CHAPTER 1

INTRODUCTION

1.1 Knowledge dissemination in the Digital Age:

"The learning environment should help people share their knowledge: to learn from each other, to innovate and work together effectively to make a difference" — David Gurteen

Preparing students for an unpredictable world will take, above all things, vision. Inherent in this vision are several key realisations: that we are working to prepare a new kind of student; that we are using brand new tools, for a life that we cannot clearly see, anticipate or describe today; that embedded in this challenge are fantastic opportunities; and that teaching should and could be the most exciting profession on the planet (Warlick 2001)

Life long learning is essential in the “Knowledge age” as everyone needs to update his knowledge to remain relevant and productive in the new economy. Learning strategy needs to be different in the digital age to leverage advances in ICT for innovative learning solutions, which facilitate "learning to learn". Learning to learn helps us to pursue life long learning and enjoy learning. In the constructivist perspective, learning is a process of the construction of knowledge and learners actively construct their own knowledge by connecting new ideas to existing ideas, while being engaged in the process of learning. Active engagement involves

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2 David Warlick, Interview with David Warlick (June 15 2001) at www.techlearning.com/db_areas/archives/TL/200106/conversation1.php
enquiry, exploration, application and reflection, leading to construction of knowledge. So it is important to create an environment for active, engaging, personalized, collaborative learning that leads to effective knowledge creation and dissemination.

The digital revolution has intensified the move towards knowledge codification and sharing of codified information resources from universally accessible digital libraries connected through communications networks. The knowledge-based economy is characterized by the need for continuous learning of both codified information and the competencies to use this information. The capabilities for recognizing patterns, interpreting and decoding information codified through information technologies can only be done through learning.

1.2 Importance of learning environment:

Studies conducted in developed countries such as U.K. and Australia reveal that e-learning had a positive impact in transforming learning, empowering learners and teachers and prepare students to face the future with confidence. Studies further suggested that even though infrastructure such as computers, networks and broadband internet access are essential for the success of e-learning initiatives, they are not sufficient. We need to create a learning environment that helps students enjoy learning and learn how to learn.

1 Towards a Unified e-Learning Strategy. EDUCATION AND SKILLS. Consultation Document July 2003
2 Dr Dale Spender and Dr Fiona Stewart. Embracing e-Learning in Australian Schools. May 2002
National Curriculum Framework 2005 * and earlier studies conducted by Government of India suggest that we should take initiatives to provide “Learning without burden” to every student. The learning at school should be a joyful experience helping students learn to learn. The recommendations include systemic reforms and integration of educational technologies wherever they are found useful. They suggest a learning environment, which is learner-centric with learning flexibility.

Albert Einstein once said “I never teach my pupils; I provide only conditions in which they learn.” We need to create an environment that helps students enjoy learning, find learning relevant and meaningful, develop skills to learn how to learn and constantly think out-of-the-box to solve problems of real world situations by applying their knowledge in different ways. Technology is helping us to think innovatively in creating and sharing knowledge. The knowledge grows exponentially with sharing and collaboration in a networked world. Sharing the learning environment and knowledge through collaboration enhances learning opportunities for all so that every student gets the opportunity to achieve his/her full potential.

1.3 Why do we need a Strategy?

We need a learning strategy to integrate and unify the initiatives by Government, industry, educationists and schools, that extends the reach of quality education to all and prepare ourselves, through our education system to cope with an ever-changing world. The strategy should help shape the vision of learning for future where in every student enjoys learning with
smile, free from stress caused by learning without understanding. We need to balance e-
learning with traditional methods, using technology as an enabling tool to enrich the learning
process.

**Purpose:**

Every student learns with smile to achieve her/his full potential. We need to create and
provide access for all to a learning environment that helps students learn how to learn and
achieve their full potential.

**Strategic vision:**

In the knowledge age, creation of wealth will largely be determined by how one
continuously acquires and applies knowledge to the changing needs of the society. So we
need to work towards an education system which prepares students for life long learning.
This requires an environment in which students enjoy learning, develop curiosity and critical
thinking with active involvement in the learning process, learn how to learn to facilitate life
long learning and collaborate by learning to share and sharing to learn.

**1.4 Strategic Objectives:**

**1.4.1 Enjoy learning:**

**SMILE** includes various strategies to sustain and enhance attention, relevance, confidence
and satisfaction. Attention can be gained and sustained with the aid of multimedia graphics,
images, animations, applets, interesting facts, content structuring and sequencing to move
from simple to increased levels of complexity and thought provoking questions to stimulate a
sense of inquiry and curiosity. Relevance refers to the alignment of content with the learner's goal, learning styles, and its application in real world situations. Students enjoy learning if teacher explains the subject matter through simple concepts and interesting facts related to social context of the learner. Confidence can be accomplished by helping students to experience success through understanding of the concepts and their ability to apply these concepts for projects and problem solving through quizzes and games. Satisfaction could be achieved by helping them perform better in their schools while satisfying the quest for knowledge and spirit of inquiry with enhanced learning experiences. Learning flexibility with control over the learning process, learning by doing through projects and simulations, learning together by sharing knowledge, interaction and collaboration and learning with understanding by learning how to learn makes learning enjoyable. Innovation in teaching and learning by leveraging technology helps us to enhance the learning experience of students. Technology facilitates presentation of subject matter with graphics, 3D animations and simulations. These multimedia presentations help teachers to explain the complex concepts in a way, which is simple and easy to understand and make learning interesting and enjoyable.

