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Learning and Teaching : Principles and Pedagogy for E-Web- and Adaptive Learning

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“We are no longer teaching if what we teach is more important than who we teach or how we teach.”

- Carol Ann Tomlinson (2003)

Chapter - 1

INTRODUCTION

Learning communities are now beginning to take many forms. There are the conventional classroom situations, but increasingly we are beginning to see new forms such as work based learning, distance learning, and virtual universities. Increasingly web based technologies are being used to support these learning environments. Such support is needed within the classroom situation to manage increasingly larger groups of students.

The emergence of the internet in the 1990s as an international network of information available to the public at large has revolutionized thinking about how information can be processed, disseminated, accessed and used in every sphere of human activity. It has now become an almost rhetorical to speak of the 'information society', the 'information age' or the 'information revolution'.

Learners would have free choice of where to study and who to lead them along the path of learning; they would want complete freedom to chose the subject and sequence of subjects; they would want to be free to study when and where, which will be most appropriate to them; they would want to be able to select or deselect providers on the basis of evidence freely available to all participants; and they would want to be able to have their studies acknowledged as being of a standard appropriate for recognition in terms of university certification. This empowerment represents a radical change for many current educational systems, but some believe that radical change is the only kind of change that will lead to improvements in the education system.

Many are very optimistic about these profound changes, seeing them as having contributed to the emergence of a 'global society', in which the traditional barriers to communication, time and space, have been surmounted and new dimensions given to the concept of reality through the creation of simulated 'virtual worlds'.

Computer tools that support learning environments must thus be configurable to support the different learning environments. Such support is needed within the classroom situation to manage increasingly larger groups of students. It is also needed in other situations where support is needed across distance. The kind of support needed depends on the situation, the kind of subject taught and the way that it is taught. What is needed is a way to design learning environments and configure support tools to support the environments. Each of these alternatives requires support of different kinds of roles and relationships within the teaching environment.

Online self-learning packages fundamentally question the traditional role of the educator by giving students grater individual control. Effective learning can be realized by providing a student with a computer, loading the educational software, and walking away. As this becomes a natural teaching

environment for younger people, it may be necessary to use only traditional methods with ‘older’ students.

There is a dominance of web-courses in the fields of computer and information sciences and by courses in education. Except from these two fields, web courses cover a very broad range of subjects. The number of subject areas that was offered varied considerably between the institutions. Nearly half of the institutions offer courses in only one category and only five offered courses in five or more categories. An administrative system should be able to handle students, teachers, courses, and course material.

An online college may have to handle thousands of students, hundreds of teachers, and large number of courses with password restricted web pages, discussion forums, distribution lists, class rosters, and student presentations. It may also have to provide administrative systems for the dispatch of textbooks, handling of tuition and examination fees, and organization of local examinations. These services constitute a major challenge for many traditional institutions. Institutions that plan to offer large scale and professional online education need an administrative system, which is integrated with the web.

The simplest strategy is probably to collaborate with an institution that already has a functional administrative system. Another solution, which requires more technical competence, is to develop an in-house system based on common internet services. The online education for standard systems are continuously being improved, but they may still need much local adaptation. They may only meet some of the administrative needs, and they could place some pedagogical limitations on the courses.

Many of the institutions have developed in-house administrative solutions in combinations with standard internet software. The tuition fees for web courses seem to vary considerably among institutions and courses. Some courses are free and open to everyone, and others seem to have full or partial external funding. The institutions that operate with tuition fees seem to have fees that are the same or not very different from fees in traditional courses.

The analysis has revealed few, if any, examples of institutions with substantial income from student fees. Likewise, there seem to be few institutions that can claim that provision of web-based courses has been an economic success, if they disregard external research and development grants.

The tutors seem to be both part-time teachers that are engaged just for the online courses and full-time teachers that also teach some online courses. It is also interesting to observe that distributed experts and students take part in the tutoring. Human tutoring seems to be much more common than machine tutoring, but some institutions include machine tutoring in addition to human tutoring.

Most institutions seem to combine individual tutoring with group tutoring. The focus between the two could however vary. Online teaching is in many courses supplemented with face- to-face meetings, video- or audio-conferences, or telephone contact.

There are a number of barriers that must be overcome before online education can become a large-scale success. Among them are financial barriers, resistance to change, bandwidth limitations, access limitations, insufficient search facilities, copyright issues, and barriers to online assessment.

The financial barriers are important. The analysis showed that few institutions had substantial income from student fees. At the same time, the cost of development and maintenance could be high. In addition, national regulations in some countries deny institutions the opportunity to charge tuition fees.

1.1. Broadening Horizons

The web profoundly influence society in general and universities in particular. One of the consequences of this tremendous surge in online communication has been the rapid growth of technology-mediated distance learning at the higher education level.

As the concept of using telecommunications to assist in education and training is increasingly accepted, environments incorporating dictums like ‘you must have a PC to do a degree’ and ‘you must have PC skills to do the job’ become intrinsic to more people’s lives.

As part of the growing demand for perpetual learning, there is also an increasing requirement in industry for online first and higher degrees, refresher courses, and higher levels of ‘instant’ understanding, company staff are often too busy to spare time to travel to a college or university. Distance learning allows them to mix and match lecturers and tutorials to create a learning portfolio of their choice at times that fit with their other commitments.

Artificial Intelligence (A1) techniques can be used to build systems that provide built-in expertise and knowledge to assist the student to learn or to create ‘software agents’ that anticipate their needs and are pro-active on their behalf. Such intelligent agents can, for example, search databases and libraries to assemble and format information which meets an individual’s requirements, thereby freeing us to spend more time on productive processes.

Simulation software and multimedia products offer animation, 'interactive theatre' and other capabilities which can help students understand and analyse complex issues. Experimentation and interaction with simulations on the screen also reduce the need for expensive physical laboratories.

This extraordinary growth of technology-mediated distance learning in higher education has prompted several different agencies to develop principles, guidelines, or benchmarks to ensure quality distance education. The web is a major technological advancement reshaping not only our society but also that of universities worldwide.

In the light of this, universities have to capitalize on the web for both teaching and learning, and one progressive development of this is the use of web-based learning in distance education settings. The benchmarks for quality assurance of web-based learning were considered important, and in general the participated institutions strove to incorporate them into their policies, practices and procedures.

1.2. Online Learners

Whom the online education serves? The intended learners can be segmented into various categories. A sample set of learners comprises:

- Corporate learners working for corporations and are seeking education to maintain or upgrade their skills.
- Professional enhancement learners seeking to advance their carriers of shift careers.
- Degree completion adult learners working to complete a degree at an older age.
- College experience learners preparing for life. Pre-college learners interested in doing degree level work prior to the completion of high school.
- Remediation and test preparation learners focusing on learning as a prerequisite to an examination or enrollment in another programme.
- Recreational or enrolment in another programme.
- Recreational learners interested in education for its own sake or for personal pleasure and enjoyment.

1.3. Teaching and Learning: Context and Aims

There is no one right way to teach in higher education. Approaches must vary by student and subject, and while computer-networked support seems desirable as a way to overcome the difficulties of coping with increased staff/student ratios and reduced resources, educational issues must come first, and the technological responses second. Caution must also be used in adopting any new technology or approach in education. The history of educational technology is littered with the high hopes and limited success of radio, film, TV, video, teaching machines, stand-alone computers and CD-ROM. If the facilities offered by computer networking and the still developing WWW are to fare better in the educational context than its predecessors, it must be closely integrated with tried and tested conventional teaching methods.

The primary teaching and learning aim was to facilitate more 'deep' learning. In the hierarchy of the cognitive domain, lectures are appropriate for conveying 'surface' learning, in the form of knowledge, manipulation and application. This is essentially knowledge which can be made objective, formal and explicit and directly accessible. For 'deep' learning, where the student applies analysis, attempts synthesis of concepts and evaluates what has been done, largely subjective and tacit knowledge is involved and this comes through experience and dialogue, and therefore is supported be in tutorials, practical and other forms of group work.

The secondary educational aim was to provide more support for different learning styles. Those individuals differ in the way they process, absorb and remember information is well-established. There are various categorizations of learning styles. Some students like to have information presented in a step-by-step, cumulative, sequential manner that develops the concept. Others learn best when they are first presented with the general concept and then the details. Some prefer to work cooperatively while others prefer independence. There is also some evidence that female students have a marked preference for face-to-face communication. Although it may not be possible to accommodate everyone's style of learning, the provision of a variety of course materials (electronic and conventional) will go some way to enabling individuals to employ their own preferred learning style.

1.4. Characteristics of Emergent forms of Teaching and Learning

Emergent forms of education will expand educational technology beyond current conceptions of flexible delivery. In the online classroom, the most effective means of achieving learning outcomes is the use of active learning techniques that encourage students to become empowered learners. The fully engaged, active learner is likely to bring new demands to the learning situation. The online environment can be a

great equalizer, and the online classroom can become the place where faculty and students partner to achieve learning objectives through interactive, self-empowering means.

Trends in education, business, and technology mandate that both become lifelong learners; in the process, each becomes both student and teacher. As WBI processes between instructor and student are no longer solely through face-to-face (F2F) contact, communication expectations change, necessitating specification of all modes of support at the beginning of coursework and consideration of both instructors with student expectations.

Distributing books electronically has therefore been a continuing gleam in the eyes of developers of electronic information products. The most recent trend in the book industry is the development of electronic books.

The research done by the cognitive psychologists indicates that ((Skinner (1953), Kolb (1976), Witkin (1976), Dunn and Dunn (1978), Bruner (1990)) indicates that the differences in learning style originate from the difference in the learning strategies every learners develop based on their previous learning experiences.

Generically, educational adaptive learning systems organize content based on the learning preference of individual learners with a definite goal to maximize learning performance with continuous intelligent feedback.

The chapters which follows describe learning in general, E-learning, web based learning and teaching, Web learning environments and principles of adaptive learning and its application in detail.

Chapter - 2

LEARNING : THEORIES & PRINCIPLES

2.1. Learning Theories - An Overview

This section examines twelve different theories on learning. They are listed below and explained further.

- Constructivism
- Behaviourism
- Piaget's Developmental Theory
- Neuroscience
- Brain-Based Learning
- Learning Styles
- Multiple Intelligences
- Right Brain/Left Brain Thinking
- Communities of Practice
- Control Theory
- Observational Learning and
- Vygotsky and Social Cognition.

2.1.1. Constructivism

Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences.

Guiding principles of constructivism:

- Learning is a search for meaning. Therefore, learning must start with the issues around which students are actively trying to construct meaning.
- Meaning requires understanding wholes as well as parts. And parts must be understood in the context of wholes. Therefore, the learning process focuses on primary concepts, not isolated facts.
- In order to teach well, we must understand the mental models that students use to perceive the world and the assumptions they make to support those models.
- The purpose of learning is for an individual to construct his or her own meaning, not just memorize the "right" answers and regurgitate someone else's meaning. Since education is inherently

interdisciplinary, the only valuable way to measure learning is to make the assessment part of the learning process, ensuring it provides students with information on the quality of their learning.

Impact of Constructivism on Learning

Curriculum: Constructivism calls for the elimination of a standardized curriculum. Instead, it promotes using curricula customized to the students' prior knowledge. Also, it emphasizes hands-on problem solving.

Instruction: Under the theory of constructivism, educators focus on making connections between facts and fostering new understanding in students. Instructors tailor their teaching strategies to student responses and encourage students to analyze, interpret, and predict information. Teachers also rely heavily on open-ended questions and promote extensive dialogue among students.

Assessment: Constructivism calls for the elimination of grades and standardized testing. Instead, assessment becomes part of the learning process so that students play a larger role in judging their own progress.

2.1.2. Behaviourism

Behaviourism is a theory of animal and human learning that only focuses on objectively observable behaviours and discounts mental activities. Behaviour theorists define learning as nothing more than the acquisition of new behaviour.

Experiments by behaviourists identify conditioning as a universal learning process. There are two different types of conditioning, each yielding a different behavioural pattern:

- Classic conditioning occurs when a natural reflex responds to a stimulus. The most popular example is Pavlov's observation that dogs salivate when they eat or even see food. Essentially, animals and people are biologically "wired" so that a certain stimulus will produce a specific response.

- Behavioural or operant conditioning occurs when a response to a stimulus is reinforced. Basically, operant conditioning is a simple feedback system: If a reward or reinforcement follows the response to a stimulus, then the response becomes more probable in the future. For example, leading

behaviourist Skinner (Skinner, 1953) used reinforcement techniques to teach pigeons to dance and bowl a ball in a mini-alley.

There have been many criticisms of behaviourism. Behaviourism does not account for all kinds of learning, since it disregards the activities of the mind. Behaviourism does not explain some learning-such as the recognition of new language patterns by young children-for which there is no reinforcement mechanism. Research has shown that animals adapt their reinforced patterns to new information. For instance, a rat can shift its behaviour to respond to changes in the layout of a maze it had previously mastered through reinforcements.

Impact of Behaviourism on Learning

This theory is relatively simple to understand because it relies only on observable behaviour and describes several universal laws of behaviour. Its positive and negative reinforcement techniques can be very effective - both in animals, and in treatments for human disorders such as autism and antisocial behaviour. Behaviourism often is used by teachers, who reward or punish student behaviours.

2.1.3. Piaget's Theory of Development

Swiss biologist and psychologist Jean Piaget (1896-1980) is renowned for constructing a highly influential model of child development and learning. Piaget's theory is based on the idea that the developing child builds cognitive structures-in other words, mental "maps," schemes, or networked concepts for understanding and responding to physical experiences within his or her environment. Piaget further attested that a child's cognitive structure increases in sophistication with development, moving from a few innate reflexes such as crying and sucking to highly complex mental activities.

Piaget's theory identifies four developmental stages and the processes by which children progress through them. The four stages are:

- Sensori motor stage (birth - 2 years old)-The child, through physical interaction with his or her environment, builds a set of concepts about reality and how it works. This is the stage where a child does not know that physical objects remain in existence even when out of sight (object permanence).
- Preoperational stage (ages 2-7)-The child is not yet able to conceptualize abstractly and needs concrete physical situations.

- Concrete operations (ages 7-11)-As physical experience accumulates, the child starts to conceptualize, creating logical structures that explain his or her physical experiences. Abstract problem solving is also possible at this stage. For example, arithmetic equations can be solved with numbers, not just with objects.
- Formal operations (beginning at ages 11-15)-By this point, the child's cognitive structures are like those of an adult and include conceptual reasoning.

Piaget outlined several principles for building cognitive structures. During all development stages, the child experiences his or her environment using whatever mental maps he or she has constructed so far. If the experience is a repeated one, it fits easily - or is assimilated - into the child's cognitive structure so that he or she maintains mental "equilibrium." If the experience is different or new, the child loses equilibrium, and alters his or her cognitive structure to accommodate the new conditions. This way, the child erects more and more adequate cognitive structures.

Piaget's Theory- Impacts on Learning

Curriculum: Educators must plan a developmentally appropriate curriculum that enhances their students' logical and conceptual growth.

Instruction: Teachers must emphasize the critical role that experiences-or interactions with the surrounding environment: play in student learning. For example, instructors have to take into account the role that fundamental concepts, such as the permanence of objects, play in establishing cognitive structures.

2.1.4. Neuroscience

Neuroscience is the study of the human nervous system, the brain, and the biological basis of consciousness, perception, memory, and learning.

The nervous system and the brain are the physical foundation of the human learning process. Neuroscience links our observations about cognitive behaviour with the actual physical processes that support such behaviour. This theory is still "young" and is undergoing rapid, controversial development.

Some of the key findings of neuroscience are:

- The brain has a triad structure. Our brain actually contains three brains: the lower or reptilian brain that controls basic sensory motor functions; the mammalian or limbic brain that controls emotions, memory, and biorhythms; and the neocortex or thinking brain that controls cognition, reasoning, language, and higher intelligence.
- The brain is not a computer. The structure of the brain's neuron connections is loose, flexible, "webbed," overlapping, and redundant. It's impossible for such a system to function like a linear or parallel-processing computer. Instead, the brain is better described as a self-organizing system.
- The brain changes with use, throughout our lifetime. Mental concentration and effort alters the physical structure of the brain. Our nerve cells (neurons) are connected by branches called dendrites. There are about 10 billion neurons in the brain and about 1,000 trillion connections. The possible combinations of connections are about ten to the one-millionth power. As we use the brain, we strengthen certain patterns of connection, making each connection easier to create next time. This is how memory develops.

Neuroscience- Impact on Education

When educators take neuroscience into account, they organize a curriculum around real experiences and integrated, "whole" ideas. Plus, they focus on instruction that promotes complex thinking and the "growth" of the brain. Neuroscience proponents advocate continued learning and intellectual development throughout adulthood.

2.1.5. Brain-based Learning

This learning theory is based on the structure and function of the brain. As long as the brain is not prohibited from fulfilling its normal processes, learning will occur.

People often say that everyone can learn. Yet the reality is that everyone does learn. Every person is born with a brain that functions as an immensely powerful processor. Traditional schooling, however, often inhibits learning by discouraging, ignoring, or punishing the brain's natural learning processes.

The core principles of brain-based learning state that:

- The brain is a parallel processor, meaning it can perform several activities at once, like tasting and smelling.
- Learning engages the whole physiology.
- The search for meaning is innate.

- The search for meaning comes through patterning.
- Emotions are critical to patterning.
- The brain processes wholes and parts simultaneously.
- Learning involves both focused attention and peripheral perception.
- Learning involves both conscious and unconscious processes.
- We have two types of memory: spatial and rote.
- We understand best when facts are embedded in natural, spatial memory.
- Learning is enhanced by challenge and inhibited by threat.
- Each brain is unique.

The three instructional techniques associated with brain-based learning are:

1. **Orchestrated immersion:** Creating learning environments that fully immerse students in an educational experience
2. **Relaxed alertness:** Trying to eliminate fear in learners, while maintaining a highly challenging environment
3. **Active processing:** Allowing the learner to consolidate and internalize information by actively processing it

Impacts on Education

Curriculum: Teachers must design learning around student interests and make learning contextual.

Instruction: Educators let students learn in teams and use peripheral learning. Teachers structure learning around real problems, encouraging students to also learn in settings outside the classroom and the school building.

Assessment: Since all students are learning, their assessment should allow them to understand their own learning styles and preferences. This way, students monitor and enhance their own learning process.

How the brain works has a significant impact on what kinds of learning activities are most effective. Educators need to help students have appropriate experiences and capitalize on those experiences. As Renate Caine illustrates, three interactive elements are essential to this process:

- Teachers must immerse learners in complex, interactive experiences that are both rich and real. One excellent example is immersing students in a foreign culture to teach them a second language. Educators must take advantage of the brain's ability to parallel process.

- Students must have a personally meaningful challenge. Such challenges stimulate a student's mind to the desired state of alertness.
- In order for a student to gain insight about a problem, there must be intensive analysis of the different ways to approach it, and about learning in general. This is what's known as the "active processing of experience."

A few other tenets of brain-based learning are (1) Feedback is best when it comes from reality, rather than from an authority figure and (2) People learn best when solving realistic problems.

Designers of educational tools must be artistic in their creation of brain-friendly environments. Instructors need to realize that the best way to learn is not through lecture, but by participation in realistic environments that let learners try new things safely.

2.1.6. Learning Styles

This approach to learning emphasizes the fact that individuals perceive and process information in very different ways. The learning styles theory implies that how much individuals learn has more to do with whether the educational experience is geared toward their particular style of learning than whether or not they are "smart." In fact, educators should not ask, "Is this student smart?" but rather "How is this student smart?"

The concept of learning styles is rooted in the classification of psychological types. The learning styles theory is based on research demonstrating that, as the result of heredity, upbringing, and current environmental demands, different individuals have a tendency to both perceive and process information differently. The different ways of doing so are generally classified as:

- Concrete and abstract perceivers: Concrete perceivers absorb information through direct experience, by doing, acting, sensing, and feeling. Abstract perceivers, however, take in information through analysis, observation, and thinking.
- Active and reflective processors: Active processors make sense of an experience by immediately using the new information. Reflective processors make sense of an experience by reflecting on and thinking about it.

Traditional schooling tends to favour abstract perceiving and reflective processing. Other kinds of learning aren't rewarded and reflected in curriculum, instruction, and assessment nearly as much.

Learning Styles Theory - Impacts on Education

Curriculum: Educators must place emphasis on intuition, feeling, sensing, and imagination, in addition to the traditional skills of analysis, reason, and sequential problem solving.

Instruction: Teachers should design their instruction methods to connect with all four learning styles, using various combinations of experience, reflection, conceptualization, and experimentation. Instructors can introduce a wide variety of experiential elements into the classroom, such as sound, music, visuals, movement, experience, and even talking.

Assessment: Teachers should employ a variety of assessment techniques, focusing on the development of "whole brain" capacity and each of the different learning styles.

2.1.7. Right Brain Vs. Left Brain

This theory of the structure and functions of the mind suggests that the two different sides of the brain control two different "modes" of thinking. It also suggests that each of us prefers one mode over the other.

Experimentation has shown that the two different sides, or hemispheres, of the brain are responsible for different manners of thinking. The following table illustrates the differences between left-brain and right-brain thinking:

Left Brain	Right Brain
Logical	Random
Sequential	Intuitive
Rational	Holistic
Analytical	Synthesizing
Objective	Subjective
Looks at parts	Looks at wholes

Most individuals have a distinct preference for one of these styles of thinking. Some, however, are more whole-brained and equally adept at both modes. In general, schools tend to favor left-brain modes of thinking, while downplaying the right-brain ones. Left-brain scholastic subjects focus on logical thinking, analysis, and accuracy. Right-brained subjects, on the other hand, focus on aesthetics, feeling, and creativity.

Impacts on Learning

Curriculum: In order to be more "whole-brained" in their orientation, schools need to give equal weight to the arts, creativity, and the skills of imagination and synthesis.

Instruction: To foster a more whole-brained scholastic experience, teachers should use instruction techniques that connect with both sides of the brain. They can increase their classroom's right-brain learning activities by incorporating more patterning, metaphors, analogies, role playing, visuals, and movement into their reading, calculation, and analytical activities.

Assessment: For a more accurate whole-brained evaluation of student learning, educators must develop new forms of assessment that honour right-brained talents and skills.

2.1.8. Communities of Practice

This approach views learning as an act of membership in a "community of practice." The theory seeks to understand both the structure of communities and how learning occurs in them.

Basic Elements

The communities of practice concept were pioneered by the Institute for Research on Learning, a spin-off of the Xerox Corporation. The Institute pursues a cross-disciplinary approach to learning research, involving cognitive scientists, organizational anthropologists, and traditional educators.

Communities of practice are based on the following assumptions:

- Learning is fundamentally a social phenomenon. People organize their learning around the social communities to which they belong. Therefore, schools are only powerful learning environments for students whose social communities coincide with that school.
- Knowledge is integrated in the life of communities that share values, beliefs, languages, and ways of doing things. These are called communities of practice. Real knowledge is integrated in the doing, social relations, and expertise of these communities.
- The processes of learning and membership in a community of practice are inseparable. Because learning is intertwined with community membership, it is what lets us belong to and adjust our status in the group. As we change our learning, our identity - and our relationship to the group - changes.
- Knowledge is inseparable from practice. It is not possible to know without doing. By doing, we learn.

- Empowerment-or the ability to contribute to a community-creates the potential for learning. Circumstances in which we engage in real action that has consequences for both us and our community create the most powerful learning environments.

Impacts on Education

This approach to learning suggests teachers understand their students' communities of practice and acknowledge the learning students do in such communities. The communities of practice theory also suggests educators structure learning opportunities that embed knowledge in both work practices and social relations-for example, apprenticeships, school-based learning, service learning, and so on. Plus, educators should create opportunities for students to solve real problems with adults, in real learning situations.

2.1.9. Control Theory

This theory of motivation proposed by William Glasser contends that behaviour is never caused by a response to an outside stimulus. Instead, the control theory states that behaviour is inspired by what a person wants most at any given time: survival, love, power, freedom, or any other basic human need. Responding to complaints that today's students are "unmotivated," Glasser attests that all living creatures "control" their behaviour to maximize their need satisfaction. According to Glasser, if students are not motivated to do their schoolwork, it's because they view schoolwork as irrelevant to their basic human needs.

Boss teachers use rewards and punishment to coerce students to comply with rules and complete required assignments. Glasser calls this "leaning on your shovel" work. He shows how high percentages of students recognize that the work they do-even when their teachers praise them-is such low-level work. Lead teachers, on the other hand, avoid coercion completely. Instead, they make the intrinsic rewards of doing the work clear to their students, correlating any proposed assignments to the students' basic needs. Plus, they only use grades as temporary indicators of what has and hasn't been learned, rather than a reward. Lead teachers will "fight to protect" highly engaged, deeply motivated students who are doing quality work from having to fulfill meaningless requirements.

Control Theory : Impacts on Learning

Curriculum: Teachers must negotiate both content and method with students. Students' basic needs literally help shape how and what they are taught.

Instruction: Teachers rely on cooperative, active learning techniques that enhance the power of the learners. Lead teachers make sure that all assignments meet some degree of their students' need satisfaction. This secures student loyalty, which carries the class through whatever relatively meaningless tasks might be necessary to satisfy official requirements.

Assessment: Instructors only give "good grades"-those that certify quality work-to satisfy students' need for power. Courses for which a student doesn't earn a "good grade" are not recorded on that student's transcript. Teachers grade students using an absolute standard, rather than a relative "curve."

2.1.10. Observational Learning

Observational learning, also called social learning theory, occurs when an observer's behaviour changes after viewing the behaviour of a model. An observer's behaviour can be affected by the positive or negative consequences-called vicarious reinforcement or vicarious punishment- of a model's behaviour.

There are several guiding principles behind observational learning, or social learning theory:

- The observer will imitate the model's behaviour if the model possesses characteristics- things such as talent, intelligence, power, good looks, or popularity-that the observer finds attractive or desirable.
- The observer will react to the way the model is treated and mimic the model's behaviour. When the model's behaviour is rewarded, the observer is more likely to reproduce the rewarded behaviour. When the model is punished, an example of vicarious punishment, the observer is less likely to reproduce the same behaviour.

A distinction exists between an observer's "acquiring" behaviour and "performing" behaviour. Through observation, the observer can acquire the behaviour without performing it. The observer may then later, in situations where there is an incentive to do so, display the behaviour. Learning by observation involves four separate processes: attention, retention, production and motivation.

Attention: Observers cannot learn unless they pay attention to what's happening around them. This process is influenced by characteristics of the model, such as how much one likes or identifies with the model, and by characteristics of the observer, such as the observer's expectations or level of emotional arousal.

Retention: Observers must not only recognize the observed behaviour but also remember it at some later time. This process depends on the observer's ability to code or structure the information in an easily remembered form or to mentally or physically rehearse the model's actions.

Production: Observers must be physically and/intellectually capable of producing the act. In many cases the observer possesses the necessary responses. But sometimes, reproducing the model's actions may involve skills the observer has not yet acquired. It is one thing to carefully watch a circus juggler, but it is quite another to go home and repeat those acts.

Motivation: In general, observers will perform the act only if they have some motivation or reason to do so. The presence of reinforcement or punishment, either to the model or directly to the observer, becomes most important in this process.

Attention and retention account for acquisition or learning of a model's behaviour; production and motivation control the performance. Human development reflects the complex interaction of the person, the person's behaviour, and the environment. The relationship between these elements is called reciprocal determinism. A person's cognitive abilities, physical characteristics, personality, beliefs, attitudes, and so on influence both his and her behaviour and environment. These influences are reciprocal, however a person's behaviour can affect his feelings about himself and his attitudes and beliefs about others. Likewise, much of what a person knows comes from environmental resources such as television, parents, and books. Environment also affects behaviour: what a person observes can powerfully influence what he does. But a person's behaviour also contributes to his environment.

Observational Learning : Impacts on Learning

Curriculum: Students must get a chance to observe and model the behaviour that leads to a positive reinforcement.

Instruction: Educators must encourage collaborative learning, since much of learning happens within important social and environmental contexts.

Assessment: A learned behaviour often cannot be performed unless there is the right environment for it. Educators must provide the incentive and the supportive environment for the behaviour to happen. Otherwise, assessment may not be accurate.

2.1.11. Vygotsky and Social Cognition

The social cognition learning model asserts that culture is the prime determinant of individual development. Humans are the only species to have created culture, and every human child develops in the context of a culture. Therefore, a child's learning development is affected in ways large and small by the culture-including the culture of family environment-in which he or she is enmeshed.

Culture makes two sorts of contributions to a child's intellectual development. First, through culture children acquire much of the content of their thinking, that is, their knowledge. Second, the surrounding culture provides a child with the processes or means of their thinking, what Vygotskians call the tools of intellectual adaptation. In short, according to the social cognition learning model, culture teaches children both what to think and how to think.

Cognitive development results from a dialectical process whereby a child learns through problem-solving experiences shared with someone else, usually a parent or teacher but sometimes a sibling or peer. Initially, the person interacting with child assumes most of the responsibility for guiding the problem solving, but gradually this responsibility transfers to the child. Language is a primary form of interaction through which adults transmit to the child the rich body of knowledge that exists in the culture. As learning progresses, the child's own language comes to serve as her primary tool of intellectual adaptation. Eventually, children can use internal language to direct their own behaviour. Internalization refers to the process of learning-and thereby internalizing-a rich body of knowledge and tools of thought that first exist outside the child. This happens primarily through language.

A difference exists between what child can do on her own and what the child can do with help. Vygotskians call this difference the **zone of proximal development**.

Since much of what a child learns comes form the culture around her and much of the child's problem solving is mediated through an adult's help, it is wrong to focus on a child in isolation. Such focus does not reveal the processes by which children acquire new skills. Interactions with surrounding culture and social agents, such as parents and more competent peers, contribute significantly to a child's intellectual development.

Vygotsky's theory – Impacts on Learning

Curriculum: Since children learn much through interaction, curricula should be designed to emphasize interaction between learners and learning tasks.

Instruction: With appropriate adult help, children can often perform tasks that they are incapable of completing on their own. With this in mind, scaffolding-where the adult continually adjusts the level of his or her help in response to the child's level of performance-is an effective form of teaching. Scaffolding not only produces immediate results, but also instills the skills necessary for independent problem solving in the future.

