a portion of your course. Standards-focused projects teach students the same essential information you might teach them through lecture and discussion. PBL teachers also find that they do considerably less “busy work” activities in the classroom. And, though projects take time to plan, teachers have more time to work with students once a project is under way.

COVERAGE VERSUS “UNCOVERAGE”
It is true that projects do not lend themselves to covering a laundry list of topics, as too often happens in the classroom. But in the case of good education, less is more. If you are pressed for time and need to include many topics in your instruction during a year, you may want to think about the concept of “uncoverage.” This means making a deliberate decision about topics that you want to teach in depth versus topics that can be simply “covered.” What parts of your curriculum can be easily and successfully handled through lectures or textbook assignments? What parts require more depth? Identify those topics that reflect the most important ideas and concepts in your curriculum—and incorporate those topics into projects. Those are the topics with which you want students to grapple. The remaining topics you can deal with through direct instruction.

INTRODUCTION TO PROJECT BASED LEARNING ARE YOUR STUDENTS CAPABLE?
Two questions regarding students immediately arise when you are thinking about a project. How much will they be involved? And, are they capable of a project, both behaviorally and academically? Student autonomy is one of the hallmarks of PBL. Still, most teachers introduce student autonomy in stages, depending upon students’ age and experience. Before planning your project, think about how much you want your students to be involved in its design and how much autonomy they will have in carrying out project activities. You may want to select the project topic, particularly for the first project in your classroom. With students who are eager and prepared, you may wish to have them select the project topic and define the learning outcomes. Your role becomes one of coach and facilitator, helping students shape the project so that it meets content standards and allows for a variety of assessments. Are your students ready and capable? That question can be answered based only on your experience and knowledge. The Handbook will offer you ideas on how to scaffold lessons for students in a way that prepares them for the academic knowledge, as well as for the skills, that may be required for them to succeed in the project. Often, teachers do not introduce projects until the midfall or later, giving them time to assess students and prepare them for project work. If students have not had experience with projects, it’s worth remembering that they will need training in such skills as collaboration, research, project management, and oral presentations. Plus, you may have to manage them closely until they have mastered self-management skills.

YOUR STYLE AND SKILLS
Once teachers feel comfortable with PBL, they usually find teaching with projects to be more fulfilling and enjoyable. PBL is a way of working with students as they discover more about themselves and the world, and that brings job satisfaction. However, in addition to strong instructional and organizational skills, PBL requires that teachers facilitate and manage the process of learning. Rather than rely on the model of the child as an empty vessel to be filled, PBL teachers must create tasks and conditions under which student thinking can be revealed—a cocreative process that involves inquiry, dialogue, and skill building as the project proceeds. Though most teachers recognize that active learning is vital, not all of us react in the same way to an open-ended process. Projects are sometimes described as chaotic or messy (though in a well-structured project, it only appears to be disorderly—it’s really just the ambiguous problem-solving process that is under way). Prior to a project is a good time to reflect on your teaching style and skills. How will you
operate in a PBL environment? Are you comfortable with children moving around a classroom or with the ambiguity that characterizes a more open-ended learning process? It may help to ask yourself this question: do you prefer to be a leader or a manager? Leaders facilitate problem solving in a group and help the group find their own solutions. Managers control the process and look for prescribed outcomes. In reality, good teachers go back and forth between the two roles. But if you are hesitant to release control over your students, you may want to avoid projects or start small until you feel comfortable and skilled in project leadership. As a leader, your job is to help each student produce a superior product by facilitating learning. As students gather data and progress in their problem solving, they will encounter obstacles and opportunities. At the heart of successful PBL is your ability to support and direct students (or conversely, your ability to let them struggle with a problem or information as they search out answers and solutions). This requires interpersonal and communication skills, as well as the ability to define the agenda for the class and push a project through to a successful conclusion. It also includes being sensitive to the fact that students finish work at different rates, with different abilities, aptitudes, and learning styles.