1.4.2 Learn To learn:

Learning to Learn is a process of discovery about learning. It involves a set of principles and skills which, if understood and used, help learners learn more effectively and so become learners for life. At its heart is the belief that learning is learnable. Learning to Learn offers pupils an awareness of how they prefer to learn and their learning strengths; how they can motivate themselves and have the self-confidence to succeed; things they should consider such as the importance of a positive environment for learning; some of the specific strategies
they can use, for example to improve their memory or make sense of complex information; and some of the habits they should develop, such as reflecting on their learning so as to improve next time. We would argue that learning how to learn is the key skill needed in the 21st century. Learning to learn approaches are enabling schools to develop their pupils as confident, successful lifelong learners. Online learning offers flexibility to students to learn anytime, anywhere at their own pace, to suit their learning preferences. Exploring the subject through educational portals and other online sources such as Wikipedia for doing projects facilitates learning to learn in students.

Learning to learn encompasses intellectual skills, attitudes and motivation such as attitudes to one's self, perceptions of one's own competence, ability to think about one's own thinking ('meta cognition' inferring awareness of one's own preferred learning style), persistence in the face of difficulty and motivation to learn. The challenge is to help people to be reflective and self-critical learners, to access tools which help them become more efficient and effective, to be able to transfer learning to learn skills from one context to the next; and to equip themselves to deal with new and unpredictable situations in the future. We should develop ways of gauging learning to learn competencies at student level through performance assessment using tests, which provide comparable data on how students cope with new and unforeseen content. Quizzes along with worked out solutions enable learners to assess their own understanding. The effectiveness of learning to learn skills is demonstrated in situations to which students bring no prior content knowledge but in which they are able to demonstrate that they know what to do in order to acquire, analyse and use new information and to process new data.
1.4.3 Collaborative Learning:

The collaborative learning brings learners, teachers, specialist communities and experts together to share ideas and good practice, contributing to new knowledge and learning. Shared resources including online libraries and educational portals help teachers to be more innovative. e-learning offers a wide range of online environments from school, college, home or to learn from other individuals or groups of learners as well as tutors, and develop the cognitive and social skills of communicating and collaborating. Collaboration among schools in sharing content and best practices in teaching is highly advantageous. Collaborative learning provides scope for negotiation of meaning, sharing of multiple views and changing the internal representation of the external reality. Collaborative e-learning which is also learner centric helps students and teachers to develop and share the knowledge in the form of learning objects.

e-learning achieves economy of scale through wide access to digital resources and information systems, combined with quality through shared tools and resources and common standards of design and effectiveness. For example, virtual classroom extends the reach of expert teachers and facilitates learning for wider audience. Educational portals with open access and sharing knowledge with friends while doing projects on internet extends learning opportunities to all. If we learn how to exploit all these capabilities, then it will be possible to achieve the aims of e-learning strategy. Collaborative learning provides scope for negotiation of meaning, sharing of multiple views and changing the internal representation of the external reality.
1.4.4 Active Learning:

Active learning involves students in doing things and thinking about the things they are doing (Bonwell and Eison, 1991). Active learning strategies allow individuals to become self-directed, collaborative and critically reflective (Luckner and Nadler, Processing the Experience, p. 13. n.d).

Active learning is learning through experiencing situations and solving problems. Students become more engaged in learning when they have a chance to dig into complex, challenging, and sometimes the problems that closely resemble real life. Project-based learning enhances the quality of learning and leads to higher-level cognitive development through students' engagement with complex, novel problems.

Active learning enables students to take responsibility for what and how they learn, achieving their personal goals as self-directed learners. e-learning can offer flexible learning on demand, anytime or anywhere, blending traditional and innovative methods to meet learners' needs on or off campus, at home and school. Self-paced and interactive materials allow learners to take greater responsibility for their own learning at the pace and level appropriate to them.

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* Diane Austin, Nadine D. Mescia, Strategies To Incorporate Active Learning Into Online Teaching, School of Library and Information Science, University of South Florida


Active learning connects learning and knowledge to life outside the school. This helps students to construct knowledge based on what they learn in the classroom and their personal experiences in the social context and world around them. The learning environment should respond to the student's home and community environment so that he/she can find learning more relevant and meaningful. Active learning helps in engaging with real world applications of the concepts and deepens understanding to acquire new layers of meaning. This kind of learning provides variety and relevance making learning interesting and engaging. Active learning is defined as “Instructor led, student centered, high involvement, practical learning strategies that can be used to help strengthen any learning environment” ---
- Linda Morable.

Simulations support a style of learning which engages the learner - helping them to take a more active role in their learning. There are many real-life situations, which are too dangerous, too expensive, or otherwise impractical to allow students to experiment or experience in real life. However, practical experience is a vital component of the learning process, underpinning understanding of concepts beyond their theoretical context. Simulations can provide an environment where students can explore, experiment, question and hypothesis about real life situations, which would otherwise be inaccessible. Also, users of an educational simulation can find the answers to 'what if?' questions, within the constraints of the world that is modeled by the program. Users interact with the simulation by modifying some of the parameters and seeing the effect when the simulation calculates the new output using these parameters.

