The digital revolution and its implications for a knowledge society

The evolution of knowledge system

Revolutionary changes in the knowledge processes have transformed society. The invention of language was in a sense the cause of the first knowledge society – through language, knowledge was created (constructed) orally, shared and 'consumed'/used. However as in our 'Gurukul' models, this required the teacher and learner to be together in space and time. The invention of script allowed knowledge (information) to be created and stored, which could then be accessed by others, in space and time asynchronous manner, which greatly allowed its expansion. The invention of print technology greatly expanded the speed in which books could be created and shared widely across the world. The invention of Radio and TV allowed for large scale sharing of knowledge across space and time, in audio and video formats. Though in each step, the speed of knowledge creation and sharing increased exponentially, it is in the last step that the knowledge processes have in addition, become much more democratic, where it is now possible for average citizens to participate in creating, storing, sharing and publishing knowledge. This is the 'digital' mode, in which knowledge is created, stored, shared and published in a 'digital' form (electronic binary) which supports a combination of text, image, audio, video forms of knowledge creation, storing, sharing and publishing.

A new world

The digital mode, enables much easier construction of knowledge through use of not only computers but also (digital) cameras, (digital) audio recorders. Software tools that can help us edit knowledge on the computer, in text, number, image, audio and video formats are available for universal use. The digital medium is amazing in storing information – a standard hard disk of 250 Giga bytes can store information available in thousands of texts/books. The most spectacular changes is in the sharing of information – the digital travels at the speed of light (as electrons) and an email can travel across the globe in a sub second. The invention of the Internet and protocols such as tcp-ip have made sharing lighting fast and extremely inexpensive. So much so that the most difficult task of 'publishing' has now become a common place activity with the creation of the web 2.0 – tools like blogs, wikis, social networking now support the world wide publishing of any information created by any person having a computer and broadband connectivity to share globally. In addition, the explosion of software tools has greatly aided this process – apart from of course web browsers, we have machine translation of languages, simulation and gaming tools, educational tools, dictionaries, thesauruses, screen readers, Braille readers etc. each of which has a significant impact on the knowledge processes. The table below provides a snapshot of this knowledge revolution across civilisation.

Table – Evolution of knowledge systems

Knowledge model / Basis	construction	Storage	Sharing	Publishing	Features
Oral / Language	Oral	Human memory	Speaking - Hearing	Not possible	Requires synchronicity of space and time
Written / Script	Text	Books	Physical	Not possible	Share knowledge across space and time, but in limited manner

Print / Printing	Text	Books	Physical	Books	Explosion
Mass Media/ Radio, TV	Analogue-Audio, video	Cassettes	Physical		Mass reach across space and time
Digital (ICT)	Digital methods (text / audio / video editors.	Digital storage (disks)	Email,	Websites, blogs, Wikis – Web 2.0 permits 'desktop publishing'	Dream of 'knowledge of all – for all – by all' possible (Wikipedia) knowledge spreads very fast and very Wide. Much easier construction and much Wider possibilities – text, audio, video

Teaching learning – a knowledge process

Teaching learning being essentially a knowledge process, has also been significantly impacted by these revolutions. From purely oral cultures (like our Gurukuls) schools have adapted text very ell (so much so that text book is synonymous with school). Ho ever, subsequent revolutions have not been equally incorporated into our learning systems. Radio and TV heralded much promise but have not seemed to realise their promise. One important reason for this failure is that unlike the text which is passive enough to allow the teacher -student to locally interpret/decode, radio and TV have been broadcast instruments which have appeared to deprive the need for local meaning making. The digital medium has the capacity to allow local knowledge construction and also supports all the modes (text, audio, video) that the previous modes supported. Hence its potential for revolutionising teaching learning needs to be explored. However this exploration needs to be firmly grounded in both educational aims/philosophies as ell as educational contexts and anchored by Educationists to be successful. Huge investments over the last decade in ICTs in education have failed largely because they have been driven by technologists without such understanding.

Key principles for ICTs and learning

From our on research as well as programmatic work, e have arrived a few foundational principles for enabling best use of digital technologies

1. focus on teacher and teacher training and not on direct student learning using ICTs (ICTs are complex and need to be interpreted to young minds and hence teachers need to build their on capacities before they can do such interpretation). The successful models have al focused on teachers

2. focus on computer / ICT aided learning and not on computer literacy

3. focus on systemic improvement rather than on specific topics/subjects

4. focus on keeping 'public ownership' over knowledge resources instead of privatising knowledge

Most importantly, the use of ICTs needs to focus on the requirements and priorities of the education system, rather than being a stand-alone experiment on some fringe issues. Educationists acknowledge that teachers are the single most important element of the school system and the country is already facing a severe shortage of qualified and motivated school teachers at different levels. Hence the use of ICTs to support teacher education could be a powerful method.

Teacher education system

Current / traditional teacher training limitations are known – being based on centralised modules rather than on individual learning needs of each teacher, lack of on-site support during actual transaction (conversely lack of monitoring on actual implementation of the workshop training), scale of training does not allow for sufficient time for reflection and peer learning/sharing. The training does not remove the isolation of the school/teacher from other institutions of learning – there is no live linkages with DIET-BRC-CRC academic support institutions as well as university departments of education, which deprives teachers of opportunities to connect with peers and mentors for their learning and also deprives education system of vital links between research/theory and practice. These limitations affect the impact of the huge amounts being invested in this area.

The NCF TE 2010 document suggests "Teachers need to be creators of knowledge and thinking professionals. They need to be empowered to recognize and value what children learn from their home, social and cultural environment and to create opportunities for children to discover, learn and develop. Educationists are also of the view that the burden arises from treating knowledge as a 'given', as an external reality existing outside the learner and embedded in textbooks. This view of education points to the need to take a fresh look at teacher preparation. Education is not a mechanical activity of information transmission and teachers are not information dispensers. Teachers need to be looked at as crucial mediating agents through whom curriculum is transacted and knowledge is co-constructed along with learners. Textbooks by themselves do not help in developing knowledge and understanding. Learning is not confined to the four walls of the classroom. For this to happen, there is a need to connect knowledge to life outside the school and enrich the curriculum by making it less textbook. The NCF TE says "In this situation, it is necessary to conceive ways in which teachers can opt for different kinds of trainings, based on their interest and requirement, and along with the recommendation of school supervisors.

Knowledge access

The diversity and richness of learning resources has a direct impact on teaching learning. Exposing teachers to a wide variety of such resources would meet diverse learning needs, excite their curiosity and interest, provoke thinking, support creativity etc. The world wide web is easily the most powerful knowledge source in the world today, with wikipedia, one website itself having the ambition of 'providing all knowledge in the world to all. Wikipedia is in hundreds of languages including most popular Indian languages. There are also websites primarily aimed at academic readership from Google scholar to Scribd etc. Knowledge is not only in text form, Youtube is a popular video site which has millions of videos related to teaching learning. KhanAcademy website has hundreds of short videos on different topics. Apart from the world wide web which can be accessed from any computer with an Internet connection, there are also special devices – e-readers are a kind of computer, specialised in providing books and publications to people, presented in a format close to that of a book (see image of Kindle, a popular e-reader from Amazon).

Knowledge store

Apart from individual computers, whose hard disks can store large amounts of information (and digital forms include audio/video as easily as text), websites/portals, wikis, blogs are all information stores that cover virtually every topic of learning. The power of the digital store is that it is very easy for it to be available for all, for posterity, while other stores are more vulnerable to destruction. Once an information is available on the Internet, it is difficult to suppress or remove it (for e.g. Efforts to remove wilkileaks server have not made any dent on access to its information, since it is now stored on hundreds of other computers, connected to the Internet).

Knowledge construction

The most important power of the digital format is that, knowledge construction has become a far simpler, easier and cheaper process. Apart from software tools like text, image, audio and video editors now available universally, (digital) devices too have become far cheaper – from cameras, to cell phones, to audio recorder, apart from computers. Netbooks with all sophisticated features, with 8 hour power backup, weighing 1 kilogram in weight are now available for less than 15000 and need to be seen as an essential pedagogical tool that all teacher must have (and more importantly, learn how to use the device well). There are also innumerable software applications in different subjects that teachers can use to deepen their own conceptual and subject matter understanding.

Knowledge sharing

The digital format allows for easy and instantaneous sharing, which can support collaboration possibilities in myriad ways – amongst teachers, between teachers and teacher educators, with mentors. Apart from collaborating for sharing information, such networks can also be used for creating position papers, responding to policy documents, engaging with other stakeholders etc.

Thus the new digital world can help us to to re-look the TE policy and program for elementary and higher education, covering both pre-service and in-service education. Use of the digital methods can help us to emphasise aspects of independent, need based, self directed and self paced learning with continuous mentoring, which can pioneer new models of teacher professional development (TPD).

Way forward

Karnataka education system must thus support the creation of the 'digital culture of learning' amongst teachers and teacher educators through appropriate policy and program, which can include following elements

1. Access to computers and Internet for every teacher (providing interest free loans to teachers to buy inexpensive netbooks/ latptops – Gujarat and Kerala have already done this. Kerala has been able to negotiate netbooks for even around 11,000)

2. Access to related devices such as (digital) cameras, projectors, video cameras[1], e-readers

3. Capacity building for teachers to understand the digital knowledge world – what it is, how it works, how it can support learning and what are its limitations and dangers

4. Hand-holding and support systems at cluster/block/district levels

5. Curriculum changes to support digital methods of teaching learning

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IT for Change (www.ITforChange.net), Bengaluru, February 10th 2011

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1 Access to devices is a necessary starting point. Yet the failure of past programs has been due to over emphasis on only hardware provision – capacity building investment needs to be at least 10 times the hardware investment, to get the best value from the new digital methods. Secondly the program needs to emphasise knowledge construction and an 'upload' mindset, and not only see ICT as a 'download' information method.