Assessment: Assessment methods must take into account the zone of proximal development. What children can do on their own is their level of actual development and what they can do with help is their level of potential development. Two children might have the same level of actual development, but given the appropriate help from an adult, one might be able to solve many more problems than the other. Assessment methods must target both the level of actual development and the level of potential development.

2.2. Principles of Learning

2.2.1. Learning is an Internal Process

Learning is an experience which occurs inside the learner and is activated by the learner. The process of learning is primarily controlled by the learner. Changes in perception and behaviour are more products of human meaning and perceiving rather than any forces exerted upon the individual. The learner has to do with something, which happens in the unique world of the learner. Health workers may resist learning new record keeping skills unless these are seen to have meaning. Teaching is seen as a facilitating process that assists people to explore and discover the personal meaning of events for them. No one directly teaches anyone anything of significance.

2.2.2. Learning is a Discovery of Meaning

Learning is the discovery of the personal meaning and relevance of ideas. People more readily internalize and implement concepts and ideas which are relevant to their needs and problems. Training patent medicine sellers builds on experience and provides relevant skills. Learning requires the exploration of ideas in relation to self and community so that people can determine:

- *What their needs are*
- *What goals they would like to formulate*
- *What issues they would like to discuss*
- *What content they would like to learn*

2.2.3. Learning is a Consequence of Experience

Learning (behavioural change) is a consequence of experience.

People

- *Become responsible when they have really assumed responsibility*
- *Become independent they have experienced independent behaviour*

- *Become able when they have experienced success*
- *Begin to feel important when they are important to somebody*
- *Feel liked when someone likes them*
- *Do not change their behaviour merely because someone tells them to do so or tells them how to change*

For effective learning, giving information is not enough. People become responsible and independent. Not from having other people tell them that they should be responsible and independent - but from having experienced authentic responsibility and independence.

2.2.4. Learning Involves Cooperation, Collaboration

Learning is a cooperative and collaborative process. Cooperation fosters learning: "two heads are better than one". People enjoy functioning interdependently. The interactive process appears to "scratch and nick" people's curiosity, potential, and creativity.

Cooperative approaches are enabling. People learn to define goals, to plan, to interact, and to try group arrangements in problem solving. Training should offer opportunities to share and collaborate on problem solving.

Paradoxically, as people invest themselves in collaborative group approaches, they develop a firmer sense of their own identification. They begin to realize that they count, that they have something to give and to learn.

Problems which are identified and delineated through cooperative interaction appear to challenge and stretch people to produce creative solutions and to become more creative individuals.

2.2.5. Learning is Evolutionary : A Slow Process

Learning is an evolutionary process. Behavioural change requires time and patience. When quick changes in behaviour are demanded we often resort to highly structured procedures through which we attempt to impose learning.

Whether such learning is lasting and meaningful to the learner is doubtful. Implicit in all the principles and conditions for learning is an evolutionary model of learning.

Learning situations are characterized by

- Free and open
- communication
- Confrontation
- Acceptance
- Respect
- The right to make mistakes
- Self-revelation
- Cooperation and
- collaboration
- Ambiguity
- Shared evaluation
- Active and personal
- involvement
- Freedom from threat
- Trust in the self

All evolutionary in nature

2.2.6. Behaviour Change can be Painful

Learning is sometimes a painful process. Behavioural change often calls for giving up the old, comfortable ways of believing, thinking, and valuing. It is not easy to discard familiar ways of doing things and incorporate new behaviour. However, the pain of breaking away from the old and the comfortable is usually followed by appreciation and pleasure in the discovery of an evolving idea or a changing self.

2.2.7. The Learner is a Rich Resource

One of the richest resources for learning is the learner himself.

In a day and age when so much emphasis is being placed upon instructional media, books, and speakers as resources for learning, we tend to overlook perhaps the richest resource of all - **the learner himself.**

Each individual has an accumulation of experiences, ideas, feelings, attitudes … which comprise a rich vein of material for problem solving and learning. Youth learn about violence and sexual coercion through sharing their own experiences and developing drama to educate others.

Learning situations need to enable people

- *To become open to themselves*
- *To draw upon their personal collection of data*
- *To share their data in cooperative interaction with others to maximize learning*

2.2.8. Learning is Emotional and Intellectual

The process of learning is emotional as well as intellectual. Learning is affected by the total state of the individual. People are feeling beings as well as thinking beings. *When their feelings and thoughts are in harmony, learning is maximized.* To create the optimal conditions in a group for learning to occur, people must come before purpose.

Regardless of the purpose of a group, it cannot be effectively accomplished when other things get in the way barriers to communication exist in people. *Before we can conduct "official business," we need to work with the people problems that may exist in a group.*

To maximize the acquisition and internalization of ideas, it seems reasonable that the people problems would have to be dealt with first.

2.2.9. "People problems" Must be Addressed

The processes of problem-solving learning are highly unique and individual. Each person has his own unique styles of learning and problem solving.

- *Some personal styles of learning and problem solving*
- *are highly effective*
- *Other styles are not as effective*
- *Still others may be ineffective*

Learners need recognize the approaches they ordinarily use so that they can become more effective in problem solving. Training experiences should expose learners to different approaches to learning. As

people become aware of how they learn and experience new models, they define and modify their personal styles so that these can be employed more effectively.

Adult Education Approaches

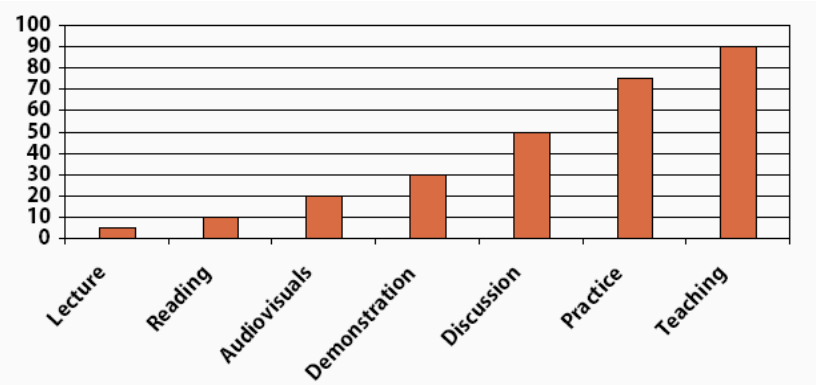
In the context of Adults the Principles of Learning with regard to the learner understanding issues, the parameters of learning could be analysed. The parameters such as motivation, readiness etc. are compared in the scenarios of Teacher Directed and Self-Directed Learning in the following Table.

Parameters / Processes	Pedagogy : Teacher Directed Learning	Adult Education : Self Directed Learning
Concept of the Learner	Dependent Personality	Increasingly Self-Directed, Self-Actualizing
Role of Learner's Experience	To be built on rather than used	A rich resource for learning and to be shared among learners
Readiness to Learn	Varies with levels of maturation	Develops from the Life Tasks and Problems
Orientation to Learning	Subject Centered	Task or Problem Centered
Motivation	External Rewards and Punishments	Internal Incentives and Curiosity

Among the Adult Learning itself the Teacher and Self Learning can be studied for various elements like climate, planning, evaluation etc.

Adult Learning Elements	Teacher-Directed	Self-Directed
Climate	Formal authority-oriented, competitive, judgmental	Informal, mutually respectful, consensual, collaborative, supportive
Planning	Primarily by the teacher - trainer	By participative decision making
Diagnosis of needs	Primarily by the teacher - trainer	By mutual assent
Setting of goals	Primarily by the teacher - trainer	By mutual negotiation
Designing a learning plan	Content units, course syllabus, logical sequence	Learning projects, learning content sequenced in terms of readiness
Learning activities	Transmittal techniques, assigned readings	Inquiry projects, independent study, experimental techniques
Evaluation	Primarily by the teacher - trainer	By mutual assessment of self-collected evidence

Percentage of Retention in the process from Lecture to Teaching is given below.



2.2.10. Individuals have Unique Learning Style

Learning Styles

"…….is all about learning how to learn" (Mumford, 1982)

" Education research and practice have demonstrated that learning can be enhanced when the instructional process accommodates the various learning styles of students" (Buch & Bartley, 2002)

"It has been observed in learning style schools that many poor achievers do not function well under stress, but their stress appears sufficiently reduced after learning through their preferences to enable them to attain significantly higher scores on tests´(Dunn et al., 1995)

The theories and principles discussed in this chapter forms the basis of learning which we are going to discuss in the coming chapters.

Chapter - 3

E – LARNING

3.1. Theoretical Foundation

The intimate relationship between the private and shared worlds is highlighted because e-learning has been most often used to provide more efficient delivery of information and, thus, favour independent learning. The nature of this dominant application is a serious limiting condition to the full utilization of the capabilities of e-learning. While autonomy and access to information are not inherently disadvantageous, there is little recognition of either the transactional nature of an educational experience or of e-learning to support collaborative asynchronous learning. It is the technical capability of e-learning's unique ability to bring together a community of learners, unrestricted by time or place, that must be understood. From this perspective, e-learning would appear to offer the means of creating an educational experience so long idealized in educational theory.

Dewey (1938) identified two principles that are reflected in the theoretical framework developed here. One is 'interaction', which unifies the subjective (personal) and objective (social) worlds in an immediate timeframe. Through this interaction, ideas are generated that illuminate the eternal world. That is, meaning is constructed and shared. Through interaction, ideas are communicated and knowledge is constructed and confirmed. The second principle is 'continuity', which goes to the importance of creating the foundation for future learning. As Dewey stated, 'the result of the educative process is capacity for further education', which has great value for both the individual and society.

Dewey would have embraced the choice and diversity of e-learning with its opportunity for 'active inquiry' and the 'individual variations' it provides; however, he would have also been adamant that discipline required to elevate the process to 'reflective inquiry' be brought to bear on the information. E-learning, and the Internet, are wonderful sources of ideas, but to be 'genuinely educative' they must provide an experience that assures 'continuity' or the foundation for new, worthwhile learning experiences.

Education is fundamentally an interactive or transactional process. The challenges and confusion surrounding control issues go to the normative role and responsibility afforded the teacher. It is the teacher who has the legitimate responsibility to define the curriculum and design the educational activities. Unfortunately, there is little opportunity for collaboration in the planning process. That is, the

student has little input or influence in planning the process or expected outcomes of the educational experience. This creates the contradictory situation where the student is expected to assume responsibility for activities and an outcome over which they have little input.

The solution inherent to the transactional perspective is to give students opportunities for dialogue regarding outcome expectations learning activities, and means of assessment. While some aspects of the educational transaction may not be open for negotiation, it is important that students share in this understanding. By being included in the larger process, and being provided choice where appropriate, students are given a sense of control and, therefore, take responsibility for the quality of the educational outcome.

The transactional perspective on teaching and learning reflects a dynamic balance of responsibility and control issues congruent with the educational purpose and the capabilities of the students. E-learning draws attention to fundamental responsibility and control issues.

3.2. The Technology of E-Learning

The intimate relationship between the private and shared worlds is highlighted because e-learning has been most often used to provide more efficient delivery of information and, thus, favour independent learning. The nature of this dominant application is a serious limiting condition to the full utilization of the capabilities of e-learning. While autonomy and access to information are not inherently disadvantageous, there is little recognition of either the transactional nature of an educational experience or of e-learning to support collaborative asynchronous learning. It is the technical capability of e-learning's unique ability to bring together a community of learners, unrestricted by time or place, that must be understood. From this perspective, e-learning would appear to offer the means of creating an educational experience so long idealized in educational theory.

3.2.1. Defining Educational Technology

The world technology drives from the Greek *tekhnologia*, meaning a systematic treatment of an art or craft (American Heritage Dictionary 2000). The original emphasis on systematic treatment and an implied adherence to tenants of science and especially the scientific method, has inspired the formal field of educational technology to embrace a modernistic, scientific, view of its activities.

3.2.2. Distance Education Technology

It has been popular to classify the technologies of distance education into so-called generations (Garrison 1985; Nipper 1989) based largely on the technological tools that support each generation. Both Garrison and Nipper have pointed out, however, that such a strictly technological deterministic point of view is itself biased and they remind us that it is not just the tool, but the way the tool is used and the system that defines the input and outputs to the tool use, that more accurately describes distance education systems. These and other authors have argued that these 'generational' classification systems help us to understand and describe the various components of a system at a given point in chronological space. Garrison and Anderson(2003) pointed out the following:

First generation

The first generation of distance education is marked by features of an industrial model (Peters 1988, 2000) or Fordist (Campion and Williams 1992) organization in which economy of scale is achieved by a Taylorist division of labour, rigid managerial controls, and related methods of accountability. This mass production model allowed distance education systems to create courses and programmes of high quality that could be delivered cost effectively to many thousands of students. A major economic feature of these systems was in increase in the upfront production costs (from those associated with classroom teaching) and a concurrent reduction of variable costs as measured by the cost per student. The technology most associated with this generation is the printed textbook and accompanying course guide. It should not be assumed that these print course materials are merely text or reference books that are typically found in academic libraries. Rather, the material is carefully designed and produced by a purposively selected course team made up of specialized, skilled professionals.

A defining feature of first-generation technology is the maximization of freedom and independence for students. Students no longer have to wait until a specific time of the year to commence studies, nor are they compelled to work to an institutionally defined timeline derived from the expected norm of effort and time commitment of a cohort of students. Individual students may complete learning activities and challenge tests and examinations at a speed they alone define. First-generation distance education systems have been labelled ***Independent study*** – implying that students work independently and not as members of a group.

Second generation

The second generation evolved within an era defined by the newer technologies of mass, broadcast media and a growing acceptance of cognitive learning theory. This generation retained an emphasis on independent study in that there were seldom restrictions on time or place of study (beyond access to the

ubiquitous radio and television). Large and, often, expensive media productions (telecourses) were created that allowed students to virtually visit the laboratory, the workplace, or to stay within the classroom with the audio and/or video images of their teachers. Advance in cognitive learning theory led to the use of advanced organizers, role models summary reflections and simulated peers to draw the user into a sophisticated media world. However, direct interaction between students and teachers was restricted to the technologies associated most often with the first generation – telephone and mail. In the second generation, course teams got much larger as full production crews added skill, perspective, and a great deal of cost to the materials. Such high, front-end costs drove the need for large student populations to amortize costs and the attempt (only sporadically successful) to market second-generation course to a global market. Bates (1995) notes that second-generation technology supported more interaction between students and delivery institutions. However, the 'teacher' was often not the creator of the course content but rather a course tutor whose task was to support and evaluate student achievement.

Third generation

The third generation takes advantages of the capacity for both asynchronous and synchronous human interaction provided by a variety of telecommunications technologies – notably audio, video and computer mediated conferencing. The Net continues to expand its capacity to deliver all modes of human communication in both asynchronous and synchronous modes, thus making such a distinction too narrow to designate as a new generation. The third generation distance- education system embraced constructivist learning theories to create opportunities for students to create and re-create knowledge, both as individuals and as members of learning groups. This knowledge construction takes place within the negotiation of content, assignments, and projects and is elaborated on in the discussion, collaborative projects and resource or problem-based curriculum designs that define quality, third generation programming.

Fourth generation

A number of authors (Lauzon and Moore 1989; Taylor 2000) have suggested that a fourth generation has emerged that combines the first three major attributesof the Net: information retrieval of vast amounts of content; the interactive capacity of computer mediated communications (CMC); and the processing power of locally distributed processing via computer-assisted programming, usually written in Java. Obviously, these are powerful new tools, but their substantiation in new models of distance education programming, beyond the capability of integrating CMC and Web resources (via development and delivery packages such as Web CT, Blackboard, Lotus Notes, etc.) is as yet quite rudimentary.

Besides administrative advantage we also expect rapid development of pedagogical innovations in the fifth generation. The use of teacher and student agents that incorporate various types of intelligence and that will allow fruitful searching, navigation, and exploitation of the 'semantic web' should occur. The fifth generation, to summarize, adds artificial intelligence to the Web or, as the original designer of the Web, Berners-Lee describes it, builds semantic meaning into the Web, such that it can be navigated and processed by both humans and non-human 'autonomous agents' (Berners-Lee, Hendler, and Lassila 2001).

The Internet acts as a type of Rorschach test for educational philosophy. When some people look at the Internet, they see it as a new way to deliver instruction. When other people look at it, they see a huge database for students to explore. When we look at the Internet, we see a new medium for construction, a new opportunity for students to discuss, share, and collaborate on constructions.

Despite the impressive convergence and cost cutting associated with the Web for educational delivery, we are convinced that Net's real potential for education is till some years from realization. The original conception and construction – the WWW was an information storage and retrieval device (Berners-Lee 1999). The systematic storage, retrieval and re-use of information has always been a defining feature of formal education, as illustrated by the location of the world's first universities in conjunction with collections of rate texts in monastery libraries. The capacity to deliver, monitor and retrieve results of educational computer programming (simulations, drill and practice, tutorials, etc.) has allowed a re-emergence of interest in computer-assisted instruction and the development of immersive environments (Dede,1996) as tools for distance education. But, the emergence of the Net as a medium of communication adds the most critical feature of the formal education process-interaction between and among teacher, students, and content.

3.3. Educational Technology and Interactions

Both human and non-human interactions are integral and reciprocal components of a quality e-learning experience.

Both classroom teachers and researchers have stressed the value of interaction within the educational process. For example, Palloff and Pratt (1999) argue that 'key to the learning process are the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions'. Michael Hannafin (1989) itemizes the five functions that technologically mediated interaction purports to support in an educational context. These functions are:

1. **Pacing:** Interactive pacing of the educational experience operates from both a social perspective and serves to keep an educational group synchronized or acting together, and in an individual perspective, serving to define a speed for progressing through the lesson such that the educational objectives are completed in a reasonable and pedagogically effective span of time. Allowing individual student control of pacing and at the same time facilitating group pacing such that collaborative learning activities are possible, is a challenge to interactive forms of e-learning and one that requires careful balance and planning during the instructional design.

2. **Elaboration:** Interaction serves to develop connections between new content and existing mental schema allowing learners to build more complex, memorable and transferable connections between existing and new information and skills. In the process of explaining their conceptions to others, the explanations grow and are cross linked with schemas built around internal course constructs and those built in the career and personal experience of students.

3. **Confirmation:** This most behavioural function of interaction serves both to reinforce and shape the acquisition of new skills through selective reinforcement. Conformational interaction traditionally takes place between student and teacher. However, it is also provided by feedback from the environment through experience and interaction with content in laboratories, through programmed computer response in interactive tutorials, simulations and games, and from peers in collaborative and problem based learning.

4. **Navigation:** This function prescribes and guides the way in which learners interact with each other and content. Adequate navigation becomes especially critical when students are confronted with the mind numbering quantity and variety of paths available on the Web.

5. **Inquiry:** Hannafin's concept of inquiry in 1984 focused on inquiry to the computer system that was displaying content and monitoring student response. The interconnected and greatly more accessible context for inquiry now provided by the Internet opens the door to a much greater quantity and quality of inquiry. However, the interactive capability for students to follow individual interests and paths makes inquiry both a motivating and personalizing function of interaction.

The Web as a communications tool has been developed and refined to simulate all of the formats undertaken using earlier technologies –including the face-to-face classroom.

3.4. Intellectual Tools

The traditional role for teachers has been as presenters of ready-made information and as organisers of learning experiences. One way in which information technology can be used in the classroom is to take over these presentational and organisational tools. This has implications for both teachers and learners: the computer. by providing an additional or alternative source of knowledge and information, may reduce the dependency of students upon the teacher. The aspiration is t hat ii us will liberate the teacher's time and enhance the students repertoire of learning skills, enabling greater student autonomy. This would allow students to maximise their active role in learning and help to prevent teaching from being construed by teachers as a technical procedure of transmitting knowledge to passive learners, It would also allow a change in the teacher's role: student autonomy in learning means that teachers no longer need to adopt a didactic approach, but gain the freedom to function increasingly as 'enablers of quality learning experiences (Somekh and Davies, 1991, p. 156).

They need to take on a more active and creative role. Through student autonomy, teachers gain the time and mental space to 'see and influence more of the learning process' (POST, 1991, p. 3). This in turn allows greater opportunities for teachers and students to engage in the kind of quality communication which generates mindful, deliberate deployment of higher-order thinking processes such as synthesising, interpreting and hypothesizing. As a result of this change in the nature of interaction, the roles of teachers and learners can become less distinct. Indeed, the roles may even be reversed at times, as students find themselves having to explain their thinking to teachers, in order to enable teachers to understand the learner. Operating in such a classroom environment necessitates active cognitive involvement on the part of learners and teachers. It is precisely this aspiration relating to the use of information technology in developing meta cognitive or thinking skills to which we must now turn.

The term 'intellectual tool' is generally attributed to Vygotsky (Wertsch, 1985). Vygotsky noted that nature endows humans with certain elementary mental functions (including, for example, memory; attention and the capacity to make associations based on contiguity). We use these basic functions to make sense of our environment. Vygotsky also observed that human culture has invented higher forms of intellectual mediation of experience. In this view it is natural to be able to discriminate an object from its background and to note another and another of the same kind. Here, say, is a sheep and another sheep. To cut notches on a tree to help us recall that we have a specific number of sheep is, however, not natural. It is to use a cultural artefact, an *aide-mimeire*. Vygotsky termed these artefacts in support of intellect 'intellectual tools'.

One of the most important challenges to an educational system is to empower the young with the intellectual tools of the culture. Children are perfectly capable of incidental learning based on their natural mental functions. The acquisition of more advanced forms of tool use, however, must be deliberate and must proceed in the full understanding of the power of the tool of its generative capacity and of the demands made on the user during the period of learning.

3.5. Information Technology as a Tool

Information technology is such an adaptable intellectual tool that it may be better visualised as many tools. Like any other sort of tool, these may be embedded within each other and used in conjunction with other tools and materials in a number of subject disciplines. For example, number is a tool that may he used within mathematics which in turn is used when analysing scientific data, providing access to scientific thinking to those who have difficulty with mathematics. We take, as a guiding principle, Vygotsky's concept of elementary and higher-level functions in relation to the degree of abstraction or decontextualisation of learning. Tools can, of course, support learning at different levels. Kozma (1991) identifies particular features of information technology systems which are of importance in relation to learning: (a) the speed of their processing; (b) the way in which they proceduralise information ('operating on symbols according to specific rules'); (c) their transformation capabilities (for example, from text to voice, or from equation to graph); and (d) the way in which they 'can help novices build and refine mental models so that they are more like those of experts'. In this discussion of IT tools we shall take four areas of IT capability which are widely used within the UK:

- communicating ideas and information;
- handling information;
- modelling;
- measurement and control.

While considering each in turn, we may be able to illustrate how IT tools can be effective in supporting learners engaged in increasingly decontextualised learning.

3.5.1. Communicating ideas and information

There are many information technology tools which can assist communication and frequently they permit the learner to develop ideas and engage in a creative process. The most widely used of these tools must be a word processor. Those who have difficulty using a pen and paper may experience an intense delight and pride in producing writing in print. At a more sophisticated level, a word processor permits the writer to

rework the text without having to 'remember' it as a whole, cut and paste many pieces of paper or rewrite manually. For 'Some a change in the way text is presented increases its value and provides some 'mental distance' from its production, both of which encourage critical rewriting. Therefore the ward processor as a tool speeds the process, produces the demand on memory and enhances creativity. It also has an effect on the way in which we may work on writing. Collaborative groups of authors can share a screen more easily than a book and the ease of changing or recovering writing increases risk taking.

However the volume of information can obstruct learning, and in practice teachers normally present children with only a small selection of information thereby considerably reducing the authenticity of the task. Information technology provides a range of information—handling tools which can help to activate this problem. At the elementary tool level a relational database may be viewed as representing records in the manner of a card index archive. The display of a pie chart of age or occupation quickly reveals differences with the present time. However, a price must be paid for the power of this tool: learners find it difficult to visualise the structure of the information, to organise their interrogation and to interpret the information provided by a database (Underwood and Underwood, 1990). The tool makes demands on the use to think in a similar way to the structure that the software imposes on the information. Other data structures which are more easily understood may be more supportive of learning: for example, 'decision tree' software which assists the learner to sort or classify objects in relation to questions with Yes/no answers.

Programs which process data into graphs and pie charts reduce the time and skill required to draw them and thereby increase the time available for data analysis. Speed in displaying data is particularly important when dealing with concept which learners may find difficult. For example, children learning physics can explore velocity graphs by walking in front of a motion detector and seeing the computer plot their own velocity. Information handling software can search, sort and represent information in graphs and charts, dealing with a range of media including pictures and sound. The data sources can either be local on CD-ROM or video disk, or on a remote computer accessible by means of either a telephone line or a digital line. Recent developments in the volume and quality of information available have already revolutionised pursuits such as journalism, and have implications for the ways in which teachers can use resource-based learning, now and in the future. For example, a learner who needs to fund the meaning of a new word may gain more by comparing ten examples of its use obtained from a CD-ROM containing all the issues of a newspaper for two years, than by finding its 'dry' definition in a dictionary.

3.5.2. Measurement and Control

Computers and related devices are also used as measuring tools, the calculating speed of information technology can he used to represent either very swift events, such as dropping an object to calculate the coefficient of gravity, or very slow events, such as the process of photosynthesis. An example already mentioned is the use of motion detectors to plot velocity graphs. Information technology can also permit learners to take many more accurate measurements and so engage in creative exploration of a phenomenon taking into account more factors titan would otherwise have been possible. The drawback, once again, is in the way IT tools may mediate and structure the learning experience, but this is a drawback which up to a point is common to all toots.

Control at an elementary level was illustrated within modelling when we described directional use of a trundling robot. At more abstract levels, control permits learners of appreciate complex interrelationships when they construct systems with electronic switches under the control of a computer program. Many IT tools may be controlled at one time. Themselves made up of electronic systems, IT tools provide the opportunity, for the first time for learners to explore other electronic systems.

3.5.3. The Information Technology Tool in the Classroom

Classrooms are not ideal learning environments; they are working compromises in mass education systems. In classrooms it is difficult for teachers and children to remain centrally focused on learning tasks. Teachers are always short of resources: space, books, equipment, and above all time to meet the demands of a large number of children. Jackson's seminal work (1968) reports teachers engaging in 'as many as 1000 interpersonal interchanges each day'. In this context four salient features of school life for pupils are: delay – in waiting for the teacher's attention; denial-in being ignored or refused by the teacher; interruption-in being asked to stop work at an inopportune time in relation to the task; and social distraction-in other children's demands for attention. Frustration levels can be high, noise levels can rise and the authority of the teacher can be called into question. As a result teachers have a central need to gain (and remain in) control of the class, to organise the children in task oriented activity and to pace their own work (for example, in keeping the children working at the same pace rather than at the pace which best suits their own needs and abilities. This tends to make teachers managers of learners rather than managers of learning.

Effective use of information technology, like any other tool, has to be acquired. You have to learn how to use a knife to cut a notch in a stick. Equally, without some facility in using software it is impossible to make effective use of a computer. The more complex the tool, the more arduous the process of learning

its use: hence the huge amount of resources devoted to teaching children how to read, write and work with numbers. Computers are complex tools, and potentially each new piece of hardware or software demands practice. This poses a real dilemma for teachers, particularly in secondary schools, where spending time on learning how to use information technology may not appear to be justified in terms of knowledge gains in subsequently learning with information technology.

There is a partial solution to this problem with more 'friendly' user-interfaces and moves towards common interface standards (all software designed to operate with similar commands) which make it much easier to use computers with a traditional keyboard. In addition, there are increasing numbers of alternative input devices such as touch screens. Concept keyboards, light pens and speech sensitive dives. These may largely overcome the barrier of typing skills and enable communication with a computer to be integrated with 'natural' communication skills such as a pointing and speaking. In some recent experiments with virtual reality the whole body movement. Nevertheless, an element of technical skill will always be necessary to use a computer, comprising a combination of practical knowledge of how the software works and psychomotor skills to operate it via an input device.

To improve the quality of learning there is a need to achieve the best possible match between these two kinds of authenticity: to the classroom authenticity to a particular discipline or field.

Despite their limitations, classrooms can he designed to more (or less) supportive of quality learning. There is a growing body of evidence — supporting our aspirations — that information technology tools can (the social dynamics classrooms, Their use disturbs the established d routines either by enforcing pair or group work, or by necessitating the movement of the whole class to a specialist computer room for part of their time. This disturbance of routine is a necessary, but insufficient, condition for change. In many cases new routines are quickly established which neutralise the disturbance and re-establish the negotiated compromises of Doyle's 'exchange of performance for grades'. However, IT tools can be used as a means of circumventing some of the classroom constraints on setting cognitive learning tasks.

Computer tasks, of tile kind described earlier can be more authentic than traditional tasks. For example, through the wide range of information sources that it makes available, information technology can provide many more opportunities for the kind of spontaneity in learning which is characteristic of learning away from classrooms. In addition, tile structure of support can be more flexible to the learner's needs in carrying the task through.

The degree of interactivity in the software — whether it he through extensions and modifications of the task in response to the learner, or through tile demand on the learners to decide upon appropriate

questions for interrogating an information bank, or through the tangible products of creativity (in writing, design work or music) — can sustain a higher than normal degree of on-task engagement and mindfulness'. This fills a gap otherwise left by the teacher's inability, through pressure of time, to provide sufficient appropriate interventions to sustain the task. Group work around a computer may be more genuinely collaborative than other group work, thereby enabling more focused group talk. ibis in turn ma enable learners to go further in developing their powers of hypothesising problem-solving without needing to resort to the teacher for help.

It would appear that the conditions for classroom teaching can be improved by technology tools. But, equally, teacher can use information technology to create a new set of mundane tasks which negate the opportunities for quality learning. Word processors can be used solely to produce display copy of previously hand-written work. Chunks of writing can be copied from large information banks to concoct the answers to teachers' questions without any gain in understanding. Simulations can be used to replace experimental work on chemicals or plants, so that instead of close reflection upon one experiment using natural entities, pupils investigate a large number of abstracted examples on the computer screen. In a mass education system the use of IT tools to enable quality learning experiences depends upon the teacher.

3.6. Assessment and Evaluation

Generally, assessment occurs throughout the course, thereby providing formative feedback to students, and at the completion of the course providing summative information on learning accomplishments to both student and instructor.

On the other hand, evaluation is used to refer to the act of comparing a unit, course, or programme against some set of performance or outcome criteria. These criteria are often set by external agents or organizations, but the interest of the teacher and student are also driving forces within evaluation policies. Comprehensive evaluation includes measures of satisfaction, perceptions of learning, costing and cost benefits, and other criteria for programme success as defined by any or all relevant stakeholders or participants.