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Interactive simulations help students to develop curiosity and critical thinking. Simulations have considerable educational potential because they provide an opportunity to 'learn by doing'. They also provide access to systems, which are otherwise inaccessible for reasons such as: safety, cost and size. Interactivity results in deeper learning because learners can hypothesise to test their understanding, learn by mistakes and make sense of the unexpected. It is believed by many educationalists that interactive courseware which allows "learning by doing" arouses interest and generates motivation providing a more engaging experience for the learner (e.g. Lewin 1951, Brookfield 1986). The much-used quote from Lao-Tse written in the 5th century BC sums this up: "If you tell me, I will listen. If you show me, I will see. If you let me experience, I will learn."

1.5 Strategic Framework:

Strategy involves a process of learning over time in which formulation and implementation start to merge. The strategy shall be aligned with the objectives and make learning affordable to a large audience, while enhancing the quality of learning. Technology enabled learning can help in enhancing the learning experience while being cost-effective. Strategy should help schools and teachers explore the possibilities of transforming the learning experience.

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1 Ruth Thomas, Interactivity & Simulations in e-Learning, MultiVerse Solutions Ltd MultiVerse Publications, 2001
2 Lewin K Field theory in social science selected theoretical papers D. Cartwright (Ed.) New York, Harper & Row 1951
We need to understand more about effective ways of using information and communications technology to enhance the student learning experience. The main objective of our strategy is to enable schools to meet the needs of learners and their own aspirations for development.

The strategic framework shown in Fig1.1 depicts strategy as a process, which evolves on a continuous basis reflecting the changes in the external and internal environment. Strategic framework can be initiated depending on the evaluation of performance against the stated objectives and goals guided by the strategic purpose, mission and core values of the organization. The framework also shows teacher as the key force that drives the whole process of transformation required to meet the strategic objectives on a sustained basis. Teacher plays a key role in implementing the strategy and initiating strategic changes required to prepare students to meet the challenges of the knowledge economy. SMILE is at the center of the strategic framework to create conditions for learning in which students achieve their full potential while enjoying learning. Key elements of the strategy reflect the key strategic processes, which create and sustain SMILE to meet strategic objectives on a sustained basis.

1.6 Strategic Context:

The knowledge economy:

The knowledge economy with associated increase in complexity and velocity of the work environment brought about by technological changes calls for a paradigm shift in the way education is viewed and delivered. Knowledge economy demands short product development
cycle time, knowledge workers with the ability to quickly adapt to the rapid changes in technology and migration towards value chain integration where in knowledge must be shared to contribute ever more value to the system.

Schools need a very different knowledge base if they are to prepare young people to make knowledge products, rather than goods. Making knowledge products is about know-how and we need to rely so heavily on learning – on accessing, using, changing and rethinking information – so that we can come up with a good idea and turn it into an entity – even a commercial knowledge product. This is why learning and earning now goes together.

ICT in education:

According to the US web-based Education Commission* (2000), while technologies may differ in format, their aims are common. They include: more interaction among students or with the instructor; the encouragement of more out-of-class student reflection; and the ability to provide synchronous and asynchronous delivery to deliver learning directly or to 'store' it so that learners can access it when required. The same Commission notes that today's students increasingly expect that their school courses will be integrated with online materials or discussions. From the new technologies and the knowledge economy there emerges a new way of learning, which is self directed, informal, just in time, any time, any where, self paced, collaborative and life long. The new technologies shape the new learning and in turn will shape the new education system with a customized model, which allows individuals to select and make knowledge, which is of interest and value to them – and

others. For teachers, these new developments represent huge challenges and the related requirements for professional development are almost incomprehensible.

1.7 Strategic Analysis:

SWOT Analysis

Schools should perform an analysis of their own capabilities and limitations as well as the external opportunities and threats. Following that, they should identify the key success factors, which enable them to exploit the opportunities and create value to their students by enhancing the quality of learning.

**Strengths**
- Existing students
- Experienced teachers
- Accredited curriculum
- Physical presence/location

**Weaknesses**
- Technology
- Lack of capital/infrastructure
- Lack of trained faculty
- Poor quality of content
Opportunities

- Enhance the learning experience and student performance
- Increased recognition and image
- National/Global expansion
- Increased student enrollment

Threats

- Attrition of trained faculty
- Fast changing expectations from students and parents
- Rapid changes in Technology
- High cost of training and Infrastructure

1.8 Key Success Factors:

E-Learning Curriculum

High quality e-Learning and support materials developed for standard curriculum areas will provide a consistent and enhanced learning environment for students and teachers. We need e-Learning modules that cover the core national/regional curriculum while being flexible enough to allow curriculum responsibility to be delegated down to the school or even the teacher.
E-learning competencies

Teachers are essential players in promoting quality education and no education reform is likely to succeed without the active participation and ownership of teachers. Clearly defined and more imaginative strategies to identify, attract, train and retain good teachers must be put into place. These strategies should address the new role of teachers in preparing students for an emerging knowledge-based and technology-driven economy. Teachers must be able to understand diversity in learning styles and create stimulating, participatory learning environments.

