TECNOLOGY FOR ADULT LEARNING

Topic Objective:

At the end of this topic student would be able to:

- Introduce information and communication technology in adult education.
- Give the importance of ICT Program.
- Discuss the term curriculum.

Definition/Overview:

Information and Communication Technology (education): Information and Communication Technology (ICT) is a subject in education, and a part of the National Curriculum. Other countries, such as the Philippines, also have ICT as an educational subject. In South Australia, ICT is not a subject until the final two years of schooling, and in Norway ICT is a course you can select for your second year of upper secondary school. From pre-school to Year 10 ICT is interwoven throughout the curriculum as part of the Essential Learning of Communication.

Key Points:

1. ICT Program

The ICT programme in the United Kingdom is co-ordinated by Becta. A major current initiative is the Curriculum Online scheme which is aimed to accelerate the uptake of technology amongst schools. Becta took over the running of this scheme from the Department for Education and Skills in 2005. Becta works closely with the Joint Information Systems Committee to develop strategy. ICT has also enabled learning through multiple intelligence as ICT has introduced learning through simulation games; this enables active learning through all senses. Many schools have specialist school status in technology and, more recently, in maths and computing, and these schools champion the use of ICT to enhance teaching and learning. DA-IICT was the first university in India to offer an undergraduate engineering degree in ICT (B.Tech, ICT), the emphasis on ICT in its curriculum apparent from the last three letters in its name.

2. Curriculum

An academic discipline is a branch of knowledge which is formally taught, either at the university, or via some other such method. Functionally, disciplines are usually defined and recognized by the academic journals in which research is published, and by the learned societies to which their practitioners belong. Professors say schooling is 80% psychological, 20% physical effort. Each discipline usually has several sub-disciplines or branches, and distinguishing lines are often both arbitrary and ambiguous. Examples of broad areas of academic disciplines include the natural sciences, mathematics, computer science, social sciences, humanities and applied sciences.

3. Learning modalities

There has been a great deal of work on learning styles over the last two decades. Dunn and Dunn focused on identifying relevant stimuli that may influence learning and manipulating the school environment, at about the same time as Joseph Renzulli recommended varying teaching strategies. Howard Gardner dentified individual talents or aptitudes in his Multiple Intelligences theories. Based on the works of Jung, the Myers-Briggs Type Indicator and Keirsey Temperament Sorter focused on understanding how people's personality affects the way they interact personally, and how this affects the way individuals respond to each other within the learning environment. The work of David Kolb and Anthony Gregorc's Type Delineator follows a similar but more simplified approach. It is currently fashionable to divide education into different learning "modes". The learning modalities are probably the most common:

- Kinesthetic: learning based on hands-on work and engaging in activities.
- Visual: learning based on observation and seeing what is being learned.
- Auditory: learning based on listening to instructions/information.

It is claimed that, depending on their preferred learning modality, different teaching techniques have different levels of effectiveness. A consequence of this theory is that effective teaching should present a variety of teaching methods which cover all three learning modalities so that different students have equal opportunities to learn in a way that is effective for them.

4. Teaching

Teachers need the ability to understand a subject well enough to convey its essence to a new generation of students. The goal is to establish a sound knowledge base on which students will be able to build as they are exposed to different life experiences. The passing of knowledge from generation to generation allows students to grow into useful members of society. Good teachers can translate information, good judgment, experience and wisdom into relevant knowledge that a student can understand, retain and pass to others. As a profession, teaching has very high levels of Work-Related Stress; WRS which are listed as amongst the highest of any profession in some countries, such as the United Kingdom. The degree of this problem is becoming increasingly recognized and support systems are put into place.

5. Technology

Technology is an increasingly influential factor in education. Computers and mobile phones are being widely used in developed countries both to complement established education practices and develop new ways of learning such as online education (a type of distance education). This gives students the opportunity to choose what they are interested in learning. The proliferation of computers also means the increase of programming and blogging. Technology offers powerful learning tools that demand new skills and understandings of students, including Multimedia, and provides new ways to engage students, such as Virtual learning environments. Technology is being used more not only in administrative duties in education but also in the instruction of students. The use of technologies such as PowerPoint and interactive whiteboard is capturing the attention of students in the classroom. Technology is also being used in the assessment of students. One example is the Audience Response System (ARS), which allows immediate feedback tests and classroom discussions.

Information and communication technologies (ICTs) are a diverse set of tools and resources used to communicate, create, disseminate, store, and manage information. These technologies include computers, the Internet, broadcasting technologies (radio and television), and telephony. There is increasing interest in how computers and the Internet can improve education at all levels, in both formal and non-formal settings. Older ICT technologies, such as radio and television, have for over forty years been used for open and distance learning, although print remains the cheapest, most accessible and therefore most dominant delivery mechanism in both developed and developing countries. The use of computers and the Internet is still in its infancy in developing countries, if these are used at all, due to limited infrastructure and the attendant high costs of access. Usually, various technologies are used in combination rather than as the sole delivery mechanism. For example, the Kothmale Community Radio Internet uses both radio broadcasts and computer and Internet technologies to facilitate the sharing of information and provide educational opportunities in a rural community in Sri Lanka. The Open University of the United Kingdom (UKOU), established in 1969 as the first educational institution in the world wholly dedicated to open and distance learning, still relies heavily on print-based materials supplemented by radio, television and, in recent years, online programming. Similarly, the Indira Gandhi National Open University in India combines the use of print, recorded audio and video, broadcast radio and television, and audio conferencing technologies. The term "computer-assisted learning" (CAL) has been increasingly used to describe the use of technology in teaching.

Topic : Can Quality In Learning Be Enhanced Through The Use Of It

Topic Objective:

At the end of this topic student would be able to:

- Introduce information technology enhanced learning.
- Give information about technology enhanced learning.
- Discuss different learning activities.

Definition/Overview:

Information Technology Enhanced Learning: The existing definitions for technology enhanced learning spread very broad and change continuously due to the dynamic nature of this evolving research field. Hence, the definition of TEL must be as broad and general as possible in order to capture all aspects:

Key Points:

1. Technology enhanced learning (TEL)

Technology enhanced learning (TEL) has the goal to provide socio-technical innovations (also improving efficiency and cost effectiveness) for learning practices, regarding individuals and organizations, independent of time, place and pace. The field of TEL therefore describes the support of any learning activity through technology.

2. Learning Activity

A learning activity can be described in terms of the

- **Learning resources:** creation, distribution, access, compilation, consumption of digital content; tools and services
- **Actions:** communication, collaboration, interaction with software tools
- **Context:** time and location
- **Roles:** A learning activity is carried out by various actors in changing roles (e.g. student, teacher, facilitator, learning coach, human resource or education manager).
- **Learning objective:** to support every human in achieving her or his learning goals, respecting individual as well as organizational learning preferences

Learning activities can follow different pedagogical approaches and didactic concepts. The main focus in TEL is on the interplay between these activities and respective technologies. This can range from enabling access to and authoring of a learning resource to elaborate software systems managing (e.g. learning management system, learning content management systems, learning repositories, adaptive learning hypermedia systems, etc.) and managing (human resource management systems; tools for self-directed learning, etc.) the learning process of learners with technical means.

TEL is often used synonymously for eLearning even though there are significant differences. The main difference between the two expressions is that TEL focuses on the technological support of any pedagogical approach that utilizes technology. However this is rarely presented as including print technology or the developments around libraries, books and journals in the centuries before computers.

3. **Growth of e-learning**

By 2006, nearly 3.5 million students were participating in on-line learning at institutions of higher education in the United States. Many higher education, for-profit institutions, now offer on-line classes. By contrast, only about half of private, non-profit schools offer them. The Sloan report, based on a poll of academic leaders, says that students generally appear to be at least as satisfied with their on-line classes as they are with traditional ones. Private Institutions may become more involved with on-line presentations as the cost of instituting such a system decreases. Properly trained staff must also be hired to work with students on-line. These staff members must be able to not only understand the content area, but also be highly trained in the use of the computer and Internet. Online education is rapidly increasing, and online doctoral programs have even developed at leading research universities.

4. Technology

Many technologies can be, and are, used in e-Learning, from blogs to collaborative software, ePortfolios, and virtual classrooms. Most eLearning situations use combinations of the techniques. Along with the terms learning technology, instructional technology, and Educational Technology, the term is generally used to refer to the use of technology in learning in a much broader sense than the computer-based training or Computer Aided Instruction of the 1980s. It is also broader than the terms Online Learning or Online Education which generally refer to purely web-based learning. In cases where mobile technologies are used, the term M-learning has become more common. E-learning, however, also has implications beyond just the technology and refers to the actual learning that takes place using these systems.

E-learning is naturally suited to distance learning and flexible learning, but can also be used in conjunction with face-to-face teaching, in which case the term Blended learning is commonly used. In higher education especially, the increasing tendency is to create a Virtual Learning Environment (VLE) (which is sometimes combined with a Management Information System (MIS) to create a Managed Learning Environment) in which all aspects of a course are handled through a consistent user interface standard throughout the institution. A growing number of physical universities, as well as newer online-only colleges, have begun to offer a select set of academic degree and certificate programs via the Internet at a wide range of levels and in a wide range of disciplines. While some programs require students to attend some campus classes or orientations, many are delivered completely online. In addition, several universities offer online student support services, such as online advising and registration, e-counselling, online textbook purchase, student governments and student newspapers. E-Learning can also refer to educational web sites such as those offering learning scenarios, worksheets and interactive exercises for children. The term is also used extensively in the business sector where it generally refers to cost-effective online training.

5. Services

E-learning services have evolved since computers were first used in education. There is a trend to move toward blended learning services, where computer-based activities are integrated with practical or classroom-based situations.

Topic : Children Writing Words And Building Thoughts: Does The Word Processor Really Help

Topic Objective:

At the end of this topic student would be able to:

- Introduce
- Give
- Discuss

Definition/Overview:

Word processor: A word processor (more formally known as document preparation system) is a computer application used for the production (including composition, editing, formatting, and possibly printing) of any sort of printable material.

Key Points:

1. Word Processor

Word processor may also refer to an obsolete type of stand-alone office machine, popular in the 1970s and 80s, combining the keyboard text-entry and printing functions of an electric typewriter with a dedicated computer for the editing of text. Although features and design varied between manufacturers and models, with new features added as technology advanced, word processors for several years usually featured a monochrome display and the ability to save documents on memory cards or diskettes. Later models introduced innovations such as spell-checking programs, increased formatting options, and dot-matrix printing. As the more versatile combination of a personal computer and separate printer became commonplace, the word processor disappeared.

Word processors are descended from early text formatting tools (sometimes called text justification tools, from their only real capability). Word processing was one of the earliest applications for the personal computer in office productivity. Although early word processors used tag-based markup for document formatting, most modern word processors take advantage of a graphical user interface. Most are powerful systems consisting of one or more programs that can produce any arbitrary combination of images, graphics and text, the latter handled with type-setting capability. Microsoft Word is the most widely used computer word processing system; Microsoft estimates over five hundred million people use the Office suite, which includes Word. There are also many other commercial word processing applications, such as WordPerfect, which dominated the market from the mid-1980s to early-1990s, particularly for machines running Microsoft's MS-DOS operating system. Open-source applications such as OpenOffice.org

Writer and KWord are rapidly gaining in popularity. Online word processors such as Google Docs are a relatively new category.

2. Characteristics

Word processing typically refers to text manipulation functions such as automatic generation of:

- batch mailings using a form letter template and an address database (also called mail merging);
- indices of keywords and their page numbers;
- tables of contents with section titles and their page numbers;
- tables of figures with caption titles and their page numbers;
- cross-referencing with section or page numbers;
- footnote numbering;
- new versions of a document using variables (e.g. model numbers, product names, etc.)

Other word processing functions include "spell checking" (actually checks against wordlists), "grammar checking" (checks for what seem to be simple grammar errors), and a "thesaurus" function (finds words with similar or opposite meanings). In most languages grammar is very complex, so grammar checkers tend to be unreliable and also require a large amount of RAM. Other common features include collaborative editing, comments and annotations, support for images and diagrams and internal cross-referencing.

Word processors can be distinguished from several other, related forms of software: Text editors (modern examples of which include Notepad, Emacs and vi), were the precursors of word processors. While offering facilities for composing and editing text, they do not format documents. This can be done by batch document processing systems, starting with TJ-2 and RUNOFF and still available in such systems as LaTeX (as well as programs that implement the paged-media extensions to HTML and CSS). Text editors are now used mainly by programmers, website designers, and computer system administrators. They are also useful when fast startup times, small file sizes and portability are preferred over formatting.

Later desktop publishing programs were specifically designed to allow elaborate layout for publication, but often offered only limited support for editing. Typically, desktop publishing programs allowed users to import text that they have written using a text editor or word processor. Almost all word processors enable users to employ styles, which are used to automate consistent formatting of text body, titles, subtitles, highlighted text, and so on. Styles are the key to managing the formatting of large documents, since changing a style automatically changes all text that the style has been applied to. Even in shorter documents styles can save a lot of time while formatting. However, most help files refer to styles as an 'advanced feature' of the word processor, which often discourages users from using styles regularly.

3. Document statistics

Most current word processors can calculate various statistics pertaining to a document. These usually include:

- Character count, word count, sentence count, line count, paragraph count, page count
- Word, sentence and paragraph length
- Editing time

Errors are common; for instance, a dash surrounded by spaces like either of these may be counted as a word.

4. Typical usage

Word processors have a variety of uses and applications within the business world, home, and education.

5. Business

Within the business world, word processors are extremely useful tools. Typical uses include:

- Memos
- Letters and letterhead
- Legal copies
- Reference documents

Businesses tend to have their own format and style for any of these. Thus, versatile word processors with layout editing and similar capabilities find widespread use in most businesses.

6. Education

Many schools have begun to teach typing and word processing to their students, starting as early as elementary school. Typically these skills are developed throughout secondary school in preparation for the business world. Undergraduate students typically spend many hours writing essays. Graduate and doctoral students continue this trend, as well as creating works for research and publication. These manuscripts are often in excess of 200 pages, and are typically the defining point of a student's career.

7. Home

While many homes have word processors on their computers, word processing in the home tends to be educational or business related, dealing with assignments or work being completed at home. Some use word processors for letter writing, rsum creation, and card creation. However, many of these home publishing processes have been taken over by desktop publishing programs such as Adobe Pagemaker, which is better suited for these types of documents.

Topic : Number Education For Very Young Children: Can It Change The Nature Of Early Years Mathematics Education?

Topic Objective:

At the end of this topic student would be able to:

- Introduce computer based Mathematics Education.
- Give first level analysis of mathematics and education.
- Discuss the second level of analysis regarding computers.

Definition/Overview:

Computer Based Mathematics Education: Computer Based Mathematics Education (CBME) refers to a mathematics education method that is enriched by using computers. In order to analyze CBME in detail, the disciplines of mathematics, education, and computers including their features should be explored more and understood deeply because the domain of CBME is based on the intersection of these three disciplines and CBME rises up over this domain. In mathematics, intersection of two different sets is defined as a set which contains elements from both sets so that intersection set demonstrates the properties of both sets. However, the situation is bit different in our case because although the features of these disciplines generate a base for the science of CBME, CBME has synthesized these disciplines and developed its own interpretation and features. This is true for all intersections as in the example of water. Water is completely a different substance than both hydrogen and oxygen.

This analysis will be performed in three stages: In the first stage, main domains and features of mathematics, education, and computers will be analyzed in order to clarify which aspects of these disciplines demonstrate what kinds of contents. In the second stage, the intersection of these main domains and their double interactions will be analyzed, and potential research areas will be described. Finally, in the third stage, a deeper analysis will be performed over the intersection of these three domains in order to explore the types of new and uncovered connections and features of this area.

Key Points:

1. **First Level of Analysis**

1.1. **Mathematics**

Mathematicians are separated into two groups when defining the features of mathematics. One group describes mathematics as a science which helps us to discover the world surrounding us whereas the other believes that mathematics is a science created by human mind. The first description suggests that mathematics spread all over the world and mathematicians are the scientists who discover these secrets (i.e Content of the book, Number Mosaics: Journeys in Search of Universals, written by Kanga is a great example for this interpretation). On the other hand, according to the second group there is no mathematics in the world instead in human mind. Human mind creates all these axioms, definitions, relations, and proofs just to advance the mathematical knowledge but not to better understand the physical world. Bereiter and Scardamalia(1996) explain this by stating that "Formal Mathematics knowledge consists of World 3 objects, constructions of human intellect.

1.2. **Education**

Although there are many definitions of education in various disciplines, it is safe to classify the aims of education into three general groups: Subject matter, skills, and improving learning abilities. Subject matter refers to the subjects to be studied and therefore to be learned through a specific of education while the term of skills refers to the skills to be gained through education as problem solving skills, cognitive skills (analyzing, synthesizing, and creating), and metacognitive skills. Despite the importance of learning subject matter in all kinds of education types, educators also try to develop or advance various skills of the students in order to have them succeed in their academic life. In addition to these, improving learning abilities is another aim of education because it is developed after learning subject matter and advancing problemsolving, cognitive and metacognitive skills. The more people learn the easier and quicker they are to learn as a result of their previous experiences, i.e. people who know any second language learn the third one more quickly, fourth one even more quickly, and so on

1.3. Computers

Generally speaking, the features of computers can be classified as storage, process, and delivery. Storage and process refer to the storing and processing information while delivery refers to the transportation of information from one place to another via diskettes, CDs and/or some cutting-edge technologies like Intranet, Internet. These three main features can not be separated with each other completely because there are some grey areas which are impossible to distinguish, and they are running together.The data and/or the information coming from the environment to the computer will be stored in storage units either using for later purposes or processing by microprocessors. The storage and processors also work either together or one after another as well as the transportation units, because transportation and updating information processes are also in continuous progress. However, only the related features of computers will be taken into account in this analysis because computers and computer technology is huge area of science by itself. Internet and Internet technology is the most popular feature which is commonly used in educational environment.

2. Second Level of Analysis

2.1. Mathematics Education

Unlike many sciences, mathematics causes permanent changes in peoples life, and affects their interpretation of the world. That is why; mathematics education has excessive responsibilities on human's life and it is not quite right to say that mathematics education consists of only subject matter. In contrast, doing and knowing mathematics improve understanding, exploring, analyzing, and problem solving skills of people.

Although some of these skills help students to explore, to understand, and to discover the world around or to survive in the world they live, like problemsolving, many of these skills are gained through the process mathematics education, which is a mental process. Mind and philosophy of mind have been great debates for centuries. Epiphenomenalism and Cartesian dualism are some theories about mind and its causes, relations with physical world. Popper defines world in a three world chema, which can be examplified in mathematics as follows:

- **World 1:** World of manipulatives and legos used to define mathematical objects.
- **World 2:** World of mental objects like numbers, symbols and events like solving equation, cancellation of polynomials.
- **World 3:** World of product of human mind like theorems, proofs, set theory, derivatives, integrals.

Each world has its own domain and area of interests. Bereiter and Scardamalia (1996) discuss the Popper's three-world schema; explain these differences in educational point of view in order to pose a question that which approaches or approaches should be superior in school curriculum. They suggest that since each has different advantages and disadvantages school curriculum should employ a combination of all these three worlds.

2.2. Computers in Mathematics

Although use of computers in mathematics varies to some extent, and it is difficult to categorize completely, analyzing with 2x3 matrixes may provide a systematic look for us.

In case of discovery of world, database features and some office tools will be used to store the data gathered throughout discovery of the world, and data management feature of computers helps a lot to organize, reorganize and restructure of these datas. It is impossible to forget the affects of computers in exploring fractals in this stage, because the exploration journey of fractals mostly depends on the developments in features of computers. On the other hand, whereas there are lots of examples of fractals in the real world, there some imaginary fractals improved in human's mind like 4^{th} or n^{th} dimensions of vectors. i.e., real life examples of 4^{th} dimension of vectors were discovered after mathematicans'. Computers are used to help mathematician in various ways:

- Mathematicians share their experiences with each others and public via internet.
- They use computers to visualize what they imagine in their mind after introducing with high level of software.
- Computers are used to generalize mathematical relations like fractals because developments in capacities of computers provide mathematicians reiterate some mathematical operations thousands time in a small amount of time.
- Mathematician use computers for calculation, evaluation of huge and complex mathematical operations, solving equations by numerical methods.

2.3. Computers in Education

Computers are used in education in a number of ways: Tutorial, Hypermedia, Simulation, Drill and Practice, Educational game, Tools and Open-Ended Learning Environment, Web-Based Learning, and Online Collaborative Environment.

2.4. Computers in Education

- **Tutorials:** Tutorials are types of software that present information, check learning by question/answer method, judge response and provide feedback and usually provide students study personally. bilelim Geometry (1999), BioLab (2006) are some examples of this type.

- **Hypermedia**: This type of software provides students a database of information with multiple navigation methods and learning facilities, and also, a freedom of independence during the learning. Art and Life in Africa (1999), How your body works (1997) are some examples of this type of software.

- **Simulations**: This type of software provides students inteaction with simulations in order to learn as in their real life and use the storage and processing features of computers. Some leading examples are ChemLab (1994), Crocodile-Clips (2003).

- **Drills and Practice**: Unlike Tutorials, this type of software provides only test of information and feedback but not presenting information at the beginning, and they look like electronic versions of drill and practice text books. Pilot Software is an example for this type.

- **Educational Games**: They are more like simulations and used from elementary to college students. The Incredible Machines (2000) is a good example of this type.

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1. First Level of Analysis

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2. Second Level of Analysis

2.1. Mathematics Education

Unlike many sciences, mathematics causes permanent changes in peoples life, and affects their interpretation of the world. That is why; mathematics education has excessive responsibilities on human's life and it is not quite right to say that mathematics education consists of only subject matter. In contrast, doing and knowing mathematics improve understanding, exploring, analyzing, and problem solving skills of people.

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2.2. Computers in Mathematics

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In Section 2 of this course you will cover these topics:

- Do Electronic Data Bases Enable Children To Engage In Information Processing?
- Does Data Logging Change The Nature Of Children'S Thinking In Experimental Work In Science?
- Can Design Software Make A Useful Contribution To The Art Curriculum?
- Children Exploring The Queen'S House In Hypertext: Has The Hype Any Educational Potential?

Topic : Do Electronic Data Bases Enable Children To Engage In Information Processing?

Topic Objective:

At the end of this topic student would be able to:

- Introduce electronic database learning.
- Give the goals of e-learning.
- Discuss computer based learning and computer based training.

Definition/Overview:

Electronic Database learning: Electronic learning (or e-Learning or eLearning) is a term where the student and the teacher use online technology to interact and participate. No in-person interaction takes place. E-learning is used interchangeably in a wide variety of contexts. In companies it is referred to the strategies that use the company network to deliver training courses to employees. In distance education Universities like Open University in UK or Penn State World Campus in the USA, it is defined as a planned teaching/learning experience that uses a wide spectrum of technologies mainly Internet to reach learners at a distance. Lately in most Universities, e-learning is used to define a specific mode to attend a course or programmes of study where the students rarely, if ever, attend face-to-face or for on-campus access to educational facilities, because they study on-line.

Key Points:

1. Goals of e-learning

E-Learning lessons are generally designed to guide students through information or to help students perform in specific tasks. Information based e-Learning content communicates information to the student. Examples include content that distributes the history or facts related to a service, company, or product. In information-based content, there is no specific skill to be learned. In performance-based content, the lessons build off of a procedural skill in which the student is expected to increase proficiency.