That distance education and E-Learning is first and foremost about education; therefore, much of the theory and practice of quality education that has been developed over the years for campus-based education has direct relevance in designing assessment for E-Learning. However, it is also true that the context within which education is practised affects design and practice. The distance education context is complicated by many factors, including: the mediation effects of the delivery and communication media;

the lack of physical proximity and body language used for feedback in classrooms; the lack of instructor perception and control over the actual learning environment; the difficulty of authentication and privacy in distributed contexts; and the reduction of informal, after-class interaction in some forms of distance delivery. These differences create a markedly different set of 'hidden curriculum' (Anderson 2001) in E-Learning that require a refocus and repurposing of classroom – developed assessment and evaluation.

Dirks identifies five major uses for assessment:

1. Communicate the achievement status for students.
2. Provide self-evaluation information to the learner.
3. Student placement for educational paths or programmes (accreditation).
4. Motivate the learner.
5. Evaluate the effectiveness of instructional programmes

Having articulated the value of assessment in an educational learning experience, we now turn the discussion to the means by which assessment is best used in E-Learning.

Assessment activities must be integrated within the E-Learning activities. However, teachers must also be careful not to overly structure the discourse through excessive evaluation and personal intervention. The social presence of the E-Learning environment must be welcoming and positive enough that students willingly respond and support each other in cognitive growth – omnipresent assessment may lead students to conclude that the discussion is a 'teacher tool' and not one which they may create and modify to meet their individual and group educational needs. In an E-Learning educational experience, discourse is the prime component of the learning process.The computer system that underlie E-Learning communications can fairly easily be used for quantitative analysis of student postings.

3.6.1. Assessment Activities

A good E-Learning experience contains a balanced set of learning activities that work individually and together to induce engagement, discourse, and higher-order learning within the learning community. The E-Learning environment can support a growing number of potential activities. Growing, because on-line technologies are continuing to evolve and support increased combinations of text and multimedia

interaction that can occur in both synchronous and asynchronous time formats. Second, as a professional community, E-Learning teachers are devising, testing, and sharing new learning activities.

Course Evaluation

Assessment of student learning is a key component of the evaluation of an on-line programme, but it is only one of the factors with which educators involved in E-Learning are concerned. The E-Learning context is complex and made up of many components. All these components must work together in a seamless fashion if quality, sustainable educational outcomes are to be produced. A model of 'proactive assessment' developed by Roderick Sims (2001) to evaluate all the significant components of the E-Learning context and intervention is presented below.

Proactive evaluation beings by determining the strategic intent of the E-Learning programme. Being able to clearly identify why the particular educational programme has been developed and delivered on-line is critical to assessing its effectiveness.

The second element in proactive evaluation is to look closely at the content of the courses. Sims(2001) points out that content for any course exists along a continuum from the static content that is predetermined by the course developer-teacher, before any students are enrolled, to content that is totally constructed by the contributions of the students and teacher as the course progresses. Each component of this content must be congruent with other components such that a cohesive and easily understood package results. For example, writing style should be consistent and should match the reading level and the degree of familiarity with vocabulary appropriate to the average learner enrolled in the course. The content of the course material must be accurate and all authors should acknowledge and bias they bring to the discussion. While this seems to be a commonsense requirement it can become problematic as the learners contribute content.

The third area of proactive evaluation focuses on an examination of the interface design. An effective interface is easily mastered by participants and allows for presentation of content in a variety of formats including graphics, video, and sound.

The fourth area of a proactive design looks at the amount of interactivity supported by the course. Traditionally, interactivity in distance education has been conceived as operating in three realms based on student involvement: student-student, student-teacher, and student-content. There are three additional types of interaction relevant to the E-Learning context: teacher-content, teacher-teacher, and content-content (Anderson and Garrison 1997).

The fifth area revolves around evaluating the quality, quantity and thoroughness of the assessment of student learning. Assessment drives much learning behaviour and in many ways defines the course – at least as perceived by student participants. A proactive evaluation of the course looks closely at the assessment activities and notes how accurately they measure both the espoused and the hidden course objectives.

3.7. Benefits of E-Learning

The educational system of today needs to impart to all learners three new foundational skills: to make learning a relevant and lifelong process—a process of continuous growth change and evolution and adaptation. The schools of the twentieth century were clustered around the idea that time would be constant and learning would be variable. Today with computers taking over, jobs that can be done with minimum education are fast diminishing.

The idea of schools as a fixed time activity is being replaced by the concept of continuous learning built around a variety of tools and techniques. The twenty-first century classroom will be wherever the learner is located—at school, on the bus ride home, in the park, at a museum, or in the playground. Traditional tools will co-exist with the hitech tools of the telematic era.

The teacher's role in this distributed setting is to be quite different from that of content presenter and test giver. The teacher in this setting will operate in a system based on four components: campfires, watering holes, caves, and life. The campfire is the informational space associated with lectures and other methods of direct instruction. The watering hole is the conversational space occupied when learners converse among themselves or with their teachers about a particular topic. The cave is the conceptual space where ideas are developed in relative solitude and where student projects are designed and built. Life is the contextual space where the things have been learned and are applied in the world outside of school.

Learning has always taken place in these four spaces, yet twentieth century schools often failed to provide the right balance and learning suffered as a result. These four learning spaces provide a framework for the community at large that can envision educational opportunity. Flexibility is the key for the effective definition of the roles. Technology can become the force that equalizes the educational opportunities of a children regardless of location and social and economic circumstances.

The internet eliminates geography as a limiting factor. A child in a remote hamlet can have the same access to the same reference materials as one located in the cosmopolitan city. Time is transcended by

telematic tools. Technology will have an increasingly positive impact on the student's creativity. Access to multiple expressive modalities is important.

Educators are also great beneficiaries of the telematic revolution. It opens up new opportunities for casual dialogues on a wide range of topics, and helps overcome the sense of isolation sometimes felt by educators whose areas of interest have few local enthusiasts. In addition to conversing with peers, communication with learners, their parents, the community at large is facilitated with the same tools. Though technology promises the panacea to better learning, sales hungry decision makers have exploited it. Now it is faced with the challenge of maintaining the delicate balance between quality and quantity.

Society has been credited with creating technology, but technology is simultaneously creating society. These observations would also suggest that technology is beginning to exercise a benevolent tyranny over humankind. People have become compulsive information consumers who favour the passive reaction of information as a form of entertainment over the more challenging act of thinking.

Maintaining quality presupposes building a code of ethics to the telematic infrastructure, just as science with out responsibility is like a sword with out a sheaths; so too, telematic education without ethics will lead to gross debasement of human energies. The ethic values to bear in mind cannot be isolated from human values and responsibilities. It should also provide built-in evaluation that protect internal human ecological aspects. Primarily quality check must respect human rights to privacy, to avoid intrusion and abuse of these rights, and to avoid placing all information on equal levels.

Chapter - 4

WEB-BASED INSTRUCTION

Today's sophisticated online learning and performance needs, the consideration of a comprehensive set of human factors that contribute to online solutions from a whole-person perspective, are critical. Traditionally, designers have focused on primarily cognitive factors (e.g., how people build, process, and store knowledge). These primarily cognitive designs often overlook other sources for individual learning differences, such as emotions and intentions. If even they are considered, they are often relegated to a secondary role.

Historically, these approaches reflect the industrial-age perspective that assumes that an instructor is available in the classroom and can respond to the audience's diverse range of complex human needs. As a result, instructors have often unintentionally created a learning dependence that detracts from the learner's ability to self-motivate, self-manage, and self- assess online learning. And also suggests that conventional classroom design methodologies and solutions may need enhancement for online learning, and designers need alternative learning models that help learners become more independent, self-motivated, and self-managed online learners.

For online learners, the lack of an instructor is emerging as a problem simply because many learners are not very experienced at self-motivated or self-managed learning. The new learner-difference models should address this problem by:

i. explaining how emotions, attitudes, beliefs, and intentions (in addition to the more commonly recognised cognitive and social factors) and their relationships influence, support, or undermine learning experiences,

ii. considering the impact of 'these factors and explain how they may influence more successful online learning, and

iii. providing guidelines for designing instruction and learning environments that help learners not only meet instructional objectives, but also improve online learning ability.

Learning orientations are helpful because they describe key attributes of the learning audience, including their proclivity to learn more successfully. There are four learning orientations:

i) transforming,

ii) performing,

iii) conforming; and

iv) resistant.

These profiles provide three specific scales for measuring key learner-difference attributes. Learning orientations have a variety of uses: they help to differentiate the audience for research, guide analysis and design of research, instruction, and environments, tailor solutions that improve performance, learning ability, and online relationships, and making the overall learning experience more satisfying and worthwhile.

One learning environment was adapted and matched three learning orientations. The purpose was to test what effects the adapted presentations had on the learning experience. The learning orientation model served as a foundation to measure, analyse, and explain the effects and interactions on multiple dependent variables over three time periods. This mass customisation approach highlighted emotions and intentions as a dominant influence on learning.

An instructional research called the System for Intentional Learning and Performance Assessment (SILPA) was used to create the three adapted presentations in one learning environment. The SILPA can presents three different environments that can match the learning orientations, foster improved learning ability, and replace traditional, "one-size-fits all" solutions. The SILPA can diagnose the audience in advance of the instruction with the electronic version of the Learning Orientation Questionnaire (LOQ). The Intentional Learning Training (ILT) was presented to the learners in the web learning environment. The purpose of this intervention was to provide online learning tools and suggest to learners how they might improve their online ability with tools for more self- directed learning.

These tools enabled learners to manage individual learning performance for the domain of expertise in an organised problem-solving structure integrated with dynamic practice and assessment activities.

By using E-Learning techniques as part of a 'blended' learning approach, retail financial services organisations can not only improve customer satisfaction, but also protect their organisations from unwanted risks. This is necessary in today's rapidly changing environment that includes pressures from many different directions:

i. Regulation: the increasing burden of regulation creates an environment in which staff must be kept up to date and requires that their employer can demonstrate compliance.

ii. Product development: product lifecycles are becoming shorter and products more complex. The staff need to know new product options and requirements, often at short notice to meet customer demand.

iii. Risk control and compliance: ensuring full compliance with both internal and external processes and procedures and ensuring that the organisation always gives the same advice in response to the same circumstances are necessary,

iv. Increasing emphasis on sales the staff may need to acquire new skills in order to make the transition from transaction processing to customer service and sales

v. Mergers and acquisitions driving value from a merger or acquisition means that the staff must learn new methods and practices, for example, when the systems from one business are rolled out into the other

vi. Open finance alliances the staff must learn to sell and service products from a different market sector, for example, the sale of insurance products through a bank branch network.

vii. High staff turnover some areas of the retail financial services industry can suffer from attrition rates of 30 per cent or more.

viii. Efficiency: today' market environment has forced a sharp focus on costs.

The most effective learning is achieved through a structured combination of approaches including face-to-face training, online learning and traditional self-study material—this is the essence of blended E-Learning. The use of E-Learning is flexible, cost effective and less time-consuming than traditional 'chalk and talk' classroom-based training Yet E-Learning will only succeed as part of an integrated strategy that uses the right learning mechanism for a particular subject Any E-Learning system needs to be integrated with other business dimensions and applications. A unique E-Learning service is proven to deliver real bottom line results. By combining learning expertise with systems integration and business consulting, Syntegra is able to support all aspects of E-Learning, including helping customers to generate appropriate content and monitoring. Syntegra has an extensive track record in training and pioneered the blended E-Learning approach.

At the heart of any successful E-Learning offering lies a learning management system (LMS). Some of the leading providers of LMS applications worldwide, in particular Syntegra have extensive capabilities with Docent, a product offering that extends beyond its core IJMS and has leveraged partnerships for distribution and implementation. Docent systems have been built to scale for hundreds of thousands of users worldwide. Syntegra developed a unique E-Learning environment, which offers a combination of an E-Learning portal and community site for E-Learning professionals.

4.1. Web-Based Instruction

Web-based Instruction (WBI) is a hypermedia-based instructional programme, which utilises the attributes and resources of the World Wide Web to. create a meaningful learning environment where learning is fostered and supported. The integral parts of a WBI system such as content development, software, hardware and internet service providers, 'features' the characteristics of a WBI programme contributed by these components. The development of the web coincided with radical changes in patterns of work and the kinds of skill required in the workplace.

A systems analysis to education, regarding the knowledge worker as a 'process component' generating new knowledge which will keep the organisation for which he or she works 'ahead of the competition'. To achieve this, existing knowledge, seen as the input to the system, must be searched and filtered to identify what is relevant to the current task. The accelerated increase in the existing stock of knowledge and its rate of production threaten to swamp the system. The knowledge worker is regarded as responsible for controlling the nature of the new knowledge in a wider social context. The role of the education system is seen as equipping the knowledge worker with the competencies to generate new knowledge responsibly. Four key competencies are identified:

i. Self-directed and just-in-time learning: the example of the need to learn how to use new software to perform a task illustrates the need for individual learner-centred access to relevant information at the time of use.

ii. Self-directed knowledge acquisition: the knowledge worker needs to be able to access what is relevant from a vast pool of potentially useful information. Hypermedia are seen as a possible solution to structuring this information in accessible forms.

iii. Information analysis: it is important to be able to find and critically evaluate the relevant information.

iv. Creative problem solving: here recognises the need for synthetic thinking in generating new knowledge by linking existing ideas to each other and the task in new ways.

Such skills are best acquired by experiential learning, for instance the use of case studies and collaborative problem solving activities. There are three computer technologies which could be valuable educational supports:

i. Electronic performance support systems: these consist of packages of training and reference materials and specialised software, often distributed across a network by a server. It is suggested that these packages could be delivered over the web.

ii. Multimedia, hypermedia and the web: The web offers immediate access to a vast store of information linked by hyperlinks, though its continued expansion depends on capacity to transmit exponentially increasing traffic and availability of access, particularly in less developed countries. To make effective use of the web, information must be organised in a form comprehensible to the user. Improvements in search engines and site design may play a major part in facilitating access.

iii. Computer mediated communication: this enables fast but asynchronous collaborative activity. This could enable the experiential learning experiences needed to acquire skills. in synthesis and creative problem solving, but make expensive use of skilled educators.

The accessibility of WBI is increasingly finding consumers, including faculty, interested in furnishing educational opportunities through the internet. WBI is a hypermedia-based instructional programme which utilises the attributes and resources of the world wide web to create a meaningful learning environment where learning is fostered and supported. The availability of web-based courses makes higher education attainable.

There are many components and features inherent to WBI, including: interactivity; multimedia capabilities; independence from device, distance, and design; global accessibility; online resources and support; learner control; convenience; ease of use; cost-effectiveness; non discriminatory application; and collaborative learning. While many of these features may be attractive to educators, the vast array of capabilities associated with WBI creates the need for consideration of a number of factors prior to the implementation of WBI.

WBI formats generally are divided into in three categories. The first category incorporates text and graphics. This approach requires the use of hypertext markup language (HTML). HTML is the text-based language used to create web pages and hypermedia, linking text and images to additional information. The second category of WBI incorporates interactivity, in which web-based training engages the learner in simulation and provides the learner with immediate results of actions.

Interactive multimedia is the third category of WBI. Multimodal interactivity, including audio and video, are key features within the interactive multimedia category. The interactive multimedia format is becoming more of the standard than ever before because of improved transfer speeds, available storage space, and ease of revision and updating. However, when designing WBI, a needs assessment should be conducted. This needs assessment should be based on learner needs such as experience with the topic, technology, and reason for taking the course.

The internet offers

(a) access to potentially unlimited sources,

(b) opportunities to develop extensive course content,

(c) informal learning processes, and

(d) reinforcement of the student's active construction of knowledge.

Potential benefits of using the internet include increased enrolment income through the ability to attract students at a distance. Additionally, since students are typically no longer occupying classrooms and university computer systems, there could be a reduced need for infrastructure in equipment and physical plant. The web will be used as a means for delivering instruction despite the absence of a solid research base supporting its effectiveness.

Online learning outcomes such as programme completion, skill acquisition, and student satisfaction have been shown in some instances to be equal or superior to face-to-face (F2F) classroom instruction. However, while both WBI and traditional instruction are effective educational pedagogues, like all instructional methods, they possess both advantages and disadvantages. There are many advantages to using the internet to deliver WBI.

Web-based education prohibits individual students from dominating conversation, potentially drawing out intimidated students who ordinarily choose not to speak up in class. Interactivity is important to enable

feedback and support for students. Since the WBI instruction affords both asynchronous and synchronous interchanges many different aspects of instruction may be accomplished.

Web-based instruction prohibits the use of visual cues, which can be used to emphasise specific information and perspectives for student benefit. Further, because of loss of connectivity, students might feel that the educational process is quite removed or fragmented, to the degree that they feel they are not learning what they should be learning. WBI includes issues with computer equipment and related interfacing technology. Included is this equipment area are servers that hold the information, the phone lines or hard wires that connect the.' equipment, the quality of the software that is used to download the information and, finally, the skill of the people using the equipment.

Other weaknesses that affect the quality of learning through the WBI process include rapid changes in technology that require large expenditures to keep up with speed and consumer needs, formatting issues around browser settings and preferences, and variance in browsers being used to access the information. Another area that confounds the issue of successfully using WBI is the continued existence of computer or technological illiteracy and lack of motivation of students/ learners to make use of web-based instruction.

Pedagogy is dictated by the educational philosophy of the instructor. Philosophies may vary, some lending themselves to WBI more than others, but too often content and pedagogy are overlooked, as technology personnel, not educators, lead the drive toward WBI. One approach to the development of web- based content and instruction is supported in the theory behind online learning.

Trends in education, business, and technology mandate that both become lifelong learners; in the process, each becomes both student and teacher. As WBI processes between instructor and student are no longer solely through face-to-face (F2F) contact, communication expectations change, necessitating specification of all modes of support at the beginning of coursework and consideration of both instructor with student expectations.

Communication must be initiated and then maintained by ongoing efforts. Text-based communication, typically the essence of distance education (DE) communication, can be easily misread; therefore, care must be taken to provide clear communications and prevent miscommunications.

Online instruction requires that the student become an active learner, constructing his or her own knowledge from the direction provided by the instructor. WBI can transform passive students into active students, with instructors guiding and facilitating, aiding them in the tasks of analysing and synthesising

information. Educators in WBI become more like coaches and facilitators linking students directly to desired resources and sources of information rather than acting in the traditional role of delivering information.

Information competency is defined as the ability to access, retrieve, manipulate, relate, understand, and evaluate information in order to fulfil expected levels of performance (ROI)—awareness, information, application, and systematic integration. The basic characteristics of WBI result in changes in the dynamics of the relationship between instructor and student.

Some of the obvious differences between web-based and campus-based instruction include an increased reliance on technology, the need for advanced development of instructional materials, and a shift in learning responsibilities to the student. Yet the creation of WBI is a time-consuming process, especially when performed thoughtfully and thoroughly to include planning, design, development, delivery, evaluation, and maintenance. Design considerations include determining the specific needs and characteristics of the audience, and establishing the goals and objectives of the course.

The second stage, development, consists of creating a content outline, reviewing existing materials for compatibility with medium and course, organising and developing content to be as integrated as possible, and selecting and developing materials and methods integrating modalities. In the third stage, the evaluation stage, goals and objectives are reviewed, an evaluation plan is developed and decisions are made regarding the use of formative, summative, quantitative, and qualitative evaluation; then data are collected and analysed. Evaluation is conducted on the use of technology, course formats, course atmosphere, quantity and quality of interaction, acquisition of content, assignments, tests, support services, student achievement, student attitude, and instructor.

Costs associated with WBI include:

a) purchase/lease of instructional materials, including software and hardware;

b) equipment maintenance,

c) telecommunication fees—broadcasting, connecting, delivering, and disseminating information;

d) personnel, including full-time faculty, adjunct faculty, graduate and undergraduate assistants, technical personnel, clerical personnel, contracted personnel from other departments, and outside designers and consultants;

e) components of direct costs—planning, course production, course maintenance, mediating/tutoring, and assessment;

f) delivery of the instruction and associated costs; and

g) time and money for training faculty and staff in the use of hardware and software.

WBI potentially offers several cost benefits:

i) a smaller number of faculty can reach a larger number of students;

ii) expenses for physical building space and operational costs such as air conditioning, electricity, water, etc., may be reduced; and

iii) students carry the financial responsibility of accessing the hardware and software necessary to complete course requirements.

The costs of WBI, however, cannot always be addressed in terms of a return on investment. WBI requires physical space only for the server, the development, hardware, and, possibly, for software storage. A computer laboratory housing hardware and software for production may already exist within the department or university, thus providing the needed physical space for development of instruction and materials. Planning for WBI includes determining the location of the instruction. Instruction can be stored on a university server, a department server, the instructor's server, or on a server belonging to a partner organisation.

Increased capabilities in software can result in greater quality and efficiency, but also require more random access memory (RAM) and hard drive space for materials produced. Not all users will be accessing the course with computers whose specifications match those of the development machine or server, so state-of-the-art equipment may not be appropriate. The more technology incorporated into the design, the less accessible the instruction becomes to the majority; therefore, students should be provided with high calibre instruction even if using a slower speed computer and modem. It is critical that WBI incorporate accessibility for individuals with disabilities. User-friendly web page development software can be purchased to create websites, although knowledge of HTML is helpful for editing purposes.

Software can be used to create, alter, and animate images, as well as to create full motion video and high quality sound. Authoring software also provides opportunities to incorporate interactive multimedia components, and additional utilities can aid in creating searchable, web-accessible document files.

However, if the course will include audio and/or video, several factors must be considered: the quality of the media and its potential download speeds, the worthiness of including such media, the possible necessity for the download of plug-ins for accessibility, and the source of plug-ins should the user require them.

3.4. Web-Based Teaching

In schools, the rapid, increase in the availability of computers and other technologies has made significant changes in the education system. The teacher's role changes to that of a coach or guide as well as an instructor. Technology creates opportunities for students to work together, such as on group projects in which students exchange ideas about the project and about how to use technology to answer their questions. The focus shifts toward more active student learning. The teacher's skill in using technology is a major factor in improving student learning with technology.

Teachers must know not only how to use technology but also when and why to use it. Teacher technology standards identify essential skills teachers need for effective use of computers and other electronic equipment in schools today. The teacher technology standards or guidelines that address several levels of competency:

i. Fundamental computer operations skills understanding of technology concepts and terms;

ii. Ability to use technology for personal research and communication;

iii. Understanding of legal and ethical issues pertaining to computer use, such as how copyright applies to classroom software use, and what additional safety measures may be needed in the classroom;

iv. The ability to use computers in a variety of ways to integrate technology into classroom activities that support student learning

Of these standards, the most difficult one for teachers is the requirement that they know how to integrate technology into instruction. For example, teachers should know what technology is appropriate for use with a particular lesson. At the same time they also must know how to manage the classroom to effectively guide students using the computer.

These standards reflect fundamental concepts and skills for applying information technology in educational settings.

i. Basic computer/technology operations and concepts: Candidates will use computer systems to run software; to access, generate and manipulate data; and to publish results. They also will evaluate performance of hardware and software and apply basic troubleshooting strategies as needed.

ii. Personal and professional use of technology: Candidates may apply tools for their own professional growth and productivity. They wilt use technology in communicating, conducting research and solving problems, In addition, they will plan and participate in activities that encourage lifelong learning and will promote equitable, ethical and legal use of computer/technology resources.

iii. Application of technology in instruction: Candidates may apply computers and related technologies to support instruction in their grade level and subject areas. They must plan and deliver instruct units that integrate a variety of software, applications and learning tools. Lessons developed must reflect effective grouping and assessment strategies for diverse populations.

Teachers are expected to meet standards of technology competency, quality professional development must be available to help them integrate technology into instruction. Rapid changes in technology are a challenge for schools and states trying to keep teachers up to date. Another challenge is teachers' lack of access to adequate equipment and software; For example, a teacher who participates in an e-mail training session needs to have the chance to use that new skill upon returning to the classroom. Training without access to equipment is a waste of time and money.

Technology gradually is infused into training. Teachers participate in intensive workshops and contribute lesson plans that incorporate technology into the classroom to share with others in the programme. Teachers also point to the lack of quality training in ways to integrate technology into the teaching process. As educators become more skilled with computer equipment, they need training in applying these skills in the classroom. Professional development in technology until recently has reflected "one size fits all" thinking, and training has focused on broad technical skills rather than specific uses for technology in the classroom.

However, teachers of different grade levels or subjects have different needs for technology training. A first-grade teacher may use a computer to help reinforce students' reading skills. But a high school

science teacher needs to use specialised equipment and software to conduct experiments in the classroom and spreadsheets to gather and analyse the data collected.

4.2.1. Online Teaching Tools

The internet provides academics with an opportunity to make their teaching better, to allow them to teach in different ways to the standard one-to-many lecture, and to reach more students. Simply put, it allows for the 'maximisation' of learning. In other words the internet allows for a more efficient and interesting way of 'imparting knowledge'. To add to this, the internet can display the following advantages. In most cases it is:

i) cheap

ii) easy to use

iii) fashionable

iv) attractive to students

v) cross-platform

vi) suitable for accessing resources of various media

vii) ideally suited for remote learning, i.e. 'remote' from the classroom either by location or time

viii) interlinking, providing access to resources held in other subject areas and institutions

ix) suited to increasing collaborative work and cross- institution communication.

Traditionally the internet seemingly provides two options. The first is a form of distance learning in which a tutor places courseware on a web server where it can be accessed by remote students' identifying the disadvantages of such a system as being expensive if one is to insure enough software to meet the demands of a complete syllabus. Alternatively there is the independent study in which learners search the internet for materials that are relevant to their interests. Again this has disadvantages most notably because the suitability of the material students access cannot be guaranteed.

In internet-based Learning (IBL), a learner is provided with access to courseware stored on the campus or the internet from either location. A successful teaching model could involve then orientating, motivating, presenting, clarifying, elaborating, consolidating, and confirming.

Along with lifelong learning, one of the most overused expressions at the moment is that of ‘resource based learning’ or ‘RBL’. Simply put, this focuses on the concept of giving the learner greater access to resources Due to the multimedia and easy to access advantages of the internet the use of online teaching has led many to advocate the policy of marrying the two together.

There is no simple answer to this, as it depends entirely on the teaching goals of the course, and the technological capability of the host institution. As a guide, however, it can be looked on as a straightforward trade-off; increased virtuality means more work required for setting up the course, and insuring its success.

4.3. Developing a New Pedagogy

Teaching online requires faculty to move beyond traditional models of teaching and to adopt new practices that facilitate student learning. Some faculty resist this notion, however, thinking that it must be possible somehow to retain the lecture/discussion model of teaching in the online medium. Unlike the face-to-face classroom, where such methods may be successful, in online distance education a lecture simply becomes another article that students need to read. Although the advent of streaming audio and video has made it possible for instructors to deliver lectures to students who have the technology to receive them, students, when asked where they derived the most benefit from an online class, have noted that they often bypassed online lecture material and went directly to the discussion board, where they were able to interact with the instructor and their peers about the subject matter (Feenberg, 1999; Palloff & Pratt, 2001). Thus, in online learning, attention needs to be paid to promoting interactivity and the development of a sense of community within the student group to achieve successful learning outcomes.

Even the most seasoned faculty in the face-to-face classroom, however, night not intuitively know how to build interactive courses online. The skills involved in delivering a course using interactive facilitative means—which we term “electronic pedagogy”—can be taught, but these skills are often overlooked when faculty are trained to teach online. Questions that need to be addressed as faculty learn about online teaching are as follows: What does it really mean to be a “guide on the side” or a “learning facilitator” rather than an instructor? How does an instructor successfully make the transition required to teach an online course so that students become empowered learners and take charge of the learning process? Is it possible to develop every instructor into a good online instructor? How can institutions discern the difference between those who will do well online and those who will not, be they faculty or students?

Not all faculty are suited for the online environment, and academic institutions are making some serious mistakes when they make their decisions about who should teach. Choices about who should teach online are often based on faulty criteria; it is usually either someone who is considered a content expert or someone who is deemed entertaining in the face-to-face class- room who is chosen. Brookfield (1995) notes that often the most popular faculty, who get the best course evaluations, are the ones who are able to entertain. Being entertaining does not translate so well online, where one's personality is reduced to text on a screen. Focusing on faculty who are con tent experts may present a problem. Although they may know their subject matter well, they might not have, or might not have been taught, the facilitative skills required for online teaching.

Personality characteristics of successful online faculty may differ from those of successful classroom faculty. Research by one of the authors reveals that it is the introverted student who does particularly well online (Pratt, 1996). We believe that this finding generally applies to introverted instructors as well. In the online environment, facial and body language cues are removed from communication. The introvert, who can be inhibited by these cues in face-to-face communication, generally appears far more extroverted online and frequently becomes quite verbal and interactive. The ability to take time, reflect, and present himself or herself through text serves the introvert well. Self-consciousness diminishes when the instructor is out from under the physical scrutiny of students.

On the other hand, the extrovert, who generally establishes presence quickly through verbal and social connection, may have more difficulty in the text-based online environment. Taking times to reflect is not the forte of the extrovert, who tends to process ideas out loud at the time they occur The responses received help the extrovert to formulate and refine his or her ideas Consequently, the asynchronous online environment, with its absence of immediate feedback, can be frustrating to the extrovert.

People who are introverts are more adept at creating a virtual environment because they can process information internally and are less outgoing socially. It is more comfortable for an introvert to spend time thinking about in formation before responding to it. It is more difficult—but not impossible for extroverts to interact this way, perhaps because they have less need to. Extroverts tend to feel more comfortable processing verbally and in the company of others. (Palloff & Pratt, 1999, p. 22)

Consequently, it can be assumed that the instructor who might not be an entertainer in the face-to-face classroom, yet who has subject matter expertise, is flexible, and is open to the development of a more collaborative way of teaching, may be the better candidate to develop and deliver online courses.

We have found that successful instructors are willing to give up a fair degree of control in the teaching and learning process. They are able to empower their learners and build a learning community An

instructor who is willing to use collaborative, active learning techniques and ideas, and who allows for personal interaction, brings in real-life examples, and builds reflective practice into teaching, is a good candidate for teaching online. The open and flexible instructor needs support, however, to make the transition to the online classroom successful. This support rests in training and mentoring.