E-Learning Infrastructure

A connected infrastructure is a requirement for remote e-Learning. However for online e-Learning, where rich content is downloaded a high-speed link is important and in some cases essential. The availability and cost of high-speed broadband connections varies widely and coverage tends to be very patchy in rural areas. The important challenge is to increase the availability of inexpensive high-speed connections. Where land-based connections are not available some governments are using satellite links such as Edusat to overcome this barrier.

E-Learning standards

In order to achieve true sophistication in terms of understanding the objectives of a learner and addressing those objectives with a highly customized program of learning, all of the components of a technology-based learning system must be speaking the same language. Accredited standards ensure that the investment in time and intellectual capital could move
from one system to the next. The goal of standards is to provide fixed data structures and
communication protocols for e-learning objects and cross-system workflows.

1.9 Key Elements of Strategy:

1.9.1 Content design:

No one knows exactly what the future holds, but there is little doubt that skilful use of their
minds will be an important part of their future. The skilled use of minds would definitely in
large part, call for strong basics, a grasp on fundamentals that student takes them forward for
a better life. Technology can make learning more interactive, facilitate collaborative learning
and enhance the learning experience. The effectiveness of technology enabled learning
experience depends on the design of the content and the instructional methods including
content structuring and sequencing. In its report, “The Power of the Internet for Learning”,
The US Commission for Web-based Education identified ‘the lack of compelling content’ as a
major constraint on the development of e-learning in schools’.

The development of learning environments needs to draw upon the knowledge relating to
learning theories, learning concepts and models, which open various possibilities and ways of
seeing the world. The instructional designer must understand the strengths and weaknesses
of each learning theory to optimise their use in appropriate instructional design strategy
depending on the learner profile, the subject matter and the school.

December 2000. At interact hp.com/webcommission/index.htm*
1.9.2 Collaboration

Learning is fundamentally both social and experiential and hence context of the learning including all of the elements that comprise the experience around the content is very important. Collaboration among participants helps them to solve problems, create project plans and design projects in a better way than they would have done individually. Participants can collaborate and help one another reach learning goals by providing feedback, answering questions, and working as a distributed group.

E-learning can support schools working together to raise standards by allowing collaboration between colleagues in different schools. Allowing pupils to take special subjects offered by another school without the need to travel. ICT should enable the development of teaching communities that can be used by teachers to share resources, including online libraries, discussion boards, and synchronous communication tools and help teachers to strengthen their curricular and teaching practices in professional collaborations to develop and review teaching materials. Network of teachers working through a School Net strengthens this form of collaboration.

1.9.3 Access to ICT:

Access refers to the ability to access the information and knowledge with the help of ICT, which facilitates learning anywhere at any time, extending the classroom boundaries and the learning experience.
Broadband facilitates access to creative content such as simulations and game-based learning to explain learning points in interesting, absorbing and imaginative ways and enhance inter-institutional collaboration with sharing of scarce teacher resources between schools in a high-speed interactive video conferencing to encourage communication and cooperation.

The distance education programs of Indian Space Research Organization (herein after referred to as I.S.R.O. in the text) such as EDUSAT are very successful by providing connectivity to remote areas through satellite link.

EDUSAT, India's dedicated education satellite carries the capability of providing audio, video and data services to India through its national and regional beams. This is a satellite operating in Ku band frequency facilitating the use of easy to handle small transmit/receive ground terminal. EDUSAT when it is fully operational in the third phase, it will have the capacity of 30 uplinks and about 5000 remote terminals per uplink.

1.9.4 Technology:

Technology transforms learning experiences by supporting the teaching and learning process with flexibility in terms of where, when, how and what to learn, and who to learn with. Technology plays a very important role in offering learning opportunities, which are relevant, compelling, and collaborative on a continuous basis. We need to use these technologies innovatively to take full advantage of the potential of global access to information, knowledge and experts. Technology can change the curriculum and students' access to it and increase the ways in which learners can be assessed, so that more students have the opportunity to
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select the range of media to best demonstrate their knowledge and understanding. Blended learning environment facilitates competency development in learners and provides learning in context across diverse student groups.

1.9.5 Teacher's role in the new paradigm:

Teacher is at the heart of this transformation in learning to facilitate every student to enjoy learning and achieve his/her full potential. The position of the teacher has been elevated and is expected to play a more important role as a facilitator in the development of students. Transformation to the new paradigm is possible through professional training of teachers to acquire competencies in educational technologies.

Teachers can access the rich, shareable, learning objects available from a digital repository and customize them to meet the specific requirements of their students depending on the learner and the context by assembling and packaging them in innovative ways. Teachers should be assisted by technical support staff to ensure that the networks and equipment are properly installed, operated, updated and maintained. Media production and services staff, such as interface designers, graphics designers, multimedia web designers support the creation and application of educational materials and programs using technology.

Teachers have to develop appropriate competencies to be able to create a learning environment in which he/she designs and enhance the learning experiences and supports learners continuously in achieving their educational goals. Teacher education programs play a very important role in preparing teachers for the new paradigm of learning in which learners
are actively involved in the process of knowledge construction and teacher would be a facilitator of knowledge construction.

1.10 Strategic Choice Criteria:

Strategic options have to be evaluated and tested for internal and external consistency, feasibility, advantage, value creation, and consonance before selecting the strategy. The role of the teacher at the centre of the learning transformation needs to be recognised and reinforced and teachers must be given every opportunity to enhance their own skills and knowledge in order to create conducive e-learning environments for learners.