2. Computer-based learning

Computer Based Learning, sometimes abbreviated to CBL, refers to the use of computers as a key component of the educational environment. While this can refer to the use of computers in a classroom, the term more broadly refers to a structured environment in which computers are used for teaching purposes. The concept is generally seen as being distinct from the use of computers in ways where learning is at least a peripheral element of the experience (e.g. computer games and web browsing).

3. Computer-based training

Computer-based training (CBT) services are where a student learns by executing special training programs on a computer relating to their occupation. CBT is especially effective for training people to use computer applications because the CBT program can be integrated with the applications so that students can practice using the application as they learn. Historically, CBTs growth has been hampered by the enormous resources required: human resources to create a CBT program, and hardware resources needed to run it. However, the increase in PC computing power, and especially the growing prevalence of computers equipped with CD-ROMs, is making CBT a more viable option for corporations and individuals alike. Many PC applications now come with some modest form of CBT, often called a tutorial. Web-based training (WBT) is a type of training that is similar to CBT; however, it is delivered over the Internet using a web browser. Web-based training frequently includes interactive methods, such as bulletin boards, chat rooms, instant messaging, videoconferencing, and discussion threads. Web based training is usually a self-paced learning medium though some systems allow for online testing and evaluation at specific times.

4. Pedagogical elements

Pedagogical elements are an attempt to define structures or units of educational material. For example, this could be a lesson, an assignment, a multiple choice question, a quiz, a discussion group or a case study. These units should be format independent, so although it may be implemented in any of the following methods, pedagogical structures would not include a textbook, a web page, a video conference or an iPod video. When beginning to create e-Learning content, the pedagogical approaches need to be evaluated. Simple pedagogical approaches make it easy to create content, but lack flexibility, richness and downstream functionality. On the other hand, complex pedagogical approaches can be difficult to set up and slow to develop, though they have the potential to provide more engaging learning experiences for students. Somewhere between these extremes is an ideal pedagogy that allows a particular educator to effectively create educational materials while simultaneously providing the most engaging educational experiences for students.

5. Pedagogical approaches or perspectives

It is possible to use various pedagogical approaches for eLearning which include:

- **Instructional Design:** the traditional pedagogy of instruction which is curriculum focused, and is developed by a centralized educating group or a single teacher.
- **Social-Constructivist:** this pedagogy is particularly well afforded by the use of discussion forums, blogs, wiki and on-line collaborative activities. It is a collaborative approach that opens educational content creation to a wider group including the students themselves.
- **Laurillard's Conversational Model** is also particularly relevant to eLearning, and Gilly Salmon's Five-Stage Model is a pedagogical approach to the use of discussion boards
- **Cognitive perspective** focuses on the cognitive processes involved in learning as well as how the brain works.
- **Emotional perspective** focuses on the emotional aspects of learning, like motivation, engagement, fun, etc.
- **Behavioural perspective** focuses on the skills and behavioural outcomes of the learning process. Role-playing and application to on-the-job settings.
- **Contextual perspective** focuses on the environmental and social aspects which can stimulate learning. Interaction with other people, collaborative discovery and the importance of peer support as well as pressure.

6. Reusability, standards and learning objects

Much effort has been put into the technical reuse of electronically-based teaching materials and in particular creating or re-using Learning Objects. These are self contained units that are properly tagged with keywords, or other metadata, and often stored in an XML file format. Creating a course requires putting together a sequence of learning objects. There are both proprietary and open, non-commercial and commercial, peer-reviewed repositories of learning objects such as the Merlot repository. A common standard format for e-learning content is SCORM whilst other specifications allow for the transporting of "learning objects" (Schools Interoperability Framework) or categorizing meta-data (LOM).

These standards themselves are early in the maturity process with the oldest being 8 years old. They are also relatively vertical specific: SIF is primarily pK-12, LOM is primarily Corp, Military and Higher Ed, and SCORM is primarily Military and Corp with some Higher Ed. PESC- the Post-Secondary Education Standards Council- is also making headway in developing standards and learning objects for the Higher Ed space, while SIF is beginning to seriously turn towards Instructional and Curriculum learning objects. In the US pK12 space there are a host of content standards that are critical as well- the NCES data standards are a prime example. Each state government's content standards and achievement benchmarks are critical metadata for linking e-learning objects in that space.

7. Communication technologies used in e-learning

Communication technologies are generally categorized as asynchronous or synchronous. Asynchronous activities use technologies such as blogs, wikis, and discussion boards. The idea here is that participants may engage in the exchange of ideas or information without the dependency of other participants involvement at the same time. Electronic mail (Email) is also asynchronous in that mail can be sent or received without having both the participants involvement at the same time. Synchronous activities involve the exchange of ideas and information with one or more participants during the same period of time. A face to face discussion is an example of synchronous communications. Synchronous activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting. Virtual classrooms and meetings can often use a mix of communication technologies.

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings.

8. E-Learning 2.0

The term e-Learning 2.0 is used to refer to new ways of thinking about e-learning inspired by the emergence of Web 2.0 . From an e-Learning 2.0 perspective, conventional e-learning systems were based on instructional packets that were delivered to students using Internet technologies. The role of the student consisted in learning from the readings and preparing assignments. Assignments were evaluated by the teacher. In contrast, the new e-learning places increased emphasis on social learning and use of social software such as blogs, wikis, podcasts and virtual worlds such as Second Life. This phenomenon has also been referred to as Long Tail Learning. The new focus in social learning replaces the traditional Cartesian View of knowledge and learning. The Cartesian perspective that underpins the old e-learning assumes that knowledge is a kind of substance, so it can be packaged using instructional methodologies in order to be delivered and transferred to the students. By contrast, e-learning 2.0 assumes that knowledge (as meaning and understanding) is socially constructed. Construction takes place through conversations about content and grounded interaction about problems and actions. Advocates of social learning claim that one of the best ways to learn something is to teach it to others.

As one example, Second Life has recently become one of the virtual classroom environments used in colleges and universities, including Princeton University (USA), Rice University (USA), University of Derby (UK), Vassar College (USA), the University of Plymouth (UK) and the Open University (UK),. In 2007 Second Life started to be used for foreign language tuition Both Second Life and real life language educators have begun to use the virtual world for language tuition. English (as a foreign language) has gained a presence through several schools, including British Council projects which have focused on the Teen Grid. Spains language and cultural institute Instituto Cervantes has an island on Second Life. A list of educational projects (including some language schools) in Second Life can be found on the SimTeach site. SLanguages 2008 was the 2nd annual conference of language education using virtual worlds such as Second Life. The event took place in Second Life at the EduNation islands.

There is also an increased use of WebEx as an online learning platform and classroom for a diverse set of education providers such as Fox School of Business for Templer University, Grades Grow, Minnesota State Colleges and Universities, and SachemWebex is a Cisco Web Meetings and Collaboration Solution. The platform has worked for educational institutions because of real time collaboration using an interactive whiteboard, chat, and VOIP technology that allows audio and video sharing. In distance learning situations, while replacing the classroom with features, institutions have also looked for security features which are inherently strong in a Cisco powered collaboration environment. The downside is that Webex is not a free platform like WiZiQ, Moodle or Lectureshare, and fees are paid per 'host' of a classroom or a meeting.

9. Computer-aided assessment and learning design

Computer-aided Assessment (also but less commonly referred to as E-assessment), ranging from automated multiple-choice tests to more sophisticated systems is becoming increasingly common. With some systems, feedback can be geared towards a student's specific mistakes or the computer can navigate the student through a series of questions adapting to what the student appears to have learned or not learned. Most software for this is still very primitive however. The term learning design has sometimes come to refer to the type of activity enabled by software such as the open-source system LAMS which supports sequences of activities that can be both adaptive and collaborative. The IMS Learning Design specification is intended as a standard format for learning designs, and IMS LD Level A is supported in LAMS V2.

Many of the aspirations for quality teaching and learning with information technology are synonymous with those for the curriculum as a whole. However, we will argue that they are promoted and facilitated by new information and communication technologies and therefore can more easily become a reality in everyday classroom practice. 'Quality' is currently a contested term. If education is viewed as a system for preparing young people to make a valuable contribution to our society in adult life, quality may be seen in terms of the cost-effective use of teacher time and resources and the functional effectiveness of school-leavers in the job market. However, if the aims if education are seen in terms of fostering individual achievement and maximising human potential, quality may be seen in terms of the intrinsic value of educational experiences and the individual achievements and personal fulfilment of school-leavers. These contrasting views are an indication of the extent to which educational debate has currently become politicised - representing extremes between the functionalism of the free market and the individualism of liberal humanism. In looking at quality in teaching and learning we do not wish to align ourselves with either of these extremes.

Topic : Does Data Logging Change The Nature Of Children'S Thinking In Experimental Work In Science

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term data logging
- Give the uses of data logging in experimental work in science.
- Discuss about data logger.

Definition/Overview:

Data logging: Data logging is the practice of recording sequential data, often chronologically.

Etymology: To log is a verb derivative of the noun logbook; the verb form means to record in a logbook, and may have been coined in the 1820s. The term logbook itself stems from the practice of floating a stationary "log" (actually a wooden block attached to a reel via rope) to provide a fixed point of reference for the purpose of measuring a ship's speed. Computer scientists adopted the verb to log circa 1963 to describe the systematic recording of specific types of data processing events.

Computer data logging: In computerized data logging, a computer program may automatically record events in a certain scope in order to provide an audit trail that can be used to diagnose problems.

Examples of physical systems which have logging subsystems include process control systems, and the black box recorders installed in aircraft. Many operating systems and multitudinous computer programs include some form of logging subsystem. Some operating systems provide a syslog service, which allows the filtering and recording of log messages to be performed by a separate dedicated subsystem, rather than placing the onus on each application to provide its own ad hoc logging system. In many cases, the logs are esoteric and hard to understand; they need to be subjected to log analysis in order to make sense of them.

Key Points:

1. Data logger

A data logger (also datalogger or Data recorder) is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. Increasingly, but not entirely, they are based on a digital processor (or computer). They generally are small, battery powered, portable, and equipped with a microprocessor, internal memory for data storage, and sensors. Some data loggers interface with a personal computer and utilize software to activate the data logger and view and analyze the collected data, while others have a local interface device (keypad, LCD) and can be used as a stand-alone device. Data loggers vary between general purpose types for a range of measurement applications to very specific devices for measuring in one environment only. It is common for general purpose types to be programmable however many remain as static machines with only a limited number of changeable parameters. Electronic dataloggers have replaced chart recorders in many applications.

One of the primary benefits of using data loggers is the ability to automatically collect data on a 24-hour basis. Upon activation, data loggers are typically deployed and left unattended to measure and record information for the duration of the monitoring period. This allows for a comprehensive, accurate picture of the environmental conditions being monitored, such as air temperature and relative humidity.

2. Data Formats

Standardisation of protocols and data formats has been a problem but is now growing in the industry and XML is increasingly being adopted for data exchange. The development of the Semantic Web is likely to accelerate this trend.

3. Instrumentation Protocols

Several protocols have been standardised including a smart protocol, SDI-12, exists that allows some instrumentation to be connected to a variety of data loggers. The use of this standard has not gained much acceptance outside the environmental industry. SDI-12 also supports multi drop instruments. Some datalogging companies are also now supporting the MODBUS standard, this has been used traditionally in the industrial control area there are many industrial instruments which support this communication standard. Another multi drop protocol which is now starting to become more widely used is based upon Canbus (ISO 11898) Some data loggers utilize a flexible scripting environment to adapt themselves to various non-standard protocols.

4. Data logging versus data acquisition

The terms data logging and data acquisition are often used interchangeably. However, in a historical context they are quite different. A data logger is a data acquisition system, but a data acquisition system is not necessarily a data logger.

- Data loggers typically have slower sample rates. A maximum sample rate of 1 Hz may be considered to be very fast for a data logger, yet very slow for a typical data acquisition system.
- Data loggers are implicitly stand-alone devices, while typical data acquisition system must remain tethered to a computer to acquire data. This stand-alone aspect of data loggers implies on-board memory that is used to store acquired data. Sometimes this memory is very large to accommodate many days, or even months, of unattended recording. This memory may be battery-backed static random access memory, flash memory or EEPROM. Earlier data loggers used magnetic tape, punched paper tape, or directly viewable records such as "strip chart recorders".
- Given the extended recording times of data loggers, they typically feature a time- and date-stamping mechanism to ensure that each recorded data value is associated with a date and time of acquisition. As such, data loggers typically employ built-in real-time clocks whose published drift can be an important consideration when choosing between data loggers.

- Data loggers range from simple single-channel input to complex multi-channel instruments. Typically, the simpler the device the less programming flexibility. Some more sophisticated instruments allow for cross-channel computations and alarms based on predetermined conditions. The newest of data loggers can serve web pages, allowing numerous people to monitor a system remotely.
- The unattended and remote nature of many data logger applications implies the need in some applications to operate from a DC power source, such as a battery. Solar power may be used to supplement these power sources. These constraints have generally led the data logger industry to ensure that the devices they market are extremely power efficient relative to computers. In many cases they are required to operate in harsh environmental conditions where computers will not function reliably.
- This unattended nature also dictates that data loggers must be extremely reliable. Since they may operate for long periods nonstop with little or no human supervision, and may be installed in harsh or remote locations, it is imperative that so long as they have power, they will not fail to log data for any reason. Manufacturers go to great length to ensure that the devices can be depended on in these applications. As such dataloggers are almost completely immune to the problems that might affect a general-purpose computer in the same application, such as program crashes and the instability of some operating systems.

5. Data Logging And Childrens Learning

Almost every science teacher would agree that practical work enjoys a central place in school science for all age groups. It follows that the possibility of using computers during practical work has the potential to fit naturally into mainstream science activities. This has been given added impetus by the IT requirement set out in the National Curriculum for Science. It is clear that as in other areas of the curriculum IT in science is here to stay. So what is involved when pupils use computers during practical work? The term data logging is usually used to describe the activity by which measurements are collected during an experiment by sensors and then sent to a computer for processing. The main elements of a data logging system are sensors to collect the measurements, an interface or data logger, a computer and a computer program to control the process.

The sensors simply respond to the physical quantities which are to be measured, such as temperature, light level, sound level, oxygen concentration, etc. These measurements are then converted into an electrical signal which is passed on to the interface or data logger. Data loggers can collect information from several sensors simultaneously and then either pass the information directly to a computer or store the information so that it can be passed on later. When the information is sent to the computer it is often displayed on the computer screen in the form of a graph. However, the software also offers other facilities such as changing the ways in which the data are displayed or allowing further analysis of the data. Data loggers can be used in two different ways. In real-time logging the graph is presented on the computer screen at the same time as the experiment is in progress, whereas in remote data logging data are collected and stored in the data logger and then transferred later to a computer. Remote logging extends practical activities beyond the school laboratory, for example to woods and sea shores, and also allows experiments to last for longer than a single science lesson, e.g. several days.

A significant recent development has been the growing availability of affordable and powerful portable computers. These computers have a number of advantages for data logging over desktop computers. For example, they can be distributed and stored easily, they have a small 'footprint' on limited laboratory bench space and their hard disk gives pupils quick access to software and the possibility of building up a library of files during their science lessons. The potential of portable computers was confirmed in the recent Portable Computers in Schools project which involved the use of portable computers in 118 primary and secondary schools in all curriculum areas. The evaluation summary suggested that in science the portables provided increased opportunities for active learning particularly in relation to scientific investigations. We have now reached a stage at which all the elements for laboratory-based data logging are in place: a wide and growing range of sensors, sophisticated and easy to use data loggers, portable computers for easy access and storage and powerful software for the presentation and analysis of data.

6. Conventional Practical Science In Schools

Practical work can be either illustrative or investigative. Illustrative practical work is used to demonstrate scientific principles, ideas or concepts whereas investigative practical work is an opportunity for pupils to explore their own ideas and develop scientific understanding. Practical work usually involves planning, collecting and analysing experimental data.Why is practical work done? There are many reasons put forward but it centres around the belief that pupils will gain a greater insight into scientific ideas and concepts by having 'hands-on' experience. However, this will only be effective if pupils have the time and opportunity to reflect on what was done and, most importantly, have guidance and help from a skilful science teacher. The teacher is needed to provide a framework and to help pupils understand the wider significance of their observations. Far too often pupils spend most of the lesson simply collecting and processing data with far too little time available for the crucial analysis and discussion of those data which is so important for an effective scientific understanding. Unfortunately, many pupils see practical work as isolated and unconnected episodes.

7. Practical Science With Computers

What are the advantages of using computer-aided practical work? Can data logging assist in achieving the aims of practical science? It is clear that presenting the results of investigations in a graphical form at the same time as the activity is in progress will save time: time which can be used for the purposes discussed above. However, a number of other benefits are claimed for data logging beyond the time-saving aspect. These benefits centre on the fact that data can be presented in a graphical form on the computer screen as the experiment is in progress. The advantages suggested for data logging include:

- an immediate link between the investigation and the result, rather than the usual long delay between 'the experiment' and 'the graph', which are often seen as separate entities by pupils.
- time for the pupils to think and to watch, rather than spend all their time recording data (often taking little notice of their experimental set-up);
- enabling pupils to look at trends and gradients on the graph;

- Making the first experience qualitative-numbers are available later if they are required. This contrasts with the conventional approach which requires numerical data to be collected and a graph to be plotted before any kind of analysis is possible;
- Encouragement of pupils to predict and to test their predictions.

8. Simultaneous collection and presentation of data

A three-month study carried out by Mokros and Tinker (1987) making use of computer-aided practical work in several areas of the science syllabus noted significant gains in terms of pupils' graphing skills. They suggested that there may be four reasons for the success of such work: 'it uses multiple modalities, it pairs real time events with their symbolic representation, it provides a genuine scientific experience and it eliminates the drudgery of graph production'. Manipulating the equipment, experiencing the activity and seeing the physical phenomena change are among the benefits claimed for practical work in general. However, as suggested above, in the case of computer-aided practical work, pupils have the added benefit of seeing the graphical representation at the same time. An example of this was demonstrated by Brasell (1985) using a motion sensor. The motion sensor is a range-finding device which is placed on the edge of a bench and is connected to a computer. As pupils move in front of the device they can see a distance against time graph forming on the computer screen in response to their movement. Brasell worked with three groups of pupils who were taught about motion graphs. In the post-tests those who had used the motion sensor performed much better than those who had been taught conventionally. However, most significantly, the group who had used the motion sensor but who were only allowed to see the motion graph after a delay of twenty to thirty seconds performed as badly as those using conventional methods. It seemed that only a very short delay was enough to lose all the benefit evident when the graph is presented at the same time as the pupils' movements.

9. Focus effect of the computer screen

A feature reported by other researchers is the focusing effect the computer screen seems to have. For example, Nakhleh and Krajcik (1993), when comparing pupils' performance on acid-base titrations whilst using different levels of technology (from microcomputer to chemical indicators), suggested that a key factor was the way new technology can have the effect of narrowing the focus of the pupil's attention to the evolving graph on the screen. The transcript, which included pupils' actions, confirmed the way in which the screen was used as the focus point for the whole activity. Pupils used the screen to provide the basis for a shared experience. The videotape shows that pupils watched and frequently pointed to the screen throughout the activity. Comments were often made by the pupils as soon as data started to appear on the screen, particularly if the data did not coincide with their expectations.

10. Graphing skills

Practical work in science involves not only the use of equipment but also the development of data analysis skills. This has been re-emphasised in the recent changes to the Science National Curriculum which requires pupils to use graphs to identify relationships between variables and to be able to identify trends and patterns in results. Nachmias and Linn (1987) have reported a number of problems associated with the use of a computer to present graphical information. They reported that pupils tend to view computer-generated graphs uncritically, in much the same way as they are uncritical of graphical information presented in textbooks. They contrast this with the way pupils are willing to question graphs they draw themselves. My experience is that pupils tend to be uncritical of graphical data no matter how they are produced.

It is clear that computers can avoid the serious problems pupils face when trying to produce manual plots of moderately difficult data. For example, in the work on electrical power discussed earlier, half of the pupils who were described by their teachers as most able could not produce a plot of power against current using values such as 400 mW and

0.25 A. The use of the computer avoids these problems. However, no matter how the data are plotted, many pupils find data analysis and interpretation difficult. A closer look at the ways in which pupils analyse data on the computer screen indicates that their graphical analysis skills are in a very dynamic state, with evidence of rapid progress being observed over the period of one session whilst using the computer. Perhaps by giving time to focus on these skills rather than those of data processing, data logging will be a major factor in improving pupils' skills in this area. The problems noted mainly related to the origin and to the scale of the graph. In several sessions pupils misinterpreted the position of the origin or assumed that data would always pass through it. When looking for patterns some pupils saw small fluctuations due to experimental error as quite different numbers; in some cases this was further complicated by pupils reading eight significant figures from their calculator screen.

11. Pupil/teacher interactions

Potentially the most significant contribution is the effect this new technology may have on the ways in which pupils interact with each other and the teacher during practical work. Teachers will need to identify ways in which they can support pupils to make the most effective use of the software tools available to them. This will involve moving the focus of classroom attention away from activities which involve the collection and processing of data to activities in which pupils use software tools to make predictions and explore relationships between variables. A number of studies looking at other aspects of IT have identified the central role the teacher plays in making effective use of the technology. The SLANT (Spoken Language and New Technology) project suggests that the way in which teachers organise their classrooms, the precise instructions they give and the relationships established influence the course of computer-based activities and the quality of the talk generated by them. Amongst their It is very difficult to investigate pupil-pupil and pupil-teacher interactions during the course of normal classroom-based practical science activities; the data discussed below came from closely observing and videotaping pairs of pupils extracted from their normal science sessions. This has provided a detailed insight into these interactions even though the situation is rather artificial.

Topic : Can Design Software Make A Useful Contribution To The Art Curriculum?

Topic Objective:

At the end of this topic student would be able to:

- Introduce the experience of one school regarding software design curriculum.
- 1988-90 art curriculum at AMVC

Definition/Overview:

- **Progress in Education:** Progress in education doesn't travel in straight lines. It looks at this within the constraints of the secondary curriculum, and in particular the successive changes resulting from the implementation of the National Curriculum and its revisions during the five year period 1989-94. It reviews early experimentation with IT in the art department, during 1988-91, when the school was participating in the Pupil Autonomy in Learning with Microcomputers (PALM) Project ; and it shows how those ideas have been used as the basis for further development of IT use in art during 1992-4, particularly with eleven- to fourteen-year-olds.
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- **Key Points:**
- **1. The experience of one school**
- Arthur Mellows Village College (AMVC) is a seven-form entry, eleven to eighteen comprehensive school of some 1,200 pupils. It is situated in the Cambridgeshire Fens six miles to the north of Peterborough. The school has a large catchment area which extends from Wittering in the west to Thorney in the east. A large proportion of the pupils are bussed into the College.
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- The art department has always, since the school's foundation in 1949, had its own identity and a continuous share of curriculum time. It is now part of a creative arts faculty, and at the time of involvement with PALM was part of a design faculty. The faculty structure, in both instances, has been concerned with administrative rather than curriculum integration. The art department now has three fifty-minute periods per fortnight of curriculum time, whereas previously it had one seventy-minute period per week. The changes came about with the school's response to the National Curriculum. The department grew from three to four full-time specialists. Pressures

from the NC at Key Stage 4 (broadly speaking, fourteen- to sixteen-year-olds) led to a reduction in the number of full art options offered as General Certificate of Secondary Education examination courses, and the introduction of GCSE art/technology 'slim' course options. Art staff teach art-related aspects of technology-in graphics, textiles and materials study.