4.3.1. Training to Support the Transition

Faculty cannot be expected to know intuitively how to design and deliver an effective online course. Although courses and programs about the use of technology in education are emerging, and attendance at conferences on the topic is growing markedly, faculty have not been fully exposed to the techniques and methods needed to make online work successful. Current soft ware applications make it easy for faculty to simply transfer material to a course site. The lure to do this is complicated by the fact that institutions, which may view online distance learning as their lifesaver during times of on-campus declining enrollment, are now registering such large numbers of students in online classes that the burden on faculty is enormous.

Training faculty to help them get started and to support their ongoing teaching online does help. In our experience, creating a mentoring relationship through the pairing of faculty who are more experienced online with those who are just starting helps to break down barriers and provides real concrete examples of what works and what does not.

Online training courses are another useful way to deliver training to faculty who will be teaching online. In an online training course, the best practices involved in online teaching can be demonstrated. The best practices relate to the activities of teaching and learning and not to the technology itself. In an online faculty development course, faculty can experience firsthand what it is like to be both an instructor and a student in the process. In our experience, the courseware to be used in the development and delivery of courses should be the software used in the training.

The course should be long enough so that faculty can be encouraged to develop the skeleton of a course or even one lesson that other participants can critique. The facilitator of the training should model good techniques for building a learning community within the course and for empowering the participating faculty to explore both the medium and the material. We have found that it is best to include in online training faculty who will imminently teach their first online courses. Faculty who are about to teach online are highly motivated to learn good techniques for doing so. Faculty who are simply interested but will not immediately be using the training might not participate to the same degree. When the group is

made up of those who will be teaching online immediately and those who are simply interested, those who will not be teaching online in the immediate future do not feel as compelled to comply with participation expectations for the course. They may drop out and create frustration for those who stay with the training and who depend on the group to learn how the online learning process works.

4.3.2. Developing New Techniques

Bates (2000) notes that in institutions where best practices in the implementation of technology are followed, faculty development focuses on teaching and learning and not on the technology itself. There is little doubt that faculty are in need of developing skills in computer literacy before they can move into teaching online. However, as we have been emphasizing, the focus in faculty development should be on pedagogical methods and not on the soft ware in use.

When presented with instructional design principles that promote inter active delivery appropriate to online teaching, faculty will often ask, "Where is the lecture?" An appropriate response to this question is presented by Lytle, Lenhart, and Skrotsky (1999), who state, "Lectures are important and certainly numerous in higher education, but are not necessarily any more valuable in the learning process than any other learning tool' (p.5) Incorporated into faculty training and development, then, should be con create ways in which content can be presented without the use of lectures. Some of the techniques can include the following:

Creating Web pages that contain no more than one screen of text and graphics

- Collaborative small-group assignments
- Research assignments asking students to seek out and present additional resources available on the Internet and in books and journals
- Simulations that mimic real-life work applications of the material discussed, such as asking a group to become a work team to develop a proposal on a given topic to be submitted to a fictitious company
- Asking students to become "experts" on a topic within the scope of the course and to then present that topic to their peers
- Asynchronous discussion of the topics within the scope of the course material being studied

What is important is to encourage and support faculty in thinking outside the box in terms of developing creative ways to present course content, keeping of in mind the technology to which students are likely to have access.

Yet another critical factor in faculty training is to help them develop sensitivity to student needs and expectations as they enter the online environment. Just as faculty struggled in their online faculty development course to understand how online learning works and what is expected, students will not intuitively know how to function in an online course. In addition, learning online poses new challenges to students who previously have been exposed to traditional learning models. We now turn our attention to what it takes to assist students in becoming effective online learners and how faculty can help them with the process.

4.4. Teacher's Role in Web Based Instruction

Emergent forms of education will expand educational technology beyond current conceptions of flexible delivery. We envisage a three-stage model that highlights the maturity of flexible learning initiatives, from flexible delivery through flexible interaction to flexible exploration. The majority of current educational technology implementations fit into the first stage and very few reach the third stage. Consequently, we represent the three levels as a pyramid, highlighting the present focus on lower level activities and the need to progress to higher level activities.

The first stage, **flexible delivery**, embraces the majority of current Web-based delivery efforts. The second stage, **flexible interaction**, supports a more cooperative form of flexible delivery by using Web and Internet technologies to enable students to interact outside traditional boundaries. Many course Web sites already utilize bulletin board and chat facilities. However, this is often an adjunct to the learning process and simply continues the information delivery notion. Movement from the first level to the second implies a more conscious utilization of synchronous and asynchronous communication devices to engage students in both lecturer-to-student and peer-to-peer investigations of problems being explored. The third stage is characterised by **student exploration of concepts using Web and Internet technologies.**

In the early 1980s, the first layer of reasons why educational software was little used in practice related directly to technology limitations. Software made for one brand of computer did not run on other brands. There were also other frustrating barriers, for example barriers related to awareness and distribution. It was very difficult for information about a certain product to come to the attention of potential users, and even if it did, for the user to have a way to sample the product or even obtain it.

If a technology product did develop into sustainable and scalable use, it was most likely to be related to a common subject (for example chemistry, medical resources) and make use of a common technical platform (now, the www).There are relatively few examples of successful commercial educational software products for higher education compared to all the products being created as parts of research projects, within the framework of multi-partner collaborations, or with support of in-house teaching and learning centres.

4.4.1. Teacher Credibility

Ivan Illich(1971) suggest that: "Instead of placing trust in professionals, it should be possible, at any time, for any potential client to consult with other experienced clients of a professional about their satisfaction with him by means of another peer network easily setup by computer, or by a number of other means. Such networks could be seen as public utilities which permitted students to choose their teachers or patients their healers".

If the learner simply wants to learn to satisfy their appetite for learning than they are operating as a normal consumer then would be able to judge the value and quality of the process on their own perceived outcomes.

Teaching is one of the most demanding social activities in out society, involving the presentation of a sophisticated cultural inheritance to a large group of learners while working within the constraints of a heavily bureaucratized 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.

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.

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 perform his or her own activities independently

Different views of the relationships between learners and knowledge influence the extent to which we see teachers as dominant actors in the classroom directing activities or stage managers of what are seen as largely self-generated learning activities emanating from learners as individuals or as a group. It is here that decisions on such matters as the ideal balance between instruction and support, between open and closed questions, between direction and enabling come into focus.

4.4.2. The Teacher's Role

Teachers also need to see how different kinds of software relate to various views of learners, their relationship with each other, and the view of knowledge that the design of the software assumes.

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 pre-specifying content for them that sets limits on the range of ways that children then use them.

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.

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 organizing 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.

The 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, all need to be explicitly moved to the centre of the class room curriculum. The development of such skills also needs to be done in ways that enable learners to develop them further for themselves through using appropriate forms of software.

4.5. Teachers' Approaches to Using Computers In Their Teaching

It seems that there are three broad approaches which teachers can take to computer use:

1) the computer as tutor

2) the computer as neutral tool

3) the computer as cognitive tool

These approaches demand different kinds of competencies of teachers and have major implications for the nature of the learning which results. Action research appeared to be an effect method of ensuring that teachers did not limit themselves to one or other of the first two approaches, but in time went on to make a real attempt to adopt the third, higher-level approach.

1) The computer as tutor

Teachers normally need to play an important part in their pupils' computer— mediated learning: in drawing out points for discussion, planning follow-up work, and if they are familiar with the software, providing lead-in activities to maximize its impact.

2) The computer as neutral tool

Teachers who have begun to be familiar with using a computer often make a different assumption — that its role is similar to that of a pencil: they see the computer as a tool which is virtually neutral and can be used to carry out the same learning tasks their pupils would have undertaken previously with pen or pencil.

If there is no change in nature of the tasks pupils undertake when they are using a computer, they might just say, "we have used it in the first place' Teachers who adopt this approach often place a high value on the computers capacity as a presentational tool, because this enhances what was already being achieved rather than changing the nature of the tasks, For example, they may encourage pupils to use a word processor to type out what they have already written by hand and print 'best' copies for display or publication, but deny them the opportunity to write direct on screen and use the power of the word processor to change the nature of the writing process.

3) The computer as cognitive tool

Those teachers best able to use computers to enhance their pupils learning are those who have come to understand that computers are powerful cognitive tools which enable them to set new kinds of learning tasks that their pupils could not attempt before. Computer use in these classrooms will be varied – and often computers will be used for tasks similar to those which would have been undertaken without them – but the possibilities they have to offer become integrated with the planning enactment and assessment of learning activities. To use computer in this way requires that teachers change their pedagogy.

The first stage, flexible delivery, embraces the majority of current Web-based delivery efforts. The second stage, flexible interaction, supports a more cooperative form of flexible delivery by using Web and Internet technologies to enable students to interact outside traditional boundaries. Many course Web sites already utilise bulletin board and chat facilities. However, this is often an adjunct to the learning process and simply continues the information delivery notion. Movement from the first level to the second implies a more conscious utilization of synchronous and asynchronous communication devices to engage students in both lecturer-to-student and peer-to-peer investigations of problems being explored. The third stage is characterised by student exploration of concepts using Web and Internet technologies. At this stage, students can explore concepts in a non-linear, student-directed fashion. They can, in effect, design their own learning experiences. For the most part, little effort has been expended at this level.

4.6. Teaching Principles

Coping with this complexity and the adoption of new technologies necessitates that teachers have a set of guiding principles. Previously, we identified the elements in this quest for learning outcomes to include assessment, workload and choice. The following principles reflect a transactional perspective and deep approach to learning. In essence, these principles are intended to create a supportive critical community of inquiry that is core to the E-Learning framework we are discussing here.

Negotiable expectations, clearly expressed, encourage deep approaches to learning.

1. Coherent knowledge structures (schema) facilitate purposeful and integrative learning
2. Control creates commitment and encourages personal responsibility to monitor and manage meaningful approaches to learning.
3. Choice in content and process is a catalyst for spontaneous and creative learning experience and outcomes while recognizing and valuing intuition and insight.
4. Critical discourse confirms understanding and diagnoses misconceptions.

5. Critical thinking must be modelled and rewarded.
6. Assessment must be congruent with expected learning outcomes.
7. Learning is confirmed through assessment.

It is imperative that those involved in higher education come to grips with the reality that technology is an increasingly important element of the educational environment and represents opportunities and constraints for interaction that can significantly influence students' perceptions.

The critical point is that contextual variables do influence the nature and quality of learning outcomes. Educators must be cognizant of the context they are creating from both a pedagogic and technology perspective.

Expectations for higher education are rising, and the foundational elements required to realize these higher-order learning outcomes and develop continuous learners have been outlined. This does not represent a reinvention of the educational transaction and learning outcomes. But it does call for a refocusing and rededication to traditional higher-education ideals. These ideals can be brought back within our grasp by technological developments.

Seen as part of a pedagogical solution, E-Learning becomes an transaction described previously. Whether we realize the full benefit of E-Learning will depend on understanding the context in which it will be introduced.

It is the new learning communities and the potential influence of E-Learning to which we must turn out attention. The challenge is to understand the emerging educational context and how we create learning environments that will facilitate development of higher-order cognitive abilities and encourage these to thrive in what has been described as the knowledge era.

4.7. Internet Pedagogy for Teaching Science

Internet is probably the most transformative technology in the history reshaping all walks of human life in an astonishing way. Use of Internet has increased rapidly from an estimated 3 million in 1990 to approximately 50 million in 1998 (Philiips & Long, 1998). Until recently, the Internet has been sued primarily as an information resource, however, now there is an increasing trend to sue it more dynamically, by allowing user interaction and participation thereby allowing it to intervene in more specific learning activities. It is becoming increasingly popular for educational technologists to advocate integrating computer into the content areas since it is now recognised that computer skills should not be

taught in isolation because separate computer classes do not really help students to learn and apply computer skills in a meaningful way. These skills need to be tied together in a logical and systematic manner to the curriculum itself. They must directly be related to the content area curriculum and classroom assignments.

The integration of modern information and communication technology into teaching and learning process of science has a great potential. Technologies are tools and their effectiveness depends on how they are employed. They allow materials to be presented in multiple media format thereby enhancing critical thinking and other higher levels of cognitive skills and processes, and provide access to worldwide information resources. However, presentation of learning material via Internet not only requires the material to be constructed to facilitate memory, but also needs to address the important consideration of the interaction between the learner and the computer. The access to vast amount of information available on the Internet cannot be deemed a fair trade off against a lower lever of learning but it must be harnessed to be beneficial and add to the potential of high quality learning through Internet (Garland et al, 1998).

Internet provides access to real database and connection with large learning communities, thus becoming a powerful source of inquiry and exploration. It enables students to go beyond the acquisition of basic science concepts to develop critical thinking skills and appreciation of science and scientific phenomena with the support of scientists in flesh and blood.

Information and resources from around the world can be accessed by anyone from anywhere in the world as long as he/she is connected to Internet. Students can browse through libraries, museums and archives and consult experts around the globe. Online virtual exhibits enable the students in schools anywhere in the world to visit guided tour of different scientific locations. They can observe scientists and explorers at work and participate in discussion with them. Moreover access to new developments and discoveries is immediately available to the students. With the passage of time, students can also be encouraged and motivated to create their own websites providing useful stuff on them.

Chapter - 5

WEB BASED LEARNING

Effective web-based learning should include not just training in the use of technology. It must be integrated with pedagogical uses of technology to bring about learning for the development of life long learning skills and other emerging goals of education to meet the demands of the information age. Whenever web technology is used in educational settings, it is vital to reflect on how this affects students, faculty members, courses and institutions.

Web-based learning is seen by many as a transformative vehicle for increasing the pace of change and reform in higher education. For these and other reasons, analysis of quality assurance in web-based learning is an essential topic for education policy makers. The common problem now in the higher education sector is to identify an effective model to assure quality in the delivery of web-based learning that can fit the various stakeholders' expectations. The first stage for doing this is to identify the critical success factors that would contribute to quality assurance in web-based learning.

As the use of technology to facilitate and deliver distance learning courses has increased, new challenges have emerged for the administration, faculty, staff and students of universities developing and implementing distance learning programmes. Many faculties fear distance learning is just a means of reducing their ranks, or a means to solve budget problems. Others fear the dehumanisation and alienation of students as well as loss of critical thinking and social skills. On the other hand, rather than feeling threatened, the faculty should embrace distance learning as a way for more students to access their courses, resulting in a greater intellectual audience and less chance of a course being cancelled due to low enrolment.

The web profoundly influence society in general and universities in particular. One of the consequences of this tremendous surge in online communication has been the rapid growth of technology-mediated distance learning at the higher education level.

This extraordinary growth of technology-mediated distance learning in higher education has prompted several different agencies to develop principles, guidelines, or benchmarks to ensure quality distance education. The web is a major technological advancement reshaping not only our society but also that of universities worldwide. In the light of this, universities have to capitalise on the web for both teaching and learning, and one progressive development of this is the use of web-based learning in distance education

settings. The benchmarks for quality assurance of web-based learning were considered important, and in general the participated institutions strove to incorporate them into their policies, practices and procedures.

At the same time, there were few benchmarks that did not enjoy consensus among the academic members, and in some instances were not even considered mandatory to ensure quality for web-based learning. In order to have an effective quality assurance model for web-based learning, it will need to, conduct study on students' perception on this issue, and incorporate the results with the perception of academic staff to form a more complete picture of the whole quality assurance model.

Each quality assurance system needs to be careful in analysing the situation of the specific institution. It needs to be very flexible in its approach, and the combination of process and technology needs to be carefully considered, as unintended consequences in one area can originate from a bad choice in another. It may be worth noting that a firm adherence to an explicit view of what constitutes good web-based learning, and an explicit view of issues of change and culture will furthermore influence the specific approach taken in assuring the quality web-based learning.

For education, broadband access means the elimination of time and distance from the learning equation. Broadband carries with it powerful multimedia learning opportunities, the full interactivity of instructional content, and the quality and speed of communications. Wireless solutions may enable underdeveloped and remote areas to quickly take advantage of the web via wireless phones, two-way pagers, and hand-held devices.

During this period, internet access in households has grown dramatically. In just a year and a half the share of households with internet access doubled, rising from 26.2% to 41.5%. rural households are catching up. Home access is important for students doing research, taking online courses and communicating with other teachers and other learners. For parents, online access means new kinds of communication with there children's schools, with their children's teachers and with other parents.

For all households, internet access is another way to connect with their communities and government services. Home access helps to advance economic opportunities: low-income users were the most likely to display using the internet to look for jobs. Those learners without internet access at home rely on schools, libraries, and other public places to provide this access. For many economically disadvantaged and minority group youngsters, a computer at school or in the library after school is the only link to the wide

world of the internet. Educational institutions are struggling to provide students with internet access, and great strides have been made in bringing schools, libraries, and postsecondary institutions online.

Post-secondary education institutions are also rapidly expanding student access to the internet. The internet is a double-edged sword for these learners. It can be a gateway to new opportunities, or a barrier that challenges them even further. Web-based learning environments can provide support and challenge through multiple means of:

i. Representation (e.g., a math concept in both text and graphic modes; animated science simulations; poetry read aloud by the author, etc.)

ii. Expression (i.e., use of text; sound; images; video; and combinations of media as vehicles for expressive literacy through writing, illustrating, speaking, video-making, and drawing)

iii. Engagement to attract the easily bored or the easily distracted learner. Designing accessibility into an internet site or a course at the beginning is far less expensive than after the fact. Designs that create barriers harm everyone, not just people with disabilities.

Teachers are the key to effective use of web-based tools and applications, but first they must become skilled at using them. It is the teacher, after all, who guides instruction and shapes the instructional context in which the internet and other technologies are used. It is a teacher's skill at this, more than any other factor, that determines the degree to which students learn from their Internet experiences.

Teachers must be comfortable with technology, able to apply it appropriately, and conversant with new technological tools, resources, and approaches. If all the pieces are put into place, teachers should find that they are empowered to advance their own professional skills through these tools as well.

While younger teachers may have basic technology skills they realise that they, like their older colleagues, do not know how to apply these skills to teaching. The ability to use technology for non-instructional purposes does not necessarily translate into either the will or the capability to use technology to support student learning. Although they are not technophobes, these new teachers lack a clear conception of effective classroom uses of technology in their subject area.

Professional development is the critical ingredient for effective use of technology in the classroom. Seventy per cent of educators polled regarding technology in instruction put professional development at the top of their list of technology challenges. Professional development is often called 'training', but the term implies much more than just building basic technology skills. It means developing a vision built on

the understanding that technology is a tool that can offer solutions to longstanding teaching and learning problems.

Fortunately, the internet is making it possible to connect teachers to each other, giving opportunities for mentoring, collaboration, and formal and informal online learning. Through the internet, teachers have access to high quality online professional development opportunities beyond what the local school or district is able to offer. And, in working in online environments, teachers obtain a collateral benefit: they learn important technological skills.

In short, a supportive social structure is one of the key elements for successful online learning. But unless new teachers enter the classroom ready to teach with technology, students will never catch up with modern technology. If teacher education programmes do not address this issue head on, they lose the opportunity to get it right with a whole generation of new teachers and the students they teach.

The intimate relationship between the private and shared worlds is highlighted because e-learning has been most often used to provide more efficient delivery of information and, thus, favour independent learning. The nature of this dominant application is a serious limiting condition to the full utilization of the capabilities of e-learning. While autonomy and access to information are not inherently disadvantageous, there is little recognition of either the transactional nature of an educational experience or of e-learning to support collaborative asynchronous learning. It is the technical capability of e-learning's unique ability to bring together a community of learners, unrestricted by time or place, that must be understood. From this perspective, e-learning would appear to offer the means of creating an educational experience so long idealized in educational theory.

Dewey (1938) identified two principles that are reflected in the theoretical framework developed here. One is 'interaction', which unifies the subjective (personal) and objective (social) worlds in an immediate timeframe. Through this interaction, ideas are generated that illuminate the eternal world. That is, meaning is constructed and shared. Through interaction, ideas are communicated and knowledge is constructed and confirmed. The second principle is 'continuity', which goes to the importance of creating the foundation for future learning. As Dewey stated, 'the result of the educative process is capacity for further education' (1916: 68), which has great value for both the individual and society.

Dewey would have embraced the choice and diversity of e-learning with its opportunity for 'active inquiry' and the 'individual variations' it provides; however, he would have also been adamant that discipline required to elevate the process to 'reflective inquiry' be brought to bear on the information. E-

learning, and the Internet, are wonderful sources of ideas, but to be 'genuinely educative' they must provide an experience that assures 'continuity' or the foundation for new, worthwhile learning experiences.

Education is fundamentally an interactive or transactional process. The challenges and confusion surrounding control issues go to the normative role and responsibility afforded the teacher. It is the teacher who has the legitimate responsibility to define the curriculum and design the educational activities. Unfortunately, there is little opportunity for collaboration in the planning process. That is, the student has little input or influence in planning the process or expected outcomes of the educational experience. This creates the contradictory situation where the student is expected to assume responsibility for activities and an outcome over which they have little input.

The solution inherent to the transactional perspective is to give students opportunities for dialogue regarding outcome expectations learning activities, and means of assessment. While some aspects of the educational transaction may not be open for negotiation, it is important that students share in this understanding. By being included in the larger process, and being provided choice where appropriate, students are given a sense of control and, therefore, take responsibility for the quality of the educational outcome.

The transactional perspective on teaching and learning reflects a dynamic balance of responsibility and control issues congruent with the educational purpose and the capabilities of the students. E-learning draws attention to fundamental responsibility and control issues.

5.1. Teaching and Learning through WEB

Emergent forms of education will expand educational technology beyond current conceptions of flexible delivery. A three-stage model that highlights the maturity of flexible learning initiatives, from flexible delivery through flexible interaction to flexible exploration can be envisaged. The majority of current educational technology implementations fit into the first stage and very few reach the third stage. Consequently, the three levels can be represented as a pyramid, highlighting the present focus on lower level activities and the need to progress to higher level activities.

The first stage, flexible delivery, embraces the majority of current Web-based delivery efforts. The second stage, flexible interaction, supports a more cooperative form of flexible delivery by using Web and Internet technologies to enable students to interact outside traditional boundaries. Many course Web sites already utilise bulletin board and chat facilities. However, this is often an adjunct to the learning process and simply continues the information delivery notion. Movement from the first level to the second

implies a more conscious utilization of synchronous and asynchronous communication devices to engage students in both lecturer-to-student and peer-to-peer investigations of problems being explored. The third stage is characterised by student exploration of concepts using Web and Internet technologies. At this stage, students can explore concepts in a non-linear, student-directed fashion. They can, in effect, design their own learning experiences. For the most part, little effort has been expended at this level.

The emergent forms of education, situated in the diversity/collaboration quadrant, encompass the flexible interaction and flexible exploration stages. These are summarised below:

5.1.1. Flexible Interaction

If we accept that effective teaching and learning involve a process of developing and changing individuals' values and beliefs, enabling them to see the world from a different perspective, then it is appropriate to view the educational process as complicated layers of social interaction. But, no matter which definition of teaching and learning we subscribe to, a high level of student-student or student-teacher interaction is inevitable. The Web and the Internet offer a wide array of opportunities to support student interaction. The facilities range from the simple bulletin board, ICQ, IRC, and other generic chat facilities to the more sophisticated online tutorial facilities like Net Meeting, white Pine's Meeting Point and Class Point, and Lotus's Learning Space. Web-based course were products like Web CT, Top Class, College, and Blackboard's Course Site, which offer interactive facilities, are increasingly being used. However, recent surveys have shown that communication facilities, alone will not deliver increased value to students or academics (Parry, Cockroft, Breton, Abernethy, & Gillies, 1999; Vargo & Craff, 1999). It is not the technology itself, but the way it is integrated into the learning process that creates value for students.

An example of an integrated learning process using Web and Internet technologies is the virtual collaborative team room. Traditional project groups often base themselves around a team room- a physical location where material related to the project can be grouped together in a work environment. As a collaboration too, the physical team room is often highly effective. Group members are able to enter the room and begin working by themselves on a particular piece of the project, and then easily adapt themselves to working in groups should another member arrive. Further, due to its ability to develop project memory, the physical team room facilities group members to pick up where another member left off on a particular task, thereby allowing for time-diverse collaboration. But the physical team room requires the co-location of all members of the project group. An alternative is to create a virtual team room utilising group applications. By locating the team room within an Internet-connected computer system, group members are able to participate in the project, and obtain many of the advantages of the

physical team room even if they are in geographically diverse locations (Davis, Motteram, Crock & Mitchell, 1999).

5.1.2. Flexible Exploration

Flexible Exploration focuses on students as active constructors of knowledge (Brown, 1994). Practically this is reflected in the widespread adoption of case-based and problem problem-based learning approaches to student learning (Bentley, Lowry & Sandy, 1999; Prawat, 1993). One of the perceived advantages of these methods is that they allow students to deal with complex realistic situations, to gain experience in practical decision-making and to develop their own models and approaches for dealing with unstructured problems (Bentley, Lowry & Sandy, 1999). It is claimed that student recall and understanding of key concepts is improved when they are actively engaged in such realistic learning activities (Mills – Jones, 1999).

The loss of richness in the material is commonly a product of tight teaching schedules or attempts to highlight the lecturer's perception of the important aspects of the case. As a result, students tend to approach the case as an exercise in re-organising the material to find the answer. This reduces both the experiential and realism aspects of the learning exercise (Bentley, Lowry & Sandy, 1999; Friedman & Khan, 1994; Gallagher, 1994). The internet and the Web offer a range of opportunities to address these concerns, particularly in terms of increased realism, improved student motivation, and an increased emphasis on self-directed student exploration of the material. At the simplest level multimedia facilities can enhance the visual aspect of case material. Audio and video tools can be sued to upgrade case exhibits and break up the written components of the material. This is often enough to improve student motivation to explore the case material on their own or with peer groups.

In teaching cases specifically developed to take a advantage of new technologies, communications tools and simple artificial intelligence agents can be used to encourage student interaction with the virtual actors in the case. Controlled interaction with artificial organisational units like steering committees or management groups can be supported allowing students to explore the material in ways not originally conceived by the lecturer. The student experience can also be enhanced by the ability to contextualise the case material within the wider context of resources available on the Web. These features all add to the complexity and realism of the problem being explored.

The following may be considered good principles for the design and development of effective educational technology systems to support emergent teaching practices.

1. **Support appropriate curriculum goals and objectives:** Educational technology needs to be developed to support educationally derived objectives and goals. This necessitates detailed exploration of how each technological mechanism supports learning in specific higher education contexts. Well-designed educational technology should allow multiple teaching goals to be realised. For a system to be widely useful and broadly accepted, it needs to fulfil a variety of educational objectives and student needs. The most important design question for educational technology is probably whether the system should be developed at all.

2. **Contextualise learning:** The use of new technologies offers the opportunity to contextualise learning in ways not previously possible. The use of on-line systems and simulators allow for student exploration of knowledge domains within a frame work resembling actual practice. It is particularly important that technology does not de-contextualise learning by conveying mixed messages.

3. **Create communities of self-directed learners**: Interactive communication facilities are of value only when they create communities of learners and not when they simply provide additional avenues of information delivery. Well-designed technology-based systems also ensure that students progress in their learning activities, while allowing them to broaden their understanding and explore tangents if they wish. One of the strengths of emergent educational technology is its ability to broaden students' conceptions of the world. Pop quizzes are useful tools, animations can engage, and discussion forums can support communication, but none of these by Good educational technology should not promote rote learning but encourage exploration, thinking, and problem solving.

4. **Encourage and facilitate open discourse:** Many existing technology-based educational systems are designed simply to provide a more flexible method for the delivery of existing teaching material. But traditional face-to-face delivery allows students the chance for social learning not automatically present in technology-mediated delivery. In traditional delivery, students meet together in class and in small groups as they walk to or from class. In these groups students may talk about such things as their reactions to material or to assignments, and work load copying strategies. New educational technology also needs to provide facilities which encourage and allow interaction between students and teachers. This discourse should, where possible, be removed from the limitations of time and locational constraints.

5. **Provide appropriate feedback channels:** Much of the existing educational technology allows only for one-way communication of material. It is important, in conjunction with the previous

principles, that emergent systems allow for teachers to support and monitor student learning through the provision of appropriate feed back. This feedback is an important aspect of any students' performance and perceived self-efficacy (which in turn affects future performance). The feedback should go beyond traditional communication of results and assessment feedback and incorporate more feedback that supports, challenges, and motivates students

6. **Support teaching and Learning needs:** When educational technology is developed from a purely pedagogical perspective, it is likely to support student needs. However, it is important that emergent systems also support teachers' needs. A system's 'success' is highly questionable if it creates extra burdens for teachers or removes those aspects of teaching that are considered enjoyable. A good system should enhance a teacher's participation with students and support other teaching-related issues like satisfaction, motivation, and career concerns.

7. **Engage Students:** Badly designed educational technology can create a gulf between students and teachers, increasing student alienation and reducing their learning capacity. In these circumstances, it is likely that there will be resistance to technology use. It is possible to overcome fear of technology by supporting a variety of learning experiences and by providing choice in learning approaches. Well- designed systems should enhance a student's perception of self-efficacy and not detract from it Educational technology should in their students and not create a perception of distance.

8. **Be accurate, adaptable and flexible:** Good educational systems can be costly, complex, and difficult to create and maintain. It is important that anticipated benefits are not negated by poor instructions, simple errors, and technology failings. Systems must be adaptable so that teachers can ensure currency of the material provided. It is also important that they be flexible to allow teachers to adapt the teaching practices to suit different student groupings and learners to adapt them to their individual learning styles. The need for structure in a technology must not remove a student's ability to self-regulate their learning experience.

Web can have a profound effect on course delivery, particularly in relation to developing delivery mechanisms capable of meeting the individual needs of diverse student cohorts. As students become more informed and ICT capabilities develop, there is a need for better-designed educational technology that supports teaching practices rather than acts as a bill board advertising technological wonder.

Our thinking on flexible learning is influenced by our belief in a multi-staged approach to flexible learning, built on the foundations of constructivism and social interactionism. The advantages of

constructivism lie in the emphasis on learning as a process of sense-making through experience. Learning under these modes is active and reflective techniques which have been proven to increase understanding and retention. Good ICTs offer many opportunities for students to become active, reflective, self-directed learners. The goals of education technology must be to support truly flexible forms of education, improve opportunities for learning, and cater for different learning styles. Distance learning in disguise will not result in long-term benefits to students and teachers. The key lesson we have learned from out development and assessment of educational technology over the last few years is that educational technology produced without a clear pedagogical foundation rarely results in improved student learning. Finally, the point must be made that educational technology should not be considered a focal point for educational reform but rather a resource to be integrated into a wide repertoire of educational resources.