1.11 Process of Strategic Change:

A successful e-learning strategy includes change strategy also which ensures that all the stakeholders are committed and capable of executing the strategy. The process involves establishing an environment for change, which provides access to adequate resources for all teachers, enabling the support of competent and motivated staff. Knowledge management and professional development of teachers are key factors that can influence change in a significant way.

The process of strategic change includes strategic approaches to development of technological infrastructure, development of technological standards processes and structures that are appropriate for the development and delivery of high quality education supported by technology. Finally strategy implementation should involve collaboration with
other schools, other academic institutions and linkages with rich archive of learning materials available as open educational resources and be informed by good practices across the world.

1.12 What is the Strategy?

The strategy is to create an environment in which unique values created for every learner. The learner himself can select and integrate various learning modules to construct knowledge following his own preferred learning style. The teacher can create value for the learners by orchestrating various learning modules through a process of synthesis depending on the learner, content and the context. The value comes from arbitrage of intelligence migration through educational portals and aggregation of learning modules through shared infrastructure and educational resources. Rewiring the network offers learners, varied forms of engagement with different sources of knowledge. Reassembly of the learning modules by the teacher enables learning in context in a way appropriate to the learner and the context.

The strategy needs to be simple and flexible to adapt to the fast changing environment of new economy, which calls for the new skills to remain relevant in the knowledge age. We should prepare students for life long learning by helping them learn how to learn. So, we need to identify the key strategic processes and simple rules to govern them. Content, technology, access to ICT and collaboration are key elements of the strategy. The right-mix and integration of key elements transforms learning and teaching and prepare students to face the future with confidence and keep smiling. Teacher is at the heart of the strategy and his/her commitment is essential to create and sustain the smile.
The key strategic processes for schools, which create value to learners, are empowerment of teachers, engaging content and a motivating learning environment. Key elements of such a strategy are collaboration, content, access and technology and they need to be integrated in a coherent manner to create and share the SMILE. SMILE creates conditions for learning in which every student enjoys learning, learn to learn and learn to share with others thereby providing learning opportunities for all.

1.13 What is SMILE?

SMILE is an acronym for simple, motivating, interactive and learner centric environment. SMILE blends the best of both the worlds - classroom learning and network enabled e-learning. Learning theories, models and the science of instruction are embedded in SMILE to create an environment that empowers learners and teachers. SMILE transforms learning and teaching by harnessing technology to implement established learning theories with creativity and innovation. We need to share the SMILE to maximize the knowledge capital and the access to it through collaboration. Learning process would be efficient and effective if the learning environment offers all the four essential ways of learning namely - learning from teacher, self motivated learning, social learning and experiential learning.

SMILE integrates the cognitive, constructive, experiential and elaboration learning theories with motivational learning model to create a learning environment that is simple, motivating, interactive and learner centric. The content design, development and delivery shall be guided by the principles of SMILE which is a highly flexible framework providing lot of scope for the

\footnote{A Vidyasagar, Maj Gen (AV) Bagga, Dr M S Bhar, Learning strategy in the digital age, University News, AIU, August – 2005. (The published article is given in Appendix H)}
teachers, subject matter experts and instruction designers to choose a right mix of learning concepts appropriate to the context.

**Simple:**

Learning with understanding requires the teacher to present and explain the concepts to learners in a simple way, which is easy to understand. This is the most challenging yet interesting competency expected from teachers in an effective learning environment, which facilitates learning without burden and learning with smile. This kind of environment ensures that every student enjoys learning and hence achieves his/her potential. The content structuring and sequencing moving from simple to increased levels of complexity reduces extraneous cognitive load keeping much of learner's working memory free. Subject matter should be organized into small modules with appropriate sequencing combined with interesting facts related to the social context of the learner, centered around a theme. This approach enables students to relate the learning in school to the environment outside the school and find it relevant and meaningful which increases the germane cognitive load. Subject matter explained through simple concepts with different applications in real world encourages schema construction and schema automation for the concepts that are consistent and relevant across varying situations. The ability to identify similar and relevant features in varying situations yields better schema construction and enhances problem solving skills and knowledge transfer. The e-content should allow individual teachers to add their own input and to make modifications, and should encourage teachers to make judgments about adaptation based on their knowledge and understanding of the capabilities of the students they work with. E-content should consist of fairly small, reusable modules so
that teachers can adapt smaller modules or learning objects more easily to correspond to their pedagogical approach and teaching style.

**Motivating:**

Keller\(^*\) suggests that students will be **motivated** to learn when they perceive some personal value and satisfaction from the effort, and when they expect to succeed. Based on these two principles from expectancy-value theory and extending them, Keller came up with four basic elements of **motivational** theory: attention, relevance, confidence, and satisfaction. Attention can be gained and sustained through graphics, images, animations, applets, interesting facts and thought provoking questions to stimulate a sense of inquiry and curiosity. Relevance refers to the alignment of content with the learner’s goal, learning styles, past experience and its application in real world situations. Confidence can be accomplished by helping students to experience success through understanding of the concepts and their ability to apply these concepts for problem solving. Quizzes and Games help them in self-assessment and improvement of their scores over a period of time and they can attribute the success to their own abilities and efforts rather than luck. Satisfaction is necessary for learners to have positive feelings about their learning experiences. The student’s satisfaction could be achieved by helping them perform better in their schools while satisfying the quest for knowledge and spirit of inquiry.