- PALM was funded by the National Council of Educational Technology in association with Cambridgeshire, Essex and Norfolk LEAs. PALM worked in partnership with teachers to research the role of IT in developing pupil autonomy in learning. It was led by a central team consisting of co-ordinator, secretary and three project officers. In Cambridgeshire Jon Pratt was seconded from his teaching post to take on this role. The core of the PALM project's research was carried out by around one hundred teachers in twenty-four schools. Thirty-six research reports written by teachers were published in the Teachers' Voices series. Although the project was intended for whole school initiatives, the directors kindly accepted a bid from the English and art departments at AMVC. This resulted in my working closely in partnership with Juliet Godber from the English department. There were carrots (computers) and cream cakes (cream cakes) and a considerable number of meetings and discussions with Jon Pratt and Bridget Somekh to set the project underway. We were encouraged to plan our own programme of research and development activities. Our self-designed brief was to introduce IT skills into the normal classrooms at AMVC, and to discover ways in which our pupils could take ownership of the benefits. The formal project lasted two years (1988-90) with a further extension of a year to 1991.

- **2. Starting Points**
- AMVC has had a long history of IT activity. A dedicated staff in the first IT department had introduced eleven- to twelve-year-old pupils to the primitive charms of the BBC Master, but the game didn't really get underway until the new generation of computers became available in the late 1980s. PALM surfed on that wave. Cambridgeshire Education had decided to align its schools with Acorn computers, to which all of its INSET and advisory service was dedicated. This decision produced its benefits and frustrations: initial software developments were painfully slow and unstandardised to other industrial/commercial systems; but there was an impressive network of support. When we joined PALM, in 1988, the IT inspector for

Cambridgeshire provided the art department with one stand-alone Archimedes machine. We had an instruction book and introduced ourselves to programs and systems that were as new to our school IT 'experts' as they were to us. Few of the pupils had had a significant IT experience before reaching the College, and those who had, through summer schools at the College, were most familiar with the relatively unsophisticated BBC Master. At the start of the PALM project the art curriculum at AMVC was becoming more clearly defined. All teachers shared a common syllabus for Key Stage 3 (broadly speaking, eleven- to fourteen-year-olds) in which pupils would be introduced to a common range of art media and themes. We were aware of the importance of building up the pupils' skills and concepts incrementally.

- **3. The 1988-90 art curriculum at AMVC**

Year	*Medium*	*Project*
7	Paint Clay Paper sculpture and drawing Card print	Still life jar of one-colour objects Our house Shoes Junk still life/plant forms
8	Lino print Graphics/paint Draw/paint	Figure in costume Carrier bag project Figure studies
9	Textile design Graphics Screenprint	Food Lettering project Village studies

- Each project was planned to start with a research element through direct drawing, or via the use of found elements (collage). Sometimes photography might be employed (village project and figure studies). Many of the projects would develop the forms and images gathered in this way through a design towards a particular end. Information about the technical process to be employed would also be taught at this time, so that appropriate forms and images could be used by the pupils. Projects that were aimed at specific design tasks (the carrier bag project and the textile design) usually involved considerable repetition of design, lettering and colour work as pupils worked through a variety of ideas from the original design brief. The skill requirements and strictures of the design process, with their elements of repetition and patient filling in of detail, were typical of the tasks that all designers faced in their work before the advent of electronic designing.

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- **4. Art And Design, It And The National Curriculum**
- The National Curriculum has been a catalyst for further development of the use of IT in art at AMVC, but like all externally imposed changes it has also acted as a constraint upon the development work already in progress. It was introduced, on a subject-by-subject basis, following the Education Reform Act of 1988. At AMVC we began initial planning for the NC in art during 1989-90 (the second year of the PALM project) but its impact was not really felt on the Key Stage 3 curriculum until 1992.

Topic : Children Exploring The Queen'S House In Hypertext: Has The Hype Any Educational Potential

Topic Objective:

At the end of this topic student would be able to:

- Introduce the terms hypertext.

Definition/Overview:

Hypertext: Hypertext most often refers to text on a computer that will lead the user to other, related information on demand. Hypertext represents a relatively recent innovation to user interfaces, which overcomes some of the limitations of written text. Rather than remaining static like traditional text, hypertext makes possible a dynamic organization of information through links and connections (called hyperlinks). Hypertext can be designed to perform various tasks; for instance when a user "clicks" on it or "hovers" over it, a bubble with a word definition may appear, a web page on a related subject may load, a video clip may run, or an application may open.

Key Points:

1. Types and uses of hypertext

Hypertext documents can either be static (prepared and stored in advance) or dynamic (continually changing in response to user input). Static hypertext can be used to cross-reference collections of data in documents, software applications, or books on CDs. A well-constructed system can also incorporate other user-interface conventions, such as menus and command lines. Hypertext can develop very complex and dynamic systems of linking and cross-referencing. The most famous implementation of hypertext is the World Wide Web and later added to the Internet.

2. Applications

The first hypermedia application was the Aspen Movie Map in 1977. In 1980, Tim Berners-Lee created ENQUIRE, an early hypertext database system somewhat like a wiki. The early 1980s also saw a number of experimental hypertext and hypermedia programs, many of whose features and terminology were later integrated into the Web. Guide was the first hypertext system for personal computers. In August 1987, Apple Computer released HyperCard for the Macintosh line at the MacWorld convention. Its impact, combined with interest in Peter J. Brown's GUIDE (marketed by OWL and released earlier that year) and Brown University's Intermedia, led to broad interest in and enthusiasm for hypertext and new media. The first ACM Hypertext academic conference took place in November 1987, in Chapel Hill NC. Meanwhile Nelson, who had been working on and advocating his Xanadu system for over two decades, along with the commercial success of HyperCard, stirred Autodesk to invest in his revolutionary ideas. The project continued at Autodesk for four years, but no product was released

Example/Case Study:

Imagine that you are sitting in front of a computer. On the screen there is a picture. It is a view of a very large park. There are no words. You have been told, however, that if you use the mouse to point to some part of this picture and press the button you may then see a new picture. This new picture shows some more of the area. What is shown depends upon where you point; it may be a view slightly further to the right or the left, or it may bring you closer to something, such as a house that was in the distance. You soon find out that you can, in turn, explore the new picture by pointing with the mouse and pressing the button. This will lead to further pictures; each taking you further on in your tour of the area, or allowing you to inspect something more closely and in more detail. You may, for example, wish to try to find a way into the house and examine some of the furnishings inside. There are many possible routes that you can take and it is also possible to retrace your steps; you find out that you can point to a symbol on the screen which takes you back to the previous picture. There are now no further demands upon your computing skills; you are free to explore.

Such an activity is, of course, easily allowable through the use of computer technology that is available today. The hundreds of photographs used to model the house and the park could be stored on a hard disk or a CD-ROM. Links between the photographs to allow a means of travelling from one place to another could be provided through almost any one of a number of commonly available 'hypertext' database applications. Our example could also have included such entities as words, both written and spoken, sequences of moving images, and music, although the method of finding one's way around this type of terrain could have been essentially the same as with pictures alone. Although widely used the word 'hypertext' is nevertheless problematic. If our understanding of the word 'text' is limited to a body of words in written or printed form then there is, of course, reason to be ill at ease with 'hypertext', unless we apply the prefix 'hyper' rather loosely. Similarly, there are problems with another potentially applicable term, namely 'multimedia'. Although the technology has arrived, a widely agreed vocabulary pertaining to it has not, and so with some reservation we will adopt the term 'hypertext'.

Our model of the house and the park is but one example of a hypertext application. Although perhaps rather basic in terms of facilities offered when compared with some other models, it does, however, share a central feature which is commonly encountered in such applications: it allows one to explore. To this end we are helped by our explorers Remee and Ashley (five years), Darren and Haylie (seven years), and Caroline and Faye (eleven and ten years), pupils from a south-east London school. The model to be explored was developed by the authors for the purposes of the present work. It was constructed from some 200 colour photographs which were scanned so that they could be recorded and displayed by the computer. The photographs showed views and details of Greenwich Park and the Queens House, the latter being regarded as a centre of historic interest and frequently visited by groups of children from schools in the locality. The Queen's House was commissioned by Queen Anne of Denmark and designed by Inigo Jones in 1616 and, today, remains furnished in a style believed to be characteristic of seventeenth-century royal apartments. Our explorers would be visiting the Queen's House as it was related to classroom work on the Tudors and the Stuarts. We wondered whether the experience of hypertext provision in the classroom would have any impact on the children's attitude to and experience of the real Queen's House when they visited with the school. We wanted to find out (a) whether, indeed, these pupils would wish to explore our model of the park and the house, and (b) having embarked on their exploration, how long they might wish to continue. We also wanted to discover what approaches and strategies they would adopt spontaneously, so on all occasions a free hand in exploring was given and with a minimum of guidance. Another question concerned the nature of any talk and collaboration that might occur, and so the pupils worked in pairs from each year group and were encouraged to talk to each other about what they saw and their decisions regarding where to go to next. We also thought 'that we might begin to get some insight into some developmental issues through considering these questions in relation to the children from the different age-groups.

Getting started presented few problems, regardless of age, once the children had been shown the basic manoeuvres with the mouse. Caroline and Faye (eleven and ten) were, within a few minutes, able to gain good control and give attention to the pictures as they appeared, Remee and Ashley (five) took a little longer. In the construction of the model there was an effort to maintain visual continuity. However, some links between pictures were more visually challenging than others by virtue of large variations in direction of view or proximity, and because of minimal interconnecting detail. We found, however, that from an early stage of exploration there was no apparent difficulty in relating one view with another. In one case, Haylie (seven) on her first encounter with a particular scene, spotted a minute fragment of a wrought-iron banister that was just visible at the top of a stair-well: 'OK down there'. This is the quality of attention to information presented visually (and to possible symbolic connotations of items or their relationships in the visual array) that makes young children experts at using picture-books, observing human artefacts and natural objects, and the interpretation of video and cinematic material. One possibility that readily comes to mind is that children are able to come to terms quickly with the qualities and limitations of the medium's inherent visual grammar as a result of their acquaintance with the many conventions adopted in television programmes. Furthermore, we also found that the pupils were amused rather than confused if any inappropriate relationships arose between where they pointed with the mouse and the picture that followed as a result. Unlike television, however, changes in view are not merely presented but occur as a result of physical action on the part of the observer. The importance of this in perceiving the form of the surroundings has for some time been recognised in work such as that reported by Hein (1980).

Each pair of pupils very quickly set themselves the task of finding a way inside the house. 'We'll just go in and then we might find something' (Faye, ten); 'I'm playing next' (Remee, five); 'I'm playing after Remee' (Ashley, five). Imagination and story-telling are two of the most powerful modes of approaching and representing the world. Here, the younger children are constructing an imaginative 'play scenario' of a kind which is noted in all early childhood studies. 'Embedded' learning commonly arising from strong incentives such as these can be effective and long lasting. Finding a way inside happened not to be easy since the door (which in reality would have been the one used when making a visit) was concealed within a central courtyard and could only be found once a series of moves through a number of pictures had been made. For Faye and Caroline (ten and eleven), initial talk was about how to explore the whole of the house, where different parts of a picture might lead: 'Oh, you want to go back, do you?' (Faye); 'See if we can go up to the landing' (Caroline). Here, the exploratory behaviour shown by these two girls links closely with the initial stages of play behaviour, in which children will investigate and verbally list every item of equipment, furnishing and accommodation they find in an area where they hope to play.

Faye and Carolines talk concerning the overall mapping can be contrasted with the five-year-olds who tended to frame their talk in terms of what was shown, or in terms of details available in close up: The foot, go on press it, you've got to stay on one of these' (Ashley); 'Look at that fence' (Remee). For Haylie and Darren, between the above age-groups, exploration of the whole house featured prominently, but was subject to the occasional diversion, as the following dialogue suggests: 'It's like you're really in a house. Take a close up of that picture there' (Darren); 'See in the door' (Haylie); 'Yes, go in the door, go in the door' (Darren). Here the imaginative experience of moving at will within an unknown environment has become real for the children, who have adopted the computer's functions as their own. From the above dialogues we may also get a sense of the kind of conversation which children engage in with regard to the extent of their collaboration. We can also see that much of the above talk reflects a desire for the child who is not controlling the mouse to direct the other in order to satisfy his or her own curiosities. With the youngest of the children, especially Remee, there was also a tendency to be less attentive when not using the mouse.

We have already noted that Remee and Ashley were slightly slower than the older children in gaining control of where they wished to go. However, within fifteen minutes they had also found their way into the house and to the upstairs rooms. Remee was beginning to become more aware of the potential offered by doors for further large-scale exploration and her actions became very selective in this respect. Like the seven-year-olds, however, exploratory behaviour also took on other dimensions; Ashley, for example, upon discovering a room full of paintings, attempted to gain a close-up view of each painting, and approached this systematically. Exploration on a large scale occurred even though some awareness of detail on the computer screen was clearly there, as may be noted above from Remee and Ashley's interest in the paintings. After some ten minutes Faye and Caroline's mouse movements were quite controlled and selective in terms of the detail that was visible. Small or indistinct areas were explored, but with the intention of gathering fuller information, for example, 'See what's in that picture' (Caroline, eleven); 'What about that, what's that?' (Faye, ten, pointing to railings in the corner of the screen). Much of the talk remained directional: 'Can we go down there?'; 'Find another part-try to get into another part'; 'Shall we go back and try the back of the house?'; 'Try from this end then'; 'Go to the first bit, we should go there.'

They were also recognising scenes that they had come across before, albeit by different routes: 'We can't go in there' (Caroline); and getting a useful sense of layout and general qualities of the house: 'Shall we go out and come in again? You know, the door on the other side of the balcony?' (Caroline). After about twenty minutes Haylie and Darren (seven) had found a way into the house and had also explored the general layout inside as well as outside. They were able to use their knowledge of layout in that they could go back and forth to find particular rooms at will. At this later stage in their exploration an interest in details and features of the rooms was becoming more noticeable. Paintings on the walls became a focus of interest; for example, Darren, on finding that close-up views were obtainable with some paintings, went systematically through some of the rooms to see how many similar close-ups he could find.

In sum, then, mapping out the terrain on a large scale was dominant at early stages of exploration before attention was paid to smaller details. This was particularly noticeable with the older children whose strategies concerned with large-scale mapping also tended to be vocalised. This observation identifies the relationship between physical action and 'knowing'.

While the above exploring approaches were beginning to emerge, other patterns were also evident, namely that for all children the time spent looking at any one view presented on the screen was relatively short, typically in the order of a few seconds. This meant that the activity was characterised by frequent clicking of the mouse button as different shots came and went. The intention seemed to be to find further views; travelling seemed to be more important than arriving. Each screen display was viewed in terms of where it led, rather than in terms of what it contained. While some of the views within the house would have shown little more than a connecting corridor or doorway, many of the others showed a wealth of potentially interesting detail which could have sustained extended perusal. However, if there were any noticeable variations in viewing time, these seemed to be dictated by the number of possibilities that a given display might present for leading on to others, and the decisions and the trials that would have to be made as a consequence of this. The above pace of exploration was held throughout, even when there was familiarity with overall layout and close-up views of details were being sought. The distinction between exploration and later, more in-depth interaction with materials has been established as a separate stage both in use of tools and in play.

In addition to maintaining a rapid pace of exploration, it was apparent that pupils from all age-groups were willing to continue this for extended periods of time. At five years of age, Ashley and Remee were content to explore for nearly half an hour. After thirty minutes Haylie and Darren (seven) were also very much involved and, likewise, Caroline and Faye (eleven and ten) after some forty minutes. That the slightly longer period of activity for Caroline and Faye could simply be attributed to age, however, cannot be assumed since they were working in classroom conditions which were less distracting than those for the younger children. Moreover, in all cases the duration of activity can be regarded as substantial and those interested in any debate on comparative attention spans may view the timings in terms of their similarity rather than their differences.

Although we might regard the children as being naturally disposed to exploration, their continued attempts to find further views may nevertheless bear further consideration. Was this merely a novelty effect, or were other motivational forces at work? Would we have witnessed the same degree of engagement with these, or any other collection of pictures, presented in book form for example? Was the continued activity an attempt to assess the nature and extent of the material? In hypertext this would be less easily apparent than with a book. Were our explorers hoping to find something more special? Might something quite different, or at least, something more dramatic or aesthetically pleasing, be discovered? On talking to the children afterwards this appeared not to be the case. Although some of the screen displays could be regarded as having met the latter criteria, exploration, as we have already noted, continued at a regular pace with any one screen being given roughly the same viewing time as any other.

A question which arises at this stage concerns whether we should view the continued activity in terms of motivation or of inertia. Is our hypertext environment a comfortable one within which one can wander aimlessly and where few mental demands are made? Although the term 'exploration' has been a convenient one to use, it is also a term which carries with it notions concerning purpose and direction. Is it right that we should regard the pupils as 'explorers'? Were these pupils exploring with questions in mind, or was the endeavour disconnected and superficial in nature? Were these pupils simply wasting time? Holt (1989) has argued that when children follow their own curiosity they may go through a vast amount of material but relatively little is retained. With language learning, for example, children are exposed to an enormous amount of verbal information of which comparatively little sticks. Importantly, however, bits which they want are picked out. What is picked out may be picked out subconsciously. However, in view of the sheer volume, this small fraction can become significant. Holt goes on to argue that if any adult attempts to make this process more efficient then they may in effect simply reduce the intake. With hypertext, material can be available in volume and, in turn, what is retained could become significant. Furthermore, Case (1985) has suggested that developmental process is characterised by an innate capability for setting goals and for deriving strategies for attaining these goals. At first no goal is made explicit and the start of any activity may be cued by almost any feature of what is present. A number of initial lines of inquiry may be entertained concurrently, evaluated and modified, if necessary, en route. Case uses the term 'exploration' to describe this process, although, initially, it could be regarded as being driven by what lies without rather that by what lies within. Protagonists of the constructivist school of early childhood education would maintain, however, that the relationship between experience and developing ways of conceptualising is more complex.

A term which has been associated with the use of hypertext is 'browsing'. As with Case's notion of exploration, a situation is presented where there is no overt target. What lies ahead is unknown. It is up to the individual to enter this situation and see what arises. However, McAleese (1993) argues that an active atmosphere can be created through hypertext, but this rests on activity being directed. He also points out that consciousness of learning can result from making information needs explicit. If we are to assume that there is an innate capability for setting goals, then, from a teaching point of view, even if we do not wish to set questions for our 'explorers' or give them explicit direction, we could at least try to get them to express their own questions or directions overtly.

If direction can be set either overtly or covertly, what might pupils gain from a hypertext environment, as opposed to any other environment? Other media such as books or film may, of course, contain a large number of items such as pictures or other elements of information. However, these elements are usually locked into a fixed sequence, which consequently restricts any connecting links. One can browse through an encyclopaedia, or a library for that matter, but the mechanisms associated with inbuilt links or cross-references can be cumbersome and a distraction. With hypertext it is relatively easy for an author to create a variety of links and also for a user to follow them. Although the pictures of the Queen's House in themselves can convey information, there is further information to be had from the links between these pictures; each link represents a relationship, and each picture can take on a particular meaning as a result of the mutual context provided. Additionally, however, the same picture, or unit of data, may yield different information and take on a variety of meanings according to the route by which it is approached. For example, if we return to the Queen's House, then an object such as a chair can be seen as a functional entity within a room or, seen in terms of its design, as a statement in terms of wealth and royalty. Importantly, in one sense we can regard our explorers as exploring the links between pictures and gaining information and meaning from this rather than from the pictures themselves. With this in mind, the rapidity with which moves were made from one picture to another and why travelling seemed to be more important than arrival may be understandable.

If we are to seek comparisons between exploration of a hypertext model, such as that of the Queen's House, and exploration in the real world environment, then, although there may be a degree of surface isomorphism between the pictures and the location that they represent, we cannot claim that this is a virtual reality. It is, of course, a construction where there is a choice of elements and links which is influenced by the underlying conceptions, perceptions and intentions of an author, as Faye (ten) indeed reminded us: 'Did you make this program up yourself?' If our construction is likely to influence children's conceptions and perceptions then we may need to plan carefully. At the level of picture composition there could be effects on choices made in the course of exploration. For example, when the starting point was the park, interest quickly focused on the Queen's House which could be seen in the distance. With regard to structure, we might consider the kind of connections we want children to make and whether these would have to represented as interconnections within hypertext. We might ponder whether we are giving our explorers freedom or imposing constraint. Children, however, are constrained in both museum education and in information technology, as with any other medium, because of the limits imposed by its very nature. They cannot be allowed to play freely with valuable artefacts, nor can they create new rules for the operation of a computer program.

Continuing our comparison with a real environment, we have found using hypertext that, although children maintain a rapid pace of exploration, they go back to where they have been before and have another look, and keep looking. That this can open the way for attention to be drawn to a range of viewpoints and detail was evident: Faye liked the close-up facility: 'You can see all the materials'; 'Silky sort of patterns'. When asked to describe the House for a distant friend, Caroline and Faye also identified long alleyways, paintings, beds, lots of windows, and the (spiral) stairs which they associated with going up high and, more creatively, with the experience of turning round 'like the whirlwind'.

Darren (seven) felt that he had 'learnt that you cannot just see things from outside but inside as well, and that it is interesting seeing all the rooms and taking close-ups of the pictures and furniture', while Remee (five), on being asked what she had noticed, replied: 'Everything, the carpet, the door, the house'.

The rapidity of travelling in hypertext may be equated with a common tendency for children, particularly when left to their own devices, in a museum setting such as the Queen's House to rush from one place to another. However, we can also argue that there is an important difference in so far as travelling in our hypertext model was characterised by perseverance; the House was repeatedly revisited and re-viewed from many different angles. An extensive model can also convey a sense that all the limits may have not been reached. With Caroline and Faye (eleven and ten), for example, this was found to be a motivating feature: 'It's nice to have the feeling that there is always a bit more to discover.'

We also found that use of the hypertext model had enhanced enthusiasm for seeing the real house. Caroline and Faye, for example, had clear ideas about what they want to look at, draw and write about, and had followed these up. Here exploration of the model had usefully linked in with subsequent firsthand experience. By way of further comparison with the real world we can, of course, quote situations where a model in hypertext, such as inside a nuclear reactor for example, can be explored with comparative ease and safety. While this may be valid for many educational purposes, models such as these can be regarded as special cases and we should be careful not to overlook the more fundamental and pervasive qualities of hypertext as a medium which can allow a range of viewpoints and details to be presented, resulting in perseverance in exploration, even with everyday objects and environments that may be regarded as ordinary.

The emphasis throughout this description has been on the creation of a new kind of environment for learning; one which, while it restricts children in some ways, has in other ways given them a freedom they would be unlikely to have in an actual museum environment. The children have responded by establishing the environmental repertoire and making links between different items, making use of playful relationships, 'real-world' knowledge and understanding, and imaginative and creative metaphors. Their use has shown hypertext to be capable of providing the setting for a developmentally appropriate curriculum, in which adult experience provides the carefully selected setting while the children make the choices that are appropriate for their experience, interests and understandings of the world. In the present work the focus could be seen in terms of the role of the adult as provider of a given setting. However, in the classroom context this role can be extended towards being the observer who is available to interact according to the needs of individuals. For example, this may include giving whole attention to and social acceptance of the child's initiative together with emotional support while the child is exploring, meeting frustration and trying things out. This can be contrasted with approaches characterised by early versions of 'programmed learning' which aimed to reduce direct involvement of the adult in individualised learning. Blenkin and Kelly have concluded that, for children under eight years of age, there is no substitute for the highly educated professional drawing on knowledge of child development and curriculum expertise.