5.2. Learning Style Instruments

Major types of learning styles as reported by Ayersman & Minden, (1995) are presented below:

5.2.1. Dunn & Dunn Learning Styles

1. Environmental (Sound, Light, Temperature, Design)
2. Emotional (Motivation, Persistence, Responsibility, Structure)
3. Sociological (Self, Pair, Peers, Team, Adult, Varied)
4. Physiological (Perceptual, Intake, Time, Mobility)
5. Psychological (Global/Analytic, Hemisphericity, Impulsive/Reflective)

5.2.2. Grasha-Reichman Learning Styles

Competitive--collaborative

- Competitive students learn in order to perform better than their peers do and to receive recognition for their academic accomplishments.
- Collaborative learners acquire information by sharing and by cooperating with teacher and peers. They prefer lectures with small group discussions and group projects

Avoidant--participant

- Depending on the reason this person does not wish to participate in a "traditional" classroom he will probably be less reluctant a candidate for web based training.

- Participant learners are interested in class activities and discussion, and are eager to do as much class work as possible.

Dependent--independent

- Dependent learners look to the teacher and to peers as a source of structure and guidance and prefer an authority figure to tell them what to do.
- Independent students prefer independent study, self-paced instruction, and would prefer to work alone on course projects than with other students.

5.2.3. Gregorc-Butler Learning Styles

Gregorc and Butler's theory organizes learners on two dimensions:

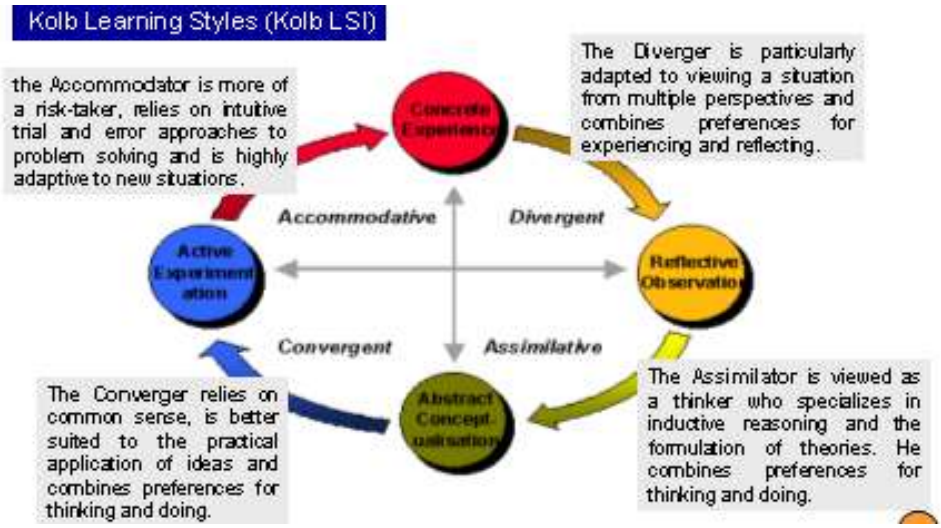
- Concrete/Abstract

  Concrete refers to the ability to take in and adapt information based on facts, and abstract refers to the ability to use imagination and intuition.

- Sequential/Random

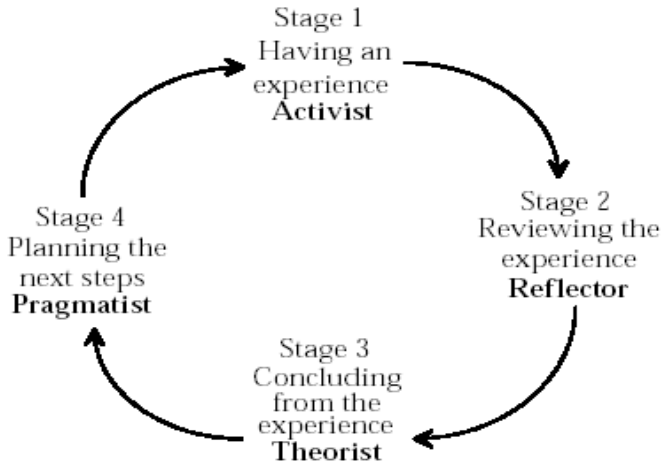
  Sequential covers the wish to obtain information in a linear process, and random covers the preference for non-organized chunks of information.

5.2.4. Kolb Learning Styles (Kolb LSI)



5.2.5. Honey & Mumford Learning Styles (LSQ)

Defines four types of learning styles which are claimed to fit around Kolb Learning cycle.



A learner can start anywhere on the cycle because each stage feeds into the next. A person could start, for example, at stage 2 by acquiring some information and pondering it before reaching some conclusions, stage 3, and deciding how to apply it, stage 4.

STYLES	Respond WELL to	Respond POORLY to
Activists *"Here, let me do that"*	New problems, being thrown in at the deep end, team work...	Passive learning, solitary work, theory, precise instructions...
Theorists *"Yes, but how do you justify it?"*	Interesting concepts, structured situations, opportunities to question and probe...	Lack of apparent context or purpose, ambiguity and uncertainty, doubts about validity...
Pragmatists *"So long as it works"*	Relevance to real problems, immediate chance to try things out, experts they can emulate...	Abstract theory, lack of practice or clear guidelines, no obvious benefit from learning..
Reflectors *"I need time to consider that"*	Thinking things through, painstaking research, detached observation..	Being forced into the limelight, acting without planning, time pressures...

5.3. Learning, Perceptual Styles & Hypermedia: Application to E-Learning

Research demonstrates that both low and average achievers earn higher scores on standardized achievement tests and aptitude tests when taught through their learning styles preferences (Dunn et al., 1995). Underachievers tend to have poor auditory memory. They learn better through graphics and animations rather than text (Dunn, 1998).

Hypermedia, providing a pool of interlinked multimedia objects for the web can be very useful in the design of courseware that addresses the learning difficulties of low and average achievers while gifted students would have no problems to adapt to the type of material presented to them.

Hypermedia therefore can provide a good opportunity for average and low achievers to improve their performance by teaching through their learning and perceptual styles.
Learning Styles are used because of the following.

- Students learn better when using preferences or characteristics in which they're successful
- Students will be better learners when they can exploit these characteristics
- When the learning experience accommodates various characteristics, more students will be successful

Families of 'learning style'

- LSRC report by Coffield, Moseley, Hall & Ecclestone in June 2004 listed five categories of learning style:
  - Constitutionally based
  - Cognitive structure
  - Stable personality types
  - Flexibly stable learning preferences
  - Learning approaches, strategies, orientations and conceptions of learning

Choosing a tool to measure Learning Style

- The following Criteria can be used
  - MUST BE – pedagogically sound
  - MUST BE – feasible to model computationally
  - IDEALLY – has internal validation
  - IDEALLY – used already

- Felder-Solomon ILS instrument for first-pass
  - Quantitative instrument
  - Validation study carried out by Zywno, 2003
  - Used in previous multimedia learning system

Felder-Solomon ILS

- 4 axes to assess learners:
  - Visual / verbal
  - Global / sequential
  - Active / reflective
  - Sensing / intuitive
- Questionnaire consists of 44 items (11 per axis) with choice of 2 answers
- Learners are scored on each axis out of 11

Scoring users' learning styles

Learning styles can be scored as follows:

VISUAL ← → VERBAL

11 9 7 5 3 1 1 3 5 7 9 11

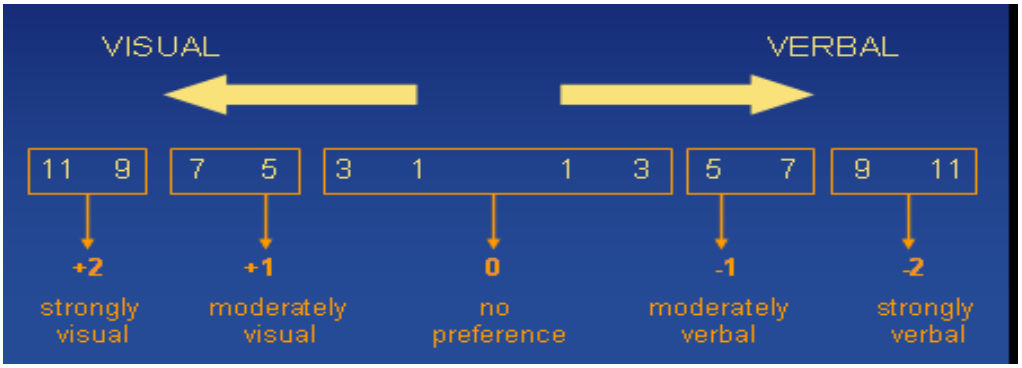
1-3 = little preference for either dimension

5-7 = moderate preference for one dimension

9-11 = very strong preference for one dimension

Modelling users' learning styles

- Visual-verbal axis as initial adaptation



Adaptation to learning style

- Visual/verbal user characteristics stored in database
- Learning style filter applied to lesson plan containing details of user characteristics
- Chunks are ordered in the virtual document .So the more appropriate chunks appear first on page
- User can still see all content if they wish

5.4. Learning to Learn Online

Students are, for the most part, unaware of the demands that online learning will place on them as learners. They generally enter an online class with con- traditional expectations, that is, that the instructor will "teach" and they will "learn" from the material the instructor provides. They do not know that the instructor is less visible in the learning process and that the instructor role is one of facilitator rather than of traditional teacher or lecturer. They also have not been told that the online learning process is less structured and demands significantly more input from them as learners to make it successful. Consequently, it is important that the instructor convey this information to students prior to beginning an online course. Many times difficulties emerge when students have differing sets of expectations from the course and the instructor and little or no attempt is made to clarify expectations at the outset.

Students generally enter an online program with the expectation that a course will be more attuned to their needs as learners. This may mean that the course is more convenient for them due to distance or work and family demands. Or it may mean that they do not like large classroom situations and prefer the potential for increased instructor-student interaction.

Because students enter online programs and courses with expectations that might not match the realities of online learning, some institutions are course creating online courses to teach students about online learning, and some are even mandating that students complete an introductory course before embarking on other online classes. Some incorporate mandatory face-to face orientations to online programs and courses, involving both computer training and training in what it means to learn online and how to be an effective online student. The assumption behind all of these approaches is the same: To maximize the educational potential for both the online classroom - and online students. We must pay attention to teaching our teachers how to teach and teaching our learners how to learn when teaching and learning are virtual.

As with faculty training, conducting student training online allows students to experience online learning before they take an actual course. Regardless of the means by which the training is conducted, the following should be included in a student orientation to online learning:

The basics of logging on to the Internet including the use of a browser,

- accessing the course site,
- using course management software,
- saving and printing material found online and
- basic Internet searching, and E-mail.

Understanding what is required to become successful online learner including time requirements and time management.

The differences between a face-to-face course and an online course, including the role of the instructor and the roles of students as well as expectations about how students will be evaluated.

Interaction between the instructor and students and among students can be ensured.

How to give feedback to other students

Appropriate interaction and communication, including the rules of "netiquette"

How to get help when it is needed (Palloff &Pratt, 2001, pp. 123-124)

Providing an orientation course might not resolve all of the issues for students as they make the transition to the online classroom. But it certainly can help to provide a clearer understanding of the differences in the type of educational experience they are about to undertake and can help to clarify expectations. Following up with a written guide to online work, whether in hard copy or placed on the institution's Web site, can help to reinforce this learning. When concerns or complaints regarding expectations arise, students can then be referred back to the guidelines that are readily available to them to help them understand the online teaching and learning methods and processes.

If the institution cannot provide student training about how to learn, then suggestions for how to learn online become the responsibility of the faculty who are delivering courses. Ways in which faculty can orient students include the following:

- Hold a face-to-face, hands-on orientation, if possible, to show students the course site and discuss online learning.
- Provide an orientation to the course on the course site or as a first discussion item.

- Provide students with a list of frequently asked questions and responses to those questions.
- Place basic information about how to navigate the course site on the welcome screen or course home page.
- Send an e-mail message to each student enrolled in the course containing orientation information. (Palloff & Pratt, 2001) p. 43)

5.5. Changing Roles and Relationships

One final issue that faculty and student development should touch on is the changing nature of faculty-student relationships created by the more facilitative methods used in online teaching. The student enrolled in higher education today, whether online or in traditional institutions, is less likely to be the 18- to 21-year-old seeking a one-time educational experience. Instead, today's student is likely to be an adult returning to school to obtain the knowledge and skills needed to compete and advance in the workforce. The adult student, therefore, is more likely to be a lifelong learner embarking on the beginning of what may he a learning process that results in the pursuit of multiple degrees, courses, or certifications (Bates, 2000). Although their previous educational experiences have been traditional—meaning that the instructor is the expert with knowledge and wisdom to impart and that the student has only to receive—the lifelong learner is looking to enter a partnership that results in the achievement of specified learning objectives.

The partnership that these students seek is not only with an instructor but also with student colleagues and with an academic institution that understands and tries to meet their needs. There is a movement occurring in the academic world; academic institutions need to be increasingly responsive to those they serve, resulting in a shift from the traditional faculty-centered institution to a learner-focused one. In this context, the relationship between faculty and students will change as well.

In the online classroom, the most effective means of achieving learning outcomes is the use of active learning techniques that encourage students to become empowered learners. The fully engaged, active learner is likely to bring new demands to the learning situation. The online environment can be a great equalizer, and the online classroom can become the place where faculty and students partner to achieve learning objectives through interactive, self-empowering means (Harasim, Hiltz, Teles, & Turoff, 1996; Palloff & Pratt, 1999, 2001).

Bates (2000) notes,

Modern learning theory sees learning as an individual quest for meaning and relevance. Once learning moves beyond the recall of facts, principles, or correct procedures and into the area of creativity, problem solving, analysis, or evaluation (the very skills needed in the workplace in a knowledge-based economy, not to mention in life is general), learners need the opportunity to communicate with one another as well as with their teachers. This, of course, includes the opportunity to question, challenge, and discuss issues.

Rather than be threatened by the shift in the faculty-student relationship, faculty can be challenged by the change and embrace it. Faculty, too, are life-long learners. The changing relationship between faculty and students serves to expand the network through which faculty can learn. We always believe, as we enter a new online course, that we have as much to learn from our students as they do from us, and we find this to be an exciting element of our online work that we welcome the looking glass.

5.6. Interactive Learning

Interactivity is one of the attractive components of web-based education and is not limited to the use of hypertext and the media. When talking about interactivity, we should refer not so much to interaction with learning material that someone has made available on the network or on CD-ROM, but rather to human-machine interaction governed by software, or, better still, personal interaction mediated by network technology.

Even when using the technology's potential to the fullest, there is no guarantee about the quality that interaction will bring to the learning process. The development of new technology, especially over the past decade, has led to the production of multimedia material of high quality, at least in aesthetic terms. Looking at these products from the communication viewpoint, we can identify two extremes. At one end, there are products with a low level of i which tend to reproduce the traditional lecture format.

Another type of interactivity, is direct interactivity between individuals, where the technology does not "drive" but acts as a passive mediator. This is the case with computer networks. While interactivity is no guarantee of quality, social interaction with peers or with one's trainers plays a key role in the learning process, both from the psychosocial and psycho-affective viewpoints. In this sense, ICT services can make an enormous contribution. Despite this, there is still a general trend in distance education toward one-way schemes.

Interaction is imperative if the quality of the process is to be raised: interaction with materials, between students and their tutors/teachers, as well as between all the participants. Information technology and, more importantly, computer communication technology can play a vital role in fostering this interaction,

even if use of these means is not in itself a guarantee of higher quality. As is usually the case, a fundamental role is played by course designers and coordinators, who have the means to steer the process toward the predefined goals.

However, raising interactivity in the process either involves investing in multimedia products which are very complex and expensive, or entails increasing the amount of online tutoring. Courseware tools also have been developed over the past few years to aid in the development of electronic learning environments by integrating access to information, interactivity, and synchronous and asynchronous communication.

Human infrastructure is the foundation of student learning, and physical, technological, and human elements must be integrated. Human infrastructure is critical to total institutional infrastructure; technology is impacting not only physical infrastructure but human infrastructure as well. As new teaching-learning paradigms evolve, the faculty must be strengthened through training and university supports. Investment in the development of faculty will build the human infrastructure essential to technology-driven higher education.

The web is not an interactive tool unless elements are incorporated to promote that interaction. The development of WBI, however, requires an even higher level of understanding. Engaging in WBI requires not only the instructor or developer to have a level of expertise in WBI but the student as well. Both must possess a level of knowledge or aptitude enabling them to perform the basic operations of both the computer hardware and system software. Both must be able to apply simple problem solving techniques as well as have a general understanding or foundation in how to navigate the WWW and use functions such as e-mail and/or fax.

The remote student in WBI will also need access to the same student services as on-campus students, such as registration, tuition payment, student support, examinations, and library services. Creating WBI without marketing and promoting the availability of course work deflates the potential profitability that increased enrolment can offer. It also prevents meeting the identified need. If the department or university does not have an individual or group of individuals designated to promote web-based courses, marketing efforts will become a faculty responsibility.

The development of an online syllabus and readings could be the entrance into WBI, followed by the incorporation of hyperlinks and the addition of text and image-based instructional materials. Professors

are currently creating web pages for courses, syllabi, readings, and links. E-mail may initially serve as the primary mode of communication, followed by the incorporation of a listserv, then synchronous chats.

Chapter - 6

WEB LEARNING ENVIRONMENTS

Internet is able to animate, stimulate, capture reality, add movement to static concepts and extend outreach to the whole world. It can present the same conventional experiment in a more dramatic and multifaceted manner and thus, can support conventional teaching practices in an effective manner.

The Eisenhower National Clearinghouse (ENC) (http://www.enc.org) is an excellent site which provides high quality material and information for science students at secondary and senior secondary level. It also provides links to websites that contain useful information on additional curriculum resources. More than producing reality, Internet makes available virtual experiences that entice curiosity of the students and open new frontiers of knowledge for them. It brings into the schools the power of instruments that no school could every afford. At the websites of Space Telescope Science Institute (http://oposite.stsci,edu/pubinfo) students can observe planets and starts through the lens of the Hubble Space Telescope. At the Molecular Expressions Website (http://micro.magnet.fsu.edu) they may examine tiny insects under fluorescence microscopy or study details of DNA structure (Haddad & Jurich, 2001). Snuffing on the Internet reveals that there are plenty of other websites which specifically provide rich stuff on different Science topics.

The WWW is a unique way of linking text, images, sounds and video resources. Simply by clicking with the mouse on highlighted text or an icon, one is seamlessly linked to another image, sound or video resource available on the same computer or the one available elsewhere on the Internet. It brings into our classroom a wealth of information including primary resources previously unavailable to educators. Multimedia components like text and graphics, audio streaming, video streaming, graphical use interface and compression technology (shockwave) enrich the learning experiences in a web-based learning environment. Audio and Video lectures of eminent scientists will provide direct stimulus to the students and thus will help them incoming closer to their relevant topics of study.

6.1. Useful Resources on the Web

The Internet has a number of websites dedicated to support science teachers which include lesson plans, suggestions for educational activities, chat rooms and forums for discussion on specific topics. Many of them have animations that teachers can sue to demonstrate concepts or entice the students to test an idea.

However, in order to use Internet as an effective tool for teaching science, it is necessary to:

* Ensure appropriate access to technology for teachers and students;

* Prepare teachers in educational uses of Internet in terms of both skills and attitude;
* Use technology to support a dynamic instructional programme including development of high order thinking skills; and
* Integrate use of Internet into the overall curriculum of the schools.

The intended online learners can be segmented into various categories. A sample set of learners comprises:

* Corporate learners working for corporations and are seeking education to maintain or upgrade their skills.
* Professional enhancement learners seeking to advance their carriers of shift careers.
* Degree completion adult learners working to complete a degree at an older age.
* College experience learners preparing for life. Pre-college learners interested is doing degree level work prior to the completion of high school.
* Remediation and test preparation learners focusing on learning as a prerequisite to an examination or enrolment in another programme.
* Recreational or enrolment in another programme.
* Recreational learners interested in education for its own sake or for personal pleasure and enjoyment.

Let us see the status of online education in USA and India, USA has reached higher level in the application of information and communication technologies to teaching and learning it made several experiments and innovations in microelectronics, computing (hardware and software) telecommunication and opto-electornics. The innovations enabled the processing and storage of enormous amounts of information along with rapid distribution of information through communication networks. Moore's law predicts the doubling of computing power ever 18-24 months due to rapid evolution of microprocessor technology. Gilder's low predicts the doubling of communications power every six months-a bandwidth explosion- due to advances in fibre optic network technologies. Due to faster and superior technological advancement, the USA is ahead of other countries in promoting online education. The following list of institutions highlight this:

Western Governors University (www.wgu.edu)

University of Phoenix (www. uophx.edu)

National Technological University (www ntu.edu)

Regents College of New York (www. regents.edu)

California Virtual University (www.california.edu)

Concordia University School of Law(www.concor.caplan.edu)

Jones International University (www.Jonesinternationa.edu)

Colorado Community College Online (www.ccconline.org)

University of Maine(www.unet.Maine.edu)

Magellan University (www.mshrllsn.edu)

Athena University (www.Athena.edu)

Florida Distance Learning Network (www.firm.edu/fdln)

Caliber Learning Network (www.caliberlearning.com)

Digital Think (www.digitalthink)

Embanet Corporation (www.embanet.com)

Internet Virtual University (www.ivu.com)

Pangaea Network (www.pangaeanetwork.com)

Global Virtual University (www.scholars.com)

University of Wisconsin's De professional development Centre (www.wise.edu/depd)

Public Broadcasting Service for the Business Channel(www.pbstbc.com)

Washington State University (www.eus.wsu.edu/edp)

University bf Texas (www.telec utsystem.edn)

Thomas Edison State College (www.tesc.edn)

Stanford University (Standard-online.stanford.edu)

Nova Southeastern University (www.nova.edu)

New Jersey Institute of Technology (www.mjit.edu)

Harvard University (extension.dce.harvard.edu)

India which is at the low level of development of information and communication technologies, too has entered online education world. Educational organisations, computer companies and sources listed below reflect the recent initiatives in online education training in India:

- NIIT's Net Varsity
- APTECH's Online V
- APTECH's Vidya
- WIPRO's Virtual Centre
- HP Virtual Class Room
- Anna University's Online Education Programme
- IGNOU's Virtual Campus
- Zee Interactive learning System
- Intel's Teach to the Future
- Learning Universe
- Birla Technology's In-house Online University
- West Bengal's Distributed Learning System
- Appolo's Online Medical University
- Tamil Virtual University
- Delhi IT Open University
- APTECH – TAMPI Online
- NALSAR Pro
- CSE and MAHE
- Educomp Datamatics
- ECIL's Varsity

6.2. UGC Initiatives For E-Learning

6.2.1. Role of Communication Technology in Indian Education

The communication technology is advancing very swiftly from single channel transmission in 1962 to 120 channels in 2005. In Education also beginning with the use of Satellite Instructional Television Experiments (SITE) in 1974 it has advanced to several stages such as Country wide Classroom (CWCR) for Higher Education in 1984 Gyandarshan in 2000, and it has reached to now 24 hour Vyas Higher Education Channel and Eklavya Technology Channel in 2004. Technology has also advanced to enable 24 hours Worldwide Internet Communication.

Today the source of learning is video programmes text and graphic based E-resources. There is going to be time and it may not be too far, when shift to the electronic mode of producing, retrieving and preserving knowledge would become a practice. There are several advantages in this. The spread of knowledge was limited owing to the cost of publication and the number of copies printed. In the case of electronic mode knowledge can reach to any nook and corner through satellite without heavy cost. Here the copies can run into as many numbers as the number of viewers. Thus per unit cost of developing knowledge, preserving and distribution becomes very small.

The other advantage is that everyone can contribute their bit in this development of video or E-content knowledge resources. It can be a small module, it can be small learning object, and it can be a full course. Therefore, everyone can produce his or her knowledge with much less cost. Yet another advantage is that electronic resources are flexible in its nature so any amendment or change or updating can take place without loss of time and without much cost. It was not so easy in the case of print media. This new electronic mode, therefore, offers greater opportunities for each of the teachers in our system of Higher Education to produce their thoughts and research findings with much less cost (CEC News , 2005).

Re-orientation

This would however, require re-orientation of our teachers. They need to use multiple resources in teaching and learning, i.e., text face-to-face video resources as well as E-content Resources. They will also be required to be reoriented to pen down their knowledge resources in a systematic way following certain standards, often referred to as 'Instructional Design Standards'. Once the teachers are oriented towards these Instructional Design Standards and are given skills to put their knowledge in the instructional design form, teachers will be able to generate a great deal of video and E-content resources.

Once the knowledge is preserved in E-content form or video form, it can be made available at the least cost in the classroom as well as to the students at their convenient time and place.

- When internet and interactive satellites are the order of the day, a re-look at the process of developing educational content becomes imperative. The availability of more bandwidth on interactive satellite, internet and Fibre optics Network has encouraged the educational service providers to think newer form of interactive educational content. The delivery of Audio Visual content is fast becoming a reality. Anytime-anywhere-rich-content is set to become part of our lives.

UGC Initiatives for E-Education Resources

Video Based E-Education

UGC, as early in 1984, took the initiative to package the knowledge in video form and make it available to teachers and students to support and supplement face-to-face and self-paced learning. This institutional mechanism took the shape of Education Media Research Centre and Audio Visual Research Centres. These were located in 17 universities in different regions. The strength of this approach was these centres provided opportunities to teachers in the universities to develop the education programme in their subject. In due course, the UGC also set up an institutional mechanism is Consortium for Educational Communication (CEC). CEC-an Inter University Centre of UGC.

Every year it adds nearly 200 programmes with a mix of syllabus and subject based enrichment programmes. Video has, therefore, been a method of packing the knowledge; it has been made available through telecast of terrestrial mode on DDI network. Since 26th January, 2004 this knowledge is made available on Vyas-a 24 hour Higher Education channel.

Video Programmes on Internet

The proposal is to make these programmes available through UGC-INFONET on internet to all the universities having UGC-INFONET connectivity in the 512 kbps bandwidth. It will take video streaming format. The receiver can also download and keep it for its use for face-to-face learning by the teacher and self-paced learning by the students. If universities so wish, they can build video library by acquiring videos from CEC or it can stream the video as and when it is telecast by the CEC. Keeping in view the developments in technology, a major initiative was conversion of 17 Education Media Centres into Education Multimedia Research Centres with basic platform and technology for e-content development. This will help and enable teachers to use this facility to develop educational programme in their subject.

6.2.2. EDUSAT Network

India has successfully launched EDUSAT on 20th September, 2004 with the precision of the world standard. National and regional beams are being made available for the use by the educational organizations. In order to be on the EDUSAT network India Space Research Organization (ISRO) has also given support for implementing this and has provided 25 SITs for CES. It shall also provide bandwidth for above SITs as well as for another 48 SITs Academic Staff Colleges in the country. This will enable to provide a network for content providers in the universities, i.e., EMRCs as well as Academic Staff Colleges where training programme for teachers are regularly conducted.

UGC is going to set up a network of institutions Connected with the EDUSAT by linking Educational Multimedia Research Centres, Academic Staff Colleges and Universities and Colleges of Potential of excellence. This network is going to cover almost all parts of the country and would offer 2-way communication. In each location, if 40 students are attending the programmes, the size of classroom could be 4000 students and there could be question-answer sessions on this network. Besides network can also be used for internet and as multiplies teaching end. Each institution can decide the area of their strength and then plan their contribution by creating teaching ends at their places. Signals of these locations would be carried out through the sub-hub at CEC to the EDUSAT and then spread throughout the country. So the teaching location can also be at as many places where SITs are installed.

The EDUSAT network will help 2-way communication under the Ku Band. This network will have the following possibilities:

- TV Broadcast; Night time Loading at Receiving end; Online Education through Internet; Telephone at Return Link; Internet as Return Link; Talkback Channel as Return Link; Webcam as Return Link; Voice Chat as Internet; Asymmetric Internet through TVRO; Video Conferencing; radio Broadcast.
- This would offer an enormous opportunity for exchange of quality knowledge and bridging the knowledge gap between the various locations. It will help in reaching out to a large number of population. This experiment would turn a new leaf in the system of higher education through dissemination of quality knowledge to people as well as offering opportunity to a large number of students to seek clarifications and answers to their questions. Possibilities and opportunities are unlimited. What we have to do is to train our teachers about the packaging of knowledge by following instructional design and then make it available to those who need it. The scientists have done it. Now it is the turn of academicians.

E-education is a futuristic endeavour and this is the most appropriate time for its implementation. The initiative, once taken shall and tremendous value to the present teaching processes and will transform it to a large extent. Also, to the best of my belief, this attempt would foster the mindsets towards innovative developments among the academic community.

6.2.3. Video Based E-education

UGC, as early in 1984, took the initiative to package the knowledge in video form and make it available to teachers and students to support and supplement face to face and self-paced learning. Under this initiative, as soon as satellite was launched it also set up institutional mechanism of development of video based educational programmes. This institutional mechanism took the shape of Education Media Research Centres and Audio Visual Research Centres (AVRC).

These were located in 17 universities in different regions. The strength of this approach was these Centres provided opportunities to teachers in the universities to develop the education programme in their subjects. UGC also financially supported teachers for the development of the programmes. In due course, the UGC also set up an institutional mechanism of quality assurance and coordination with the Media Centres. This institutional mechanism is, Consortium for Educational Communication ***(CEC)***. CEC-An Inter University Centre of UGC.

The Institutional mechanism of 17 Media Centres and Coordination Centre, CEC helped building considerable knowledge resources over a period of 20 years. Today it has three types of video based education in a large number of subjects.

(i) Syllabus-based programmes in 11 subjects - each subject covering 100-150 syllabus based lectures and each lecture of nearly 30 minutes duration.

(ii) Educational programmes in and around a subject and visually rich. These are 8000 programmes in 49 subjects. Duration of each of programmes is 15-20 minutes.

(iii) Third category is short video based question & answer programmes of 2-5 minutes.