Interactive:

Collaboration and interaction among learners is a very important component of effective learning. Simulations, streamed video, project teams, chat rooms, bulletin boards, online references, personalized coaching and email are some techniques that could help create an interactive online environment. Interactive learning can be stimulating and encourage critical thinking as it facilitates problem solving.

E-tools like Flash animations, Java applets promote visualization of concepts and help students gain insights through interactive simulations. Retention can be enhanced through clear understanding of the concepts and their applications in real world situations. Interactive components like applets help the student to actively interact and involve in the process of understanding which stimulates schema construction of concepts and there by increase germane cognitive load. However the learning outcomes of these visual simulations depends on the level of expertise of learners. Non-linearity in content sequencing of web based learning portals enables interactive, flexible learning through features like keywords, search and explore.

Simulations provide a means for the student to have hands-on experience without the costs or risks involved in working in a "live" environment. Experiments may not always clearly demonstrate what happens within the apparatus as it is closed. Students mostly see the end results. Simulations on the other hand can be used to demonstrate the effects in all stages. Content design for e-learning should provide for such interactive simulations which help

* A. Vidyaa Sagar. Implementation of Non-linearity and Interactivity in e-Learning. National seminar on e-Learning, ELTFCI INDIA 2005 (The published article is given in Appendix I)
learners to gain an overall understanding of the process by changing the initial conditions in a simulated experiment. Knowledge management gives priority to the way in which people construct and use knowledge. Learning and doing are more important to the success of disseminating knowledge.

**Learner-Centric:**

Learning is an active process in which meaning is developed on the basis of experience. Learners actively construct their own knowledge by connecting new ideas to existing ideas on the basis of their experience while structuring and restructuring of ideas is an essential part of the learning process. Learner-centric pedagogy gives primacy to learner's interests, experiences, preferred learning style and their active participation. The content design should enable learners to construct knowledge from their own experience, in their own way and develop multiple perspectives. The content design and delivery to learners in multiple ways such as inquiring, questioning, thinking, reflecting, experimenting, discussing and debating in collaboration with others. Learner-centric approach also allows learners to learn at their own pace and to engage with concepts, reflect on the underlying cause and effect relations, patterns, similarities and interconnections to deepen understanding. Learning should be situated in the social context of the learner.

Assessment with hands-on problem solving should be integrated with the content instead of being a separate activity so that participants play a larger role in judging their own progress. Open-ended questions promote extensive dialogue among participants and provide room for negotiation of meaning and sharing of multiple views to change the internal representation of the external reality. Learner-centric instructional design should focus on the
organization and sequencing of subject matter content by addressing the four design problem areas: selection, sequencing, synthesizing, and summarizing. Active engagement involves enquiry, exploration, questioning, debates and reflection, leading to theory building and the creation of ideas. So the focus should be on the underlying principles of how knowledge is created, how it is organized and how it is used and on how learners engage with and reconstruct knowledge.

1.14 Learn with smile:

Fig 1.2 depicts the way SMILE enables schools to achieve the strategic objectives and shows that the objectives are interdependent. Sharing the SMILE in a networked, collaborative environment extends learning opportunities to all which in turn helps us to increase the wealth of knowledge by sharing the knowledge. SMILE helps students to learn how to learn and enjoy learning, while being actively involved in the collaborative learning environment.

*Fig 1.2* SMILE

e-Learning can greatly increase student performance and satisfaction if the content design and delivery is simple, motivating, interactive and learner centric. Creating a highly motivating learning environment calls for re-purposing content to make it interesting and engaging. The content design shall be learner centric and yet flexible to meet the

* A Vidy Sagar, Maj Gen (Dr) RK Bagga, Dr M.S.Bhat, Learning strategy in the digital age. University News AIU. August – 2007 (The published article is given in Appendix H)
requirements of a wider audience, which may be achieved through simple, shareable learning objects. The content developed shall be anchored to the established learning theories and instructional design methodology to explain learning points in interesting, absorbing and imaginative ways, with emphasis on conceptual understanding, retention and application of knowledge in real life situations.

E-learning is most effective when it is combined with more traditional forms of instruction, often called a "blended approach," providing students with as many learning opportunities as possible. E-learning offers the teacher a whole new set of teaching tools that include digital libraries, multimedia simulations and assessment tools. Innovation and creativity are required to design and develop a learning environment that offers highly satisfying on-line learning experiences. Concepts presented in graphics-rich format with relevant applications and interactivity creates an engaging learning environment. Self-paced learning, anywhere, anytime, extends the classroom boundaries and the learning experience. Computer and communications technologies are transforming the classroom and revolutionizing teaching practices to make learning a more interactive, engaging and enjoyable experience.