The Queen's House in hypertext has enriched rather than reduced the child-adult relationship, seen in the context of developmental approaches. A further stage might be to see what its relationship could be to a planned course for junior age children in the context of, say, a National Curriculum study unit. Museum educationalists are exploring how they can include opportunities for play in their provision. Is there a parallel development to be looked for in the possibilities inherent in hypertext?

Rather than attempt to examine complex forms of hypertext we have focused on one that is relatively basic. Through this focus, however, we find that a model consisting of no more than a network of items presented in one modality is capable of holding attention for extended periods of time; we have also found, incidentally, that college students have become similarly engaged. In all cases no extrinsic incentive was necessary, nor did the model require any inbuilt tasks or directions or end goals for the user to be stated. Furthermore, it should be noted that the content represented nothing more than that plainly visible at a given location.

It might, of course, be instructive to test the extent to which a hypertext environment lends itself to exploration by replacing the Queen's House with a singular object that could be available for inspection alongside its hypertext representation. Although this may sound rather extreme, there might nevertheless be some useful consequences for classroom application if the outcomes were similar to those for the Queen's House. For example, historical artefacts could be used, and through hypertext pupils could be encouraged to have another look at a variety of details and attributes. Close-up photographs of flowers and minibeasts might usefully lend themselves to this treatment for the purposes of scientific study. A variety of objects could provide a similar focus for study in relation to design and technology. Paintings could lend themselves to this treatment in the context of detailed study in art. Developing resources of this type could be relatively easily accomplished and, no doubt, much could be gained by pupils creating their own models. More ambitious models could, of course, represent such structures as the cardiovascular system, the atom or an oil refinery.

It might also be reasonable to speculate that data in a variety of other forms could be interlinked and hold attention in a similar way. However, simplicity in modelling is, perhaps, an important feature which should not be overlooked. Although the availability of a model in hypertext for open-ended exploration may not in itself necessarily be a formula for classroom activity, there are qualities here which could be drawn on more generally and provide a basis for enriched classroom activity.

In Section 3 of this course you will cover these topics:

- Computers And The Teacher'S Role
- Classroom Investigations: Exploring And Evaluating How It Can Support Learning.
- Using It In Classrooms: Experienced Teachers And Students As Co-Learners
- Getting Teachers Started With It And Transferable Skills

Topic : Computers And The Teacher'S Role

Topic Objective:

At the end of this topic student would be able to:

- Introduce the role of teacher.
- Give the use of computers in teaching process.
- Discuss

Definition/Overview:

Teacher in role: Teacher in role is a method of teaching that utilizes techniques of drama to facilitate education. It is a holistic teaching method designed to integrate critical thought, examination of emotion and moral values and factual data to broaden the learning experience and make it more relevant to everyday life situations.

If the role of a teacher is to teach, the role of a student must be to learn. However, it has been agreed that learning is not only an exercise in reading and reciting facts, but in gaining a deeper insight of events and situations. This is where drama becomes an invaluable tool. Through the use of drama and dramatic conventions a teacher does not only teach and learn the what but also the why and how.

Key Points:

1. **Teachers Role and the use of Computers**

Teaching is one of the most demanding social activities in our society, involving the presentation of a sophisticated cultural inheritance to a large group of learners while working within the constraints of a heavily bureaucratised National Curriculum. Compulsory computer use can easily be experienced as an extra burden rather than a potential aid. Nevertheless, while teachers have little choice over whether to use computers, they retain a great deal of control over how and when they use them. owever, the computer is not simply another curriculum innovation; it is also arguably the most important technical aid to teachers wishing to explore their own practice. This is because it is an immensely flexible (albeit often infuriating) device for generating and modifying curriculum innovations to enable learners and teachers to try out for themselves new approaches to teaching and learning. As the contributions to Part One of this book demonstrate, the nature of the computer radically changes when the teacher replaces one piece of software with another; in choosing which software to use the teacher is making a first approximation at specifying what kinds of learning they are hoping to promote. Once chosen, most forms of software allow teachers and learners a great deal of freedom in how they make use of it. Thus the detailed formulation and implementation of computer-based classroom activities allows for a closer approximation to what kinds of learning can be achieved. But this requires teachers to see the computer not as an exotic extra, but as a responsive and integral element in a classroom curriculum that has been rethought to include a view of what computers might do. To ask how teachers need to use computers is in large part to ask how the computer might be used to support and explore the theoretical and practical implications of their own philosophy of education, with a view to its improvement.

2. The Structure Of The Pre-Computer Classroom Curriculum

The accounts of classroom events given in Part One clearly reveal that there are various ways in which teachers can conceptualise classroom life. Behind the diversity of experiences explored in those chapters lie a range of views that the contributors take of learners, curriculum materials, adult knowledge and the pattern of relationships between these and the teacher's role. How teachers regard each individual in a class varies greatly, but behind those variations it may be possible to distinguish a general disposition. One position is to consider that learners should be encouraged and enabled to become alert receivers and sensitive appreciators of externally generated knowledge; another that they are interested explorers of such knowledge; a third that they are active and imaginative creators of their own understanding. Many intermediate positions are possible here, but nevertheless many educational controversies are presented in terms of these underlying distinctions, such as debates about the relative importance of spelling, grammar, imagination and originality in writing.

There is again a choice to make when teachers consider how each individual should relate to other class members. A teacher may wish to promote a view of others as potential collaborators with whom the individual must learn to work, or as competitors to be related to in a pattern of healthy and good-natured conflict for fairly earned success. In contrast to both these perspectives stands the view that others in a class are irrelevant distractions and that ideally the individual should pursue his or her own activities independently. Here too intermediate possibilities are present, but simply to say that gets us little further forward unless some rationale can be offered for why a particular balance is favoured. Our views on the characteristics of individual learners and their relationship to the group are in turn affected by how we think of classroom knowledge, and the connections between that and what we may call adult knowledge, i.e. the immense body of conflicting beliefs, values, skills and capabilities that form the human resources with which members of a society conduct their affairs and attempt to realise their individual and joint intentions. One position here could be that classroom knowledge should be an unvarnished selection of the most important adult knowledge, to be confronted by learners with little or no mediation. Whether the learner, the teaching profession, the community, industry and business or the government should define what adult knowledge to present distinguishes several very significant variants within this general position. What they all share is a distrust of the education establishment and of what are seen as its self-interested attempts to interpose itself and its arcane and inefficient procedures between the learner and 'real' knowledge, as embodied in one or other notion of 'real life'.

Over against this position we can place the belief that it is essential that adult knowledge be carefully and professionally presented to school-age learners in ways that make it easier for them to grasp. One way in which this can be done is to introduce curriculum materials or activities that provide the learner with a series of simplifications of adult knowledge, each presentation progressively closer to the full picture. Some children's fiction, school assemblies, children's encyclopaedias, five-a-side football, Lego blocks and the infants' Wendy house exemplify this approach. Such constructions present unembellished simplifications of adult knowledge but do not of themselves generate learning. For this to emerge, the teacher (or perhaps another learner) must provide some framing, direction or instructional support. However, a related category of curriculum materials builds in such directions from the start, thus partially filling a role that might otherwise be taken by the teacher. This category includes such things as textbooks, some educational television, worksheets and (as a marginal case) structured reading schemes. Here too teachers face choices: how far to rely upon curriculum material and experiences that have no instructional component, and how far to rely upon materials in which such instruction comes prepackaged.

3. The Computer As A More Effective Curriculum Resource

So how can we most usefully characterise the ways in which the computer can be used within the diversity of classroom cultures that we find in our schools? Clearly, what computers can do depends substantially upon what software they are running at any time; and there are many kinds of software. This suggests that we should ask instead what sorts of computer packages are best suited to supporting particular kinds of learning, and how far each kind of software is amenable to use within a different pedagogic framework from that for which it appears to have been designed. Here we could envisage a range of possibilities: at one end of the range the chosen software would completely determine the sort of activities needed to accompany its effective use; at the other end of the scale some kinds of software might be relatively neutral, being highly malleable and responsive to many different teaching approaches.

Some types of software (the 'open-ended' or 'tool' packages) assume that the learner is predominantly an active creator of knowledge. Productivity tools, such as presentation packages, word processors, outliners, ideas processors, spreadsheets, graphics packages, music composers and database packages, all allow users to collect and enter their own data and so are in this category because they all leave the initiative to the user. Programming languages and modelling packages, too, require the user to take the lead in defining the purpose of the activity and in evaluating the results of his or her own choices as they are in effect devices for enabling users to externalise and evolve their own conceptualisation of some process. Gay Vaughan's account of the use of LOGO with four- and five-year-olds in Chapter 3 is a good example of this process of externalisation in action, while other kinds of open-ended software are discussed in Scrimshaw (1993a), Straker (1989) and Underwood (1994).

While open-ended packages assume an active learner, as far as other dimensions of the classroom curriculum framework are concerned they are much more flexible. To start with, they all allow a variety of kinds of group relationships when they are being used; individual use, collaborative work by a group with a shared task or competitive working are all possible. They also have some capacity for what we might call self-adjustment to their users. As they are essentially empty shells into which users place and manipulate content of their own choosing (text, pictures, numbers, formulae or whatever), users can choose for themselves the level of complexity of that content, and the level of sophistication of the manipulation of it. This is presumably in part because the software does not require such activities of them or indicate the need for them. In addition open-ended packages, like any others, may create obstacles to learning simply through their lack of user friendliness in the sheer mechanics of operating them, rather than any intrinsic difficulty in the content they are used to order and modify. However, not all types of open-ended packages are neutral as between different modes of use. Electronic mail and computer conferencing are (like the telephone and the postal service) impossible to use except in collaboration with others willing to act as recipients and initiators of messages too. Bernadette Robinson (1993) has also discussed this point at some length. As she notes, computer conferencing may be used not only for the transmission of factual information but also as a powerful tool for creative writing, a point supported and expanded elsewhere by Brent Robinson (1993). What we have in this sort of software, then, are learning media that are at least as flexible in most respects as other kinds of open-ended software, but which have a built-in requirement for shared use.

In the second main category of software types the emphasis swings from the learner as knowledge creator to the learner as interested explorer. Here either the software designer or the teacher provides a structured body of content that learners then explore. This category includes what we might call the 'filled' versions of the tool packages discussed above, i.e. those in which the database, spreadsheet or whatever is presented to the learners with some content already in place. Related types of software include text disclosure packages, talking books for young children, video games, adventure games, simulations and the hypermdia simulations and encyclopaedias now appearing on CD-ROM. Finally, data logging device are another rather different form of tool package.

Here, however, the filling is provided through the ongoing collection of data from the environment itself. Thus these packages offer a distinctive mix of active data collection by the learner and close control over what kinds of data are collected by the program designer and by the nature of the environment in which the equipment is used.

These sorts of package are all neutral as between individual and collaborative use, but they differ not only in what knowledge they embody but also in the form that it takes. Many databases (for example most of those that can be accessed remotely) are designed for adult use, and to that extent can claim to be direct introductions to some aspect of the adult world. Conversely simulations, video games and adventure games (which can be seen as a rather exotic form of non-real-life 'simulation') are by definition simplifications, and thus potentially easier for younger learners to understand, although the underlying complexity of such popular simulations as SimCity and Civilization suggest that this point can be overstated. So too are many forms of control technology devices, such as LOGO-based floor turtles. Between these two subgroups are packages that may take either adult or simplified forms, such as electronic encyclopaedias and all the filled tool packages, which may be presented with content that makes greater or lesser concessions to the relative lack of experience of younger users. Another subgroup within these more exploratory kinds of software are instructional hypertexts, in which some teaching material is included to help the learner deal with the substantive content provided. Here too there can be wide variations in the level of complexity of the instruction provided. Related to these are the drill and practice programs in which learners reinforce and/or test their knowledge. Such programs may have some form of branching built in, through which the user is channelled from activity to activity according to the responses made. This kind of program has developed over the past fifteen years into intelligent tutor packages, which respond with a much greater degree of relevance and flexibility to the learners inputs to the computer. These packages may have an explicit didactic element or may be designed in a more exploratory and occasionally collaborative mode. These programs assume an alert user who is willing to make choices, but one who reacts to the program's initiatives and definition of the task, rather than creating such a definition for him or herself, or exploring in a more or less open-ended way the information provided; they thus stand on the borderline between exploratory and receiver models of the learner.

CD-ROMs are becoming increasingly widespread in schools and homes. CD-ROM disks are simply another device for storing information, operating on the same general principles as audio CD disks. CD-ROM disks, however, store and play back a much wider variety of kinds of information; text, diagrams, photographs, animations and computer programs can all be included as well as sound. The reason that CD-ROMs need separate discussion from an educational point of view is that they store far more material than floppies. This allows the designer to include around a quarter of a million pages of text on each disk, or to include items such as good-quality sound and animations (including short video clips) that take up so much space that only a CD-ROM can hold enough of them to make up an effective presentation. Consequently CD-ROM titles range from text-only designs, through multimedia encyclopaedias (where the text is leavened with many pictures and some sound and video clips) to CD-ROMs whose most obvious characteristic is a great deal of animation and sound. Thus far more complex software packages can be provided through this medium, such as general and special-interest encyclopaedias, annotated databases of pictures and a variety of 'talking books', in which learners follow an animated story with access to both a printed text and a spoken reading. Something of the potential of CD-ROMs in schools are beginning to be reported and first indications are positive. What emerges from all this is that the distinctions drawn earlier between kinds of curriculum materials reappear in rather similar form when we look at computer packages. While there are also many differences in convenience and speed (not all favouring the computer), software packages can be grouped in the same ways as conventional materials as far as their potential roles in classroom teaching and learning are concerned.

4. The Computer As Catalyst For Radical Educational Change

The previous section assumes that the importance of computers lies in their capacity to help us pursue our current conceptions of education more effectively than we could do with traditional kinds of resource. It also assumes that the wider place of the school and teachers within society will remain the same. Can these assumptions be sustained? If we look beyond the classroom and the school we see a world in which changes are continuous and diverse. Historically schools have been partly sheltered from these processes, because in their location, staffing and to some extent in the knowledge they were expected to transmit they were physically and organisationally separate from the society around them. But as the millennium approaches, all these three screens between schools and society are, for good or ill, disintegrating, making schools far more open to external influences. This opens up another route by which computers will influence teaching and learning, because society itself is being powerfully and directly changed by the ways in which computers are being employed. As we have seen earlier, electronic networking involves the connection of individuals to each other via the computer and to massive databases of stored information. This facility is already available to, and in some cases used by, schools but the fastest growth is in the electronic interconnection of companies, universities, government bodies and individual homes through computers. This is evolving into a vast network, precursor to an eventual 'lnformation Superhighway'. This is currently estimated to link over 20 million people worldwide. All of them have, in principle, access to each other and to the databases that each is prepared to make available to others, either free or for a small charge.

Schools can choose to link into this network, and to the extent that they do, they redefine both what constitutes learning groups for their pupils and the role of teachers. When the group includes other children and adults from all round the world, the teacher's contribution to the group's discussion is quite different from that which is possible and required when everyone involved is present face to face in the classroom. This development also raises questions about how children themselves might use information available on the network.

5. The Redefinition Of Public Knowledge

In business management and commercial practice massive changes have already taken place and are already partially reflected in schools. But computers are also altering how, for instance, English, art and history are conducted and conceived of as academic and creative activities. In consequence the option of simply seeing computers as a better means of transmitting the traditional curriculum is already dissolving, especially for students now preparing for teaching. First, in many areas the form and substance of what constitutes knowledge is being modified by the introduction of the computer, even in areas in which the motive for this change was simply to provide some improvement in ways of accessing or generating kinds of knowledge whose nature was assumed to be impervious to the effects of such changes. In many cases this was indeed so, but in others it was not. Novels written in hypertext format are not simply equivalents of the linear novels published on paper. Art packages do not simply reproduce in a more convenient way the artwork produced with traditional media (although some of them to some extent can), and the same is true of computer-based musical composition and performance.

If we turn to more practical activities and the sorts of craft knowledge and skills that define them, the changes are, if anything, even greater. Today computer-aided design is changing the ways in which all kinds of objects from dresses to aircraft are being created, while electronically generated simulated news studios now replace the images of real studios behind the news reader. Occupations such as accountancy, stockbroking, product development and marketing have been significantly altered in many firms by the introduction of spreadsheets and computer databases to identify, for instance, the quantitative aspects of possible future developments, and to locate patterns and problems in current practices. More generally, electronic communications within companies are changing the balance between individual and group activity on a massive scale, with the development of such interesting devices as electronically shared personal diaries that allow members of a team to see at once when a suitable time for a group meeting is available, to set up that meeting and to have it recorded in everyone's diary automatically. In the same way shared files that several people can access and change, even if they are in offices in different countries, are transforming what can be meant by co-authoring.

Whether people are working at a checkout counter, stocktaking in a warehouse or producing a parish newsletter, computers are redefining what capabilities their tasks require, and in ways that cannot but feed back eventually into the school curriculum. These changes are not only in individual techniques and skills, but are also altering the whole balance in thought and action between the intuitive and the explicit, and between the rationally simplified and the qualitatively complex. These are changes that teachers not only should not, but in practice cannot, ignore.

6. The Teacher's Role

What are the consequences of such changes for the way in which teachers do their work? This is best approached by again looking separately at computers and software that can be seen as improving the effectiveness of current kinds of teaching and learning, and then turning to the more radical demands made by those new technologies that are beginning to require a wholesale rethinking of the teacher's role. There is something to learn about any new piece of software of a straight-forwardly technical kind, although perhaps less than might often be feared. How teachers use a particular program has to take account of all these aspects, but it is not completely determined by them, although both programs and more frequently the accompanying advice for teachers suggest that the designer favours a given approach. In practice teachers can employ software in ways that fit their own educational philosophies, rather than automatically taking up the particular educational stance that the designer may favour. In that sense virtually all software packages are, as far as the teacher's role is concerned, open to at least a fair degree of interpretation, as a variety of studies have shown. Open-ended packages can, as we have seen, be closed down by the teacher prespecifying content for them that sets limits on the range of ways that children then use them. These limits can subsequently be selectively loosened or tightened as the activity progresses. On the other hand, the teacher may instead want to open up the ways in which a learner uses an open-ended package, because the learner has too restricted a conception of the possibilities it offers to use it to best effect. This strategy is exemplified by John McGowan's creation of a help file for his students. Even where the package provides prestructured material that the teacher cannot change, the teacher can still use the package in various ways by presenting it to learners within a different framework of instructions and suggestions.

In practice, therefore, teachers are faced with very similar choices when using computer packages as they are when using any other kind of curriculum materials, namely how to adapt and interpret them to fit their own philosophy of education and the best interests of the learners they work for. But neither the full implications of what we each take our philosophy of education to be or what constitutes the best interests of learners are ever fully obvious to us, for our understanding of both evolves and changes continually in the light of experience. This is especially obvious when we face a new situation which itself offers more possibilities and limitations than are immediately obvious. This implies the teacher's role too cannot be rigidly prespecified and then applied in every situation. For instance, to ask if the teacher should be an unobtrusive stage manager or a hands-on director of classroom activities is to miss the point; sometimes one is appropriate and sometimes the other. The problem is to know which strategy to use when. One approach to this problem has been to look to the notion of scaffolding. The term refers to the actions that a helper takes to reduce the demands of some task on a learner so that he or she can concentrate on gaining the particular skill or understanding that the task requires. This concept is clearly relevant to classroom learning (although it is by no means restricted to that arena). However, it needs a fuller definition if it is to be of practical use to teachers. Maybin et al. offer the following provisional formulation:

['Scaffolding'] is help which will enable a learner to accomplish a task which they would not have been quite able to manage on their own, and it is help which is intended to bring the learner closer to a state of competence which will enable them eventually to complete such a task on their ownTo know whether or not some help counts as 'scaffolding', we would need to have at the very least some evidence of a teacher wishing to enable a learner to develop a specific skill, grasp a particular concept or achieve a particular level of understanding. A more stringent criterion would be to require some evidence of a learner successfully accomplishing the task with the teachers help. An even more stringent interpretation would be to require some evidence of a learner having achieved some greater level of independent competence as a result of the scaffolding experience (that is, demonstrating their increased competence or improved level of understanding in dealing independently with some subsequent problem).

Scaffolding in this sense does indeed get us beyond thinking about what teachers do in terms of a single kind of approach, as the form that scaffolding might need to take would clearly differ from context to context. It also emphasises the role both of the teacher's intentions and the learner's subsequent achievements in deciding whether scaffolding has been successfully accomplished. Finally, it makes very clear that such a view of the teacher's role requires a great deal of careful observation and reflection by the teacher, so that the links between what the teacher attempts and the subsequent learning can be identified with some confidence. However, the concept of scaffolding is not by itself sufficient, for it makes no distinction in terms of the relative value of different kinds of learning; or, indeed, between ethical and unethical (as distinct from effective and ineffective) methods of scaffolding learning. It needs therefore to be set within a wider conception of education based upon a thought-through philosophy. This is even more clearly the case when we turn to those forms of software and delivery systems (such as CD-ROMs and electronic networking) which demand a radical rethinking of their role by teachers.

The first difference that these two technologies introduce is to increase greatly the range of knowledge available to learners. This alone changes the teacher's role. How, for instance, does the teacher respond to a situation where different pupils have based individual project work not upon the information contained in books in the classroom or school library, but upon data gathered from an encyclopaedia on CD-ROM or electronically from outside sources that, in total, are too many and diverse for the teacher to check directly for accuracy? Electronic networking also widens the range of learners in a group far beyond the classroom walls, through computer conferences and e-mail. But when the group with which a learner interacts includes other learners and adults from all around the world, the teacher's contribution to the group's discussion is quite different from that which is possible and required when everyone involved is present face-to-face in the classroom.

Such networking also expands the range of 'teachers' available to children. These include not only those fellow learners elsewhere who can advise their peers on a particular topic, but adult experts. This raises the question of how, for instance, the teacher contributes to a discussion on science between pupils and a working scientist whom they have contacted for advice, or how two teachers in different countries jointly organise and support a shared project involving both their classes. So how can schools and teachers respond to these new possibilities? One option is simply to view the wider resources as something to be closely controlled by the teacher by setting closed tasks that require only materials which the teacher already knows to be available on the CD-ROM or in the national database that the learner is to use. While such tightly focused activities have their place, they hardly make full use of the potential available and will not, if used exclusively, help learners develop their own capacity for independent study. Such closed tasks therefore need to be supplemented with activities and instruction that enables learners to benefit from both the wider range of knowledge available and from their interactions with learners and teachers outside their own school. The implication of the first requirement is that teachers need to teach the processes of learning rather than its products. The conventional learning skills, such as locating, collating and summarising information, and identifying connections and contradictions within a body of information, all need to be explicitly moved to the centre of the classroom curriculum. The development of such skills also needs to be done in ways that then enable learners to develop them further for themselves through using appropriate forms of software.