6.2.4. E-Content Development

While developing E-Content one should keep the strength of various theories, in view and adapt the approach which suits most to target group, objectives of learning and expected out come of learning.

The following nine events in the instruction suggested by Gagne is kept in view while developing E-Content:

1. Gain attention: Start by gaining your learners' attention using an analogy, anecdote, paradox, photograph, magazine article, demonstrations or any other media. Display an outline of the lecture plan in a visual form (e.g. an illustration, a summary, a diagram, a map, or chart). This gives learners a framework into which they can organize subsequent content.
2. Inform learner of objectives: Describe what is the plan to achieve, what learners will be doing and what they may be using. State, 'At the end of the lecture you will be able to….' Create expectancy via your objectives and description of the structure of the lecture.
3. Stimulate recall of prior learning: Relate the new lesson to situations or knowledge that the learners are already familiar with, e.g. the previous lesson.
4. Present stimuli with distinctive features: Describe the key points in the lesson, emphasizing distinctive features, using a variety of techniques if possible. For example, use photos, drawings, the real thing etc. Vary the format in order to maintain attention and to increase comprehension.
5. Guide learning: Present the instruction in small steps (chunking) leading from simple to complex.
6. Elicit performance: Involve learners in questioning, discussion and demonstration to confirm that they have learnt from the instruction, to increase comprehension and to maintain through active participation.
7. Provide feedback: As learners respond to the questioning, provide them with reinforcement or remediation when necessary.
8. Assess performance: Use a quiz or assignment to confirm mastery of the objectives.
9. Enhance retention and learning transfer: Provide the opportunity for learners to apply the outcome of their training in a real world environment e.g. realistic assignment using real data and equipment. Incorporate the full experiential learning cycle into activities so that students are encouraged to reflect on and analyze their experiences.

Instructional design should help in achieving the following outcome of learning :

1. Ability to process the information and report
2. Ability to critically evaluate the information and make comments
3. Ability to solve the problem
4. Ability to apply the knowledge to real life situation
5. Ability to relate the subject / problem in larger and global context so as to see full implications of the issues

6. Ability to develop a world view which helps the development of mankind
7. Ability to transfer the knowledge effectively to others

Keeping these points in view the E-Content, can be developed in several formats. Some of them are:

Video Based Programme

- Video based educational programmes focused on subject matter like video lectures;
- Video based educational programmes in and around a subject, such as enrichment programmes; and
- Video based short learning objects in the form of questions and answers.

Web Based Programmes

Web based education programme in hyper text / XML form;

- Web based education programme in text and visual forms with the support of multimedia inputs like images, graphs, charts, animation, process demonstration, integrated navigation and so on;
- Web based learning repository in searchable mode and archival library mode such as video and text clips.

When one attempts to develop E-Content, he has to think about the approach for developing learning objects, learning objects repository or re useable learning objects, assembled E-Content, e-courseware, system of evaluation and learning management, more particularly when the system of learning is going to be global. Once the subject matter is on internet it will reach to one and all globally, unless restricted by design.

Here it would be helpful if the contents could be following type :

1. Assembled E-Content;
2. Short course / unit / module;
3. Full courseware;
4. Short reuseable learning objects.

Technology Applications

- The content development can follow simple conversion of knowledge / information into digital form. This is often seen in various websites, which does not qualify to be called as learning resources with specific objective and outcome of learning. It is an open ended system of information sharing.

Instructional Design

- The other could be based on scientific method of instructional design, which guides the students to achieve specified objectives and aims at outcome based learning. It is an integrated system with facility of navigation.

Learning Object Repositories Form

- The third could be short re-useable learning objects and put in Learning Object Repository in archival server and it is in searchable mode.

Every year it adds nearly 200 programmes with a mix of syllabus and subject based enrichment programmes. Video has, therefore, been a method of packing the knowledge, it has been made available through telecast on terrestrial mode on DD1 network. Since 26th January, 2004 this knowledge is made available on Vyas– a 24 hour Higher Education Channel.

VCDs of these programmes have also been made available to educational institution within and outside the country. These are also being made available to Indian Air Force and Military Academics. Enrichment programmes on health & culture are also made available at DD Bharati network for the benefit of general public.

Video Programmes on Internet

It was proposed to make these programmes available through UGC-INFONET on Internet to all the universities having UGC-INFONET connectivity in the 512 Kbps bandwidth. It will take video streaming format. The receiver can also download and keep it for its use for face to face learning by the teachers and self-paced learning by the students. If universities so wish, they can build video library by acquiring videos from CEC or it can stream the video as and when it is telecast by the CEC. The technology followed for streaming video is converting MPEG signals into MPEG-4 signals which enables video streaming with variable bandwidth**.**

Video on Demand

So far these videos were in u-matic and beta format. During 10th plan these are being converted into digital format and put on video archival server so that video on demand can be made available to teachers and students for face to face or self paced learning. Strategy is while converting them in digital format, multimedia inputs, where necessary and possible, will be done. Here the focus would be on stable knowledge. Archival techniques is to allow the full video streaming or various chunks related to specific

learning objects within a programme. This technique would help us to build video based Learning Objects Repository. This could be meta tagged and put on server so as to enable teacher and students to search and use it for face to face learning.

Keeping in view the developments in technology, during the 10th Five Year Plan, a major initiative has been taken by the UGC to develop E-Content and make available to teachers and students for face to face and self paced learning.

The initiative pertains to conversion of 17 Education Media Centres into Education Multimedia Research Centres. Each of the 17 Centres will be provided with basic platform and technology for E-Content development. This will help and enable teachers to use this facility to develop educational programme in their subject. This could be in : (a) assembled form, (b) small unit / module and, (c) full courseware. UGC has developed a scheme of E-Content development to financially support the teachers to develop the E-Content in their subjects. This scheme is being operated by CEC.

E- interactive facility will help in building web based nationwide class room. It is proposed to distribute E-Content through all the available methods of distribution.

6.2.5. Creation of E-Content Elements of CEC

CEC of UGC develop E_ Contents using the following E-Content elements:

Digital Video

The video content were compressed and converted to MPEG4 format.

The video was imported into FLASH and compressed with the help of Sorenson technology and converted to Flash Movie.

Textual Content

Download: The transcribed document of the video content was made available to students as a download option.\

Glossary: Important words were scanned in the video presentations and were made available as GLOSSARY.

FAQ: A new FAQ list was generated with all probable questions that would be asked by the students. This helped reinforce the concept as presented in the module.

Summary: A new summary was rewritten by the subject expert for offering to students.

Quiz: An interactive quiz model is included in every module to check the understanding of the students.

References: The subject expert provides references of extra reading materials on the subject.

Case Studies: Case studies on the subject discussed, were also developed by the subject experts and were included in the module.

Feedback: A feedback channel was provided to students through a Feedback form.

Discussion: A peer to peer discussion forum with multiple threads were provided students to resolve their issues with the peer group and counsellors.

Integration of E-Content Elements

FLASH was selected as the integration environment and student-end interface.

All elements were imported into FLASH and placed on respective places in an attractive layout following International Best Practices.

Different modules were made available through an interactive Menu.

Standard Instructional Design practices were incorporated after due research.

6.2.6. Reusable Learning Objects (RLOs)

The term *Learning Object*, first popularized by Wayne Hodgins in 1994 when he named the CedMA working group "Learning Architectures, APIs and Learning Objects", has become the Holy Grail of content creation and aggregation in the computer-mediated learning field.

The terms *Learning Objects* (LOs) and *Reusable Learning Objects* are frequently employed in uncritical ways, thereby reducing them to mere slogans. The serious lack of conceptual clarity and reflection is evident in the multitude of definitions and uses of LOs.

Multiple Definitions of Learning Objects

Currently, there are as many definitions of LOs as there are users. Here is a small sample:

1. "For this standard (*Draft Standard for Learning Object Metadata v6.1)*, a Learning Object is defined as any entity, digital or non-digital, that may be used for learning, education or training"

2. "...a Learning Object... [is] 'any digital resource that can be reused to support learning.' This definition includes anything that can be delivered across the network on demand, be it large or small. Examples of smaller reusable digital resources include digital images or photos, live data feeds (like stock tickers), live or pre recorded video or audio snippets, small bits of text, animations, and smaller web-delivered applications, like a Java calculator. Examples of larger reusable digital resources include entire web pages that combine text, images and other media or applications to deliver complete experiences, such as a complete instructional event"
3. "Learning Objects are a new way of thinking about learning content. Traditionally, content comes in a several hour chunk. Learning Objects are much smaller units of learning, typically ranging from 2 minutes to 15 minutes."
4. [A Learning Object] is defined as the smallest independent structural experience that contains an objective, a learning activity and an assessment." (L'Allier 1997)

L'Allier's definition of the LO is the most clearly articulated of the four. However, any definition that stipulates the intended use, method and measuring mechanism of a LO beforehand restricts the LO's reusability because the methodology, the intention and the assessment are determined by the instructional situation and not the LO itself.

Concept of the Reusable Learning Object

A conceptual definition should clearly lay out the principles of its foundation, in this case learning and reusability, two fundamental predicates of the LO.

Learning

For any digital object or media asset to acquire the status of a LO it should be wrapped in a *Learning Intention*, which has two aspects: form and relation.

Form

Form is the framework in which a digital object is embedded, and it is the *form* that sets a media asset on the path to becoming a LO. *form* not only changes a digital resource into a LO but also transforms viewers into learners.

Relation

The understanding through which an object becomes an object of knowledge cannot be arbitrary nor can it be founded solely on immediate reactions based on sensibility; instead it should come through a reasoned reorganization of sensibility.The type of discourse envisioned here is a way of relating to the LO

analogous to the computer interface that establishes a relation between the user and the bits of information stored in the computer memory banks.

A media asset or a digital object can become a LO only when it is incorporated into a *form* and provides a *relation* to itself as LO in order to facilitate the understanding of that object. Therefore a LO is a totality that combines its digital element and an exposition.

Reusability

Reusability is the second principle that serves as the foundation for defining a LO. While *form* and *relation* provide a mechanism for the internal constitution of a LO, reusability accords value to it. A LO can avail itself of the flexibility, scalability and adaptability offered by information technology only when the object in itself is predisposed for reuse by multiple developers in various instructional contexts. To achieve genuine reusability the development and operation of LOs should be considered mutually exclusive processes.

Form and *relation* shape a cohesive internal composition of a LO, and the reusability achieved through separation of object creation and its use facilitates free exchange of LO assets among developers, organizations and institutions. It is through exchangeability articulated here as reusability that the LOs acquire value; without value they remain simple digital images or Web pages.

Now that the foundational principles for the concept formation of a LO have been delineated, the LO can be defined as:

A Learning Object is an independent and self-standing unit of learning content that is predisposed to reuse in multiple instructional contexts.

Creating Learning Objects

Content developers have traditionally conceived content from the point of its use. Since use is context and instruction specific, content intended for one particular use is generally invalid for other purposes. The reusable LO - organized content for pedagogical purposes - is a new way of thinking about content creation and its instructional use. The success of this strategy rests on the rigorous separation of the LO and its use for instructional purposes, however. Although sound pedagogical principles should inform the creation of a LO, it should not be coded by any specific teaching methodology or instructional theory. Genuine reusability and optimum functionality of a LO can be achieved only when the LO attains a high level of abstraction.

The LO should be thought of as a word or preposition, and the usages of LOs as language-games. Like a word, a LO is abstract, but can be understood and shared among users. Similarly, as individual words

cannot independently produce meaning, the LOs - self-standing and self-referential - in themselves are insufficient to generate significant instruction. Therefore, several LOs have to be brought together in order to create an instructional situation. How many LOs, how they are related, and for what purposes will be determined by the instructor's objectives, pedagogical methodology and instructional design theories.

Creating LOs that conform to the conceptual definition advanced here requires that the structure of the LO reflect the two basic foundational principles, learning intent and reusability. This can be achieved by determining the granularity, or the size, of a LO and its composition.

Granularity

The size of a LO is crucial to achieving success in its reusability. The current determinations based on learning time and any digital or non-digital asset are subjective and arbitrary. For an effective and functionally sound determination we should revert to a concept or idea that forms the basic building block of rational knowledge. A LO, ideally, should include only one or few related ideas. The rule to be applied is: how many ideas about a topic can stand on their own and can be reused in different contexts? If a LO consists of more then one idea, one of these should be the main idea and the others should be derived from it or be dependent on it. If we take the concept or idea for determining the size of the LO, we free it from subjective considerations such as time and an individual's instructional choices and chosen methodologies.

Composition

While the concept/idea determines the size of a LO, fulfilling the reusability principle, the composition of a LO puts into practice the *Learning Intention* principle. The formal composition of a LO is the arrangement of elements. An element could be text, image, video, animation, glossary, assessment, multimedia, etc. Preferably a LO should be a combination of multiple elements. The multiplicity not only reinforces the concept communicated, but it also opens up multiple avenues to foster a richer understanding of the idea(s) represented, facilitating learning based on learners' choices and learning characteristics. Furthermore, the same content can be served for learners with disabilities without requiring additional developmental considerations.

Developing Learning Objects

The success of the LO strategy depends on a development process that is carefully thought out and methodically executed. The planning and production rests on two processes: conceptualization and collaborative development.

Conceptualization

Conceptualization is a key phase that lays the basis for success of the LO strategy. LO modelling requires a double vision: on the one hand, a global understanding of curricula to conceive a content object as part of larger whole, and on the other, a micro vision to create content as standalone information for it to function as a reusable object (Longmire 2000). With this comprehensive visualization we will be able to achieve a maximum rate of reusability.

Experts in the implementation of this content framework should proceed in three steps:

1. Select a topic or theme in a discipline or one that spans different disciplines.
2. Identify different levels and depths the topic is treated at in the discipline. This will provide an intensity map where ranges of depths, from the lowest to the highest level of complexity, are mapped.
3. Design LOs in such a fashion that a combination of them can be used for each level of instruction.

Collaborative development

The information space opened up by the recent technological developments is the site of production, circulation and consumption of knowledge modules: the reusable LOs. The space of the information age is located in the interconnected global network of computers. The programmers who write the code for the operation and interconnection of these computers create the information space; the graphic designers design and develop interfaces to facilitate the management, input and manipulation of information located in the space; and the subject experts provide the ideas/concepts stored as information bits. Since the role of experts from all three fields is crucial for the successful development and use of LOs, the creation should be a cooperative and closely aligned process wherein the experts use each other's knowledge to create ideas, make them visually compelling and store them in databases for access and manipulation.

Furthermore, as the nature and functional requirements of knowledge are ever-changing in the knowledge economy, no single academic or subject expert can generate a total knowledge adequate to the tasks. Therefore knowledge experts should develop only 'events' of knowledge that can combine with other 'events' to develop into a 'program' on demand. This 'events' approach should be seen as strength instead of weakness, since it is a contribution to a collective knowledge that is flexible, functional and adaptable.

Standards and Specifications for Developing Learning Objects

As LO development is a collective enterprise among the programmers, graphic designers and subject experts, a standardized approach can accelerate and establish efficiency in the LO strategy. It is important that the developers agree to a set of specifications for development of LOs covering such areas as technology, editorial requirements, and stylistic considerations. A commonly agreed on standard will

enable genuinely sharable and reusable content objects, without which we will revert back to current iterations: static Web pages.

Technical Standards

The technical specifications should address the interoperability of LOs and the physical structure to facilitate easy manipulation of the elements. Success depends on the flawless execution of LOs in all operating systems and delivery media. What is crucial for achieving interoperability is the selection of language for producing LOs. The language should be chosen with the future in view, that is, we should not attempt to make objects compatible with all earlier generation technologies, but instead we should focus on the next generation technology..

Editorial Requirements

Every discipline has its own discourse and rules of construction for its discourse. Subject experts in a discipline should agree beforehand on editorial standards to ensure the consistency of language across the LOs. Similarly, a common terminology should be created for referring to concepts in a discipline. To accommodate the requirements of LO strategy and individual stylistic preferences, a LO can have a glossary that explains the terminology used in the LO and which cross-references other terms used in the discipline to refer to similar concepts.

Stylistic Considerations

Appearance and style are extremely important for an effective presentation of LOs. Developers should draw up specifications for use of color, fonts, and layout of images and text. These structural elements should be consistent across LOs so that they can be easily combined for instruction. An ideal situation would be to develop several interface and stylistic environments that are user-controlled, which would enable the user to choose the most suitable form of interacting with and exploring the knowledge.

6.2.7. Learning Objects and Electronic Books

Any discussion of electronic books has to take into consideration humanity's long experience with the written word in general and the book in particular. Equally important are the reading practices that were shaped by the typography of the printed book over several centuries. Such a reflection cannot be simply a question of technology; it requires a historical, sociological and philosophical perspective.

By designating the digital representation of written text as an e-book, we have already posited a tension between the e-book and the material book. Nevertheless, this confrontation cannot be avoided since our

long experience with the book has necessarily placed it as a measure and an impediment for design, production and acceptance of E-Books. In positioning E-Books vis-à-vis material books the analysis should address three levels of the book's existence: concept, object and metaphor.

The experience of book is not simply exhausted in the visual representation of text it presents us. *Book* as a three-dimensional object offers us a plurality of sensual experiences. Our body can feel its texture, we can hold it between one or two hands, it can sit in a lap, the pages can be turned and folded, it can be carried or kept on a shelf. The tactile sensation of a book and its capacity to engage our whole body and mind while interacting with it is what binds us to it so closely.

The E-book essentially belongs to a single domain: the visual. Recent experiments in presenting E-Books like material books is an attempt to recreate, through a hierarchical organization of visual content, the tactile experience of a book. The e-book as a visual mode of presentation, however rich it may be, is limited since it does not offer the same sensual experience as the material book. As a result all attempts to simulate material books will yield at best partial results.

The recent reversal in the fortunes of e-book manufacturers seems to suggest that the e-book is doomed to failure from the beginning because of a radical divergence between the book and e-book as objects and on the conceptual and metaphorical levels.

Computers have a decisive advantage over other media since they can combine textual, visual and aural elements into a single package that can be experienced simultaneously. Furthermore, multimedia elements provide interaction that is absent from books as well as other media. E-Books should embrace this advantage and create a unique form of new and different experiences for its audience, generating its own idiom and diction for communicating these experiences. The success of this strategy requires a community of users who are educated in new reading/viewing/interacting practices. In this context E-Books should emphasize communal or collective readings, in opposition to material books, which are essentially directed towards individualized self-experiences.

LOs that are appropriately conceived and constructed will be the first building blocks for rapidly and efficiently constructing targeted reader experiences. LOs can play an important role, especially in e-textbooks and learning materials since knowledge organized into reusable LOs can be easily combined to produce educational materials. However, we should strive to move beyond the text-centric approach and concentrate on designing participatory environments that engender memorable experiences in readers and audiences.

6.3. E-Learning Platform : Brihaspati

IIT Kanpur has developed an Open-source, Freeware E-Learning Platform that is available to all for enhancing existing learning environments in their institutions through their campus networks. A pamphlet on this is available at http://home.iitk.ac.in/~ynsingh/tool/pamphlet.pdf

IIT Kanpur is using this tool since January 2003. All the students and instructors have access to large number of courses through this. Faculty uses this facility to post the lecture notes, handouts, and reference material (in electronic format) on the Intranet for supporting the classroom teaching. Students find this very useful. They can also have discussion groups. This leads to lot of informal learning as students get time to think over what others have posted and discussion is spread over a large duration. Also, the students need not be present at one location at one point of time for discussion. Thus the spatial and temporal limitations are alleviated. Another advantage is lot of electronic content for courses is generated which gets streamlined over the period. This becomes a good resource material for the students and for instructors.

The tool for virtual classroom is called "Brihaspati" and it is open source software that could be used by any university. This is a very user-friendly open source framework and could be effectively used to build e-education application. One can also modify it and use it in domains like Human Resource Development and e-Governance. This tool is listed on sourceforge.net. This can be accessed through the UGC website www.ugc.ac.in.

6.4. E-Books

Despite the attractive qualities of printed books, their drawbacks have long been recognized. They can be extremely costly to produce, store, ship, and sell. Because they are a static medium, revisions typically take a significant amount of- time and effort to produce, so there is often little incentive to keep them up to date. Searching for information in books and retrieving it can be difficult. The success of the retrieval is generally only as good as the indexing. Distributing books electronically has therefore been a continuing gleam in the eyes of developers of electronic information products. The most recent trend in the book industry is the development of electronic books (or E-Books), which has the potential to be the most far-reaching change since Gutenberg’s invention. (Poonkothai, 2005)

A text or monograph which is available in an electronic format. E-Books are simply digital versions of books that can be obtained electronically and stored and read on either a traditional personal computer, a common handheld device or a dedicated E-Book ‘reader’. In many ways, E-Books seem perfect: They’re easy to obtain and they offer advantages over hard copy books.

E-Books have many advantages such as,

- ***Storage:*** The ability to have a number of books with you at one time is really great.
- ***Search/Find:*** Because E-Books are basically text based files we can search for a certain part of - E-Book without having to flip through it endlessly.
- ***Size:*** In addition to being able to carry a large number of E-Books on Pocket PC at onetime, the Pocket PC is not only smaller than a paper back book.

E-Books on the WEB are available to access in the following manner.

- ***Downloadable E-Books:*** The contents of a book are available on a Website for downloading to the user's PC.
- ***Dedicated E-Book readers:*** The book's contents are downloaded to a dedicated hardware device which has a high-quality screen and special capabilities for book reading. -
- ***Web-accessible E-Books:*** The E-Book remains on the provider's Web site and can be accessed for a fee. Readers can 'purchase' the books to receive indefinite access.
- ***Print-on-demand books:*** The contents of a book are stored in a system connected to a high-speed, high-quality printer, from which printed and bound copies are produced on demand. The contents may be available on a chapter-by-chapter basis to enable the creation of' single copies of customized books.

Ways of buying E-Books and storing E-Books are through PC, Discs or specific readers available in the market for this purpose.

Publishers are working hard to ensure that once an B-Book has been purchased it can't be copied. Each E-Book being encrypted can only be unencrypted by the reader for which it was purchased with systems of passwords.

6.4.1. Advantages & Disadvantages of E-Books

The following are the evident advantages of E-Books.

(i) They're quicker to obtain.

(ii) E-Books are more updated and upgraded.

Information changes rapidly today. Books on many subjects can become dated very quickly. E-Books can be easily and quickly kept up-to- date. When we order an E-Book, it can have the most up-to-the-minute information available.

(iii) Usually one gets far more than just the book.

Most B are sold with bonuses and related information that usually don't tome with the purchase of a traditional book.

(iv) E-Book take up less space.

(v) E-Book don't use up trees: E-Books use very few natural resources. We save trees and help reduce pollution from pulp mills.

(vi) They're more portable: Quick and easy access to hundreds of books on your desktop computer, notebook or B-Book reader.

(vii) References can be hot-linked: Easy links to Web sites and other references can be placed in an electronic book. While reading, we can click on hot links to other places to find out more. With the proliferation of wireless networks, this will become even more useful.

(viii) It can be custom branded: Other people's E Books can be branded with one's name and one can allow others to brand one's E-Books with their name. There are many vital E-Books and reports that the creators will often allow you to give away or sell, with your name or company's name shown on the cover or linked at the end.

(ix) Global searches and find information quickly: It saves the time.

(x) The technology will get better: 'This is an emerging technology and people are often slow to change. As the quality of monitors improve we'll be reading electronic books.

Disadvantages of E-Books are the following

1. • Requires equipment to be read.
2. • As accessible as print based books?
3. • Unfamiliar and new
4. • Low market penetration
5. • Different standards currently in use
6. • Lower sales

6.4.2. Library Service on E-Books

In the era of E-Books, libraries are going to integrate E-Books into their services.

- Libraries circulate E-Book readers with a number of titles pre-loaded.
- E-Books have records included in the catalogue.
- The only E-Book available are those installed on the circulating E-Book readers.
- Limited choice for users, one user unable to read library's E-Books on their own E-Book readers.
- Can be downloaded directly from the library catalogue to user's preferred E-Book reader.
- Only one user, at one time to each purchased copy of the E-Book.
- Books removed automatically from user's E-Book reader at the end of loan period and made instantaneously available in the catalogue again
- Existing book suppliers expand services to include E-Books.
- New organisations manage E-Book access and acquisition on behalf of the library.
- Access through passwords and authentication procedures.
- Internet accessible micro payments – per page view.

Chapter - 7

PRINCIPLES OF ADAPTIVE LEARNING

7.1. Adaptive learning systems-Definition

Adaptive learning systems can be defined as the **intelligent systems that are dynamically organized based on the observation of the learning preferences of an individual for the best learning performance.**

So, important characteristics of the Adaptive learning systems are:

i) A **well defined pedagogical framework** to identify and differentiate individual learning preferences

ii) A **well defined quantification of learning performance and learning preference inference model** and

iii) A **dynamic content sequencing engine** to organize learning assets to match the individual learning

7.2. Functional Learning Strategies

The genesis of adaptive learning can be attributed to the development of formal theories of knowledge representation in the connectionist and symbolic approaches to learning. Adaptive learning systems provide the promise of improved pedagogical integration of technology in education because they facilitate,

- Formal representation of knowledge domain for assembly of knowledge objects to encourage a particular educational trajectory
- Inclusion of various learning styles and strategies for the inference of learners preferences
- Performance evaluation mechanisms for continuous assessment of achievement of learning goals
- A frame work to provide intelligent feedback on the learning performance
- Optimization of individual learning performance

The promise of adaptive learning remains in the successful implementation of a pedagogical framework necessary to accommodate learning styles and strategies, multimedia presentation to enhance learning in the context of learning pedagogy and continuous feedback provided by an intelligent engine to match the learning preference of individual learner.

Genesis

Adaptive learning system originates from substantial contribution made in the area of artificial intelligence, adaptive controls and optimizations research where they are generally referred to as technological systems that have ability to learn and adapt based on received input signals. Generically educational adaptive learning systems organize content based on the learning preference of individual learners with a definite goal to maximize learning performance with continuous intelligent feedback.

7.2.1. Apprenticeship

Step-by-step procedural learning. It is a “Building Block” approach for presenting concepts in a step-by-step procedural learning style similar to mentor-student interaction.

7.2.2. Incidental

Events in the story or case-study with role playing. Based on the "events" in a story or an educational trail that triggers the learning experience. Learners begin with an event that introduces a concept and provokes questions.

7.2.3. Inductive

Numerous examples that confirm to generalized principles. Learners are first introduced to a numerous example that point to a central generalized principle.

7.2.4. Deductive

Principles leading to further trends and parametric variations. The learners are introduced to a principle by and learn applying the principle in several situations and use principles to generate logical extensions.

7.2.5. Discovery

Experiments leading to data and data leading to a discovery or a principle. An enquiry method of learning in which students learn by doing, testing the boundaries of their own knowledge.

7.3. Steps in Adaptive Learning

First task is to allow for different ways to organize content offering different context and perspective for learners. The second task is to identify the way a learner would like to learn by conducting diagnostic assessment on the learning preferences. The third task is to use assessment results to provide continuous

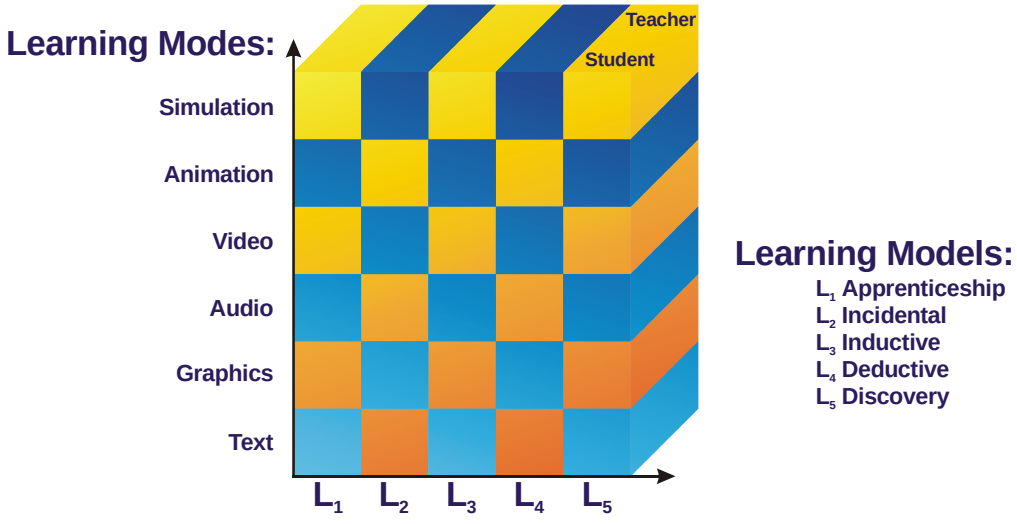
intelligence feedback that motivates and provides guidance to overcome concept deficiencies and provide help in maximize learning performance.

The research done by the cognitive psychologists indicates that ((Skinner (1953), Kolb (1976), Witkin (1976), Dunn and Dunn (1978), Bruner (1990)) indicates that the differences in learning style originate from the difference in the learning strategies every learners develop based on their previous learning experiences. These references in the learning strategies are related to the learning pedagogy including all the five strategies discussed above.

7.4. The Learning Cube

Sonwalkar (2003 & 2005) suggested a pedagogical model based on the learning cube. The three dimensional learning cube provides a logical framework to identify individual learning preferences based on the learning styles that define distinctive pathways. Three dimensions of learning cube represent **learning media, learning models and strategies and interactivity.**

The learning cube provides a multidimensional framework to organize learning objects developed in text, graphics, audio, video, animations and simulation in the five learning path way conforming to the pedagogy of apprentice, incidental, inductive, deductive and discovery learning models. The third axis of the cube indicates the increased interactivity between the student and teachers. The learning cube is given below.