The most successful strategy should reinforce concepts already being taught, while motivating students to apply those concepts to new problems in any subject area. Strategy to create such an environment should be simple, affordable, scalable and flexible to be aligned to ever changing demands of the knowledge economy. We can create value in a networked world by leveraging the intelligence and expertise spread around the world and by creating a common infrastructure and pool of shared knowledge resources. The real value in learning can be created by teacher in a learning environment through orchestration of various shared stories, learning objects, simulations, examples, problems and applications customized to the
context and the needs of the learner. Interactive medium in e-learning is ideal for helping learners develop the skills they need for the knowledge-based economy through learning by doing and learning with collaboration and communication in a social context.

1.15 Share the SMILE:

The future of education is promising as school learning in the coming years stands to be fruitful, innovative and above all rewarding for teachers and learners. The future needs to be created with vision and conviction that these new goals are worth achieving, along with support and commitment from all.

E-Learning initiative requires know-how, access to state-of-the-art technologies, design of content, preparation of appropriate teaching materials, and the support of a set of educators and trainers. We should create networked partnerships among schools to share e-learning resources, and to develop and adopt good practice with the new possibilities presented by greater school-community links. We have to identify projects to develop productive collaboration and identify the optimal conditions for partnerships including partnership with government and industry.

Public and private partnerships and stronger community links may range from the development of digital content to working together to ensure that school communities are networked. The need for students to have access to the best information and the latest technology are two factors that are expected to drive collaboration among schools and even among states. Schools will find it more economical to combine and share resources including
teacher skills and technology and systems to combine resources. We can look forward to a national school system with shared resources.

We have to develop a national network of schools connecting all the schools equipped with appropriate physical infrastructure to facilitate collaboration and sharing of educational resources and the best practices in teaching and learning. This network can leverage the already existing Education Satellite (herein after referred to as EDUSAT in the text) hubs spread all over the country in all the state capitals. Technology such as broadcasting through satellite extends the reach of quality education to remote areas where broadband internet access is not available. Rural schools where teachers in special subjects like science are not available can benefit from distance education programs such as EDUSAT. A combined network achieves economies of scale in developing e-learning content and sharing the same with open access. Access to open education resources enables disadvantaged students from remote areas to acquire knowledge and skills required to join the mainstream and participate actively in the knowledge economy. Open source solutions customized for schools can be utilized by all schools through a service-oriented architecture. The common infrastructure so developed helps all the schools to offer quality education for all the students at affordable costs.

1.16 Strategic Actions:

1.16.1 Networking Educational Institutes with shared resources:

The principle of combined public and private provision of broadband internet access will be fundamental to encouraging access for all. The goal of long-term affordability of universal e-
learning is not achievable through the current means of short-term, top-slicing and central capital funding. In the longer term, educational institutes will have to take responsibility for e-learning planning and provision within their overall expenditure. For the benefits to be fully realised we must improve resource planning, procurement and collaboration to reduce the costs of e-learning. We must also improve quality, achieve economies of scale and increase value for money. We have to build a 'National Educational Institutes Network' with partnership between Government, schools and industry with the mission of providing broad band internet access to every teacher and student to enable collaboration between learners, teachers and experts all over the country to share their knowledge and best practices to maximize the knowledge capital and the access to it.

Networking of educational institutes through a common infrastructure should adopt a scalable, service-oriented architecture to provide services to educational institutes on a broadband network. EDUSAT program in India offers services over satellite to all rural and remote educational institutes with satellite receivers. This is a cost effective solution to provide access to quality content and experienced teachers in special subjects for all educational institutes. Satellite interactive terminals in classrooms offer live audio-video interaction with experts and students from other educational institutes. Online classrooms can be created to enable classes in one or a number of schools to receive programs from teachers in other schools. These programs may include discussion forums, WebCT and videoconferencing.
1.16.2 Centre for excellence in educational technologies:

Centre for excellence in educational technologies dedicated to research in new methods of teaching can train teachers to be more creative and innovative in their teaching. We should stimulate greater innovation in instruction design and teaching methods to accelerate the development of the next generation of learning, preparing students to face the challenges of knowledge age. The focus should be on design flexibility for teachers and engaging activity for learners. We also need research to map out future directions. This research should reflect how teachers teach and learners learn. As we research and develop more innovative pedagogical methods, we should look for ways to deliver them more effectively through e-learning.

Centre for excellence in educational technologies is required to train teachers in information and communication technologies to enable them to utilize e-learning technologies for developing content anchored in instruction design with good pedagogy in creative and innovative ways. We can achieve innovation in teaching only by supporting teachers to share their knowledge and methods of teaching to evolve best practices and interesting ways of teaching. Teachers need to be able to find, access, create, use and adapt the resources they require to build lessons that will suit their teaching methods and the learning styles of their learners with a common approach to technical, pedagogical and quality standards.

Technology and training will allow educationalists to deliver learning riches that would not have been possible earlier. The solution will be the emergence of well resourced and savvy teachers, whose understanding and creative use of technology helps them achieve undreamt of levels of excellence for themselves and for their students. In the new knowledge society, it
is often said that there can be no more exciting or significant profession than that of teaching. Education is now central to the prosperity of society and teachers can be among the most important of the professionals.