Another major contribution from the teacher is to assist learners to find out how to collaborate with and learn from others. This requires the explicit teaching and learning of ways of organising co-operative activities involving computers, whether in face-to-face groups round a single machine or through co-operation at a distance via a conferencing or e-mail system. In order to do this, teachers themselves need more opportunities and support in using the new technologies in collaborative contexts, so that they can both identify the problems and possibilities for themselves and find ways to model these activities in their own practice with learners. Finally, when introducing these newer technologies teachers too need time to reflect upon and research what is happening. What all this suggests is that the ever-increasing influence of the computer in schools and in the wider community will demand a far deeper reappraisal of the teacher's role than is commonly recognised, requiring a fundamental and continual process of rethinking what is taught, how it is taught, and why. If this change is not to be externally imposed, teachers themselves will need to develop forms of reflective classroom practice that enable them to make the best use of the educational and professional opportunities as they open up.

Topic : Classroom Investigations: Exploring And Evaluating How It Can Support Learning.

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term information technology.
- Give Action Research As A Strategy For Teacher Professional Development
- Discuss the Pupil Autonomy In Learning With Microcomputers (Palm) Project

Definition/Overview:

Information technology: Information Technology (IT), as defined by the Information Technology Association of America (ITAA), is "the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware." IT deals with the use of electronic computers and computer software to convert, store, protect, process, transmit, and securely retrieve information.

Key Points:

1. Action Research As A Strategy For Teacher Professional Development

Classroom investigations using an action research approach are a particularly effective means of bringing about teachers' professional development in information technology. This chapter draws on the research of the Pupil Autonomy in Learning with Microcomputers Project (PALM) 2 which adopted this approach in twenty-four primary and secondary schools in East Anglia during 1988-90. Similar approaches have been used very successfully in teacher training, both with tutors and student teachers. Teachers need to be competent and confident users of the hardware and software, but this in itself is not enough. They need, also, to understand how to organise the classroom and to structure learning tasks so that IT resources become a necessary and integral part of learning rather than an add-on technical aid. Unfortunately, many courses in IT concentrate on technical matters such as how to operate particular software packages. Consideration of how to use this software in teaching is often squeezed into whatever time is left at the end of sessions. Teaching of this kind-almost literally key press by key press-is very time-consuming and has the disadvantage that it concentrates upon the area of teachers' weakness rather than building upon their existing professional knowledge. Even when courses of this kind are perceived by participants as useful and enjoyable, some research by Ridgway and Passey (1991) suggests that they often do not result in any changes in teaching practice.

Action research involves participants in any social situation (such as a classroom, a hospital ward or a small business) investigating their own practice with the aim of improving it. The term action research indicates that there is not the usual separation between research and the application of its outcomes to practice at a later stage. Instead, research and action are integrated in a cyclical process of collecting evidence (data), examining it very closely (analysis), deciding if there are any implications (interpretation), planning a course of action on the basis of this evidence, putting this into practice, and evaluating it by collecting data, analysing it and interpreting it, and so on. Action research is close to what good teachers do on a daily basis in the ordinary course of their work, with the very significant addition of data collection. Teachers reflect continuously upon what they are doing and adapt their practice to achieve the best possible outcomes in the classroom (or the staff meeting, or the parents' consultation evening). The crucial difference between action research and what Donald Schn in his book The Reflective Practitioner (1983) calls 'reflection-in-action' lies in the collection of data, or evidence. Even if a busy teacher is only able to collect a small amount of data, this can be considered much more carefully in a quiet moment away from the classroom than is ever possible at the time when events are rushing past at speed. Data also help to overcome the normal human problem that we interpret things mainly from our own point of view-experiencing them of necessity through our own senses and making quick judgements on this basis. In the PALM project teachers referred to their data (e.g. a child's opinion given in an interview) as giving them 'an extra eye' because their data often showed them things they otherwise would have missed.

For an innovation to be effective, those responsible for implementing it need to feel a sense of ownership. It is always difficult for established professionals to introduce change because it means abandoning some of the tried and trusted strategies built up from years of experience. In addition, an innovation is often threatening to those who have to introduce it, because they subconsciously experience it as a criticism of their own past achievements. A further problem is that no change is entirely for the better-there is always some trade-off between the advantages and the disadvantages of the innovation by comparison with retaining the status quo. All this means that unless teachers believe in an innovation it is very unlikely that they will introduce it effectively. Under coercion they may introduce some elements at a minimal level, but they will perceive it to be either impractical or educationally indefensible to make major changes if they cannot see any real benefit. In the case of IT, it is particularly important to convince teachers of its value because many perceive themselves to be technologically incompetent and feel deskilled and demoralised when they first begin to use computers in the classroom. As a result of the high level of 'ownership' and depth of understanding of the innovation which action research can engender in teachers, it is recognised as one of the most effective ways of bringing about educational change. Of course, since it is carried out alongside their normal full-time work, teachers are seldom able to meet the ideal and carry out the whole action research process. However, the power of action research lies in their involvement as researchers while at the same time the main focus of their energy continues to be teaching and learning.

2. The Pupil Autonomy In Learning With Microcomputers (Palm) Project

The Pupil Autonomy in Learning with Microcomputers project (PALM) sought to combine computer-mediated curriculum development and teacher professional development in a single action research process. It had two aims:

- to work in partnership with teachers to research the role of IT in developing pupil autonomy in learning;
- to investigate the effectiveness of action research as a means of teacher professional development in the IT innovation

The project was led by a central team of which I was the co-ordinator, with three teachers acting as full-time project officers (Jon Pratt, Cambridgeshire; Erica Brown, Essex; and Bob Davison, Norfolk) and a secretary (Laura Tickner). In the three LEAs PALM worked under the auspices of the Adviser or Inspector for IT, who set the broad framework of county policy for IT. There were altogether twenty-four PALM schools ranging in size from a large secondary school with 1,422 pupils to a small primary school with fifty-nine pupils and drawing upon a mixture of rural and urban catchment areas.

PALM provided no funding for the purchase of computers. Most of the schools, however, acquired some new hardware as an indirect result of being in PALM, because the project raised the profile of IT with senior management, or gave the school a higher priority with the LEA IT inspector. Nevertheless, none of the schools had sufficient hardware to provide an environment in which there was immediate access on demand for teachers or pupils. The general level of equipment varied considerably. The ratio of computers to pupils in each secondary school ranged from 1:167 to 1:22 at the beginning of the project in September 1988, and from 1:43 to 1:8 at the end of the project in June 1990. In the primary schools it ranged from 1:230 to 1:31 in 1988, and from 1:115 to 1:24 in 1990. These appeared to be typical ratios for schools in East Anglia at that time; the improvement over a two-year period reflected a general improvement in the level of equipment in all schools, although participation in the project was a contributory factor. The size of the schools varied considerably (secondary from 1,420 to 427; primary from 459 to 54) but this was often not the crucial factor in determining the number of computers per pupil. Access to computers for teaching was far from ideal. In primary schools computers were usually shared between several classes on either a daily or a weekly basis. In secondary schools they were normally located in a specialist computer room which had to be booked in advance, although in a few cases departments had one or two computers permanently allocated to their rooms. It was a priority for PALM that the participating schools should benefit from working with the project in two ways:

- through teachers developing more effective strategies for using computers to enable pupil autonomy in learning; and
- Through headteachers and IT co-ordinators developing more effective strategies for in-school support for teachers using IT.

The project did not offer what most headteachers and teachers at first assumed (funding for computers and traditional style in-service training in its use for teachers). Therefore, the aims and working methods of the project had to be fully explained and the terms of participation negotiated. This had to be done in such a way that the participant teachers would be given control over their own action research, while the overall aims and working methods of the project retained coherence and integrity. PALM was itself an innovation, and there is a danger that innovations can undergo significant changes at the point of entry to a school. The action research methodology had to be established and expectations of more traditional kinds of working methods had to be resisted. For example, we needed to resist the request to 'Tell us what we have to do'. Instead, we explained that PALM would be looking at the impact of computer use on children's learning. We suggested that computers cost a lot of money and it was important to evaluate their usefulness. We said we were asking teachers to use computers in the normal course of their teaching and to look closely at the learning which took place; and that, in order to ensure that the project's work had practical outcomes, we wanted individual teachers to decide on the exact focus of their investigations.

Most heads and teachers became interested when we explained PALM in this way, although the teachers' degree of enthusiasm was strongly related to their feelings about computers (in many cases apprehension and anxiety). The teachers' role as action researchers was difficult for us to explain and their response developed gradually as they practised the role with our support. In each school there was a teacher with overall responsibility for IT, and nearly always these teachers were the key contacts for the project; we encouraged them to undertake research into their own role in supporting colleagues as managers of change, but although many developed and extended their roles, only one undertook sustained action research of this kind. Of the one hundred teachers who undertook substantial research and development work in PALM, fifty-one were in primary (or middle designated primary) schools and sixty-seven in secondary schools; forty were men and seventy-eight women. The primary school teachers taught across the whole curriculum. The specialisms of the secondary teachers are set out in Table (although it should be remembered that a small number consciously directed their work towards cross-curricular projects). It is of interest that considerably more teachers of arts-based subjects worked with PALM than did teachers of science-based subjects. It should be noted that six teachers taught more than one subject and so have been counted twice.

English	18
Humanities (geography/history)	17
Art	6
Modern languages	5
Special needs	5
IT	5
Maths	5
Science	4
Home economics	4
Music	2
Business studies	1
CDT	1

Subject disciplines of the secondary teachers who carried out action research in PALM

PALM was set up with the assumption that, because of the length of time since computers had been introduced into schools, we would be working with teachers who already had some experience in computer use. However, schools were not selected on the basis of high levels of equipment or a reputation for good computer use (the methods of selection were different in the three LEAs but in none was this a factor). Whether for this reason, or because the level of competence in schools generally was lower than expected, or because the project unintentionally attracted teachers selectively, PALM actually worked with very few teachers who already had computer experience. At the end of the two years the project officers estimated retrospectively the level of computer experience of each teacher at the time of joining the project.

Topic : Using It In Classrooms: Experienced Teachers And Students As Co-Learners

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term technology integration.
- Give Experienced teachers and students as co-learners

Definition/Overview:

Technology Integration: Technology Integration is a term used by educators to describe effective uses of technology by teachers and students in K-12 and university classrooms. Teachers use technology to support instruction in language arts, social studies, science, math, or other content areas. When teachers integrate technology into their classroom practice, learners are empowered to be actively engaged in their learning.

When technology is integrated into the classroom, educators are taking the constructivist approach to learning. The amount of available information is doubling every three years according to statistics. By the time kids graduate from high school, today's students will have been exposed to more information than their grandparents were in a lifetime. It has been claimed that ninety percent of the technology we will use in the next decade has not been invented or currently there is no access to at the moment.

Key Points:

1. Experienced teachers and students as co-learners

With increasing emphasis on school-based teacher education it is timely to consider how, and what, students might learn about using information technology during school placements. In 1992 a directive from the Department for Education indicated that courses should contain 'compulsory and clearly identifiable elements' for students to gain practical experience of using IT in classrooms, and that these opportunities should 'provide a sound basis for their subsequent development in this field'. It may be relatively straightforward to make arrangements for students to work in school classrooms, but it is more difficult to establish favourable contexts in which they can learn that IT could be more than a supplementary activity in a school curriculum.

2. Institutional Context

At the University of Northumbria, school-based provision has grown from various ad hoc initiatives in different schools and subject areas, towards more elaborate partnership arrangements across whole programmes. Since the early 1980s, and especially since the introduction of 'serial school experience', tutors have looked, with varying degrees of success, for pockets of good practice in all subject areas in primary schools. Cornish et al. (1994) have recently described how inquiry-based school experience for teaching English has evolved in our institution, and at the same time they have noted the different characteristics of primary school-based provision across subjects: The range of 'confident' contexts for science and technology was (predictably) much smaller than for maths and English, and this led to a narrower spread of contexts and experiences in the former than the latter. Despite these difficulties some colleagues in other subject areas have been able to adapt to circumstances, as in the case of expressive arts where a full cohort of specialists works in one or two schools with a strong commitment to arts education. One consequence of the uneven history of placement practices is that tutors have been opportunistic and resourceful in seeking educative school contexts for students. Action research and classroom inquiry projects are woven throughout initial teacher education programmes, and they also form a major part of post-qualifying provision. In English, for example, a research-based approach to classroom work has been acknowledged as 'the strongest vehicle for the development of partnership activities', and there have been many notable examples of experienced teachers from our post-qualifying progamme working on teaching and learning issues with student teachers as part of their courses.

3. Particular Problem Of It In Placements

If the task of locating and using teachers' expertise has been found to be so problematic in key subject areas, it is not surprising that difficulties arise in finding favourable classroom contexts for observing and using IT in classrooms and then matching these with students' own stages of development. Amongst experienced teachers, distinctions between those with or without expertise and confidence in IT are not simply related to factors such as designated status for supporting students, subject knowledge or length of teaching experience. What is particularly important is a teachers willingness and openness to work and learn with students who are using IT. We have found that some teachers who are allocated students still avoid using computers in their classrooms. Sometimes, hestitant students have been placed with reluctant teachers and both have taken advantage of the chance to ignore or sidestep IT in a kind of conspiracy of silence: 'Because I'm not very competent about using IT in the classroom and the teacher wasn't either, we avoided the issue' (interview with student).

Another interrelated factor affecting worthwhile learning opportunities for students in schools is the apparently variable availability of computers in classrooms. We say apparent, because sometimes a teacher might make a computer inaccessible to a student as a strategic way to avoid having to acknowledge his or her own apprehension about using it effectively. As one IT co-ordinator said about the absence of a machine in a student's classroom: 'That's just an excuse for not using IT. There are machines on trolleys so there could easily be one in the classroom. The truth is the teacher's frightened of it and if that wasn't an excuse she'd find another' (interview with primary school IT co-ordinator). Problems of access and unhelpful organisational arrangements in schools can affect the extent to which IT can be an integral part of central teaching and learning processes rather than a marginal activity in corners of classrooms. One student, placed in a middle school, said:

4. Dimensions Of Placements

School-based provision for learning to use IT is variable and, given the current emphasis upon matching subject specialisms of students and teachers, discovering favourable settings for IT development can sometimes be a challenge to tutors and a lottery for students. As part of an overall strategy to evaluate and develop school-based experiences in IT, it is important to identify and describe best practices across a range of subjects and to build a critical review of case studies into university curriculum sessions and mentor meetings.

4.1. Willingness of teachers to use IT with students

Willing to use IT with students----Avoiding IT with students

This dimension refers to the extent to which class teachers are willing to work with students using IT. We acknowledge that this oversimplifies a subtle and complex range of orientations towards IT, but the extent of teachers' personal confidence to use computers with students, even if uncertain about their own skills, has been seen to be an influential factor in shaping students' opportunities to use them in classrooms. We are aware that teachers' feelings of confidence will be related to the degrees of challenge and risk which they allow themselves to accept. We have evidence that extreme lack of confidence can lead to avoidance or rejection of computers and to students being denied access to equipment.

Problems can arise when the orientations of the student and the teacher are markedly different, such as when the teacher rejects or avoids its use or when an enthusiastic, confident teacher over-challenges an exposed and reluctant student. Circumstances such as these test the negotiating skills of students and the mediating skills of university tutors.

4.2. Arrangements for access to computers

Constantly available------Inaccessible

Concerns about the availability of equipment have been common amongst students, especially those who seek to integrate IT into the primary school day or to have computers readily available in the classroom during secondary school lessons. The mid-point on this dimension can refer to having to book networks or computer labs in middle schools or secondary schools, or having to 'take your turn' in primaries. Sometimes the use of a rota system can be incorporated into planning, but we have evidence to show that it can also be a limiting and even off-putting factor.

4.3. Envisaged potential of IT in the curriculum

Integral/reconstructing----Supplementary or 'add on' activity

This is a key dimension referring to the extent to which the experiences of students in schools enable them to understand more about how children learn through IT and about how National Curriculum programmes of study can be enhanced by IT in a fundamental way. For some students, using IT means merely trying out software, such as an engaging educational game, with a small group of children as a separate clasroom activity. For others, it may mean that children are working at processes which are intrinsic corner-stones of learning within school subjects such as crafting writing, using evidence from databases or creating graphical images. This dimension is related to teachers' values and their notions of subject integrity. Easdown (1994), for example, has described how secondary school history teachers, mentoring student 'interns' in Oxford, had reservations about using time on IT unless it mirrored what historians do. For example, simulations were sometimes rejected because they presented pupils with simplistic models of historical issues, but databases were acceptable, on the grounds of appropriateness and value, because they enabled children to find and draw conclusions from data.

4.4. Nature of professional learning envisaged for student

Transforming understanding----Gaining technical 'know-how'

This dimension, like the previous one, is a key to evaluating what is learned about IT from a period of school placement. In plotting the position of any particular practice it is the main concern of the partners to determine which is to be given most weight. We are not suggesting that transforming understanding and technical 'know-how' are mutually exclusive ends of a continuum. It is necessary to recognise that competence in basic and technical matters can be crucial at a time when students may feel generally vulnerable in classrooms, and many teachers are put off using computers because the machines keep going wrong and they are unable to fix them. The salient issue, however, is the extent to which the placement experience results in the student seeing IT in new ways, and for this reason it should be the focus of systematic inquiry and reflection.

The dimension reflects the nature of the partnership between the teacher and the student. For example, the presence of a student can provide opportunities for teachers to investigate and learn more about their children's learning and how this can be affected by the use of IT. The focus, purposes and methods of working together between the students and the teachers are shaped to a great extent by their assumptions about the kinds of professional learning which might result for both partners.

4.5. Main strategy of experienced teacher to support a student

Inquiring/creating new knowledge----Telling, demonstating

This dimension refers to how experienced teachers try to support students, and how their strategies will affect what students will see, practise and talk about. As with the previous dimension, we are not undervaluing the occasions when experienced teachers might simply tell or show students what to do, but are trying to draw attention to the difference between confining support to that and nothing more, compared with aiming to create new knowledge through investigating the use of IT in classrooms. The latter requires, at least, that teachers are willing to learn. Most fruitfully, teachers, as co-learners, will identify dilemmas or feelings of unease about particular aspects of teaching and learning and then try things and talk about them; a mixture of posing questions, making plans, taking provisional action, recording what happens and deliberating from the basis of the evidence available.

Both partners will need to use and combine their prior personal knowledge and technical know-how in order to edge forward through 'wondering if', being watchful, and 'taking stock'. Concerns about success and failure are suspended and the teachers' and students' roles may become blended so that, at times, teachers may be observing in order to record and analyse classroom processes rather than to assess a student's level of competence. Cameron Jones (1987) has shown that, even within the hurly-burly of classrooms, some teachers do have the capacity to attend to simultaneous occurrences in their relationships with student teachers, just as they have learned to do with children. She refers to how the supervising teachers in her study were able to 'sustain this kind of parallel processing as they handled student-related information and pupil-related information simultaneously'. By giving on-the-spot comments on what was happening, their students gained 'live, episodic, insider commentary on the fine grain of classroom practice as it actually unfolds'.

5. Using The Dimensions To Plot Characteristics Of Placements

The dimensions can be used to plot the pattern of particular placement characteristics and to show the actual nature of any variations. Example 1 plots the experience of a student placed with a teacher who is willing to help the student with IT, uses the computer regularly as supplementary activity for groups of children, demonstrates its use and tells the student what works well and what won't be successful, as though the teacher's knowledge was objective and predictive. The critical task for university and school partners is to create educative events and frameworks to enable teachers and students to engage in co-learning. Such co-learning is likely to take place over an extended period, with students revisiting the school for different purposes and teachers getting to know what is happening in university sessions and, where possible, participating in them. Given favourable contexts and using a combination of serial school experiences of, say, half days over a set period and blocks of full-time placements, students have scope to achieve both breadth and depth in learning to use IT in classrooms.

It is important to give students some modest experience of co-learning with teachers as early as possible in the course. For example, a group of first-year students was asked to explore data collection and presentation with Year 2 children at a first school during a period of serial school experience. The students were expected to outline a provisional plan and identify the potential for IT use; and the class teachers, some of whom had no prior experience of this aspect of IT, were asked to provide a framework, within the school's curriculum requirements, for trying out the students' ideas. The starting point for students was their own college work on data handling. During the course they had considered its potential for IT use in classrooms, but at that stage they were unfamiliar with the practical demands of classrooms and they did not know what software and hardware would be available in specific schools. They were challenged to find out what was both practicable and worthwhile given the time-scale and contextual factors in the schools. In effect, they had to consult and negotiate with class teachers, and in the process apply their own recently acquired knowledge as well as discover what the teachers' experience and knowledge could offer to them. This could not be achieved instantly at the outset, as is sometimes implied in preparation meetings which are scheduled to cover basic tips and pointers. Over time, ideas were revisited and unanticipated things were learnt as an integral part of working together. The teachers were asked to identify data handling activities which were directly related to their current teaching topics and which should be able to continue after the designated period of serial practice had ended.

Example/Case Study:

Interview with students

Some students have said that their class teachers apologised for not having the computer available at times when they wanted to use it. For example, one had the use of a computer for only the second and third weeks of a six-week placement; another found that 'all three computers were in Year 2 for SATs'; and one student arrived at a school just after the computer was stolen. Lack of availability of the equipment at critical moments can restrict, and sometimes obstruct, the productive use of IT: 'They did it on a rota system. What they were using had nothing to do with what the lesson was about. It was just their turn'. 'I don't have one to make use of in an integral way. What I am doing is OK to introduce this to all the class, but I really want a small group to use it all week. I can't do that unless I book the room, and it's not available again this week' (interviews with students).

Overall the picture is patchy, but improving. As well as having scheduled classroom IT practice in serial school visits, students are expected to include IT in their block placements. From a survey of our final year primary BEd students in 1992, we found that although 81 per cent had used IT during their final block placement of six weeks, a proportion (40 per cent) had not made any reference to IT in their written evaluations. Furthermore, of those who had used IT, 8 per cent had not mentioned it in their lesson plans. They had continued their class teachers' practice of using IT as a routine, isolated activity, and children took turns to use the computer. Whilst it is important to ensure that IT is used by more and more students, it is also necessary to give serious consideration to how the educative quality of the students' school experiences can be enhanced.

Example 1

Teacher willing						Teacher avoids
Computers available			Computers inaccessible			
IT integral			IT supplementary			
Transforming		Technical know-how				
Inquiring		Telling, showing				

Example 2

Example 2 plots the case of a dutiful but sceptical teacher who for some time has used IT activities as disembodied, routine events, and has only just become willing to explore the use of databases as an integral part of a history project. This teacher sets up an inquiry with a student into how children use a database in relation to other documentary source materials they have been given. The teacher and student inquire together: the student starts the children's project work, then conducts and records focused conversations with the children about what they have been doing whilst the teacher oversees the whole class. The student then categorises themes from the children's conversations along with the teacher's observation notes, samples of children's work and her own lesson evaluation notes. She returns to the school and together they identify key issues and plan a set of new discussion activities for the children with a more concentrated focus on one feature of the database. They also discuss what evidence they will collect at the next stage as their partnership deepens.

Teacher willing					Teacher avoids
Computers available			Computers inaccessible		
IT integral			IT supplementary		
Transforming			Technical know-how		
Inquiring			Telling, showing		

Topic : Getting Teachers Started With It And Transferable Skills

Topic Objective:

At the end of this topic student would be able to:

- Introduce
- Give
- Discuss

Definition/Overview:

The Code of Federal Regulations: A person is considered to have skills that can be used in other jobs, when the skilled or semiskilled work activities (that person) did in past work can be used to meet the requirements of skilled or semi-skilled work activities of other jobs or kinds of work. This depends largely on the similarity of occupational significant work activities among different jobs.