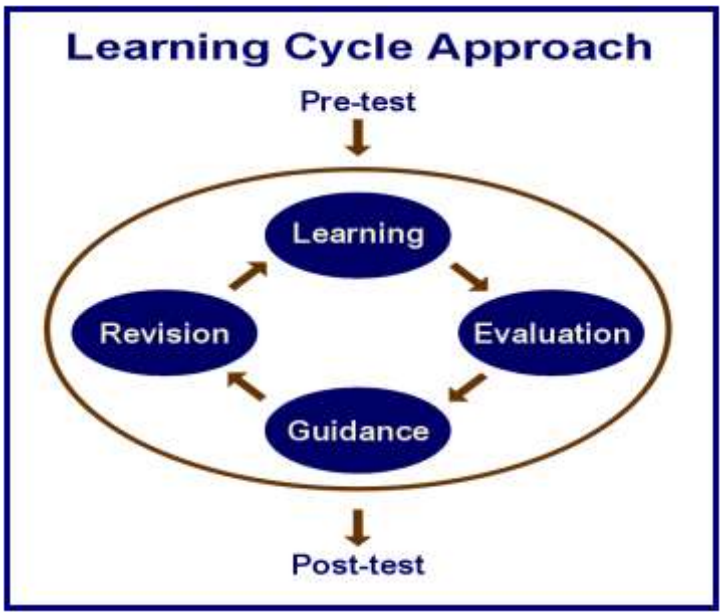
LEARNING CUBE

Content is presented to students based on the learning style of preference. In the incidental learning style, learning happens primarily within a context of case studies. Content provided by expert is less sequenced in ways that explains the events involved in the case study. For students who like to learn this way, the content makes sense. But for students who prefer to learn inductively, deductively or through discovery, content is sequenced in ways that best facilitate each style of learning. These learning strategies allow students to pursue the study of difficult subjects within the pedagogical environment that works best for them.

To identify students in finding out which strategy works best for them. The strategy is identified by an interference engine that uses diagnostic tests for making the assessment. The methodology involves using the assessment to measure performance in real time and providing continuous intelligent feedback necessary for online learning assistance. Diagnostic quizzes are embedded within each concept to assess the level of mastery that a learner has achieved. Based on the students' results, an accelerated revision path with intelligent may be provided to each learner.

7.5. Adaptive learning cycle

The four iterative processes involved in that rapidly converge to the learning style of the individual student are illustrated in the following Figure.



ADAPTIVE LEARNING CYCLE

The above figure indicates the learner circles through this learning cycle until the desired level of mastery is achieved.

The adaptive learning system consists of four step learning process.

1. Learning of the concepts based on a given learning style /model
2. Diagnostic evaluation of the concept mastery
3. Concept deficiencies are identified and the learning preference correlation is generated.
4. Content is dynamically re-sequenced as a short remedial revision to ensure every learner master concepts.

This cycle is repeated until every individual learner reaches the desired level of competency.

The adaptive learning systems

i) provide instructional support to faculty to create multiple teaching pathways

ii) deliver content with different learning pathways and reduce the dependency on faculty lectures

iii) allow students to learn better by customizing their own learning strategies

iv) provide increased cognitive opportunity to students to learn difficult concepts by providing multiple perspectives on the concept

v) provide continuous feedback to students, freeing faculty to be involved with learners in the role of "guides on the side"

vi) monitor learning progress of the students and provide remedial content

Thus, adaptive learning systems support instructional learning styles, pedagogically driven instructional design, pedagogical effectiveness for online education and learning technology standards.

7.6. Adaptive Learning Systems in the World Wide Web

The World Wide Web is becoming an increasingly popular vehicle for delivering online learning courses (Khan, 1997). An application installed in one space can be used by learners from any place in the world. They have to be equipped with any kind of Internet connected computer.

Principally there is no difference between server based learning systems and via the WWW or via intranets, although the variety of users in intranet will not be as large as in WWW based learning systems. In both different levels of background or prior information will require adaptive and adaptable learning systems that are able to take into account that existing knowledge in order to provide an individually tailored training course for the particular learner.

The problem is that most of the existing web based learning systems consists of a network of hypertext pages. A challenging research goal is the development of advanced web based learning applications which can offer some interactivity and adaptivity. Adaptation is especially important for Web based learning mainly for two reasons.

First, most web based applications are to be used by a much wider variety of users than any stand alone applications. A Web application which is designed with a particular class of users in mind may not suit other users.

Second, in many cases the user is “alone” working with a web “tutor” or “course”. The assistance that a colleague or a teacher typically provides in a normal classroom situation is not available.

Existing web based systems use different types of adaptation techniques. These comprise the following:

7.6.1. Adaptive Presentation

The goal of adaptive presentation is to adapt the content of a hyper media page to the user’s goals, knowledge, and other information stored in the user model. In a system with adaptive presentation, the pages are not static but adaptively generated or assembled from different pieces for each user. For example, with several adaptive presentation techniques, expert user may receive more detailed and deep information while novices receive additional explanations.

7.6.2. Adaptive Navigation Support

Adaptive navigation support is to support the student in hyperspace orientation and navigation by changing the appearance of the visible links. In particular, the system can adaptively sort, annotate or partly hide the links of the current page to simplify the choice of the next link. Adaptive navigation support can be considered as an extension of curriculum sequencing technology into a hypermedia context. At the same time it is less directive than traditional sequencing. ; It guides students implicitly and leaves them with the choice of the next knowledge item to be learned and next problem to be solved.

7.6.3. Curriculum Sequencing

This is also referred to as an instructional planning technology. The goal of Curriculum sequencing is to provide the student with the most suitable, individually planned sequence of knowledge units to learn and sequence of learning tasks to work with. It helps the student to find an optimal path through the learning material.

7.6.4. Intelligent Analysis of Students' Solutions

It deals student's final answer with to educational problems, no matter how these answers were obtained. Intelligent checkers can tell exactly what is wrong or incomplete and which is missing or which incorrect piece of knowledge may be responsible for an error. Intelligent analyzers can provide the student with extensive error feedback and update the student model.

7.6.5. Interactive Problem Solving Support

The goal of Interactive problem solving support is to provide the student with intelligent help on each step of problem solving-from giving a hint to executing the next step for the student. The system which implements this technology can watch the actions of the student, understand them, and use this understanding to provide help and to update the student model.

7.6.6. Example Based Problem Solving

In this context, students solve new problems taking advantage of examples from their earlier experiences. Examples based problem solving does not require extensive client-server interaction and hence can be used easily in adaptive learning systems on the Web.

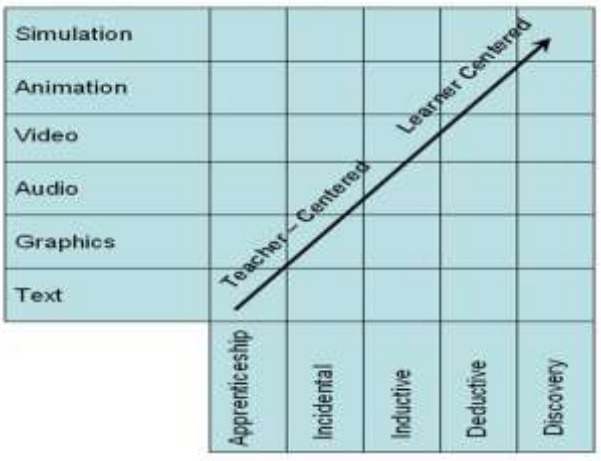
7.7. Pedagogically driven Instructional design for Online Education

Pedagogy can be defined as the method by which educational content is exposed to learners. There are more than 300 different pedagogical strategies that have been proposed to define the underlying cognitive process. The pedagogical theories that are widely debated are activist, constructivist, reflective, incidental, apprenticeship, inductive, deductive and collaborative.

The Learning Cube (Sonwalker, 2005) is an attempt to provide a framework in which multimedia assets can be correlated with pedagogically driven learning styles. Based on the learning cube, one can generate a simple 2D model of flexible cognitive approach to pedagogical strategies for online education. The model correlates learning assets (media) with pedagogical learning styles. The learning path scales from student centered to teacher centered relative to involvement with media. And the degree of independence offered by the learning strategy. The learning path could deviate based on perceived learner needs in any given instance.

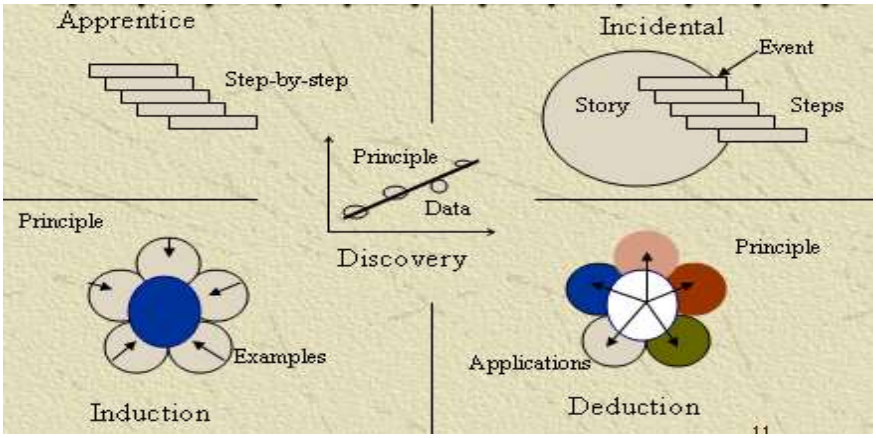
7.7.1. Flexibility in Design

Education reforms are moving towards student centric from teacher centric. The old method of text based teaching is now moving towards the simulation / animation based learning techniques. This gives an opportunity for discovery learning style from the apprenticeship learning style. This is explained in the following figure.



The content included will vary for the same concept based on the style in which the course designer likes to present the matter. The method he adopts will have the description / explanation / presentation style based on the styles he adopts. In the adaptive learning courseware design on a specific concept will involve explaining in all the five styles. Many of the files and the inputs are repeated, but in varied styles.

The method of presentation (the content sequencing strategies) will generally adopt a style as explained in the following figure.



The content sequencing strategies

7.7.2. Design parameters

The design parameters are numerous and need careful consideration. A few important decision parameters include learning objectives, pedagogical learning styles, synchronous vs asynchronous, textbook vs experiment based, media assets and enhancements, duration of delivery, technological constraints and educational standards.

Learning objectives

Learning objectives are loosely defined and as such do not provide much help in the development of the instructional design.It is important therefore to describe the course objectives in the form of a finite set of fundamental concepts that will be taught in the online courses.

Pedagogical learning styles

The pedagogical learning styles-apprenticeship, incidental,inductive,deductive,and discovery –define the pedagogical strategy for the exposition of the course content.

Synchronous Vs Asynchronous

The instructional design will change dramatically based on whether the instructor is available to students by synchronous communication online or by asynchronous e-mail. The predominant mode for online

courses will be synchronous, so appropriate devices such as chat rooms, discussion boards, and news groups need to be included in the instructional design.

Textbook Vs Virtual Experiment Based

The content development to support online education will change if the source is the textbook. In the case of online courses content is defined in terms of the course structure hierarchy, . Besides viewing course content creation in terms of the hypermedia textbook, it is important to define the interaction between instructor and student.

The online virtual experiment course requires a much different design method. In web based experimental courses termed web-labs the content developed as a set of simulation that support discovery – based learning. Such environment could include animation, 3D visual simulations, or virtual reality based immersion learning. Such simulation are called hypermedia laboratories, and they connect to the interactive asynchronous interface between instructors and learners.

Media Assets and Enhancements

Media assets – text, graphics, audio, video, animation and simulation-constitute the content collection for an online course. The instructional design can take the advantages of the learner's cognitive preferences if the content is available in each of the various media formats.

Duration of Delivery

Stand- and -deliver lectures when converted to online, computer based instruction, actually require more content to ensure that the concepts are presented in an interactive, multimedia fashion. In a purely asynchronous online environment, the duration can vary, so it is essential to provide instructor feedback for the duration of the courses.

Technological Constraints

Technological constraints are important design variables-especially in relation to the success of interactive Web pages that can be accessed via the Internet. Web browsers pose technical limitations on the media objects that can be distributed via the Web. Similarly, Internet servers and chat servers demand careful consideration in technical design.

Educational Standards

The content organization and the Instructional Management System must provide the user-friendly, interactive environment. The course structure, object hierarchy, course structure objects, learning assets and assessment models must be of international accepted standard.

7.8. Rating Online Courses

Although it is clearly advantageous for asynchronous learners to access educational information and content anywhere and time, it is difficult to evaluate the quality and effectiveness of online courses and learning modules.

Pedagogical effectiveness is at the heart of online courses and defines critical parameters for the evaluation of course. Sonwalker (2005) proposes a new instrument for overall evaluation of online courses based on a five factor summative rating system plus a Pedagogy Effectiveness Index (PEI) as described below:

7.8.1. Pedagogy Effectiveness Index (PEI)

The PEI can be defined as a summation of learning styles, media elements and Interactivity.

$$\mathbf{PEI = \sum S_i * p_i + \sum M_j * p_j + \sum l_k * p_k}$$

Where S = Style, M = Media and I = Interaction; the subscripts define the elements ranges; I = 1 to 5, j = 1 to 6 and k = 1 to 5 and $\sum$ represents summation.

The probability of the pedagogical effectiveness increases as the cognitive opportunity increases with the inclusion of learning styles, media elements and interaction. The PEI is based on a simple probability distribution and should be considered as an approximate indicator specifically relating to the flexible learning approach depicted by the pedagogical learning cube.

7.8.2. Summative Rating for Online Course

Though PEI serves as an indicator of the pedagogical richness of a course, online course delivery systems include several additional factors that affect the measure of success. Objective criteria for a summative evaluation should be applied in five major areas including the following factors

1. **Content:** It is important that an independent authority authenticates the accuracy and quality of the content. The source and the author of the content must be given proper attribution to avoid copy

write and compensation issues and to hold the author responsible for the contents quality. The evaluation factors of the content include quality, authenticity, validity, media, presentation and attribution.

2. **Learning:** The learning factors at the core of the educational quality of an online course include concept identification, pedagogical styles, media enhancements, interactivity with the educational content, testing and feedback and collaboration.
3. **Delivery Support:** A software module should manage user authentication, portfolio information and records of users' activities throughout the course, as well as course content elements including video streaming servers, audio servers and HTML server. The evaluation factors include user management, course content accessibility and reporting.
4. **Usability:** Web pages that are loaded with information require excessive scrolling within a window and can be detrimental to the educational quality of the presentation. Design experts recommend presenting small chunks of the information in 800X600 pixel windows. Page layout and ease of access from other parts of the course site are crucial to the success of the online course. Evaluation factors include graphical user interface, interactive design, clarity, and chunk size and page layout.
5. **Technological:** The issues that influence the technological success of online courses include available network bandwidth, target system configuration, server capacity, and browser software and database connectivity. Most large scale online courses are powered by a database backend. The data base connectivity and connection pooling mechanism can become a bottleneck if not dealt-with properly.

7.8.3. Overall Rating

The summative evaluation results in the sum of ratings of all the factors in each of the five categories and the PEI can be combined to give a final result that provides a view of overall effectiveness of the online course.

Overall Rating = PEI x Summative Rating Score

The overall rating formula is having the advantage of incorporating scores of both the pedagogical and delivery systems to provide a final rating that will be useful for comparing online course offerings.

Chapter - 8

ADAPTIVE LEARNING SYSTEMS

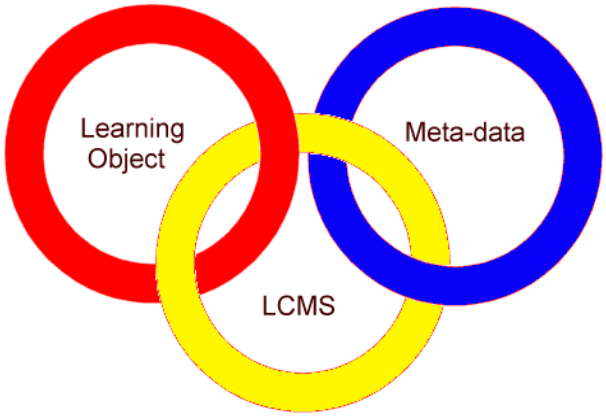
This chapter deals with different adaptive learning systems and E-learning environments towards adaptive learning .Some of the fundamental elements contributing to adaptive learning are described below.

8.1. Learning Objects

For years, the e-learning industry has anticipated the day when learners could personalize, assemble on the fly, and access e-learning on demand. Development teams would be able to build content a single time, store it electronically, reuse it, and deploy it in different formats with a simple button click. A small content piece--a learning object--would establish the foundation upon which these capabilities rest. According to many e-learning professionals, that day has dawned. To others, it's still in the distant future. Who should you believe? You can decide for yourself, but I'll try to separate fact from fiction--promise from practicality--by examining the learning object concept and the technologies and standards that define, create, and use it.

At its most basic level, a learning object is a piece of content that's smaller than a course or lesson. But the learning object doesn't exist in a vacuum; it's one of three interdependent components:

- the learning object itself
- metatagging, or the standardized way to describe the content in code
- a L**earning Content Management System** (LCMS) that stores, tracks, and delivers content.



LCMS vendors and other learning object evangelists promise that when you combine those three components, the organization, developers, and the learner benefit.

Content developers benefit because they can build content once and reuse it in several courses and delivery media, and they can search for and use content that other developers have built and stored in the database.

The organization benefits because it's able to

- develop and deploy learning content quickly and efficiently
- port content easily between multiple LMSs or LCMSs
- reduce content development and delivery costs
- reduce maintenance time and costs.

Finally, the learner benefits because he or she can access

- individualized learning paths
- competency-based rather than course-based learning events
- content that has been adapted to his or her individual learning style
- immediate, just-in-time, just-enough performance support.

8.1.1. The Elusive Object

Learning object. Reusable learning object. Reusable information object. Shareable content object. Modular building block. Chunk. Nugget. Lego. Whatever. The list goes on, but each term is simply a synonym for learning object.

Learning objects are different things to different e-learning professionals. In fact, there seem to be as many definitions as there are people to ask. But in general, learning object definitions cover the following categories:

- **content**: a learning objective, the content and learning activities supporting that objective, and the assessment that's mapped to the learning objective
- **size or seat time**: a chunk of learning that takes no longer than 15 minutes to complete
- **context and capabilities:** a nugget of learning that can exist stand alone and be delivered to a learner on an as-needed, just-in-time, just-enough basis
- **tagging and storage:** a piece of content that's described with a standardized set of metatags.

8.1.2. The LCMS: Object Creation, Storage, and Delivery

Storing small objects in a database is nothing new. In the systems development and engineering fields, the object paradigm is used to manage large things. In general, the smaller the stored items, the more numerous the opportunities to reuse, track, and combine them. But to the training industry, electronic object storage and reusability are new concepts that have ushered in a new tool that turns course-based content development on its head--the LCMS.

A typical LCMS offers the following capabilities: content authoring or assembly, content management, workflow management, content storage, and content delivery. Most LCMSs store content in an XML database, but deliver it in HTML for Web browsers. Many are capable of delivering the content to other media, such as CD-ROM and print.

What benefits do LCMSs offer? You create and store content once, but deliver it many times, often simultaneously to different users. And the database stores content separately from presentation, which enables publishing of the exact same content in different formats.

A standardized learning object would adopt a particular learning theory and respond to a set of business requirements. As a result, all learning content entered into a standards-compliant LCMS would follow the same instructional philosophy and have similar functionality to support it. But that’s not good for learners or the industry. Instead, LCMS vendors have based their learning object definitions on different learning theories and individual cases.

From an instructional standpoint, Chapman identifies two learning object categories: prescriptive and adaptive. By far, prescriptive learning objects are the most common among LCMS vendors. Prescriptive learning objects focus on structure. In other words, all learning objects in that LCMS adhere to a particular instructional design structure and granularity. By contrast, adaptive learning objects focus on learners and can change according to the learner’s profile and shifting needs.

8.1.3. Adapting to Learning Styles

For example, Adaptive Tutoring Systems of Toronto, Canada, employs an adaptive learning object design. Its LCMS redefines a learning object on the fly, as the system monitors individual learner performance and adapts to an individual's learning style. President Bruce Miner says, "Our adaptive

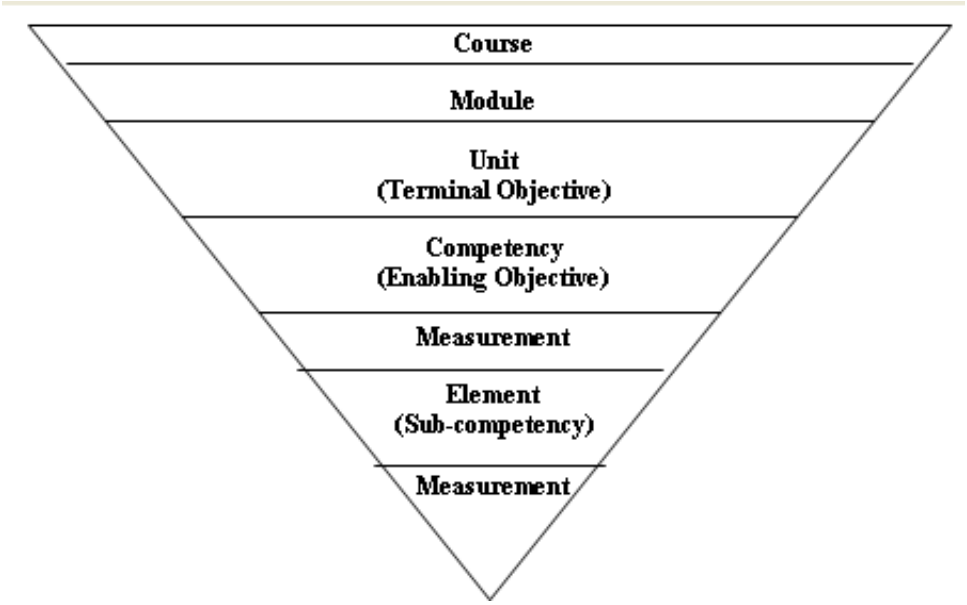
technology focuses on the learning style and context of the student. We ask, How does the student learn best? Then, we render the content that fits that style."

Adaptive Tutoring Systems uses artificial intelligence technology to track a learner's performance and preferences, continually update user profiles, and deliver learning objects accordingly. Developers save time and money by creating one learning object that addresses several learning styles. They don't need to create a different learning object for each learning style. For example, as the artificial intelligence system adapts to a visual learner, that learner will receive less text on the screen and will see graphics emphasized.

Also, the ATS system can deliver learning object content appropriate to the user's bandwidth, for example, reducing the video frame rate for learners with modems. "All this [bandwidth delivery] information sits inside the learning object," says Miner.

8.1.4. Competencies and Learning Objects

Generation 21's LCMS, Total Knowledge Management, falls into the prescriptive learning object category. But don't let the prescriptive tag fool you. TKM does allow some flexibility in design and delivery. TKM specifies a content hierarchy, in which smaller content assets are combined into larger ones as you move from the bottom up. "A learning object is not just a small piece of content," says director of systems engineering Rich Sutton. "It can be a course, a module, a unit of instruction, or a competency, which is a skill or knowledge for a task."



Each TKM hierarchy level can be considered a learning object. That’s because TKM can deliver any level individually, down to a single media object, such as a graphic or sound file. From an instructional standpoint, however, TKM considers the dynamic learning object at the competency level.

Within the hierarchy, a competency "should be measurable and have an objective associated with it," says Sutton. "The idea behind the system is to make those competencies digestible pieces of information. A competency could be a [step-by-step] procedure for how to change a tire, or [general] knowledge about how to change a tire," he adds.

In addition, even though the TKM learning object hierarchy is fixed, the system offers some adaptive delivery capabilities. Based on measurement items delivered during the learning experience, the system tracks how quickly each learner absorbs new information and skills. The system then dynamically modifies how and in what sequence it presents the learning object content to each learner.

8.1.5. A Content Framework

TopClass, the LCMS of WBT Systems of Waltham, Massachusetts, might technically fall into the prescriptive learning object category, but it doesn’t seem to be a perfect fit. "What you don’t get from us is a highly regulated, just fill-in-the-blanks architecture," says Duncan Lennox, WBT Systems CTO.

"Our philosophy is to provide a framework in which you can build your own set of learning objects, without imposing a particular instructional design philosophy or level of granularity," says Lennox. "We take a pragmatic approach. As an infrastructure company, it’s not our place to enforce a particular ID philosophy on you, or impose a level of [learning object] granularity."

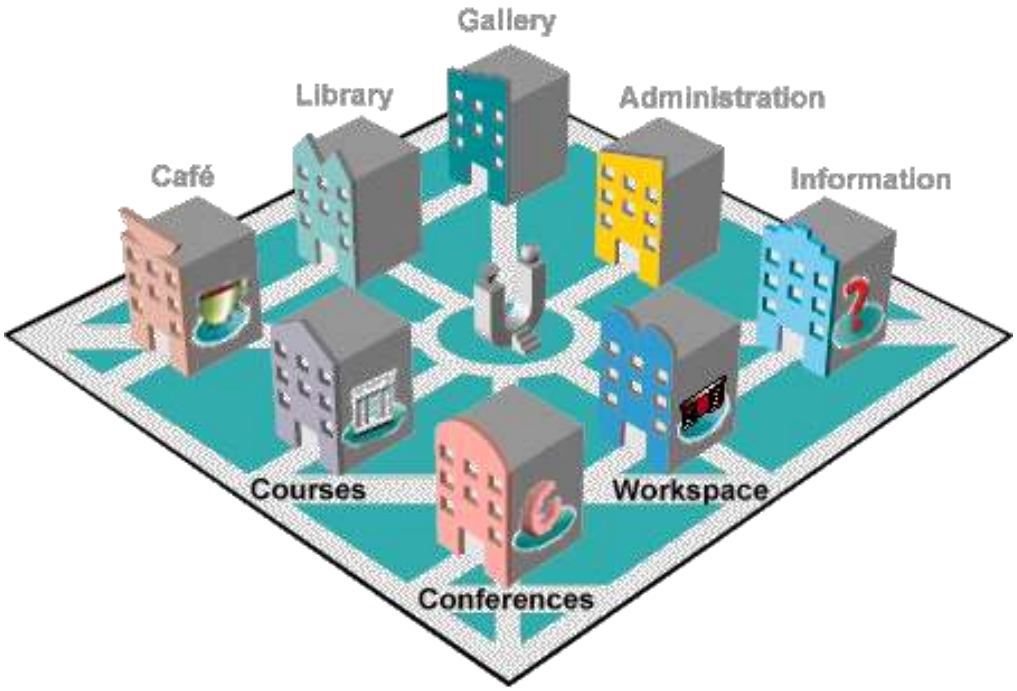
Like Generation 21’s TKM system, TopClass implements the learning object concept through a "hierarchical structure, like Russian dolls. There are smaller objects contained in larger objects," he adds. But the hierarchy doesn’t impose or recommend a smallest or largest object. In fact, TopClass lets you differ the granularity from learning object to learning object which means you don’t have to settle on a single definition of a learning object. Instead, you can address the needs of the course developer, the content, and the audience on a case-by-case basis.

WBT Systems designed the TopClass authoring environment with non-trainers and non-instructional designers in mind in response to organizations that need to reduce course development time, Lennox

explains. TopClass meets this need by "putting the tools directly in the hands of the SME," he says. TopClass's Publisher tool lets SMEs drag and drop such files as Word documents and PowerPoint presentations into the database. The idea behind the design is simple: The people creating learning content work in tools that they're familiar with, and then they migrate content to the repository for tagging, storage, management, and delivery.

8.2. E-Learning Environments Towards Adaptive Learning

Provide both independence (flexibility and autonomy) of learners and at the same time promotes a two-way interaction between the student and teacher through the use of networked learning and communication tools.



E-Learning Environments

- Provide support for multimedia and hypermedia courseware.

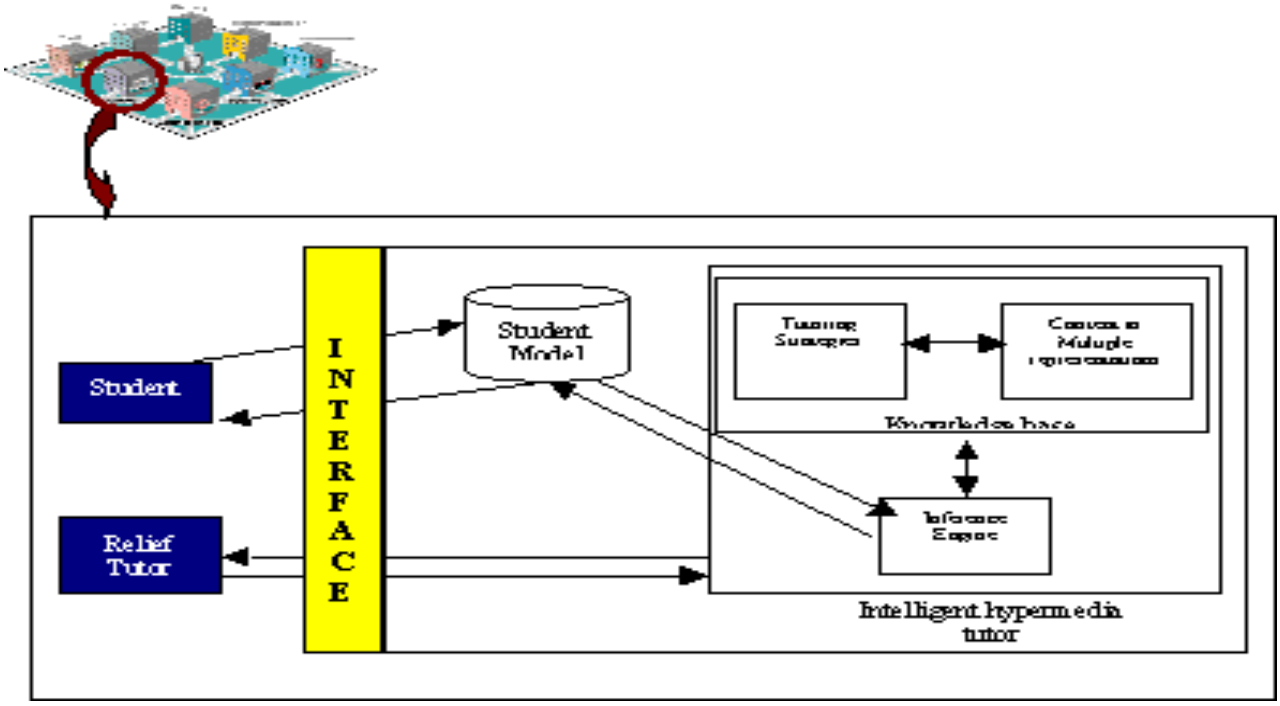
Hypermedia is defined as the integration of a computer and multimedia, to produce interactive, non-linear environments with the flexibility and interactivity that contribute to active learning by the students. (Lockard, Abrams, Many, 1997)

- All materials are exactly the same (hosted on a web-server) for all students.