**PBL AND YOUR SCHOOL**

PBL works extremely well in schools that have extended blocks of time instead of 50-minute periods. Similarly, when schools are formed around small learning communities such as academies or Once teachers feel comfortable with PBL, they usually find teaching with projects to be more fulfilling and enjoyable. PBL is a way of working with students as they discover more about themselves and the world, and that brings job satisfaction. PBL is a natural tool for teaching and learning. But if your school does not have these reforms in place, it is still possible to create excellent projects for students. You will also find that good projects in classrooms encourage changes in the culture and structure of schools. Schools are under increasing pressure to raise standards, improve climate, and personalize education. PBL can contribute significantly to this process by encouraging teacher collaboration, motivating students to achieve, using the tools and language of project management and organizational change, and helping to incorporate school-wide learning outcomes into the curriculum. In particular, PBL fits well with efforts to create a high-performance school culture that values both rigor and relevance. In addition, projects are a great way to involve parents and community members in the educational process, a result that often leads to more support for the school and a better understanding of the needs of students. A question often asked by teachers in low-performing schools is: can Project Based Learning work in my school? It can. For students with basic skills issues, it may be necessary to include more direct instruction during a project, design shorter projects, or tie projects closely to fewer and more specific standards. But PBL offers all students the opportunity to investigate authentic topics of interest to them, thus engaging them in the learning process in ways that traditional instruct
Computer Aided Learning (CAL)
COMPUTER Assisted Learning (CAL) has been a term of increasing significance during the last decade and can also be referred to as Computer Based Instruction (CBI), Computer Aided Learning (CAL), or Computer Aided Instruction (CAI) (1). For the purpose of this review, we can simply define CAL as the learning procedures and environments facilitated through computers. However, the keyword for understanding CAL is interaction. Computers can facilitate interaction during the learning process on multiple levels. On one level we have interaction of the student/ user with the content and the learning material (for example with an interactive patient on a CDROM). On another level, computers can host interaction of the student/user with the tutor, peer interaction or interaction between members of whole ‘virtual’ learning communities. The concept of interaction with content was first introduced in applications as early as the 1980’s and is probably the best studied aspect of CAL (2). Computers’ facilitation of interaction between humans, however, has only emerged during the last decade, as explosive technological progress and the Internet allowed reliable and inexpensive communication. Computer literacy is still low. New authoring tools make it easier for faculties to develop their own CAL software. In the future we will see more sophisticated software with virtual patients who can communicate and interact with the student in a very realistic way. The software will even “step out” from the screen and help the student with clinical procedures. However, at present CAL should not replace traditional education, but rather be used more as a supplement and for self-directed studies. Computer mediated human-human interaction is a whole new area in CAL, which presents special methodological considerations and requires separate study CAL applications where interaction is limited between the user and the content, as the educational experience with these applications is wider, and their future prospects are also remarkable. These CAL applications were initially designed for local use as part of the traditional curriculum. However as both technology and educational experience mature, the real potential of these programs unfolds in distance learning. It is important to remark that although interactive CAL programs are accessed from different places, they are directed by the same educational principles. For instance an “interactive patient” can be accessed through a CDROM in the university ICT lab supplementing the local curriculum, and the same application can be available on the web as part of a distance learning course. In both cases, the learning principles and methodological implications are identical, as long as the interaction remains between the user and the content. Therefore study of this kind of application even if in a local environment, is directly applicable to the use of CAL in distance learning, where the future of the medium undoubtedly lies.

Definitions:
Computer Aided Learning (CAL) or Computer Assisted learning can be defined as learning or teaching subjects like mathematics, Science, Geography, and etc., through computers with subject wise learning packages/materials.
· It may include all types of Technology-Enhanced Learning (TEL), where technology is used to support the learning process.
· It is said to be: "Pedagogy empowered by digital technology".
· In broader sense, it may be considered as a part of E-Learning.

History of Computer-based Learning
Computer assisted learning, or CAL, is not a new phenomenon. Computer Assisted Learning can be defined as a computer program or file developed specifically for educational purposes. The technique used throughout the world in a variety of contexts, from Primary school to University. In the 1980s, the first computer assisted learning became available to University students. The CAL Idea is highly dependent to the following educational events:


Main Objectives:
These visual, animated learning materials not only help to memorize the tough topics at ease but also it will act as a virtual laboratory experiments.

Some so called hard subjects, viz., English, Mathematics and Science will be joyful through computer.

Computer aided learning packages will serve as a better teaching learning materials.

This audiovisual technique will help and motivate Children With Special Needs (CWSN) to read.

Above objectives will in turn help to reduce drop out, repetition rate. Enhance in the achievement levels etc.

Implementation technique:
A computer room(laboratory room is must) with some computers along with an audio and visual output device to show learning packages on a large screen using an LCD projector. After discussion of subject, teacher may show learning packages on that particular topic. Student can practice and also an evaluation can take place like EExam( as it is also on computer and at the same time result can be displayed to the students).

Infrastructural Components:
1) Laboratory Room.
2) Computers and LCD Projector.
3) Learning Packages.
4) Trained Teachers.
5) Motivation.
6) Discipline, Administration and etc