Key Points:

1. Getting teachers started with IT and transferable skills

The most challenging and memorable episode for teachers is often in the first stages of their acquaintance with a computer. Below is a description, personal to Bridget Somekh, of events which occurred over ten years ago. It relates to a personal computer of that time, the BBC 'B' manufactured by Acorn Ltd. Despite the changes in the technology, similar strong emotions are felt by teachers new to technology today. Routines of unconscious thought directly transferred into action are a central part of carrying out skills. When we lack those routines there are two incapacitating consequences: first, we have to use up intellectual energy on thinking what to do; and second, we experience a sense of loss of personal worth both in our own eyes and in the eyes of others. The seriousness of the second of these consequences can be understood in terms of Mead's theory of the individual. Only through 'engagement' of the 'I' and the 'me' with the 'generalised other', according to Mead, does the individual 'develop a complete self': It is in the form of the generalized other that the social process influences the behavior of the individuals involved in it and carrying it on, i.e., that the community exercises control over the conduct of its individual members; for it is in this form that the social process or community enters as a determining factor in the individual's thinking. Translated into crude terms, what this means is that when we are called upon to use a skill which we do not possess, the actor and problem-solver which is the 'I' is undermined by both loss of self-esteem through self-criticism of the 'me' and a perceived negative response from those around us (the 'generalised other').

2. Computer Skills For Educational Purposes

Our particular interest over the past decade has been in the acquisition of computer skills for educational purposes. These have included skills at two levels:

- the technical-level skills of being able to use a machine and software effectively;
- what might be called the higher-level skills of being able to use a computer as a tool to support either one's own learning or the learning of students.

The former are crucially important because without them there is no possibility whatsoever of acquiring the higher-level skills. But they often pose so many problems for the learner that their acquisition comes to appear as an end in itself. It is vital that teachers acquire the higher-level skills, and one way of helping them to do so is to make the acquisition of the technical skills much less daunting and time-consuming. A major problem in teaching technical-level computer skills is that peoples perceived needs are immediate and specific. ('How do I use this particular computer, this particular printer, or this particular piece of software?') Many children and most teachers or student teachers expect to receive instruction of this specific kind. It is very time-consuming. At present levels of resources in schools and higher education institutions, instruction in how to use a substantial word-processing package, such as MS Word, can easily fill up the computer slots in a course for half a term. And all the evidence suggests that learners who receive specific instruction in MS Word only acquire specific skills in that one piece of software, with very little or no transfer of skills to other kinds of software or even other word processors, and certainly not to other machines. It would appear that a quite different approach to teaching computer skills is essential if computers are to be used cost-effectively in education, at least in the short term.

PALM used action research as a strategy for motivating teachers to acquire computer skills through self-teaching. This may sound naive, but to an extent the strategy proved very successful. The majority of teachers who worked with PALM had few computer skills when they joined the project and by the end counted themselves as confident, if not highly proficient, users. Of course, this was not unsupported self-teaching. PALM provided a considerable amount of on-the-job support through the three full-time project officers. Once motivated to self-teach, participating teachers were provided with both educational and technical backup. They also had access to low-level financial resources: this meant that they were not blocked for lack of computer paper, printer ink or backup disks-the kind of disincentives which Pirsig calls 'setbacks' or 'gumption traps in which you're thrown off the Quality track by conditions that arise from external circumstances'. From the point of view of research there was a price to pay, in that the teachers' action research into pupils' learning in PALM progressed much more slowly than similar work in other projects. Nevertheless, their research still generated a considerable amount of knowledge and understanding of the higher-level computer skills needed to realise some of the potential of computers as learning tools. And because their research was carried out in ordinary-rather poorly equipped-classrooms in England in 1988-90, it provides a meaningful knowledge base for other teachers wishing to acquire these higher-level skills.

Bigum (1990) suggests a much simpler strategy for promoting self-teaching in student teachers, by providing them with 24-hour, open-access computer facilities and a good technician constantly on hand to provide help if needed. Learning computer skills is then the responsibility of the student, with the help of manuals. According to Bigum the success of this approach lies in providing a context where 'situated learning' is possible. The theory of situated cognition has been most clearly stated by Brown et al. (1989). They argue that learning is easiest and most productive when it takes place in an authentic situation, alongside experienced practitioners of the discipline. This obviates the need for teachers to develop unnecessary abstractions-instead, part of the cognitive task is 'off-loadedonto the environment': The context of activity is an extraordinarily complex network from which practitioners draw essential support. The source of such support is often only tacitly recognized by practitioners, or even by teachers or designers of simulations. Classroom tasks, therefore, can completely fail to provide the contextual features that allow authentic activity. The theory of 'situated cognition' also helps to explain the usefulness of action research as a strategy for teachers' learning in PALM, since they acquired most of their higher-level computer skills and many of their technical skills in the classroom working alongside their pupils.

3. Enabling Skills: Creating Confidence Through Routine Procedures

Despite the success of these approaches, with their emphasis on self-teaching, there still remains a problem with the acquisition of transferable technical-level computer skills. Increased motivation and a decrease in the sense of cultural alienation together remove many of the barriers to teachers' development of these skills. But the story with which this chapter begins illustrates a continuing and more basic problem which must also be addressed. Conceptual inquisitiveness on its own cannot confirm and maintain the kind of positive self-image which seasoned computer-users bring to the learning of new skills. Conceptual inquisitiveness must be matched by a set of practical routines which enable exploration and both promote self-confidence and ensure that confidence is reflected back to the learner from peers and observers. In terms of Mead's theory of the self, only in this way can the 'I' embark on exploratory learning without being undermined by self-criticism of the 'me' exacerbated by apparent loss of esteem from the 'generalised other'.If you watch an expert computer user tackling a new piece of software or a new machine, you are likely to notice a high level of exploratory key pressing, often accompanied by mutterings and exclamations: 'Ah, yes! Hey, WHAT!? I see!' You are unlikely to notice very lengthy perusal of the manual, though it will be to hand and may be searched for the answer to some specific questions. The key-pressing may appear almost random, but will actually incorporate systematic elements. It will partly be governed by knowledge of how computers and software designers tend to work (drawing on past personal experience), and partly entail a set of routine procedures which are informative because they elicit responses from the machine.In October 1990 one of the authors was lucky enough to watch Leon Shuker of ILECC (Inner London Educational Computing Centre) working with postgraduate primary students at Goldsmiths' College. Instead of setting out to teach them how to use a particular piece of software he taught them a set of procedures for handling any software on a BBC machine. If they ran into problems, he told them, there were three keys they could press to try to sort things out: Escape, Return and Space Bar.

After they had tried these two or three times they should assume that there was something wrong with the computer-rather than themselves-and give up. We are probably oversimplifying, but what impresses us about this approach is the simplicity of the message. The students were clearly reassured and had no difficulty in beginning to explore the software. He had enabled them to approach the computer in the style of an expert user-and this brought with it a sense of confidence.There are two elements which make up a skill:

- an element of knowledge and understanding (Bridget could not have learnt to fit a Wordwise chip without being told its correct location in the BBC computer and given a strategy for inserting the legs without breaking them);
- an element of routinised action (which Bridget lacked, with the result that she experienced a strong sense of disfunctionality and actual physical discomfort).

When an expert computer user approaches a new piece of software or a new machine, he or she draws upon transferable technical skills in computer use. These rely upon two essential and interdependent ingredients:

- personal confidence;
- a set of routine exploratory procedures.

4. Transferable skills analysis

Transferable skills analysis is a set of tests or logic to determine what positions a person may fill if they currently have no position (eg. a recent immigrant) or they cannot do their last position (for example, because of an injury). An informal transferable skills analysis can be performed with the help of a career counselor, career portfolio or a career planning article or book. Transferable skills are determined by analyzing past accomplishments or experience. For instance, a stay-at-home parent and homemaker might find they have skills in budgeting, child development, food services, property management, and so on. The formal transferable skills analysis (TSA) process used by vocational evaluators consists of compiling occupations from the U.S. Department of Labor's Dictionary of

Occupational Titles (DOT) to represent a person's work history, and analyzing the work activities (Work Fields) a person has performed in the previous jobs, along with the objects upon which the work activities were performed (Materials, Products, Subject Matter, and Services, or MPSMS). These data are then used to identify a set of occupations that a worker should be able to perform. If the worker has been injured or otherwise disabled, their residual functional capacities can also be considered by the worker traits associated with their DOT work history.

Example/Case Study:

Skilled performance and the self

In 1985 I was seconded from my job as Head of English and Drama at a Cambridge comprehensive school to the post of Curriculum Development Officer with the Netherhall group of software developers. At the time I had been using a BBC 'B' computer for word processing for about a year, and during the previous three months had used it in teaching writing to a mixed-ability class of eleven-year-olds. On my first day at Netherhall I was asked by the Director, Rod Mulvey, to fit a Wordwise word processing chip into a BBC computer. I can still remember my strong feeling of incapacity. I knew that this required me to take the top off the machine. I had in my hand an open box with a small rectangular piece of metal sitting on a bed of foam. If I had not known it was delicate, its packing would have made this obvious. My hands seemed to hang by my sides without any functionality. I had to think through what to do firstand what nextthere were no routines of action to call on from previous experience. Of course, I needed knowledge of the right location for the chip in the machine. It had two rows of little metal 'legs' down each side of the base and I needed knowledge that the tips of one whole row should be inserted in one row of tiny holes, just far enough to enable me to bend them slightly inwards, bringing the other row of legs to a position where their tips could also be inserted. I was told these things and left to try them out. My sense of physical incapacity in simply using a screwdriver and turning the machine over to find the screws stills lingers in my mind. I was literally sweating as I got the chip into place and pressed it carefully home into the two rows of holes. In the next eighteen months I was to repeat this operation many times, sometimes taking chips in and out of machines several times in a day. I only broke off one leg in that whole time, and that was in my final week of the job. I suppose I had become overconfident.

This story from personal experience illustrates the problem we want to address. A great deal of what we do in our daily lives is highly routinised so that we scarcely have to think in order to transfer intention into action. That bit of our 'thinking' which governs body movement becomes automatic, freeing up our intellects to concentrate on other things. We can literally 'do two things at once'. Once we have acquired a skill like fitting a chip into a BBC computer we are able to carry out the job while simultaneously chatting to a teacher or children standing by our side. There may just be a moment or two, at the tricky point of bending those little legs, when we have to stop talking and give the job our full attention. For the rest of the time we perform the task confidently, and we look confident performing it, and our sense of looking confident and knowing exactly what to do, quickly and without fuss, builds up our own sense of our worth in the eyes of others.

Self-Teaching As A Strategy For Transferable Skills Acquisition And Situated Learning

Bridget Somekh takes up the story again

In my early work I attempted to tackle the problem of transferability of computer skills as a motivational problem and a problem of self-image. My theory was that if you begin by exciting the interest of a teacher or student in the educationally interesting things which a computer can do, they will learn the basic technical skills easily because they perceive a need for them. Partly this will be because their interest will help to overcome any emotional blocks they may have to using technology, what Pirsig calls 'internal gumption traps' or 'hangups' of which he identifies the most difficult as the 'value traps' which 'block affective understanding'. In my experience of working with teachers during 1984-5 such emotional blocks were often obvious. Sometimes they were exhibited through body language (awkward sitting postures, starts and jerks in response to 'bleeps'), sometimes through the repeated efforts of individuals to distance themselves from computer use by incorporating their lack of computer skills into their projected self-image ('I'm no good at computersdon't ask me, ask the children'). The latter phenomenon exactly matched the 'I'm no good at maths' syndrome. It is a peculiarity of British culture that many people feel very comfortable constructing themselves as non-technological or non-mathematical people, whereas they would not dream of claiming: 'I'm no good at reading.'

My growing understanding of the barriers to the computer innovation led me to adopt strategies which would increase teachers' professional motivation and reduce their sense of cultural alienation ('hangups'). I worked experimentally, basing my strategies on the hypothesis that once I had gained teachers' interest in the potential of computers as learning tools they would not only acquire computer skills easily, but be able to transfer these skills easily from the use of one specific computer or software application to another. There is a lot of evidence to support the view that a high level of motivation can have this effect, not least in the fact that almost all highly skilled computer users profess to be largely self-taught.

In the Pupil Autonomy in Learning with Microcomputers (PALM) project I used action research as a strategy for creating and sustaining teachers' motivation, and thereby supporting their development of both technical and higher-level computer skills. Teachers were asked to experiment with computer use in their classrooms, in order to research their educational potential. Their misgivings about any possible harmful effects of computer use were reconstructed as research questions which could best be investigated by teachers using computers in their teaching and evaluating the impact of their use on pupils' learning. My hope was that by diverting the focus of teachers' attention away from the acquisition of technical skills, and towards issues which were of the highest professional concern, we would enable them to acquire technical skills easily: I believed that the perceived difficulty of acquiring technical computer skills was created by fear and a sense of alienation from machines (because, in their appearance and the discourse or 'jargon' which surrounded their use, computers carried the cultural stamp of Science and Technology). Once teachers started experimenting with their use and researching their value, I believed they would not find computers difficult.

In Section 4 of this course you will cover these topics:

- Partnership In Initial Teacher Education
- Do Electronic Communications Offer A New Learning Opportunity In Classroom?
- It And The Politics Of Institutional Change
- Managing Change In Educational Institutions: Reflections On The Effects Of Quality Audit And A Staff Development Project

Topic : Partnership In Initial Teacher Education

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term teacher education.
- Give the information regarding Teacher Education At Goldsmiths' College
- Discuss the Development Of The New School-College Partnerships

Definition/Overview:

Teacher education: Teacher education refers to the policies and procedures designed to equip teachers with the knowledge, attitudes, behaviours and skills they require to perform their tasks effectively in the school and classroom.

Key Points:

1. Teacher Education

The education of new teachers, in common with most vocational education, involves a complex process of preparation for the job and guided practice on the job. The partnerships between schools and teacher training institutions that have developed in England and Wales during the 1990s bring together experienced teachers, student teachers and college tutors in close working relationships. As a result, what students must achieve to qualify as teachers has had to be made explicit. All parties must understand the new distribution of responsibility for the different areas and stages of training, and must also agree on criteria of assessment which are clear and unambiguous. The development of partnerships has major implications for a curriculum area such as information technology, which is taught mainly through other subjects. Practices concerning student teachers' use of information technology in school, which have developed informally and unsystematically, are likely to be more closely scrutinised by both students and staff across the team of schools in a partnership. As a result, comparisons may be made and norms of practice may develop across schools. Norms may primarily be in terms of the use of information technology by student teachers, but they may also reflect the role of IT in the teaching of the relevant subject or age phase in each school, and its wider role in management and administration. Partnership may thus offer the institutional mechanisms and impetus for greater coherence in the student's experience of using information technology in school.

Information technology's role in the curriculum is a diffused one and in important respects still unsettled. In this situation the activities of partnership, comprising discussion, planning and assessment across schools, could also become a powerful strategy for in-service teacher professional development in the use of information technology. A significant subtheme in what follows will, therefore, be the changing priorities of experienced teachers in the use of information technology.

2. Teacher Education At Goldsmiths' College

The role of information technology in teacher education at Goldsmiths' College was strongly influenced by its participation from 1990 to 1992 in Project INTENT. The project worked within a philosophy that emphasised the close association of development with research. The priority given to independent judgement and initiative was to prove highly significant when the partnership teams considered new arrangements for information technology. Another feature of Project INTENT was the close involvement of management. At Goldsmiths' this meant that the project's three-member team included a newly appointed Professor of Education who was in line to become the next Dean. As a result, organisational impetus was given to developing an appropriate structure of working groups in relation to information technology, which cut across boundaries of subject and age-phase.

Prior to 1990, arrangements for IT in the courses for student teachers at Goldsmiths' included informal permeation of IT across all subjects. This was described with approval by a member of Her Majesty's Inspectorate, in November 1991, as using information technology 'wherever and whenever it is appropriate'. However, despite its strengths, it had proved difficult to monitor and audit this arrangement. In 1990, the new working groups decided on arrangements for distributing responsibility for information technology across teacher training courses that would be easier to sustain and more effective than previous arrangements. Student teachers would continue to be provided with informal opportunities for the use of information technology in all their courses. But these would now, in almost all course elements, include occasions on which the whole of a class would have opportunity for 'hands-on' experience within a context that was appropriate to that course element. Such occasions, clearly identifiable to staff and students, would be timetabled to ensure that enough computers were to hand for use by all students. This form of permeation would occur, for example, in each of the primary curriculum areas. It was designed to meet national criteria for the accreditation of teacher education, which at the time specified that courses should contain 'compulsory and clearly identifiable elements' of IT

By 1993, new government directives prompted a radical review of the arrangements for monitoring students' use of information technology with children. There was a move away from the specification of course content for the purposes of course evaluation to the use of exit criteria in the form of profiles of student competences. At Goldsmiths' there was general agreement for using competences to monitor students' experience with information technology. This was premised on the term competence being understood in a formative and imaginative way. The language of competences did not require a narrow, reductionist interpretation. More general misgivings about the concept of competences were to be treated as warnings rather than as barriers against its use.

3. The Development Of The New School-College Partnerships

The next priority was to improve the student teachers' use of IT with children. This student experience occurred in college as well as in schools. New informal bilateral arrangements between the college and individual schools were led by the college, mainly at first within the undergraduate BA (Ed.) course for primary teachers; they included regular visits by children from a neighbouring primary school to work with students in college and using IT as a resource. A full account is given in Byrne Hill (1992). Goldsmiths' had already developed partnership arrangements with a small group of secondary schools in its postgraduate programme. The initiative for this small-scale scheme within one subject had come from teachers in the schools and the subject tutor in College. After 1993 the government required that all secondary courses should increase the element of training based on the school site. This model of decentralised partnership was therefore extended, with modifications, to all secondary subjects and subsequently to the postgraduate primary course and the undergraduate courses. For most purposes the partnerships were initiated and run by teams of college- and school-based tutors. Each team in the secondary programme represented a subject and comprised from ten to twenty-eight teachers. It was co-ordinated by a college tutor and each of the school-based tutors was normally responsible for two student teachers.

Some significance attaches to the terms used. 'School-based tutor' was preferred to 'mentor', because the term implied that the role included responsibility for assessment and joint planning as well as for advice and counselling. Tutoring was understood as significantly more than a 'taking care of' role. The term 'mentor' was occasionally used informally, but was not considered to be sufficiently clear or rigorous for formal arrangements in teacher education, with its pressing needs for accountability and quality assurance. It should be noted that these teachers were not a cross-section of the teaching profession. They were selected or came forward because of their experience in teaching their subject and their interest in professional development. They may therefore be considered to have reflected more deeply than the average teacher, especially in relation to the importance of the school as a context for teacher education.

4. New Partnership Teams

The new partnership teams were immediately presented with the question of how to provide all students with appropriate opportunities for the 'planning and management of lessons in which children learn with information technology alongside other resources'. In early meetings of the new partnership teams the discussion focused on IT provision in terms of access to equipment. Discussion then moved on to the identification of essential uses of IT in each of the subject areas. The enhanced responsibility for the training of teachers prompted unusually forthcoming responses from school-based tutors about what each of them believed and practised. The postgraduate programme for secondary school teachers took the lead in the development because it was able to build on the existing small-scale scheme. Partnership arrangements with the schools for the ten secondary subjects were adopted in two stages and came into effect in autumn 1992 and autumn 1993. The arrangements are currently managed by partnership teams which meet termly. An individual or small committee within each school co-ordinates arrangements across all the subject departments that are working with the College. Not once, however, at any partnership team meeting was any significant reference made to a wider school structure or authority in relation to the curriculum role of information technology.

During 1993-4 the partnership teams were presented with a series of initiatives prepared by the Goldsmiths' College IT in Teacher Education Committee. This innovative committee, chaired now by the head of the department of teacher education, was part of the legacy of Project INTENT. It proposed that all students should give a fully planned and evaluated lesson involving IT during their first teaching practice in the spring term. The writing up and evaluation of this lesson would count as one of the pieces of assessed work. The committee agreed that an early priority for the partnership teams was that students should have adequate, school-based opportunities for the use of information technology. The main obstacles were believed, at the beginning, to be the wide diversity of, and limited access to, IT equipment in schools. Therefore school-based tutors were surveyed to obtain a description of the IT facilities available in each teaching subject. The feedback from this survey significantly altered the terms of the inquiry, because it emerged that in most subjects in most secondary schools the extent and quality of the IT resources were not the major constraints. School-based tutors widely recognised that the equipment did not have to be state of the art. On the contrary, the planning of an adequate student teacher's experience with IT could be based on minimum resources, for example a word processor, a database and a spreadsheet. IT literacy for the student teacher was not primarily concerned with knowing more about computers, but knowing how to make an IT application work as an integral part of an activity. More fundamentally, therefore, the survey of facilities prompted discussion of the nature of the competences in IT that school-based tutors expected of beginning teachers. Henceforward, efforts to foster students' competence in the use of information technology were subsumed within the wider responsibilities of the new partnership teams.

The College's IT in Teacher Education Committee responded to this feedback from the partnership teams in early 1994. It proposed, first, that the partnership teams should discuss the feasibility of a student teacher's entitlement to use information technology in work with children that was specific to each school. This statement of entitlement would take appropriate account not only of differences in equipment, but also of differences in subject philosophy and in understanding the role of information technology within a subject. Second, the committee inquired whether it might be possible in the longer term for teams to agree a minimum student entitlement across the schools for each subject, and to describe the form that it might take. Discussion within the teams subsequently explored further questions relating to the competences that school-based tutors expected of beginning teachers, both in terms of expertise with IT and its relationship with curriculum and classroom management. Spelling out responses to these questions would achieve a number of purposes. Students would know what opportunities to prepare for, and what competences they were expected to achieve. Both schools and College would be clearer about what new teachers needed from them and what each partner was providing.The following section summarises the response of the partnership teams according to subject.

It is based on the opinions of 147 school-based tutors in a cross-section of 74 schools in south-east London and north Kent. These are drawn partly from the questionnaires which team members completed in May 1993 and partly from the discussions which occurred at subsequent partnership team meetings during 1994 as the teams responded to the College's IT in Teacher Education Committee's request for their views on the feasibility of a student entitlement to the use of IT in school. In the commentary that follows the presentation of the responses from each subject, a comparison is made between what school-based tutors believed to be important and the recommendations of government guidelines both at the time and more recently. This is useful as a test of the feasibility of government policy for IT.

5. The Feasibility Of A Student Entitlement To The Use Of Information Technology In School

5.1. Science (twenty schools)

The school-based tutors in science distinguished between how they expected students to use information technology as a general professional tool and what they expected of students in the classroom. As general preparation they expected students to have already learned before going into school how to use information technology for:

- o lesson planning;
- o the production of classroom materials;
- o organising information about pupils on a database or a spreadsheet.

Students were reported often to lack these general skills; a few were even physically apprehensive of computers. On the students' use of information technology in the classroom, however, school-based tutors believed that they should be less specific. Any tight statement of entitlement concerning the curriculum uses of information technology was liable to run into serious timetable problems. One example illustrated this point: the use of a database for the study of patterns of illness by a Year 8 class could not be rescheduled to match the timetable of a student teacher. Tutors preferred to put the onus for the classroom use of information technology on student teachers, to offer them a 'menu of suggestions', and at the end of a teaching practice to require student teachers to provide an adequate answer to the question of what they had managed to do. A menu might comprise, for example, use of three of the following: a database, the graphical facilities of a spreadsheet, a hyperstudy, secondary sources on a CD-ROM, word processing with less able pupils, and data logging. All schools possessed appropriate data logging equipment, but the tutors did not consider that they should require students to be able to use it. They argued this on grounds of what they believed to be the equipment's complexity. It would be more appropriate, in their view, for students to choose from a menu.Summary and comments:

o Student teacher entitlement: student to choose from a menu.

o Cross-school entitlement: feasible on the basis of a menu which allows choice to schools as well as to students.

o Essential competences of new science teachers:

general: word processing, desktop publishing, data handling and use of a spreadsheet;

in the classroom: a range of flexible competences which were not specified in detail.