8.3. The HYPERLEARN PROJECT

A study of learner perceptions, interactions and learning experience in a learning/cognitive style based adaptive learning environment compared to :

1. Traditional e-learning systems
2. Adaptable e-learning systems



Study 1 : Evaluation of students perceptions of web-based learning :

Effects of learning and perceptual styles differences on performance, gender ,motivation and willingness to follow online courses.

Effects of learning and perceptual styles on students' evaluation of the media elements in the environment.

Effects of learning styles and perceptual styles on the networked learning tools on the platform

Instrument used

VAK survey and Honey and Mumford Questionnaire, KOLB LSI, Grascha, Reichman etc..

Students Evaluation Questionnaire.

Student results in assessment

Study 2: Studying how different learners perform in a collaborative computer conferencing environment. (Text-based).

The effects and types of students' interactions will be observed based on their various learning/perceptual styles. A specialized asynchronous forum system with built-in student tracking will be developed.

Study 3 : Development of an adaptive learning/cognitive styles based environment, using a prototype course based on the theoretical underpinnings of the proposed instructional method.

Sub-Study 1: A group of control students use the non-adaptive (i.e presenting same material to all learners) hypermedia learning environment while another group uses the adaptive hypermedia environment that will present them with materials based on their preferred learning styles and perceptual styles. The learning paths that the students take in the non-adaptive system will be compared with those that the system presents individually presents to the learners. Performance of learners in a pre-test and a post-test concerning the subject will also be taken and analyzed.

Sub-Study 2: A group of students uses the adaptive learning environment while another group uses the same system but with the possibility not to follow systems path when they feel their learning preferences are not met. As usual system has built in monitoring functions to better help analyze the information gathered. Performance of learners in a pre-test and a post-test concerning the subject will also be taken and analyzed.

8.4. Integrated Learning Style theory in Adaptive-Learning

Integration of learning style theory in an adaptive educational hypermedia (AEH) system

- Education and the W W W
- Adaptive educational systems
- Scholar’s Desktop and WHURLE
- Introduction to learning styles
- Implementation of learning styles as a new adaptation mechanism for WHURLE

Requirements for a good ILE

- Support of separated levels of authoring
- Facilitate repurposing of content
- Navigation and linking capabilities
- Pedagogically informed
- Adaptation to learner needs

The need for adaptive systems

- People are different!
- Limited capacity for learner differentiation in most commercial ILEs
- Development of various systems to allow for this differentiation "adaptive educational hypermedia", or AEH

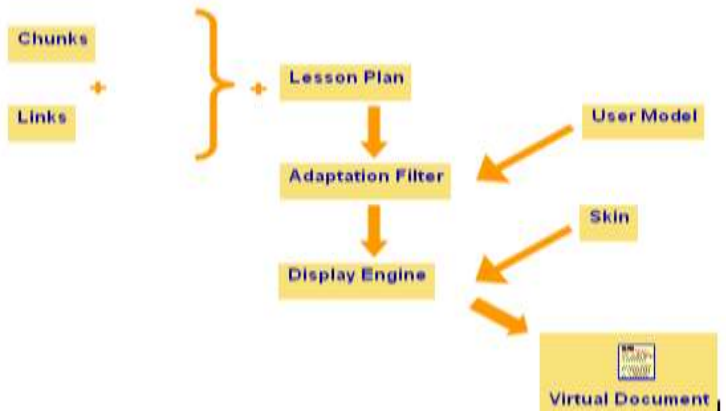
A brief history of WHURLE

- Scholar's Desktop
- Web-based 'Scholar's Desktop'
  WHURLE (Web-based Hierarchical Universal Reactive Learning Environment)
- Adaptive to user characteristics

The WHURLE framework

- Content is stored as conceptually discrete "chunks" of information in XML
- Lessons are stored as hierarchical "lesson plans" (XML)
- Adaptation at chunk level based upon user profiles (stored in database)
- Navigational overlay creates the "Virtual Document"

WHURLE architecture



User modelling in WHURLE

- Current user model assigns learners into stereotypes based on prior knowledge within a knowledge domain - Beginner, intermediate, advanced
- Stereotype is determined when learner first uses the system
- This stereotype develops as they continue to interact with the system

8.5. Interactive Web-Based Adaptive Learning Environment

The successful application of learning style theories and derived instructional strategies in traditional classroom environments [Lemmon (1985)] stimulated the idea of using an adaptive computer environment to achieve similar effective learning outcomes in a computer-based learning scenario.

A substantial amount of research on the topic of 'adaptive educational media' has been conducted under the umbrella term 'adaptive hypermedia'. This is a relatively young area of research and was established by Brusilovsky (1996 and 1999). The year 1996 was also the year of the introduction of Microsoft's Active Server Pages (ASP) technology that allowed the dynamic generation of HTML pages on the wide spread Windows platform. From this perspective, ASP can be regarded as one of the key enabling factors for adaptive educational hypermedia: it gave a large number of researchers access to easily programmable adaptive hypermedia technology.

Other important factors pushing the development of adaptive educational media are the increasing availability and the decreasing prices for dedicated broadband Internet connections. In Australia, for example, the prospected availability of cheap 'always-on' Internet in remote areas has the potential to spark a considerable boom in the demand for e-Learning courses. With the increase in processing power and constantly dropping RAM prices in the last few years, the possibilities of multimedia-supported learning have expanded likewise, allowing for media-rich and more versatile computer-based learning environments than ever before.

However, despite the boom in multimedia-capable computers and broadband Internet access, most of the existing adaptive environments focus on text-based strategies. Little research exists on the effectiveness of matching learning styles with multimedia representations of content (Carver et. al. (1996).

Research in predictive statistical models and learner modelling is advancing rapidly. A strong trend in educational technology research is to focus on individual preferences and traits of learners (Corso et.al. *2001)*. Learner-centred design is superseding the 'one-fits-all' mentality of static CD-ROM-based learning.

However, learner-centred design is not a simple task. Some researchers suggest that learning styles are not actually stable, but vary with the task the learner encounters. Adaptive environments that allow for these

fluctuations are scarce; mechanisms that predict these fluctuations and make tailored media recommendations for learners are not existent at present.

8.6. Learning Styles Research

This research project relies on the widely accepted theory that each learner has an individual learning style. James and Blank define a learning style as 'the complex manner in which, and the conditions under which, learners most efficiently and most effectively perceive, process, store and recall what they are attempting to learn.'

Whilst there is almost unanimity amongst educational theorists on the existence of learning styles, there is still disagreement on whether the existing learning style should be matched by instructional methods or whether the learner should be encouraged to adopt a different, more efficient style (Tendy & Geiser (1998)). This discussion is sparked by research on the different learning styles of gifted, average and non-gifted students.

A comparative analysis conducted by DeBello (1990) determined 'one of the highest reliability and validity ratings' for the Dunn & Dunn model (Rundle & Dunn (2000)). It covers six complementary domains of learning preferences. The following Figure displays a visual representation of the model and highlights the two domains that are relevant.

The Dunn & Dunn Model

Due to the physical limitations of a computer-based environment, software can only accommodate preferences in the perceptual and psychological domain. However, all domains are tested for and written recommendations are given to the learner for the complete model. This enables the learner to personally take care of identified physiological and environmental preferences, which can't be addressed in a computer learning environment (e.g. providing a glass of water next to the computer or choosing the ideal study time).

8.7. Multimedia Learning Research

A number of researchers compared multimedia learning setups with 'single media' learning setups. Paivio, for example, found strong evidence supporting his Dual Coding Theory (Paivio (1986)). He postulates that the human brain works with (at least) two cognitive subsystems: one specialized on the processing of nonverbal objects (i.e. imagery), and the other specialized on dealing with language. According to his theory, instruction is more efficient by presenting information in both visual and verbal form.

Paivio's research is supported by Mayer's 'Cognitive Theory of Multimedia Learning'. Mayer's experiments showed that particular combinations of media were advantageous for learning, whereas other combinations had a detrimental effect. The use of too many media was also detrimental; he described this as the 'redundancy principle'. These findings have guided the choice of media in this project.

Whilst research on the overall effectiveness of multimedia learning in comparison with traditional learning is still equivocal, research results within the area of computer-based learning are more conclusive. Several comparative studies on static and adaptive environments clearly indicate the superiority of the latter (Martinez & Bunderson (2001)).

8.8. Adaptive Education Research

Research in computer-based adaptive education research revolves around the questions 'What can be adapted?' and 'Which parameters should the computer adapt to?' This also raises the issue of how these parameters can be measured. Brusilovsky attempts to answer these questions.

Adapting with what?

Brusilovsky proposes a taxonomy for adaptive hypermedia environments in which he divides existing research into ‘adaptive presentation’ and ‘adaptive navigation’ approaches. Furthermore, he summarises methods and techniques that are used in these two approaches.

The goal of adaptive presentation is to adapt a hypermedia page on the content-level to the learner model. An example would be the usage of the ‘conditional text’ technique when introducing the concept of an ‘if-statement’ in Java. To take advantage of conditional text, all available text is divided into several chunks. Each chunk is dependent on a condition related to the learner’s knowledge. When the system assembles a page for presentation, it displays only the chunks that have a true condition. For example, a learner with previous knowledge in Visual Basic gets an example comparing the Java syntax with Visual Basic; a learner with prior knowledge in C would get the equivalent example comparing C and Java. Previous knowledge can also be taken into consideration and a more advanced learner encounters a more complex explanation of the topic with extended background information.

Adapting to what?

Adaptive environments are built around a central learner model, which stores information about the learner. It usually contains personal information about the learner, preference and learning style information to improve human-computer interactions and performance related information such as the test history, current work and future objectives.

Inadequate use of learning style theories has been criticised in the literature. According to Schulmeister and Weidenmann, the ‘pigeonholing’ of people is precarious as type theories can too easily become stereotypes, which trivialise human complexity. Hammond suggests that learning styles should be regarded as context-dependent variables, which may in fact vary with the current task, the experience of the learner with the topic and the point in time when learning takes place: ‘different individuals will adopt different learning styles for the same materials, and a single individual may change learning styles from one occasion to another.’ (p. 55)

8.8.1. Artificial Intelligence in Education

A vast amount of research exists on statistical methods that shape learner models and attempt to predict learner behaviour. A comparative review of current methods by Zukerman and Albrecht states that Bayesian networks, a research with gaining popularity in the Artificial Intelligence community, are more flexible, extensible and accurate than other predictive models such as neural networks.

8.8.2. Existing Projects and Environments

A number of researchers have examined and developed adaptive computer-based educational environments in the last few years. Examples of existing adaptive environments and current work in progress in this area include

iWeaver (Christian Wolf (2002)),
iDesigner (Sonwalkar (2003)),
3DE (Corso et. al. (2001)),
ActiveMath (Melis et. al. 2001)
AdaptWeb (Freitas et. al. (2002))
AHA! (De Bra et. al.(2002))
AMLE (Kurzel et. al. (2002))
Arthur (Gilbert & Han (2002))
AVANTI (Fink and Nill (1997))
CAMELEON (Laroussi & Benahmed (1998))
CS383 (Carver et. al. (1996))
ELM-ART (Weber & Brusilovsky (2001))
iTeach (Guicking (2001))
SILPA (Martinez & Bunderson (2001))
TANGOW (Carro et. al. (1999))

Existing environments exhibit either one or more of the following drawbacks which restrict them to adapt to fluctuating learner preferences:

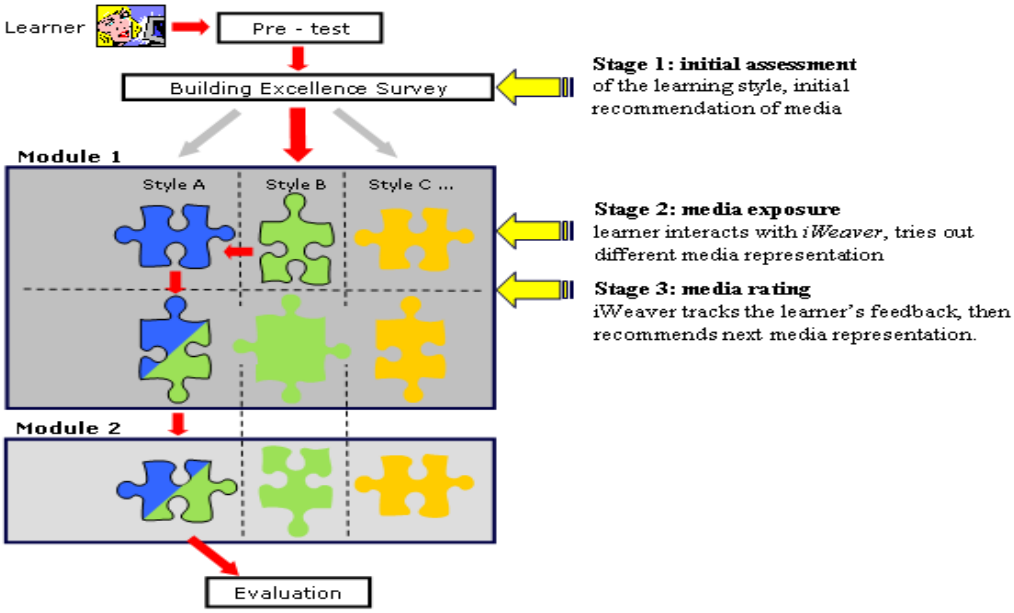
- *Timing of adaptation.* In some environments, the establishment of the learner model by assessing goals and personal preferences is carried out only once: after the first login of the learner.
- *Variety of adaptive response.* The adaptive response of most of the available environments is restricted to textual representations and images only.
- *Use of learner models.* Environment developers tend to create their own model for learner preferences, which lacks in supporting reliability and validity studies.

8.9. *iWeaver*

This section of the paper will describe technical aspects of *iWeaver* and gives a rationale for the selection and recommendation of media representations for specific learning styles.

Adaptive Intelligence

The following figure displays a flowchart for a learning situation in *iWeaver* from a learner's perspective.



Flowchart of an iWeaver learning situation

Stage 1. As soon as the learner first enters the environment, they answer the 118 questions of the Building Excellence Survey. The results of this survey determine the initial learner model that *iWeaver* works with. After the survey, the learner is given an explanation of their assessed learning style and recommendations on a media representation for the first content module.

Stage 2. The key idea behind *iWeaver*, which distinguishes this environment from others, is the dynamic adaptation to changes in learner preferences. *iWeaver* uses a 'soft' interpretation of the assessed learning style profile. The learner has the option to choose another media representation than the one that was recommended for their style. In the example in figure 2, the learner tries the representation for style A as well.

Stage 3. After each module, the learner is asked for feedback on the representations they encountered and for a ranked rating. These ratings are set against the currently existing learner model. The Bayesian network then adjusts the learner model, attempting to derive predictions of future preferences and adjustments for future recommendations. In the example in figure 2, the learner is equally satisfied with both representations. As a result, a combination of the representations A and B is recommended for the

next module. Please note that this is a simplified example that only works if the representations for style A and B are compatible.

iWeaver allows for extended learner control as encouraged by Kay, which is a recent trend in adaptive educational environments. Kay recommends giving the learner direct access to their learner model to train and develop their metacognitive skills. Increased learner control also provides a means of quality control for the learner model that is being developed by the system.

However, giving the learner complete control over their learner model poses some problems, such as a higher cognitive load for the learner and the need to word 'learner model jargon' in an understandable manner for a lay person. *iWeaver* therefore implements increased learner control in a simplified way: by giving the learner the option to choose different media representations, they can influence their learner model without significantly increasing their cognitive load.

Connecting Preferences with Representations

iWeaver is capable of addressing five perceptual and four psychological learner preferences as described in the Dunn & Dunn model (figure 1). The preferences in the perceptual domain relate to how we like to perceive information with our senses. The psychological domain covers preferences relating to how we process information and solve problems.

The following table outlines the characteristics of the nine implemented learning preferences and which media representations *iWeaver* recommends for them (a detailed description of these representations follows in 'technology aspects' later in this section):

Perceptual Domain - Learning styles and allocated representations			
Preference	***Description***	***Recommended Representation***	***Representation Type***
Auditory	Preference to listen to instructional content	PowerPoint-style presentations with synchronous audio, no text	Multimedia representation
Visual (Pictures)	Preference to perceive materials as pictures	Diagrams, illustrations, graphs, flowcharts, animations + audio	Multimedia representation + text or audio
Visual (Text)	Preference to perceive materials as text	Reading, context-aware note-taking tool	Text + additional tool
Tactile	Preference to interact	Interactive multimedia elements	Multimedia

Kinesthetic	physically with learning material	(‘interactivelets’): puzzles, drag & drop fill-ins, small games	representation + text
Internal Kinesthetic	Preference to make connections (to personal and to past learning experiences)	Extra examples of real-life relevance, links to prior content	Additional text

Psychological Domain - Learning styles and allocated representations			
Preference	***Description***	***Recommended Representation***	***Representation Type***
Impulsive	Preference to try out new material immediately	Try-it button (allows immediate trial)	Additional tool
Reflective	Preference to take time to think about a problem	Context-aware note-taking tool, questions that encourage reflection	Additional tool
Global	Preference to get the ‘big picture’ first, details second	Advance organisers [2] or mind maps	Additional multimedia representation
Analytical	Preference to process information sequentially: details first, working towards the ‘big picture’	Sequential lists of key points and components	Text (default)

It is not feasible to offer all representations to all learner types. Giving the learner too many options in a hypertext environment can have a detrimental effect on the learning experience: it can lead to the ‘lost in cyberspace’ syndrome. Another threat is the ‘serendipity’ effect, which refers to the phenomenon that learners can get easily distracted by clicking non-relevant but interesting information in a hypermedia environment.

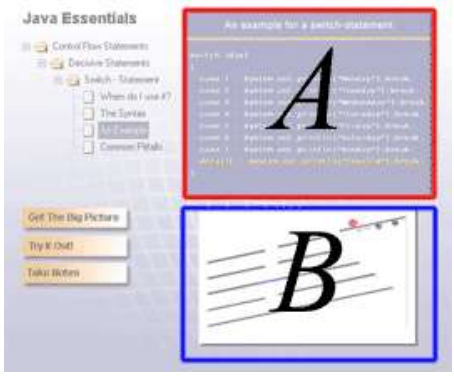
If the learner has too many options to choose from, it increases their cognitive load and decreases motivation. In an adaptive environment, this effect can occur if the learner samples too many media representations and moves on to the next topic before finding a match. This has a detrimental effect on the learning experience, because the learner loses interested in the topic or regards the presented information as redundant.

iWeaver endeavours to avoid this effect, by implementing a Bayesian network. This network attempts to predict the preferences of the learner, based on prior behaviour and selections. This limits the number of offered recommendations.

A technical key problem of offering the learner different representations of learning content is that these presentations may either not be compatible or that it is not possible to display them concurrently in one browser window. The following Table in combination with the following figure shows which preferences can be combined:

Preference	**Screen Space**
Perceptual Domain	
Auditory	A
Visual (Pictures)	A + B
Visual (Text)	A
Tactile Kinesthetic	A + B
Internal Kinesthetic	button - addition to B
Psychological Domain	
Impulsive	button - pop-up window
Reflective	button - pop-up window
Global	button - pop-up window
Analytical	A

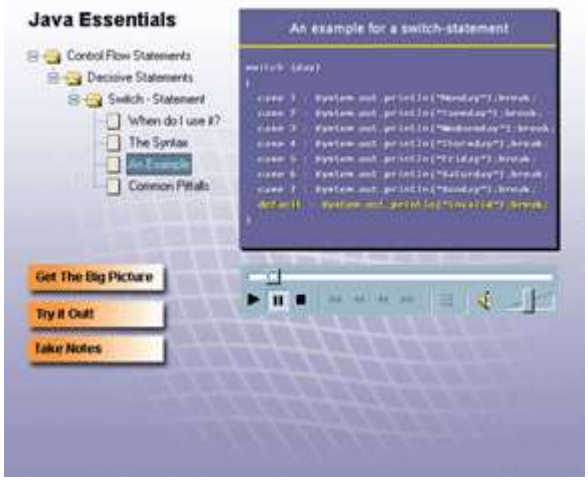
Concurrent display of different media representations



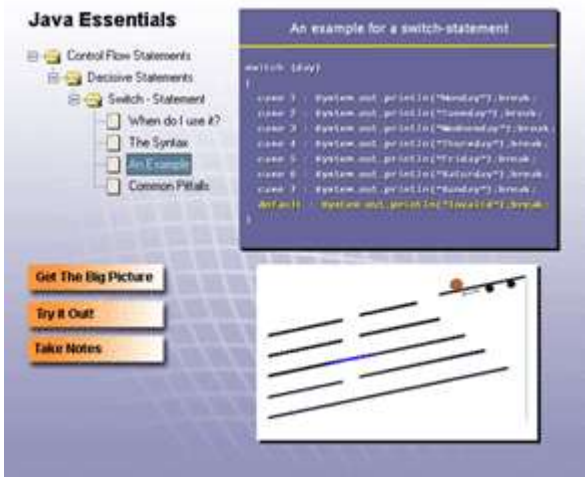
Segmentation of screen space

It is for instance not possible to view the media representation for ‘Tactile Kinesthetic’ and ‘Visual (Pictures)’ at the same time, because they require the same screen spaces. Representations can be displayed concurrently, if their screen space requirements do not interfere with those of other representations. Please note that all representations in the psychological domain are presented in a pop-up window that appears in response to a button click. An analytical-sequential structure of the text is considered the ‘default’ structure of textual information.

The following screenshots show two adapted versions of an *iWeaver* lesson:



The auditory learner interface



The visual learner interface

Technology Aspects

iWeaver is written in HTML and Java, using JavaServer Pages (JSP) technology and JavaBeans. The environment runs on the Tomcat web container and uses MySQL as a database to store data persistently. The design decisions were influenced by three factors: platform independence, free availability of the software for non-commercial use and fast performance under medium load.

Text-Based Representations. Text-based representations are implemented by providing the learner with different variations of textual content. The text for these variations is stored in the database and dynamically 'rendered' into the generated HTML pages.

Auditory Representation. A PowerPoint-style presentation with synchronous streaming audio is allocated to auditory learners. The technology to implement this representation had to satisfy the following criteria:

- Streaming audio: playback should start immediately or with a short buffering delay
- Media synchronisation support: seeking back and forward within the streamed audio file
- Seamless integration in the existing browser window

The three major players in streaming technology are the RealNetworks Media Player, Apple Quicktime Player and the Microsoft Media Player. All three players were reviewed for these criteria, but only the Apple and the Microsoft player managed to satisfy all of them. The Microsoft Media Player was chosen as a development platform in conjunction with the Microsoft Internet Explorer.

The term ‘streaming’ is used relatively loosely in the context of multimedia. For the purpose of this project, it is important to distinguish between ‘true streaming’ and ‘progressive downloading’. The difference lies in the used protocol. Progressive downloading uses the standard Internet protocol TCP (Transmission Control Protocol), whereas true streaming uses the UDP (User Datagram Protocol) protocol.

True streaming requires an additional media streaming server. It is more efficient and more stable than progressive downloading. However, it triggers a re-buffering delay of a few seconds every time the learner seeks a new position in the audio stream. Progressive downloading allows seeking only in already downloaded data, but without a delay. As frequent re-buffering constitutes a potential confounding factor for the learning outcomes of modem users, a comparative test between the two protocols will be carried out in the pilot phase of the project to assess which one is more suitable for the final prototype.

iWeaver uses the Synchronised Multimedia Integration Language 2.0 (SMIL) to synchronise the audio track with the corresponding PowerPoint slides and clicks from the learner on keywords. SMIL is an XML-based markup language, stored in simple text files, which allows authors to write (i.e. textually describe) interactive multimedia presentations. SMIL is a W3C recommendation and was finalised in August 2001 as an open, recommended Internet standard.

A SMIL presentation can consist of multiple components of different media types, linked via a synchronised timeline. For example, in a slide show, the corresponding slide is displayed when the narrator in the audio starts talking about it. SMIL is text- and component-based and a recommended W3C standard, which guarantees the scalability and future extensibility of *iWeaver*. The switch-over between ‘true streaming’ and ‘progressive downloading’ is very simple to implement, for example.

Visual Pictures / Tactile Kinesthetic Representations. Tactile kinesthetic and visual learners are offered multimedia representations created with Macromedia Flash. The vector-based Flash technology is a quasi-standard on the Internet. Flash allows the production of very small files which are quickly downloaded, even with a slow modem connection. Flash supports basic streaming (progressive downloading) and includes an advanced ActionScripting language that permits the programming of interactive behaviour. Flash is used in *iWeaver* for animations, puzzles, drag & drop fill-in examples, little games and riddles.

Impulsive Representation. A ‘try-it’-button allows the learner to try out small pieces of code directly in a browser window, without the need to switch to a locally installed Java development environment. The

source code can be edited in a text field. The raw code is then sent to the server, where it is compiled. In case of a compilation error, the respective part of the code is displayed as well as the error message; otherwise, a HTML page is returned with an embedded applet.

Apart from accommodating impulsive learner preferences, this 'web-based compiler' technology has multiple other benefits. It gives potentially interested learners access to a trial environment for a programming language without the tedious process of installing a complete development environment. Furthermore, learners on computers with severe access restrictions, for example on a computer in a public library or an Internet café, benefit from this technology, as they still have the possibility to compile and to try out their program code.

Reflective Representation. Reflective learners are offered a context-aware note taking tool. Clicking the respective button opens a window in which they can enter notes, comments or ideas reflecting on the new material. These notes are stored together with the context/topic in which they were taken in the database. A learner can review the notes by either accessing the topic where they were taken or by accessing a virtual notebook, which stores all the notes, sorted by topic.

Global / Analytic Representations. Global learners have the option to access an advance organiser via a button click in a pop-up window. Advance organisers can be mind maps or images which direct the learner to relevant prior learning as well as pointing forward to new material. It gives the learner the 'big picture' of where they are at in the learning process.

8.10. iDesigner

iDesigner Adaptive Learning Server (ALS) is a fully integrated J2EE-based (Java 2 Enterprise Edition) highly scalable deployment environment for on-line courses. The server accepts files that are generated by iDesigner and then converts them automatically into a full online course. IDesigner Server features rich user tracking, intelligent feedback, real-time dynamic generation of remedial courses, and reporting to assess learner performance improvements.

The iALS allows the user to select graphical templates that define the look-and-feel of a course. This automates the entire process of generating a course with multiple learning styles. The results of this instructional design process are immediately viewable on the web. This means that the course designer can see and demonstrate results to the customer as well as make changes on the fly.

The user of iALS is able to design and display a complete course, which can be seen and used by both course designers and by students. Reports are provided automatically. In addition, because the use of multiple learning styles is supported by iDesigner, the user has the opportunity to introduce some or all of the different learning styles and become familiar with their methodology and pedagogical effectiveness.

Mass-customization: Although courses are taken by thousands of users, each user gets his own customization based on the learning style preferences.

Adaptive Remedial Feedback: iALS has a powerful artificial intelligence engine based on the statistical inference algorithm, which dynamically generates remedial courses.

Statistical Inference Engine for Learning Style Determination: The server has a powerful engine to determine the best suited learning style.

Universal Deployment: iALS courses can be dynamically deployed on the Internet, LAN, CDROM, and Wireless devices Pocket PCs, Tablet PC, PDA, etc.

User profiling: The statistics collected on individual learners are used to keep user profiles for future use by the system.

Reporting Metrics: iALS has a sophisticated reporting engine for individual user performance, cumulative averages and group results.

Integrated Environment: Fully implemented J2EE environment that provides a multi-tiered scalable deployment of the on-line courses. The iDesigner ALS integrates web-server, web services, streaming media server, chat/discussion servers, and user profiling services.

A Breakthrough in Learning Effectiveness

It is widely accepted that each person has a preferred learning style and that learners per form best when they are able to study using their style. The iDesigner Adaptive Learning Server tracks the progression of each learner through their program including which concepts they study, which learning styles they use, and how well they master concepts. Most learners find they enjoy studying in one style more than

another. Many will use the multiple learning styles to review complex concepts or for a change of pace as they progress through the course. All the material is covered no matter which learning styles they choose. After each assessment the learner is presented with information on which learning styles they have tried and which ones are giving them the best results.

A Breakthrough in Learning Effectiveness

iDesigner™ is a course structure and assembly tool for creating the most effective online learning available today. iDesigner makes it easy to create courses that adapt to the needs of each individual learner through the concept of adaptive learning. This concept, coupled with iDesigner's intuitive and intelligent technology, create the only form of online learning that incorporates pedagogical techniques into web-based courses.

Reuse Information Assets

iDesigner's intuitive inter face and the intelligent reuse of learning objects finally makes the development of advanced web-based courses affordable. iDesigner provides the ability to easily reuse information assets such as PowerPoint presentations, Word documents, audio, video and virtually any web-compatible media.

Easy To Use Tool

iDesigner's intuitive, graphical, drag and drop design makes it as easy to use as popular of f ice applications. iDesigner provides the course developer with a simple framework that streamlines the instructional design process, typically the most time-consuming part of on-line course development. iDesigner enables the creation of course structure, concept tree and learning strategies with sound pedagogical models embedded in the tool itself. Furthermore, iDesigner enables course creators to develop sophisticated web-based courses without the need to know HTML programming.

SCORMTM 1.2 Conformant

While other authoring tools claim SCORM compliance, iDesigner goes a step beyond with full SCORM 1.2 conformance. iDesigner is one of the first SCORM 1.2 course assembly products that support content sequencing in multiple learning styles. iDesigner generates the SCORM conformant version of XML for full reusability and interoperability of learning modules with all other systems. Content created using

iDesigner 3.0 has been tested using the ADL Co-Lab's test software, which demonstrated conformance with SCORM version 1.2.

Continuous adaptive feedback identifies learners' optimal learning style and presents the course accordingly. Average passage rate of 95% ensures learner competency. iDesigner's ease and speed of use simplify the creation and maintenance of high quality web-based courses .It provides an intuitive instructional design framework to guide course development .Intelligent diagnostic systems identify the learner's weak areas and create customized remedial courses ,easily integrates with leading LMS's or can run as a stand alone application. Features best-in-class content management for high reuse of learning objects and rapid course updates .Robust reports give powerful performance feedback to learners and managers .

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