1.16.3 Educational portals with accredited, appropriate, accessible content:

Educational portals like MIT 'open courseware', BBC and Wonderwhizkids with engaging and motivating content in the form of learning modules will be helpful to teachers for use in their class rooms. Schools can share their own online programs with the involvement of students and collaboration with other schools in similar projects. Teachers are not professional digital content producers – although they can improvise – so they need access to a rich digital library – to a digital repository full of world class learning objects – which they can point to, package, present to their students, who will use the content to make their own knowledge products. e-learning content includes curricula online such as the courses recommended by board of education or government to very small objects such as graphics or animations, that can be accessed over the Web and downloaded for use in a particular piece of teaching. We also need to focus on development of standards to assure the pedagogic quality of e-learning provision, and mechanisms for monitoring and updating the standard in the light of changing technologies and access requirements.

Education for all therefore requires access with equity and equality to ensure that the quality of learning each student receives is the same. The most promising innovation is the concept of Open Educational Resources (herein after referred to as OERS in the text). The concept of OERS refers to open course content, open source software and tools. OERS apply to teaching and learning the basic principle of sharing that underpins academic
research. Distance educators have talked for years about sharing courseware. OERS made possible the sharing and adaptation of courseware on a more equal basis. Re-usable learning objects are the equivalent of the published articles on which subsequent researchers can build.

Government, experts, teachers, learners, universities, schools nongovernmental organizations, private initiatives like British Broadcasting Company (herein after referred to as BBC in the text) and Massachusetts Institute of Technology (herein after referred to as MIT in the text) can successfully combine connectivity and shared courseware to develop a global archive of e-learning materials which can be shared on an equal basis. e-Learning, with Free Open Source Software and Open Educational Resources, give us the chance to do that.

1.16.4 Blended learning with flexible curriculum and assessment:

Blended learning leverages technology to assist teachers in creating an environment in which teachers and learners enrich the learning process with technology assisted knowledge construction and sharing through interactive forums.

National curriculum Framework (herein after referred to as NCF in the text) recommended softening of subject boundaries so that students get a taste of integrated knowledge and the joy of understanding. Schools must provide opportunities to question, enquire, debate, reflect, and arrive at concepts or create new ideas. An element of challenge is critical for the process of active engagement and learning various concepts, skills and positions through the process. Blended learning enables students to seek knowledge beyond the textbook with access to enriching content with multitude of perspectives and ideas. The purpose of assessment is
necessarily to improve the teaching-learning process and materials, provide learners with feedback, and set standards for them to strive towards. Tests in knowledge-based subject areas must be able to gauge what students have learnt, and their ability to use this knowledge for problem solving and application in the real world.

Open-book exams and exams without time limit, online self assessment supported by worked out examples ensure that students acquire problem solving skills and become confident. Assessment needs to become more open, flexible, creative and user friendly. All subjects could be offered at two levels with students doing at least three/two of the six at standard level and the remaining three/four at higher level. Blended learning with online assessment makes it possible to present a wider range of performance parameters and flexible assessment.
1.17 OVERVIEW OF THE REMAINING CHAPTERS

Chapter 2: Review of literature on knowledge dissemination and learning

The existing literature including research articles published in various journals, National Curriculum Framework of NCERT, Govt. of India and books in the areas related to knowledge, knowledge dissemination and learning have been reviewed and summary is presented in this chapter. Learning theories and models proposed by various scholars in the field of education have been studied to understand the principles of learning to be followed for effective dissemination of knowledge. The core principles underlying various learning theories have been synthesized to arrive at a holistic learning model, which can leverage technology for the benefit of teachers as well as students.

Chapter 3: Review of literature on learning strategies for the Digital Age

The existing literature on strategy, strategy for the new economy, e-learning and e-Learning strategies has been reviewed and the summary of the review is presented in this chapter. Successful e-Learning initiatives in the international context, which are relevant and useful in the Indian context have been identified and analyzed. The principle underlying this selection of case studies is open access. The vast wealth of intellectual capital that is open for sharing among students of the world can be utilized by Indian school students. So such successful initiatives, which are helping millions of students to share the knowledge is discussed in this chapter. Further EDUSAT program of ISRO, Govt. of India, to reach the un-reached and provide access to quality education through a simple and affordable solution to schools in remote rural areas is also discussed. E-learning initiatives by Indian industry are
also discussed to integrate the initiatives of schools, government and industry for the benefit of teachers and students in the pursuit of excellence in education.

Chapter 4: Research methodology

The research problem, methodology, instruments used and the hypothesis developed are discussed in the chapter. The data collection procedure and the methods and techniques that were adopted to analyze the data are discussed. The profile of the schools from which primary data is collected is discussed in this chapter.

Chapter 5: Data Analysis and discussion of results

The data that was collected from school was analyzed strategically by using software statistical package SPSS version 11. The hypotheses were tested and the details of the results, which are the outcomes of various statistical techniques are presented here. The results are discussed and the relevant inferences are quoted in the appropriate context.

Chapter 6: Key findings and Conclusions

Based on the research work and the findings, the conclusions are presented in this chapter. Main findings, recommendations for further action, limitations and scope for further research are discussed in detail.
Chapter 7: Appendices

Appendix A: Questionnaire to Students
Appendix B: Questionnaire to Teachers
Appendix C: Questionnaire to Principal
Appendix D: Students Data Tables
Appendix E: Teachers Data Tables
Appendix F: Implementation of Non-linearity and Interactivity in e-Learning
Appendix G: E-Learning strategy in "Wonderwhizkids" – a science portal
Appendix H: Learning Strategy for the Digital Age