School-based tutors would not expect students to develop competences either in data logging or in modelling (for the formulation and testing of hypotheses, using spreadsheets or simulations). These are areas in the teaching of science, however, where the appropriateness of using information technology is much emphasised in the guidelines published by the National Council for Educational Technology and by the School Curriculum and Assessment Authority 5). There were no suggestions that the use of information technology was limited significantly by problems of access to equipment.

5.2. Mathematics (twelve schools)

School-based tutors agreed, with one dissenting voice, that new teachers of mathematics should be familiar with the following: LOGO, a graphics calculator, data handling and use of a spreadsheet (particularly for statistical analysis). Students' knowledge of curriculum software was reported as varying widely, a few being unfamiliar even with spreadsheets. In general, use of mathematics-specific software, such as mathematical games, did not present students with problems.

Topic : Do Electronic Communications Offer A New Learning Opportunity In Classroom?

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term electronic communication network.
- Give the information regarding communication through computers.

Definition/Overview:

Electronic communication network: An electronic communication network (ECN) is the term used in financial circles for a type of computer system that facilitates trading of financial products outside of stock exchanges. The primary products that are traded on ECNs are stocks and currencies. ECNs came into existence in 1998 when the SEC authorized their creation. ECNs increase competition among trading firms by lowering transaction costs, giving clients full access to their order books, and offering order matching outside of traditional exchange hours.

Key Points:

1. Communication and Computers

Over the last fifteen years or so communication mediated by computers has grown in volume and variety. Many of these computer systems have been connected with one another and those networks have linked to form a vast global network, often called the Internet. The original Internet served the needs of researchers. Today there is wider participation. The process is continuing to expand rapidly and to merge with many aspects of cable, telephone and satellite networks, resulting in the concept of Information Superhighways around the world. This futuristic communications channel is frequently perceived as containing valuable information on just about any topic, within and outside the curriculum. It also provides flexible messaging system between millions of people, including researchers and other experts. Additional services such as video conferencing, leisure and commercial activities are also developing rapidly. The aim is lifelong learning, hopefully including the professional development of teachers.

By 1996 electronic communications had proved their value to enhance learning, but most activities have been outside the normal curriculum. In future, the structure of teaching and learning may change to permit communications technologies to play as important a role in education as they do in commerce. Teaching and learning opportunities which become available through electronic communications are described, including a brief outline of the services and a range of case studies of their application to education for the purposes of enhancing the curriculum and professional development of teachers.

2. Applications Of Electronic Communications

There is a wide range of applications of electronic communications to teaching and learning, as shown in the box. They range from information banks to individual communication as a conduit for information. At one end of the range, banks of information are available from which teachers and learners can retrieve information much as they do from libraries. The difference is that access and volume are virtually unlimited. Many of the world's university library catalogues are available to search. Although it isn't possible to pick a book off a shelf, the full text of other files is available, including abstracts of published work, data from space missions and regional information from many parts of the world. Some information can be up-to-the-minute, for example news services or weather map 'movies' of the previous twenty-four hours. In August each year in the UK a timely service called ECCTIS provides up-to-date information enabling students to match their exam results with the remaining places available in higher and further education.

Electronic communications can be used in a 'store and forward' mode, rather like a mixture between a library catalogue and an answering machine. Participants connect to their host computer to collect and send information at a time that suits them. The host computer can also be considered as a link to remote equipment. This has frequently been a large computer; for example, NASA make a supercomputer in the USA available to schools, and access to surveillance cameras, telescopes and microscopes is also possible. Electronic communications can also be used in real-time mode, with both participants on-line at the same time; it feels more like a telephone call. This point-to-point communication permits a range of applications including video conferencing and collaborative work using personal computers running the same programs. For example, video conferencing has also been used to link classes for discussions and to provide a 'remote' guest speaker, possibly through a satellite link. Further information on the technical aspects of electronic communications is provided by the National Council of Educational Technology, and a range of services and facilities in relation to open and distance learning is described in Mason (1994).

Learners in all phases of education may also publish their work in such systems. Over 10 megabytes per day of discussion messages were flying between universities in May 1994 and since then the growth has been exponential. These messages are between groups as well as individuals. Classes can be linked to work collaboratively. Others comprise less formal interest groups; they post messages on a particular theme on a communal electronic notice board. Individuals using the Internet include electronic pen pals and those negotiating their collaborative work. That is the other end of the continuum of electronic communications: the ability to send messages to individuals or groups around the world for immediate reception or collection at the convenience of the reader.

Electronic communications are also used for management purposes. Many universities describe their courses on the World Wide Web, which is a colourful part of the Internet. Within universities, campus-wide information services permit the electronic publication of directories, calendars, minutes and discussions. Schools are also developing similar provision of information. In addition, a national service provided by British Telecommunications (BT) called Campus Connect provides management services, including the ability to transmit exam entries directly to examination boards. However, it should be noted that curriculum applications may enhance management applications and vice versa. This is because the information and equipment can be used for dual purposes. For example, students can design-and update-information to publicise their school. Unfortunately, it seems that every time a new opportunity is created it is accompanied by a threat. In this case increased access is accompanied by unauthorised and possibly malicious use. Access without authorisation is called hacking and is a criminal offence. Students need to become educated in their responsibilities with electronic communications just as they are in other aspects of personal social and moral education, and educational institutions need to take security precautions in the use of electronic information, just as they do with other valuable items on the school premises.

3. The Potential For Teaching And Learning

There is a wide range of applications that support teaching and learning. I will take one in detail to illustrate the ways in which teachers and their institutions have developed good practice with electronic communications. One American service, AT&T Learning Network, which became available in the UK during 1994, provides a managed facility. Dial-up access to the Internet is complemented by technical support and curriculum guidance, including project management and student materials. Classes which enrol are placed in a Learning Circle with about six others (at least one of which is overseas) and they all work on the same theme. Co-ordination, provided by AT&T, identifies clear stages, including guidelines for good social behaviour and deadlines within project work to ensure a positive learning experience which is celebrated with a joint publication by all involved. The stages acknowledge that it takes time to get ready, to open a collaborative enterprise, and to permit everyone to plan their own part of the project before exchanging work. The final publication is a collaborative venture arising from this work. Margaret Riel (1994) has researched the value of this activity in relation to the skills that employers find valuable. Her findings show that these activities foster the knowledge and skills that employers say they want, such as good communication skills and the ability to work in teams. There are several general themes for Learning Circles which capitalise on the different perspectives and resources available to share across the locations. For example, 'Places and perspectives' encourages students to explore the history, culture, government and geography of their region and to compare it with their distant peers.

4. Poten tial For Professional Development

Professional development can be improved through the application of IT, especially communications. The best case is when IT enhances a teacher's learning. Most of the applications in the box on page 169 can be used for professional development. I have been involved in this area of research and development for over ten years. Perhaps the style could be described as development with research because, with my colleagues, we have tried to fit our perceptions of the potential of electronic communications to the needs of teachers and learners. This 'technical action research' is informed, at one end, by an exploration of the strengths and weaknesses of the communications channel, for example e-mail. At the other end, it is informed by observation and action of ourselves, our students and practising teachers. In this way we have developed a range of case studies which employ electronic communications in a way which demonstrates their educational value and identifies the new issues that they raise. Several case studies will now be described briefly, first within initial teacher education and then for the purposes of continuing professional development.

5. Initial teacher education

Collaborative approaches have proved worthwhile in initial teacher education. I have designed the application of electronic mail in several ways to stimulate student teachers to consider multicultural themes and to take a comparative view of education. The activities are cross-curricular in many ways: they develop IT and communication skills as well as collaborative work and a consideration of approaches to flexible learning. I will take two examples to illustrate this. The first originated in the USA in the form of a competition for teams of student teachers. The second was designed from a similar curriculum activity in the school classroom. (The e-mail day for small schools described in Davis, 1994, is the primary school version.) Both case studies were applied simultaneously to primary and secondary teacher education and thus also increased awareness across the phases of education.

6. The case competition

The University of Virginia has developed the use of case competitions to help teachers to learn how to behave according to a set of professional procedures. This has been adapted from professional training strategies for lawyers and doctors. In a case competition teams of teachers must work as a team to: identify issues in the case; consider the values and reasons underlying the actions of people; seek knowledge, and use it to develop a rationale for action with an accompanying forecast of courses of action and speculations of the consequences. Case competitions have taken place locally in the USA and there is an annual national competition in the University of Virginia. I observed a case competition in April 1994 and afterwards worked with colleagues to plan an electronic, or virtual, version.The first international 'virtual case conference', held in May 1994, increased access to this mode of problem-solving teacher education by eliminating the need for teams to be on the same campus. Instead, the time scale of the competition was lengthened from a weekend to a month and communication took place electronically. Five teams of student teachers in three different countries took part. The student teachers considered the case of a newly qualified middle school science teacher in a school with a possible theft problem, when a group of 'playful' boys breaks a mercury thermometer. As is often the case, science was not her main teaching subject: 'She was worried about letting students conduct experiments, because so much could go wrong, and she wasn't comfortable with the subject matter'.Teams in the USA, Canada and the UK considered the case, supported by on-line discussion with experts and each other. Each put together a reflective report analysing the situation and providing advice. As one of the tutors, I can confirm that the development of reflective practice and the students' growing understanding of comparisons between educational systems was a delight to observe. The project and its context are described in detail in Kent et al. (1995).

7. E-mail days

Projects for student teachers to encourage collaboration across courses, institutions and cultures have taken simpler thematic forms too. The first e-mail day for student teachers took place in November 1990 with a multicultural theme. This is a theme within all initial teacher education courses. The introductory briefing material was provided by Professor Tony Adams of the Department of Education, University of Cambridge. I was the overall project co-ordinator and taught several primary and secondary classes in Exeter. The third partner institution was the University of Linkoping in Sweden. The groups were introduced to the tasks and each other at the start.

8. Recent applications

Cross-curricular activities such as these are now very difficult to arrange because of the time pressures imposed by increased school-based training. For this reason electronic communications are starting to take a different role: to link student teachers based in schools back to the university tutors and resources. In Exeter dial-up electronic communication via modems is being developed for three main purposes:

- library access, including reservation of books;
- support from the personal tutor and other students;
- curriculum activities, through documents and messages for discussion groups.

Other university departments of education are also developing the use of electronic communications for similar activities. In common with Exeter, they find that there are major organisational and access issues. In Exeter we have loaned a modem to partner schools to facilitate communication. However, shared access to a computer, modem and telephone line within a school can cause problems, and communication during the school day can be difficult for a student on teaching practice. The Open University has been able to overcome many of these issues in their part-time PGCE because they are using a distance learning mode of study. Student teachers are given a personal computer and a modem as part of the course and have sole use of it from home while studying. It is given to the host school on completion of the course. Many of these students make excellent use of discussion groups which are set up for them by the Open University. In addition to general topics each subject discipline has its own section. For example, science student teachers have been swapping lesson plans, worksheets and teaching strategies with occasional supportive, provoking or reflective messages from their tutors.

9. Continuing Professional Development

One of the main benefits of electronic communications listed by US teachers has been the development of their teaching and reflection on the process of learning, even where the school curriculum is the main focus. Therefore activities described in the previous section have an effect on teachers' professional development. Electronic communications can also be applied more directly. Several years ago I created what I called the UK national electronic network for pre-vocational education and training, called ResCue. It was created in association with all the further education Regional Curriculum Bases (RCB) across the UK. The aim of the network was to develop new practices in teaching and learning with an emphasis on basic skills in the context of vocational activities. This required teachers to change their practice and to develop resource-based learning with relatively few resources. ResCue was therefore designed to hold a catalogue of published resources which had been especially keyworded for basic skills and vocational topics. Each RCB held a collection of these resources for inspection and loan. A second catalogue held a collection of donated assignments in full text. Teachers were encouraged to collect this text and edit it to suit their students. Notice boards advertising inservice training events in each region were also available on-line. ResCue's success on the Campus 2000 network service (now CampusWorld) was limited because relatively few teachers had the IT skills and confidence to make use of such a service. Many staff felt that the IT area of their college was 'out of bounds' to them. Somekh (1989) discusses these social and cultural contexts of schools that can hinder access to IT. However, access to IT is improving both in terms of skill and access. The political potential of the Information Superhighway appears to be giving rise to many new projects. Several in the USA are taking the approach of building a community of practice among teachers in the hope that it can become self-sustaining.

Topic : It And The Politics Of Institutional Change

Topic Objective:

At the end of this topic student would be able to:

- Introduce the term new institutionalism.
- Give Problems In Introducing Information Technology Across An Institution
- Discuss Cultural alienation and stereotyping

Definition/Overview:

New institutionalism: New institutionalism describes social theory that focuses on developing a sociological view of institutions--the way they interact and the way they affect society. It provides a way of viewing institutions outside of the traditional views of economics by explaining why so many businesses end up having the same organizational structure (isomorphism) even though they evolved in different ways, and how institutions shape the behavior of individual members. Sociological or political new institutionalism should not be confused with new institutional economics.

Key Points:

1. Common Problems In Introducing Information Technology Across An Institution

Very few educational institutions have so far managed the introduction of information technology across the whole institution effectively. 'Patchy' was the word Her Majesty's Inspectorate (HMI) used to describe the use of IT in initial teacher training institutions (ITTEs) in its 1988 report, and at various times over the last five years it has proved notoriously difficult to find examples of whole schools using IT effectively when there has been a specific need (e.g. for purposes of evaluating the effectiveness of government initiatives, or to develop tests for the IT attainment targets in the National Curriculum). Although many institutions have made some progress, effective change in IT across the whole institution appears to be inherently difficult. There seem to be four main reasons for this, which are outlined below.

1.1. Cultural alienation and stereotyping

Most people who have never used a computer make assumptions about its purposes and use. These are culturally constructed. Computers emanated originally from the world of engineering, and their appearance-and in some cases their mode of operation and language on the screen-still belongs to the engineering culture. Those who develop expertise in computer use acquire a technical language and in-front-of-screen behaviours which serve to set them apart from novices, and give them a sense of power that they frequently learn to turn to advantage. (Often there may be very tangible pay-offs in terms of career opportunities.) Specialists in disciplines such as literature, history or art cannot feel at home in this environment until they bring their own uses to it and 'make it their own'. It is not far-fetched to say that frequently the computer conjures up for them, subliminally, the ubiquitous machines of science fiction and the implied threat of a future depersonalised, or even dehumanised. Gender further complicates the issue since many men and women have a tendency to see computers as the province of the male. The vehemence with which some people reject computer use, and the real difficulties and therefore high costs of giving them 'training', are indicators of the extent to which the computer is perceived to threaten their culture and values.

1.2. Compartmentalisation

In the early days, computers typically came into secondary and HE educational institutions through the mathematics department or, more rarely, the science department. However, because of the departmental divisions in the institutional structure and hierarchy, the normal progress was towards establishing separate departments of computer studies. Individuals were duly appointed to be heads of these new departments and given charge of the computers and the keys which locked the computer room (often called a laboratory, which served to underline the computer's cultural origins). The expectation was firmly established that computers were a specialist discipline rather than a general tool, and it has proved very difficult to change this perception. All cross-curricular initiatives are hard to establish in institutions with a departmental structure and information technology is probably no worse in this respect than others. Nevertheless, in the late 1980s the very people who might have led whole school development were often reluctant to do so, sensing that it would undermine their own power base by effectively taking away their rooms, machines, subject discipline and specialist examination teaching.

1.3. Equitable allocation of resources

Computers, of course, are expensive. In any institution the allocation of money is part of a political process, contested by different interest groups. It highlights issues of power and serves to delineate management style. This means that even if senior managers retain the power to allocate sizeable sums of money (which they often do not, depending instead on a committee-based decision-making structure), they make decisions about its allocation on the basis of a large number of stated and unstated considerations. These are likely to include established budgeting traditions, perceived fairness, the informal standing of the individuals concerned (are they liked by colleagues?), 'trade-offs' for services rendered, bargaining for services required, and so on. This creates a 'catch 22' situation for IT: it is only when all colleagues across the institution have adequate access to computers that they will perceive money allocated to purchase computers to be well spent, but without considerable resources being allocated this precondition can never be met. The exception, of course, is the maverick principal who has decided to make IT the central plank of the school's development and a marketing strategy in its own right. There are one or two well-known examples of this among secondary schools, such as Stanley Goodchild's Garth Hill during the 1980s which capitalised on its location in the Berkshire 'silicon belt'. However, even City Technology Colleges, with generous funding and new forms of school organisation, have not always used their lavish IT resources to best effect in the classroom.

1.4. Responsibility without power

It is common practice in most institutions to give special responsibilities to individuals for some aspects of the corporate endeavour. In institutions with a line management structure there is usually a group of people who share this responsibility, working to the head of department or sector leader. A problem commonly arises when responsible individuals do not have control of adequate resources or decision-making powers to put in train the necessary action to fulfil their responsibility. This problem, summed up by the phrase 'responsibility without power', is much more common in relation to IT for two reasons: first, the amount of money needed to establish, and thereafter to maintain, IT equipment is much larger than that needed for most other aspects of institutional work; second, the cross-curricular nature of IT means that, in order to be effective, the IT co-ordinator in secondary schools and initial teacher education establishments needs to be able to influence not only members of the IT department but all colleagues across all departments. Even in primary schools where there is no departmental structure, the wide-ranging responsibility to work with all colleagues is difficult to fulfil. For both these reasons, effective management of change in IT may only be possible with the active involvement of at least one member of the senior management team who has some capacity to work across departmental boundaries. But that is not to say that change has to be an entirely management-led undertaking. Rather, those initiating change from below need to be able to draw upon the resources of management at key points if their efforts are not to be continually frustrated by the very features of organisational structure and culture that need to be changed.

2. Partnership In The Management Of Change: A Two-Level Approach To Whole Institutional Development

To address these problems and thereby manage the development of IT effectively within the participating institutions, the Initial Teacher Education and New Technology Project (INTENT) adopted an approach to IT development based upon Fullan's model of educational change. An action research methodology provided the opportunity to research the effectiveness of the resulting change process within participating initial teacher education establishments. INTENT's aims were to enable all tutors-regardless of their subject specialism and of whether their focus was on primary or secondary teaching-to prepare student teachers to use computers in their teaching of children. They went well beyond developing improved specialist courses in computer use or computer awareness. The implication was that all tutors should use computers in their own teaching of student teachers as well as in the preparation of teaching materials, and should be ready to supervise student teachers using computers either on teaching practice in schools or on occasions when children and their teachers came into the higher education institution. These aims were ambitious, given the state of IT development in ITTEs in 1990. However, the project was timely since the criteria for accreditation of initial teacher education courses required all students to acquire IT competences; in that sense the project's aims fitted an urgent need of the participating ITTEs.

In developing strategies for putting these aims into practice, the project coordinator was strongly influenced by the ideas of Fullan, although this was often not a conscious influence and was never made explicit to other members of the team. In his book The Meaning of Educational Change (1982), Fullan emphasises the complexity of the social processes of change. Individuals at all levels-teachers, students, heads, inspectors, local and national policy-makers-have significant roles to play if change in practice is actually to occur. In particular, those responsible for implementing change need to 'make sense' of what it is about and why it is being suggested. This 'personal meaning' is essential because of the strong link between the commitment to change of teachers (and other professionals) and their professional values. Fullan also stresses the importance of 'integrating general knowledge of change with detailed knowledge of the politics, personalities and history peculiar to the setting in question'. He draws upon a considerable body of research to illustrate the 'multivariate nature of change', that is, its dependence for successful implementation upon people at different levels in an institution and the large number of expected and unexpected ramifications that it gives rise to. He points out the importance of an educational innovation being seen by those concerned as 'authentic' in the sense that its main purpose is to improve educational practice. There may be many reasons for an educational innovation being suggested (to cut costs, promote good public relations, further the career of one or more individuals) and it may be reasonable for teachers to resist an innovation if they do not consider it to be educationally worthwhile.Fullan sets out the classic stages of an innovation: its source (where did the idea come from and why?);

- its adoption the decision of an institution to initiate the work);
- its implementation (teachers and students putting the new ideas into practice);
- its institutionalisation (changes in practice established as the norm so that they will continue without any special support).

He describes each of these stages in detail, exploring likely problems and giving practical advice drawn from research evidence on how to tackle them and on the importance of the roles of all the different players. He stresses the importance of staff development and participation, good relationships between teachers, support from the head, a clear time-line, good communications and an internal (or local) consultant to support teachers. Among several examples of successful change, he describes the action research approach of John Elliott and says that this 'indicates that collaborative research between an outsider and teachers on practical and theoretical aspects of instruction can constitute a fundamental staff development experience' .

In the light of Fullan's model, there were several features of Project INTENT which served to develop the team's commitment to the aims of the project and the outcomes of its action research, including writing for publication. First, the project had high-level endorsement. The funding from the National Council for Educational Technology (NCET), and the interest of HMI in its progress, acted as instrumental imperatives for senior managers 'who had taken the money and felt an obligation to deliver'. Second, it was perceived by participants to be 'authentic' in Fullan's sense. An intrinsic commitment to the project's aims developed which, as one team member put it, 'shone through and carried us along when times got sticky'. Third, while the institutional goals were diverse, there was a strong sense of corporate vision and corporate responsibility. In part this was because the co-ordinator offered direction and leadership to the team, but also because she 'used' the strengths of different team members-and the respect in which they were held by others-to develop commitment and vision. Fourth, the project in many ways modelled its own message, in the sense of valuing the contributions of all equally, adapting its management strategies according to need, changing its organisational structures as necessary, and encouraging upward management within the institutional teams. These same strategies were then applied in the individual institutions to a greater or lesser extent.The significant elements of the INTENT approach to IT development, based upon Fullan's analysis of the innovation process, and also upon the work of Elliott consisted of: individual decision-making within each institution about the exact focus of development work and strategies to put it into action (to ensure a fit with local needs and institutional culture);

- a senior manager in each institution working in close collaboration with a staff development tutor (or two half-timers) (to ensure high-level support and good communications);
- the staff development tutor relieved of course teaching responsibilities for a year in order to support colleagues in using IT (to provide internal consultancy);
- a second project year during which work continued without external funding for the staff development tutor (to encourage the shift from implementation to institutionalisation);
- action research (of a kind) carried out by both the 'senior manager' and the staff development tutor into the effectiveness of their own roles in promoting IT development (to ensure staff development and the development of 'personal meaning');
- tutors who were encouraged to carry out action research into their use of IT (to support staff development and the development of 'personal meaning');
- residential meetings of the inter-institutional team of senior managers and staff development tutors (support and co-ordination in the widest possible sense);
- external support from a full-time national co-ordinator (support and coordination).

Topic : Managing Change In Educational Institutions: Reflections On The Effects Of Quality Audit And A Staff Development Project

Topic Objective:

At the end of this topic student would be able to:

- Introduce post secondary or tertiary education process.
- Give the information regarding 1. Institutional preparation

Definition/Overview:

Post-secondary or tertiary education: Post-secondary or tertiary education, also referred to as third-stage, third level education, or higher education, is the non-compulsory educational level following the completion of a school providing a secondary education, such as a high school, secondary school, or gymnasium. Tertiary education is normally taken to include undergraduate and postgraduate education, as well as vocational education and training. Colleges and universities are the main institutions that provide tertiary education (sometimes known collectively as tertiary institutions). Examples of institutions that provide post-secondary education are vocational schools, community colleges and universities in the United States, the TAFEs in Australia, CEGEPs in Quebec,and the IEKs in Greece. They are sometimes known collectively as tertiary institutions. Tertiary education generally results in the receipt of certificates, diplomas, or academic degrees.

Key Points:

1. Institutional preparation: what had to be managed?

1.1. Preparing the documentation

The timescale for this varied from four to six months, although recently some institutions have had as much as a year's notice. To manage this process, and given the diversity of the sector, an institution typically decides whether to vest responsibility for the preparation in an individual or a committee. Much depends upon the size and complexity of the HEI. In the case of Worcester, the operational responsibility was mine, guided, in the case of strategic and tactical decisions, by the strategic management team (SMT). An example of the former type of decision concerned the extent to which the College's transitional status (in terms of growth in numbers and the extent of curriculum development and change) should be stressed as a context. A further issue concerned the development of a critical appraisal of the College's quality assurance procedures, their effectiveness and proposals for their development (which also forms a compulsory criterion). An example of the latter tactical decision concerned the emphasis given to particular sections of the criteria with regard to how best to communicate with a team of auditors, at that time unknown to the College, none of whom might be drawn from the former CNAA sector.

The documents required were collected and organised into a coherent selection which was intended to convey to its audience a clear picture of the College, its mission and strategic plan, and its QA procedures and mechanisms. As a former CNAA institution, once the broad framework of contents was decided this was not a difficult task-but it was time consuming. I was assisted by two temporary clerks (recent young graduates, relatively inexperienced in the world of work but relatively skilled in searching and selecting documentation). They were involved full time for six weeks in the preparation of the initial documents and for a further month in the preparation of follow-up documentation and the programme for the visit. No account was kept of the cost of reprographic services but the staffing cost to the College in terms of time spent was around 15,000 and the estimated total cost was not far short of 20,000. Seven sets of documentation must be prepared for the HEQC and even this medium-sized, single-site College required at least three other sets for its own use. The grand total of documentation assembled measured half a cubic metre.

2. What was learned in the preparatory phase?

The preparation of documentation and associated management activity provided the following benefits. Although the College was well versed in annual monitoring activity, had recently reviewed its combined studies degree and undergone HMI inspections in both humanities (including ITE) and science, this was a first opportunity since its 1987 CNAA Institutional Review to look at the institution as a whole. Although during the previous year the strategic plan had been fully revised, which had involved all committees and given all individual staff the opportunity to contribute to it (both ideas and editorial advice), the preparation of the documentation did provide a stimulus not unlike an annual spring clean. Like the results of an annual spring clean it was discovered that the contents of some of the shelves had been mislaid. One clear value concerned the confirmation of institutional self-knowledge. By the time the documentation had been sent to the HEQC I had shared my preliminary thoughts on the anticipated findings of the audit report with the SMT. The result of this process was used in several ways. It led, for example, to immediate operational developments intended to shorten the timescale involved in committee work on the annual monitoring process. It also helped in deciding on the level of detail needed to respond to the auditors' request for further documentation, as, for example, the extent of the changes which the College was undergoing and their effects on the complexity of committee structures became more apparent.

It was also necessary to decide how best to prepare the whole College for the visit. As a small institution it was anticipated that the proportion of staff interviewed would be relatively large compared, for example, with a multisite university in excess of 10,000 students. The College's staff development programme for the previous year had included sessions on both the quality audit and the Quality Assessment 1 exercises which had been well attended by managers, teaching and support staff. This was augmented, at the start of the academic year, half way between news of the visit and the submission of the documentation, by a revision paper which described the audit process and the anticipated contents of the documentation. I also attended a meeting of each School's teaching and support staff to explain the action plan and timetable for the visit. Having spent my formative years in physical education I described this process privately to friends as a sort of pre-match briefing, to which their response was to express the hope that I did not suffer the same fate then threatening the England soccer manager of the day, Graham Taylor. This was followed up by monthly news sheets on progress, including the contents sheet of the documentation, and briefings for the members of key committees thought likely to be involved in the visit.

2.1. The institutional visit

An audit team comprises four members, three auditors and an audit secretary, who receive the documentation soon after it is submitted. The team normally meets once before the visit, the result of which is a request to the institution for further documentation and decisions about the programme for the visit. Typically the secretary arrives at the institution on the Tuesday afternoon prior to the three days of the visit to check administrative and domestic arrangements. The visit proper lasts from Wednesday to Friday, during which time the team see some twenty-five different groups of staff and students totalling between 100 and 150 persons. There is no doubt that an audit team works very hard. From 9 am to 4.30 pm is spent in almost continuous meetings with groups of staff and students and the evenings in the writing and discussion associated with formative evaluation. Meetings with students typically feature in the team's working lunches. The programme is designed to allow the team, when following a particular line of inquiry, to triangulate between managers, staff and students using the documentation as a reference point. In order to maintain consistency of approach amongst the many different audit teams working nationally, the protocols for an audit visit are followed precisely. Auditors do not tour the campus, or visit the senior common room. They spend their time in one or two rooms and are visited by the different groups which make up their programme.

A policy decision was taken by the strategic management team (SMT) as soon as an invitation to be audited was received that the College wished to obtain maximum benefit from the audit. 'Going over the top' was to be avoided but a helpful, professional and courteous stance was to be adopted for all parts of the process. This resulted, as already stated, in particular attention being given to the requirements of audience when preparing the documentation. Care was also taken with the domestic arrangements provided for the team during their stay. They were given reasonable and convenient accommodation in which to work, with adjacent parking, and were kept supplied with the necessary coffee, tea and buffet lunches to enable them to 'keep going'. As a result the audit team provided the College with good value for money for the time they spent at Worcester.

Once the participant groups in the programme had been agreed upon, they were briefed during the ten days prior to the visit. The auditors had decided, for example, to meet members of a validation panel and the subject team whose proposal had been scrutinised. The briefing for this consisted of reminding colleagues of the documentation which had been provided for the auditors: the validation programme for the previous academic year as well as case study materials of the particular validation event, including the validation report, procedures for validation including the guidelines for the responsibilities of panels and for the preparation of proposals. Colleagues were reminded of what they already knew and had routinely experienced.

3. What was learned during the visit?

The meetings held on the first day of the visit were purposeful but tense. The auditors had met only once previously and did not know each other. Each chaired one-third of the first day's meetings, which tended to create some tension within the team while each was 'tested' in front of the others. Day two was much less tense and colleagues who were involved on both days believed that this was because the auditors had established a good professional working relationship and had begun to enjoy the experience. The dynamics of audit are, therefore, important and luck must play some part in this. The twenty-minute pre- and post-meeting briefings held for the College groups were valuable in confirming that the auditors' lines of inquiry were broadly as anticipated. This reassured colleagues who, without exception, rose to the occasion. The decision not to hold formal rehearsals based upon our anticipations also proved effective as colleagues responded to the auditors' questions, as opposed to giving answers practised in rehearsal.

In Section 5 of this course you will cover these topics:

- Organize The Use Of It In Educational Institutions
- Managing Curriculum Development: Using School Teacher Appraisal To Find The Means.
- Strategies For Staff And Institutional Development For It In Education

Topic : Organize The Use Of It In Educational Institutions

Topic Objective:

At the end of this topic student would be able to:

- Introduce information technology high school.
- Give the information to manage information technology.

Definition/Overview:

Information Technology High School: Information Technology High School is a public secondary school located in Queens, New York. The school is part of the New York City Department of Education school system.

Key Points:

1. How should you manage information technology in your context?

There are two main approaches to the deployment of computers in schools and universities: either whole rooms are dedicated to IT or single computers are placed in each classroom. An intermediate approach is to provide clusters of computers in a variety of locations, each perhaps with a focus on one discipline or age-group. The advantages and disadvantages of each approach are listed below.

2. The computer laboratory

2.1. Advantages

- ease of management and supervision of equipment;
- ease of use for whole class teaching;
- security simplified;
- peripherals and software can be shared.

2.2. Disadvantages

- promotes a didactic approach;
- mixed ability teaching difficult;
- access can be restricted;
- health and safety difficulties multiplied.

3. A single computer in the classroom

3.1. Advantages

- encourages a flexible approach to organisation;
- acts as a focus for group work;
- does not demand specialist support and facilities.

3.2. Disadvantages

- time restrictions on students' access;
- may be of little use in a formal teaching situation;
- management is devolved to students;
- may increase security difficulties;
- increased costs if networked to the main computer room.

4. Approaches To Sharing Information Technology Resources

4.1. Networks

Computers can be used individually in a 'stand alone' mode or they can be linked together to form networks. In a network a group of computers are linked together, so that facilities such as hard disks, printers and software can be shared. Networks do require competent management but can be a cost-effective way of providing access to equipment. If set up securely they can be relatively free from virus infections or hacking, and software is relatively safe from interference. In a local area network (LAN), wires or fibre optic cables are used to link together all the computers in one room or throughout a building. Usually they are all connected to a network server which provides them with a shared source of software. It is useful to give those new to a computer network an analogy of the way it operates. This is particularly important if networks are slow or unreliable. Wide area networks (WANs) enable communications between computer users at a distance, usually over telephone lines. They may be suitable for distance learning contexts, access to remote databases, electronic mail or conferencing.

4.2. Single computers

The single computer in the classroom also requires managing and organising. Software needs to be available, either on a hard disk or in a disk box belonging to the class. A number of local primary schools in the Exeter area have decided to provide a work disk for each of their pupils, but some programs such as Front Page Extra are set up to save work to the program disk. Regular virus checking is recommended. A local secondary school had to shut down its IT rooms for two weeks while all disks were checked after a virus infection. A monitoring system will help you to ensure that all children have regular access to the IT facilities and also to record and assess their work. Some schools use a tick sheet by the computer and also collate an IT portfolio of children's work.

4.3. Clusters

Another possibility is to provide a cluster of computers in several different rooms. The purpose of this is to allow teachers scope to integrate IT use with other classroom activities while going beyond what can be achieved with a single computer. A cluster of four computers may be fitted into a room whilst still allowing space for other activities. At Exeter we use clusters in primary studies, technology, art, music, PE and modern languages teaching rooms. Clusters permit a diverse provision so that the resources are purchased to suit particular curriculum applications. The major difficulty with such an approach is that of management: security arrangements are more complex; a greater diversity of technical skill may be needed; software resources may have to be duplicated unless the computers are networked; and appropriate software licences will have to be purchased. It is often a good idea to locate a cluster in the library or resource centre so that students have access to them together with books and learning resource packs, including software and support materials. The systems can act as a source of information, either by accessing on-line databases or from CD-ROM based reference material. At Exeter, in addition to a number of networked machines, we have an IT teaching room in our library which is available on open access.

4.4. Portable computers

The rapid development, decreasing size and cost of portable computers offer new possibilities and pose new challenges. Any classroom becomes a potential computer room with a set of portable computers. Recent projects funded by the National Council for Educational Technology and the Scottish Council for Educational Technology demonstrated the power of portables organised in a variety of ways. In some schools working with us at Exeter, all the children in a class were provided with a low-cost portable word processor. In two first schools, we provided smaller sets of machines which could be used by individuals or groups. These machines proved to be a valuable additional word-processing resource which complemented the classroom computers, and the young children found them easy to use. Once the teachers had overcome the difficulty of keeping the batteries charged, management was found to be simple. In a local secondary school 'pocket book' computers were found to be a valuable resource, even though the school had at first requested larger portables.

However, battery life is a problem in the more powerful machines: they may only offer a few hours use after each charge. Sharing machines may be difficult due to the size and position of their screens, and colour graphics are expensive. The less powerful, smaller machines offer better battery life but have limited screens and a smaller range of software and may cause difficulties in transferring files to desktop workstations. Portable computers are vulnerable to theft and damage and can be more expensive to repair if they use custom-made components. These problems should decrease with the rapid development of the technology.

5. What about supporting the staff involved?

All staff involved in using IT in their teaching will need access to staff development and training. It is valuable to set up a support system involving technicians and ancillary workers, to ensure that machines run reliably, that software is managed effectively, and that teaching is not unduly disrupted by technical hitches. At Exeter we have found that appropriate training is as important for support staff as for academics and administrative staff. Library staff who have complete familiarity with the computer and information systems available are able to advise staff and students on their use. In addition, it can be useful to give teachers access to the institution's computerised administration system if one exists. We have not yet managed to do this at Exeter due to complex issues of security, software compatibility and staff training. The cost of training and support for personnel in addition to that of hardware and software is often a hidden extra expense that requires careful planning and negotiation.

6. How should you organise teaching rooms?

It is important to provide a suitable environment for computer use. Costs will include such things as installation and security, as well as the provision of the correct furniture and lighting. The latter are becoming much more important now that students are likely to spend more time on machines as a result of better access. Ad hoc arrangements using existing furniture, 'daisy-chained' wiring and non-specialist lighting may no longer be acceptable. Computer systems require tables and chairs of the correct height for their users. Primary school furniture has been slow to adapt to this need. There are less obvious factors to consider too. Measures must be taken to prevent screen glare from sources such as the windows. Electrical wiring should be secured out of the way. Avoidance of magnetic emissions from VDUs is important, as is adequate ventilation to remove dust from laser printers. Where computers are likely to be used by a single individual for extended periods of time, Table 16.1 provides a list of requirements to comply with basic health and safety regulations.

Table: Requirements to comply with basic health and safety regulations for extended computer use

Tables of sufficient height and depth to enable work at a suitable distance from the screen
Tilt and swivel screen stands, adjustable keyboards
Adjustable typists' chairs
Flicker-free lighting and shades for outside windows
Flicker-free screens
Covered wiring, protected by a circuit breaker
No undue noise (in particular no high-pitched, continuous hum)
Adequate fresh air ventilation
Positioning of machines so that no one is sitting near the sides or back of VDUs
Regular breaks from VDU work at least every hour

Topic : Managing Curriculum Development: Using School Teacher Appraisal To Find The Means.

Topic Objective:

At the end of this topic student would be able to:

- Introduce national curriculum assessments.

Definition/Overview:

National Curriculum assessments: National Curriculum assessments are a series of educational assessments used to assess the attainment of children attending maintained schools in England. They comprise a mixture of teacher-led and test-based assessment depending on the age of the pupils. The assessments are completed at the end of each Key Stage and record attainment in terms of National Curriculum attainment levels, numbered between 1 and 8. The expectations for each stage are set out as follows:

Key Stage	**School Year**	**Approximate Pupil Age**	Expected Level[1]
Key Stage 1	Year 2	7	Level 2
Key Stage 2	Year 6	11	Level 4
Key Stage 3	Year 9	14	Level 5/6

Key Points

Example/Case Study:

'One blue, two yellows, a red and a green'

'Do you know: we've got one blue, two yellows, a red and a green!' This was exclaimed with some excitement by the head teacher of a small, five-teacher primary school at the end of a session during the appraisal training day shared with two other schools in Cambridgeshire. She was referring to the outcome of an exercise, variants of which are commonly used in management training, in which each teacher was issued with about sixty coloured cards in one of four colours. Each card contained some skill or aptitude such as 'Performing on stage or in public' and 'Analysing and summarising information'. The four colours represented skills in each of four domains:

- information processing and ordering skills;
- physical and manual dexterity skills;
- creative and expressive skills;
- interpersonal and management skills;

Although participants were not informed of the significance of the colours at the outset.In addition, each person had four 'header cards' which were used to head columns entitled: 'Very competent', 'Competent', 'Adequate at present', 'Needs development'. The instructions given to participants (the detail is important here) were:

- Arrange each card under the appropriate heading according to your own personal assessment of your stage of development.
- Invite a colleague to look at your card layout. They may:

  - challenge any placement you have made but only positively (i.e. where they think it belongs in a higher category of competence);
  - ask you to explain and explore the reasons for particular placements.

They may not:

  - move any cards themselves;
  - force you to change any cards against your will.

- Repeat the above for your colleague.
- Reflect on and make final changes to your layout. Consider any 'colour bias'-what does this suggest to you?

- Request that you can look at the layout of colleagues who work in the same team/year group/department. What differences/similarities are there? What implications are there for the way you work together?
- From your own layout select just two cards, one from the Undeveloped column and one from the Competent column, both of which conform to the following criteria:

  - it is something which would actually improve your life/work by developing it further;
  - it is something that it is possible for you to develop further.

Topic : Strategies For Staff And Institutional Development For It In Education

Topic Objective:

At the end of this topic student would be able to:

- Introduce the development of information technology in teachers professional work.

Definition/Overview:

The development of information technology: The development of information technology in teachers' professional work and its development within organisations appears to occur in phases, rather than as one smooth transition.

Key Points:

1. An integrated approach

Evidence from around the world shows that it frequently starts with the adoption of an application or two by enthusiastic individuals. A middle phase involves leadership by a co-ordinator who frequently begins with an attempt to standardise hardware and software, then often changes the focus to the curriculum. At the end of the development an ideal situation can be the infusion of technology throughout the organisation, where it is used and developed by everyone, as and when appropriate.

2. Dimensions Of Professional Development

The process of professional development is approached from two interacting dimensions:

- the individual's personal view;
- the social context within which that person works.

John Butler (1992) emphasises the role of reflection in bringing these two dimensions together. The individual reflects on information gained personally, considering it within the social context of work where it may be employed. The social context for teachers today, both inside and outside education, is clearly influenced by new technologies. Teachers already appreciate the role of IT to communicate information, for example through television and other media. And they will appreciate its use to handle and control data which affect them, for example in money transactions. New technology also has the potential to change learning, teaching and its management. Teachers at all levels will need support to add the various IT tools and approaches to their professional practice. Teachers need new personal knowledge about IT and an appreciation of a range of applications to match their interests. They need to develop skills and strategies for their own professional practice. In addition, they need 'public knowledge' of the ways in which their institution(s) expect IT to be used and accessed. Given the low level of confidence and skill that many teachers start with and the rapid development of IT, the complexity of professional and institutional development in schools and teacher education institutions becomes apparent. To unravel this complexity I will consider the individual first and then move on to groups and whole institutions.

3. Personalised Strategies For Staff Development

Teachers and trainers come across IT in many ways, but to progress to a stage where IT applications are adopted as naturally as a book or artefact to enhance learning can be a stressful process requiring commitment and support. One of my colleagues, Angela Horton (1992), once called this her 'pilgrim's progress'. The first step in professional development is to engage in it and, while this sounds obvious, it should be recognised that individuals are being asked to take a risk. Accepting that improvement is required may suggest that current practice is inadequate. Teachers must also take risks when they first apply new tools and technologies in their classrooms-they are taking on the unknown. A supportive environment with some counselling is therefore appropriate and important. To reduce the risk and to embed professional development in the knowledge and prior experience of individuals implies helping them to make links with associated and relevant practice. The links are between relevant IT applications, their curriculum interests or personal experience, and their approaches and values in teaching and learning. This approach considers professional development to be a form of learning. The University of Exeter was one of the five institutions involved in Project INTENT with the aim of improving the use of IT in initial teacher education. The Exeter INTENT team included four people working together to develop courses, resources, staff and the institution generally. As part of this process we discussed and attempted to clarify strategies for the professional development of our colleagues. We agreed that the first and most common strategy was 'informal discussions and conversations'. This was seen as the key and yet was the hardest to quantify and evaluate because it was about listening to the concerns of individuals and counselling them.We recognised that this strategy was used repeatedly and that staff development must mean that we, the agents of development, become more informed about the professional work of colleagues. It was clear that colleagues with limited knowledge and skills in IT were unable to describe what they wanted. The counselling involved the two dimensions: the individual's personal view and the social context within which that person worked. Individuals needed to build up their mental picture of what IT could do for them. Also, we needed to gain an understanding of individuals' environments and the way in which they taught: their social context. It is important to note that the professional development was not one-way. Each of the four INTENT team members also underwent professional development in both dimensions in terms of increased understanding of different disciplines and appropriate uses for IT within each discipline.

Colleagues in this discipline needed to identify applications of IT which they found valuable. An early workshop using a painting package showed the diversity of their approach as artists, but it did not ignite their enthusiasm. One colleague produced a beautiful sketch and another a wonderful explosion of pattern and colour, but neither was satisfied with the tools, preferring the precision and feel of the pencil or the infinite variety of tone and colour possible with a traditional palette. A computer as a paintbrush was rejected because traditional media were more appropriate for what they wanted to teach. However, some time later we did find a tool that caught their imagination for an area within art where new demands required a new approach. The use of interactive video disks of museums and art galleries proved to be a far more effective means of studying 'the masters' than the traditional use of postcards and an occasional visit to an art gallery. Having found a key IT tool, the second dimension of context had to be addressed. Other colleagues had to be convinced of the value of the video disks. New practices were required so that students could access the materials within the constraints of course time and location. An expensive resource could not be duplicated for each student and so course organisation, assessment and classroom management had to become more flexible. Instead of all students studying the same topic simultaneously, the teacher set small groups of students a topic to investigate and this concluded with the presentation of the topic to the whole group. The interactive video disk was a major resource for the task, so students booked time to use it. Their presentation to the whole group and the handout produced for their fellow students was assessed instead of the traditional essay. In this way my colleagues successfully adapted their classroom management and this process of change continues to evolve today.

4. Phases Of Professional Development

Professional development of the individual is a process which occurs in phases. Brown (1994) describes an evaluation of a teacher training programme in schools which sought to enhance management of IT and classroom applications of IT to enhance learning. He describes three phases: Typically novices are concerned in developing their own competence. Concern then switches to the tasks to be undertaken: for example they may focus upon the support necessary to get learners to use IT for particular tasks. The final stage can involve a more critical reflection on the use of IT: how it is used to enhance learning rather than just encourage its use per se.

In the USA, Berenson and Snyder (1991) have shown striking changes in final grades of a university course by adopting approaches to staff development first developed for schools. They describe a spiral of changes which started with tutors building knowledge of new tools and adopting a constructivist approach to teaching undergraduates. This approach encouraged students to construct their own knowledge in mathematics through using IT. The second stage of 'vision making' involved identifying tools and active student-centred strategies for using them. In the third stage staff 'took risks' to trial these new visions within their courses. The spiral continued as more knowledge-building occurred. Active learning strategies introduced were co-operative learning, class discussion, probing questioning, student-generated problem-solving and inquiry/guided practice. Use of IT included graphic calculators, computer graphics and laser disk. For example, calculus group projects became the basis for study groups and gave students the opportunity to communicate mathematically with each other.

Professional development may be stimulated by a range of factors. In schools there is often pressure from management to conform to new requirements, such as those imposed by a National Curriculum. However, most teachers also demand that changes benefit their students. Therefore the start, or a move to a new phase in the process, is the discovery of a key IT application which persuades them that IT is relevant to their purposes-that it does enhance teaching and learning. Timing of events in these phases of professional development is also important. During Project INTENT I worked closely with Angela Horton, who led the teacher education of sixty primary student teachers. I describe in detail in another article this case of one university tutor's development. Angela's first course was planned and delivered jointly as a workshop for sixty student teachers with a circus of activities based on appropriate software and historical artefacts. Angela and I together led the session from our respective expertise in humanities and IT, with the collaboration of two other tutors. The second phase took place early in the following term. Angela noted the effect of the students' interest: