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The role of ICT in higher education for the 21st century

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Abstract

Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of Endeavour within business and governance. Within education, ICT has begun to have a presence but the impact has not been as extensive as in other fields. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centered learning settings and often this creates some tensions for some teachers and students. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. This paper highlights the various impacts of ICT on contemporary higher education and explores potential future developments. The paper argues the role of ICT in transforming teaching and learning and seeks to explore how this will impact on the way programs will be offered and delivered in the universities and colleges of the future.

Introduction:

Information and communication technology (ICT) is a force that has changed many aspects of the way we live. If one was to compare such fields as medicine, tourism, travel, business, law, banking, engineering and architecture, the impact of ICT across the past two or three decades has been enormous. The way these fields operate today is vastly different from the ways they operated in the past. But when one looks at education, there seems to have been an uncanny lack of influence and far less change than other fields have experienced. A number of people have attempted to explore this lack of activity and influence (Soloway and Prior, 1996; Collis, 2002). There have been a number of factors impeding the wholesale uptake of ICT in education across all sectors. These have included such factors as a lack of funding to support the purchase of the technology, a lack of training among established teaching practitioners, a lack of motivation and need among teachers to adopt ICT as teaching tools (Starr, 2001). But in recent times, factors have emerged which have strengthened and encouraged moves to adopt ICTs into classrooms and learning settings. These have included a growing need to explore efficiencies in terms of program delivery, the opportunities for flexible delivery provided by ICTs (Oliver and

Short, 1997); the capacity of technology to provide support for customized educational programs to meet the needs of individual learners (Kennedy & McNaught, 1997); and the growing use of the Internet and WWW as tools for information access and communication (Oliver & Towers, 1999).

As we move into the 21st century, these factors and many others are bringing strong forces to bear on the adoption of ICTs in education and contemporary trends suggest we will soon see large scale changes in the way education is planned and delivered as a consequence of the opportunities and affordances of ICT. This paper seeks to explore the likely changes we will see in education as ICT acts as a powerful agent to change many of the educational practices to which we have become accustomed. In particular, the paper will explore the impact both current and emerging information and communication technologies will be likely to have in coming years on what is learned, when and where learning will take place and how the learning will occur.

The impact of ICT on what is learned

Conventional teaching has emphasized content. For many years course have been written around textbooks. Teachers have taught through lectures and presentations interspersed with tutorials and learning activities designed to consolidate and rehearse the content. Contemporary settings are now favouring curricula that promote competency and performance. Curricula are starting to emphasize capabilities and to be concerned more with how the information will be used than with what the information is.

a. competency and performance-based curricula

The moves to competency and performance-based curricula are well supported and encouraged by emerging instructional technologies (Stephenson, 2001). Such curricula tend to require:

- ✓ access to a variety of information sources;
- ✓ access to a variety of information forms and types;
- ✓ student-centered learning settings based on information access and inquiry;
- ✓ earning environments centered on problem-centered and inquiry-based activities;
- ✓ authentic settings and examples; and
- ✓ teachers as coaches and mentors rather than content experts.

Contemporary ICTs are able to provide strong support for all these requirements and there are now many outstanding examples of world class settings for competency and performance-based curricula that make sound use of the affordances of these technologies (Oliver,2000). For many years, teachers wishing to adopt such curricula have been limited by their resources and tools but with the proliferation and widespread availability of contemporary ICTs, many restrictions and impediments of the past have been removed. And new technologies will continue to drive these forms of learning further. As students and teachers gain access to higher bandwidths, more direct forms of communication and access to sharable resources, the capability to support these quality learning settings will continue to grow.

b. information literacy

Another way in which emerging ICTs are impacting on the content of education curricula stems from the ways in which ICTs are dominating so much of contemporary life and work. Already there has emerged a need for educational institutions to ensure that graduates are able to display appropriate levels of information literacy, "the capacity to identify and issue and then to identify, locate and evaluate relevant information in order to engage with it or to solve a problem arising from it" (McCausland, *et al.* 1999). The drive to promote such developments stems from general moves among institutions to ensure their graduates demonstrate not only skills and knowledge in their subject domains but also general attributes and generic skills. Traditionally generic skills have involved such capabilities as an ability to reason formally, to solve problems, to communicate effectively, to be able to negotiate outcomes, to manage time, project management, and collaboration and teamwork skills. The growing use of ICTs as tools of every day life have seen the pool of generic skills expanded in recent years to include information literacy and it is highly probable that future developments and technology applications will see this set of skills growing even more.

The impact of ICT on how students learn

Just as technology is influencing and supporting what is being learned in schools and universities, so too is it supporting changes to the way students are learning. Moves from content-centered curricula to competency-based curricula are associated with moves away from teacher-centered forms of delivery to student-centered forms. Through technology-facilitated approaches, contemporary learning settings now encourage students to take responsibility for their own learning .In the past students have become very comfortable to learning through Tran missive modes. Students have been trained to let others present to them the information that forms the curriculum. The growing use of ICT as an instructional medium is changing and will likely Continue to change many of the strategies employed by both teachers and students in the learning process. The following sections describe particular forms of learning that are gaining prominence in universities and schools worldwide.

a. Student-centered learning

Technology has the capacity to promote and encourage the transformation of education from a very teacher directed enterprise to one which supports more student-centered models. Evidence of this today is manifested in:

- ✓ The proliferation of capability, competency and outcomes focused curricula
- ✓ Moves towards problem-based learning
- ✓ Increased use of the Web as an information source, Internet users are able to choose the experts from whom they will learn the use of ICT in educational settings, by itself acts as a catalyst for change in this domain. ICTs by their very nature are tools that encourage and support independent learning. Students using ICTs for learning purposes become immersed in the

process of learning and as more and more students use computers as information sources and cognitive tools (Reeves & Jonassen, 1996), the influence of the technology on supporting how students learn will continue to increase.

b. Supporting knowledge construction

The emergence of ICTs as learning technologies has coincided with a growing awareness and recognition of alternative theories for learning. The theories of learning that hold the greatest sway today are those based on constructivist principles (Duffy and Cunningham, 1996). These principles posit that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts. In constructivist theories, social interactions are seen to play a critical role in the processes of learning and cognition (Vygotsky, 1978). In the past, the conventional process of teaching has revolved around teachers planning and leading students through a series of instructional sequences to achieve a desired learning outcome. Typically these forms of teaching have revolved around the planned transmission of a body of knowledge followed by some forms of interaction with the content as a means to theory is based on the notion that learning is an active process of constructing knowledge rather than acquiring knowledge and that instruction is the process by which this knowledge construction is supported rather than a process of knowledge transmission (Duffy and Cunningham, 1996). The strengths of constructivism lie in its emphasis on learning as a process of personal understanding and the development of meaning in ways which are active and interpretative. In this domain learning is viewed as the construction of meaning rather than as the memorisation of facts (Lebow, 1993; Jonassen and Reeves, 1996). Learning approaches using contemporary ICTs provide many opportunities for constructivist learning through their provision and support for resource-based, student centered settings and by enabling learning to be related to context and to practice (Berge, 1998; Barron, 1998). As mentioned previously, any use of ICT in learning settings can act to support various aspects of knowledge construction and as more and more students employ ICTs in their learning processes, the more pronounced the impact of this will become.

The impact of ICT on when and where students learn

In the past educational institutions have provided little choice for students in terms of the method and manner in which programs have been delivered. Students have typically been forced to accept what has been delivered and institutions have tended to be quite staid and traditional in terms of the delivery of their programs. ICT applications provide many options and choices and many institutions are now creating competitive edges for themselves through the choices they are offering students. These choices extend from when students can choose to learn to where they learn.

a. any place learning

The concept of flexibility in the delivery place of educational programs is not new (Moore and Kearsley, 1996). Educational institutions have been offering programs at a distance for many years and there has been a vast amount of research and development associated with establishing effective practices and procedures in off-campus teaching and learning. Use of the technology, however, has extended the scope of this activity and whereas previously off-campus delivery was an option for students who were unable to attend campuses, today, and many more students are able to make this choice through technology-facilitated learning settings. The scope and extent of this activity is demonstrated in some of the eg. below.

- ✓ In many instances traditional classroom learning has given way to learning in work-based settings with students able to access courses and programs from their workplace. The advantages of education and training at the point of need relate not only to convenience but include cost savings associated with travel and time away from work, and also situation and application of the learning activities within relevant and meaningful contexts.
- ✓ The communications capabilities of modern technologies provide opportunities for many learners to enroll in courses offered by external institutions rather than those situated locally. These opportunities provide such advantages as extended course offerings and eclectic class cohorts comprised of students of differing backgrounds, cultures and perspectives.
- ✓ The freedoms of choice provided by programs that can be accessed at any place are also supporting the delivery of programs with units and courses from a variety of institutions, There are now countless ways for students completing undergraduate degrees for example, to study units for a single degree, through a number of different institutions, an activity that provides considerable diversity and choice for students in the programs they complete.

b. anytime learning

In concert with geographical flexibility, technology-facilitated educational programs also remove many of the temporal constraints that face learners with special needs (Moore and Kearsley, 1996). Students are starting to appreciate the capability to undertake education anywhere, anytime and anyplace. This flexibility has heightened the availability of just-in-time learning and provided learning opportunities for many more learners who previously were constrained by other commitments (Young, 2002).

- ✓ Through online technologies learning has become an activity that is no longer set within programmed schedules and slots. Learners are free to participate in learning activities when time permits and these freedoms have greatly increased the opportunities for many students to participate in formal programs.
- ✓ The wide variety of technologies that support learning are able to provide

asynchronous supports for learning so that the need for real-time participation can be avoided while the advantages of communication and collaboration with other learners is retained.

- ✓ As well as learning at anytime, teachers are also finding the capabilities of teaching at any time to be opportunistic and able to be used to advantage. Mobile technologies and seamless communications technologies support 24x7 teaching and learning. Choosing how much time will be used within the 24x7 envelope and what periods of time are challenges that will face the educators of the future (Young, 2002). The continued and increased use of ICTs in education in years to come, will serve to increase the temporal and geographical opportunities that are currently experienced. Advancements in learning opportunities tend to be held back by the ICT capabilities of the lowest common denominator, namely the students with the least access to ICT. As ICT access increases among students so too will these opportunities.

Emerging Issues

A number of other issues have emerged from the uptake of technology whose impacts have yet to be fully explored. These include changes to the makeup of the teacher pool, changes to the profile of who are the learners in our courses and paramount in all of this, changes in the costing and economics of course delivery.

a. expanding the pool of teachers

In the past, the role of teacher in an educational institution was a role given to only highly qualified people. With technology-facilitated learning, there are now opportunities to extend the teaching pool beyond this specialist set to include many more people. The changing role of the teacher has seen increased opportunities for others to participate in the process including workplace trainers, mentors, specialists from the workplace and others. Through the affordances and capabilities of technology, today we have a much expanded pool of teachers with varying roles able to provide support for learners in a variety of flexible settings. This trend seems set to continue and to grow with new ICT developments and applications. And within this changed pool of teachers will come changed responsibilities and skill sets for future teaching involving high levels of ICT and the need for more facilitative than didactic teaching roles (Littlejohn et al., 2002).

b. expanding the pool of students

In the past, education has been a privilege and an opportunity that often was unavailable to many students whose situation did not fit the mainstream. Through the flexibilities provided by technology, many students who previously were unable to participate in educational activities are now finding opportunities to do so. The pool of students is changing and will continue to change as more and more people who have a need for education and training are able to take advantage of the increased opportunities. Interesting opportunities are now being observed among, for example, school students studying university courses to overcome limitations in their school programs and workers undertaking courses from their desktops.

c. the cost of education

Traditional thinking has always been that technology-facilitated learning would provide economies and efficiencies that would see significant reductions in the costs associated with the delivery of educational programs. The costs would come from the ability to create courses with fixed establishment costs, for example technology-based courses, and for which there would be savings in delivery through large scale uptake. We have already seen a number of virtual universities built around technology delivery alone (eg. Jones International University, www.jiu.edu). The reality is that few institutions have been able to realize these aims for economy. There appear to have been many underestimated costs in such areas as course development and course delivery. The costs associated with the development of high quality technology-facilitated learning materials are quite high. It has found to be more than a matter of repackaging existing materials and large scale reengineering has been found to be necessary with large scale costs. Likewise costs associated with delivery have not been found to diminish as expected. The main reason for this has been the need to maintain a relatively stable student to staff ratio and the expectation of students that they will have access to teachers in their courses and programs. Compared to traditional forms of off-campus learning, technology-facilitated learning has proven to be quite expensive in all areas of consideration, infrastructure, course development and course delivery. We may have to brace ourselves for the advantages and affordances which will improve the quality of education in the near future to also increase components of the cost.

Stakeholders and influences

The ideas that have been discussed in this paper suggest that while ICTs may not have had a large impact to date, their use will grow to play a significant role in many aspects of the design, development and delivery of educational programs in the coming years. The various influences that have been discussed provide examples of an agent that has the capacity to influence education at all levels and hence to be an agent supporting and encouraging considerable change. When the future of education is considered in this way, it is interesting to speculate among the stakeholders, for whom the change will be the greatest. Clearly the stakeholders for whom technology would seem to proffer the most influence and change are the students. So while institutions are pondering how they will be influenced in years to come, whatever the outcomes, the beneficiaries of the activity and change will be the students.

Summary and Conclusions

This paper has sought to explore the role of ICT in education as we progress into the 21st century. In particular the paper has argued that ICTs have impacted on educational practice in education to date in quite small ways but that the impact will grow considerably in years to come and that ICT will become a strong agent for change among many educational practices. Extrapolating current activities and

practices, the continued use and development of ICTs within education will have a strong impact on:

- ✓ What is learned;
- ✓ How it is learned;
- ✓ When and where learning takes place;
- ✓ Who is learning and who is teaching.

The upshot of all this activity is that we should see marked improvements in many areas of educational endeavour. Learning should become more relevant to stakeholders' needs, learning outcomes should become more deliberate and targeted, and learning opportunities should diversity in what is learned and who is learning. At the same time, quality of programs as measured by fitness for purpose should continue to grow as stakeholder groups find the offerings matched to their needs and expectations. To ensure that the opportunities and advantages are realized, it will be important as it is in every other walk of life to ensure that the educational research and development dollar is sustained so that education at large can learn from within and that experiences and activities in different institutions and sectors can inform and guide others without the continual need for re-invention of the wheel. Once again ICTs serve to provide the means for much of this activity to realize the potential it holds.

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Virtualization of education in Modern era

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Abstract

Present world has become technical drastically. Education also includes its features for to cope the global objectives. This educational technology called virtual education by which everybody can get the accessible education. Virtual education or we can say it gives a new definition to portable education. Virtual education is completely based on electronic, which is needed the eligibility of higher technical user. Therefore, this paper purposes to provide the knowledge about the virtualization of education and required feature for its implication.

At first this paper discussed, educational virtualization is a virtual learning environment created with computer network communication and multimedia technology. It allows teachers and students to aware each other in different location and to undertake many of the teaching learning activities of physical classroom environment through real time communication.

This paper also included the discussion on how virtual classroom introducing India a knowledge economy. This segment prescribes that how Indian Government today emphasize virtual education instead of traditional education which is required by present society. Virtual classroom though at a nascent stage in India may provide a solution to the excessive demand of brick and motor institute. The platform of virtual education enables simulation of face-to-face interaction with the students while maintaining the control of classroom by the teachers. It enhances the learning experiences with its advanced feature like- whiteboards, audio-video, content sharing, chatting etc.

Further this paper through a light on importance and drawbacks of virtual education. Including the importance, this paper shows how virtual education is a way to achieve quality-based education. Virtual schools hold advantages not being required to attend and travel to face-to-face classes and integrating the digital media in to the curricula. It replaced the traditional features of education system and also provide the golden opportunity to several kind of educational deprived people. It also a fine way to achieve flexibility in educational system and support to critical thinking activities which is according to our contemporary age.

Mentioning the drawbacks of educational virtualization this paper discussed so many drawbacks just like- the lack of technical tactics in Indian educational system, lack of motivation, unconscious, ignorance and frustration related to computer and other technical skills, pedagogy level of Indian education and the status of teachers and pupil in Indian educational scenario. Besides it lack of administrative support, social mobility, traditional thinking level, differentiation between urban and rural pattern are some other resistance in achievement of educational virtualization.

Lastly, the paper gives a short tip that how we enhance the pattern of the educational virtualization in India. Besides it present paper shows that the race of converting traditional education in to educational internationalization is bigger in India. So many higher educational institutes provide virtual education facility in India.

Introduction

In modern era, the world has become technically enhanced in every field such as-social, economical, industrial etc. The educational field is also not escape from the effect of modern technological tactics. We find a great improvement and development in modern educational phenomenon. Present educational system in India is quite perturbing as compared to 1.80 million schools in China India has only 1.20 million. Against 900 universities in China and 3600 in USA, India has only 362 universities. Further about 26 million peoples are added every year to the existing educational system. Making it easily task to provide quality education and educational virtualization is the method to achieve the goal of quality education of Indian educational phenomenon.

The mid 1990s shows an adventives feature in educational section and that is starting of virtual schools. Although virtual schooling is largely a phenomenon that occurs in Northern America but it is a relevant face of contemporary Indian Educational System.

Meaning of Virtual Education:- A virtual school or a classroom is based on the use of modern technologies in teaching learning methods which helps to increase the pedagogical Knowledge and their cognition. Educational virtualization is also a kind of teaching learning process based on the principle of active pedagogy with the possibility of synchronous and asynchronous interaction. It is an online learning platform offered by an educational organization where by individuals can earn credits in the particular area of interest that can be counted toward graduation or advancement to the next grade.

Classroom: A Key to Make India a Knowledge Economy

Virtual classroom is the answer the storage of quality education provides not just within in India but also abroad. There is a huge demand of Indian teachers not only in entire India but also worldwide. Indian students travel miles to develop nations to pursue higher education with new age technology and knowledge sharing platform in India and abroad. The Government of India, in taken so many decisions to change the teaching pattern of Indian education and accept the essentiality of educational virtualization in higher education field but India is observing a reverse trend. Virtual classrooms though at a nascent stage in India, may provide a solution to the excessive demand of brick and motor institute.

The discussion also highlighted many aspect of Indian educational scenario including the booming of coaching practice. “Coaching practices is growing highly commercial in India, preparation for entire examination for IIT, IIM and other institute of repute attract 60 laks application, who spend an average of nearly 12000 each on coaching amounting rupees 7200 crore per year. A coaching institute serving students through correspondence and online, which trend emphasized to the need of educational virtualization in India. The platform enables simulation of face-to-face interaction with the students while maintaining the control of classroom by the

teachers. It enhances the learning experiences with its advanced feature like-whiteboards, audio-video, content sharing, chatting etc. In fact, next two cloning virtual classroom could be the best solution to the storage of quality education provides the globe.

Importance and Drawback of Virtual Education

Everything in this world related to different field has dual features just as a coin. The whole world and related things has some advantages and disadvantages also. The idea of educational virtualization is also not escaped from this philosophy of the nature.

Virtual school hold advantages including: not being required to attend and travel to face-to-face classes and integrating the digital media in to the curricula. Virtual schools can be considered a great equalizer, as these schools can make education accessible to non-traditional students. Additionally, students with physical disabilities or transportation issues may find that they are able to succeed in virtual school without the burden of getting to a physical location for schooling. The idea of virtual classroom may change the rigid olden pattern of education that force to students for traditional brick and motor schools. Now the new trend gives an opportunity to our students to learn more according to their interest and need without the boundation of time and location. In our society, so many people are facing so many problems so that they hesitated to social interaction. This is the reason they do not like to be the part of our formal educational pattern just like-physical handicapped, industrial worker (they may no more time for study), teen pregnant women and others. The virtual classroom a golden opportunity to all those kind of people so that they cannot only educate themselves but by self-development, they will be the part of globalization.

Flexibility is one of the great advantage of online education which driven the individuals in learning environment allows them to excel them to own pace. Virtual classrooms also provide the critical thinking activities environment according to the modern age. Individual who participate in virtual schooling have the opportunity to integrate other means of technology into their knowledge production. Individuals who participate in virtual schooling have the advantage of building upon their twenty-first century skills, which include global awareness, computer literacy, self-directed learning, online communications, collaboration and employable resources.

Drawbacks

Although there are so many advantages of virtual education but so many drawbacks are also makes it a convoluted just as if we are taking about in Indian education first drawback is so many resistance of technical education such as- unfortunately today a huge number of Indian teachers not have a higher technical skill required for virtual education. Sometime the resistance is very strong because there are so many big factors that influence this resistance: ignorance and lack of motivation and unconscious resistance just like: computer related frustration or some kind of omnipotence.

Another challenge of virtual education is the pedagogic level of Indian education. To teach in a virtual classroom does not mean to film a traditional class and to put it in the internet so that the students attend virtually; neither it means to record it, to transcribe it in text and then to copy it in a web page. It means to transform the traditional pedagogy toward a technical pedagogy. In current scenario, the Indian pedagogy spouses that our teacher should be qualified in new pedagogic techniques but feels it too much difficult because of lack of technical education environment. One of other difficulty of virtual classroom is the traditional social Indian background, which is not so based on technological tactics. This is why our students are not so familiar with the virtual feature of Indian education. The students hesitate to take an active position in their search for their knowledge with the use of technical base technique. Besides it lack of required administrative support, lack of more technical equipment which resistance for virtual education, the traditional social structure of India, lack of social mobility and a huge different of rural and urban education features are so many resistance in the accessibility of educational virtualization which can be prevented because this is the need of our modern era.

Conclusion

India is a country of tremendous brain and skill, which is demanded in all over the worldwide. It is also a great educational hub since past. Nalanda and takshila were one of the most developed universities of world in contemporary era. Today Indian government takes a great interest in enhancement of education. In this way, government has announced so many reformative rules and regulation in the entire educational sector (primary, secondary and higher education). Government of India is too much aware about the development of higher educational sector so many more our requirement attracts the government attention towards the formulas of higher education enhancement. Government of India takes so many steps about this. 15 bills are still awaiting discussion and approved in the parliament. This shows the seriousness of government about the change of the traditional educational face in India. One of the approach is to make internationalization of Indian higher education effective, is to develop a coherent and comprehensive policy, which aims at infusing excellence, bringing institutional diversity. In modern era, so many Indian higher educational institutes set themselves as an icon in educational virtualization trends just as- IIT, IIM, JNU, AIIMS etc. However, today there are so many challenges and hindrances are waiting for a perfect solution in the achievement of educational virtualization. If we take a right step towards educational virtualization with a concern of its flaws, then we can make a great change not only in the field of distance education but also in our entire educational system. Thus, we can make our students development that is not limited to the national level but also with the part of entire globe.

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Role of ICT in Higher Education

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Abstract

Presently higher education is experiencing a major transformation in terms of access, equity and quality. This transition is highly influenced by the swift developments in information and communication technologies (ICTs) all over the world. The introduction of ICTs in the higher education has profound implications for the whole education process especially in dealing with key issues of access, equity, management, efficiency, pedagogy and quality. At the same time the optimal utilization of opportunities arising due to diffusion of ICTs in higher education system presents a profound challenge for higher educational institutions. The paper discusses about the benefits and challenges posed by integration of ICTs in various aspects of higher education in the present scenario.

Introduction

Higher education systems have grown exponentially in the last five decades to meet the demands of quality education for all. This aspect has further gained momentum due to swift advancements in Information and Communication Technology (ICT). Demand for skilled and competent labour is ever increasing in the contemporary globalised society. In this backdrop, access to quality in higher education for all has emerged as determining factor of economic growth and development. In order to increase the access to higher education and improving its reach to everyone, contribution of open and distance learning facilities is on the increase. One of the distinctive features of human beings is their ability to acquire knowledge. Transfer of knowledge, which is one of the foundations of learning, is among the most fundamental social achievements of human beings. Building strong relationships with students is something that frequently explains why faculty takes pleasure in the challenge of working at a small university.

The concept of moving the traditional classroom of desks, notebooks, pencils, and blackboard to an online forum of computers, software and the Internet, intimidates many teachers who are accustomed to the face-to-face interaction of the traditional classroom. In the past 10 years, online instruction has become extremely popular as is evident in the rise of online universities, such as University of Phoenix Online and Athabasca University (Canada), and on-campus universities offering online courses and degrees, such as Harvard University and University of Toronto. For many students who find it difficult to come to campus due to

employment, family responsibilities, health issues, and other time constrains, online education is the only option. Advancements, standards, specifications and subsequent adoptions have led to major growth in the extensibility, interoperability and scalability of e-learning technologies. E-learning is fast becoming a major form of learning. Computer multimedia offers ideal opportunities for creating and presenting visually enriched learning environments.

Management institutes and educators have attempted an increased incorporation of collaborative group work, problem-solving and decision-making through technology as an integral component of pedagogy. There is no doubt that technology-based tools can enhance student's cognitive performance and achievements if used appropriately, in accordance with knowledge learning and as part of a coherent educational approach, computer-based systems have great potential for delivering teaching and learning material. The rapid development of Information and Communication Technology (ICT), particularly the Internet, is one of the most fascinating phenomena characterizing the Information age. ICT powers our access to information, enables new forms of communication, and serves many on-line services in the spheres of commerce, culture, entertainment and education.

Information and Communication Technologies (ICT):

Information and Communication Technologies (ICTs) are referred to as the varied collection of technological gear and resources which are made use of to communicate. They are also made use of to generate, distribute, collect and administer information. ICT is a force that has changed many aspects of the way we live. Information and Communication Technologies consist of the hardware, software, networks, and media for collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services. ICTs can be divided into two components, Information and Communication Infrastructure (ICI) which refers to physical telecommunications systems and networks (cellular, broadcast, cable, satellite, postal) and the services that utilize those (Internet, voice, mail, radio, and television), and Information Technology (IT) that refers to the hardware and software of information collection, storage, processing, and presentation.

Role of ICT in Higher Education:

In the current information society, people have to access knowledge via ICT to keep pace with the latest developments. In such a scenario, education, which always plays a critical role in any economic and social growth of a country, becomes even more important. Education not only increases the productive skills of the individual but also his/her earning power. It gives them a sense of well-being as well as capacity to absorb new ideas, increases their social interaction, gives access to improved health and provides several more intangible benefits. The various kinds of ICT products available and having relevance to education, such as teleconferencing, email, audio conferencing, television lessons, radio broadcasts, interactive radio counseling, interactive voice response system, audiocassettes and CD ROMs have been

used in education for different purposes. The Information and Communication Technology (ICT) curriculum provides broad perspectives on the nature of technology, how to use and apply a variety of technologies, and the impact of ICT on self and society. Technology is about the ways things are done; the processes, tools and techniques that alter human activity. ICT is about the new ways in which people can communicate, inquire, make decisions and solve problems. It is the processes, tools and techniques for:

1. gathering and identifying information
2. classifying and organizing information
3. summarizing and synthesizing information
4. analyzing and evaluating information
5. speculating and predicting information

Enhancing and upgrading the quality of education and instruction is a vital concern, predominantly at the time of the spreading out and development of education. ICTs can improve the quality of education in a number of ways: by augmenting student enthusiasm and commitment, by making possible the acquirement of fundamental skills and by improving teacher training. ICTs are also tools which enable and bring about transformation which, when used properly, can encourage the shift an environment which is learner-centered. ICTs which can be in the form of videos, television and also computer multimedia software, that merges sound, transcripts and multicolored moving imagery, can be made use of so as to make available stimulating, thought provoking and reliable content that will keep the student interested in the learning process.

E-learning:

E-Learning or Electronic learning is a general term used to refer to computer-enhanced learning. It is commonly associated with the field of advanced learning technology (ALT), which deals with both the technologies and associated methodologies in learning using networked and/or multimedia technologies. It is also known as online learning. Distance education provided the base for e-learning's development. E-learning can be 'on demand'. It overcomes timing, attendance and travel difficulties. E-learning allows delivery, dialogue and feedback over the internet. It allows mass customization in terms of content and exams. E-education can provide access to the best gurus and the best practices or knowledge available (UNESCO, 2002). ICT can play a valuable role to monitor and log the progress of the students across time, place and varied activities. E-learning allows higher participation and greater interaction. It challenges the concept that face-to-face traditional education is superior to it (Bhattacharya and Sharma, 2007).

E-learning has the following advantages:

- Eliminating time and geographical barriers in education for learners as well as teachers.
- Enhanced group collaboration made possible via ICT.
- New educational approaches can be used.
- It can provide speedy dissemination of education to target disadvantaged groups.
- It offers the combination of education while balancing family and work life.

Benefits of ICT in education to the main stakeholders:

Stakeholder	Benefits
Students	• Increased access, • Flexibility of content and delivery, • Combination of work and education, • Learner-centred approach, • Higher-quality of education and new-ways of interaction.
Employers	• High quality, cost effective professional development in the workplace, • Upgrading of employee skills, increased productivity, • Developing of a new learning culture, • Sharing of costs and of training time with the employees, • Increased portability of training.
Governments	• Increase the capacity and cost effectiveness of education and training systems, • To reach target groups with limited access to conventional education and training, • To support and enhance the quality and relevance of existing educational structures, • To ensure the connection of educational institutions and curricula to the emerging networks and information resources, • To promote innovation and opportunities for lifelong learning

Source: UNESCO, 2002.

Potential Drawbacks-cum-Challenges to Using ICT in Education:

While using ICTs in education has some obvious benefits, ICTs also bring challenges. First is the high cost of acquiring, installing, operating and maintaining ICTs. While potentially of great importance, the integration of ICTs into teaching is still in its infancy. Introducing ICT systems for teaching in developing countries has a particularly high opportunity cost because installing them is usually more expensive in absolute terms than in industrialized countries whereas, in contrast, alternative investments (e.g. buildings) are relatively less costly (UNESCO, 2009).

Although ICT offers a whole lot of benefits there are some risks of using ICT in education which have to be mitigated proper mechanisms. They are:

- It may create a digital divide within class as students who are more familiar with ICT will reap more benefits and learn faster than those who are not as technology savvy.
- It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.

- It can affect the bonding process between the teacher and the student as ICT becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
- Also since not all teachers are experts with ICT they may be lax in updating the course content online which can slow down the learning among students.
- The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
- There is a need for training all stakeholders in ICT.
- The cost of hardware and software can be very high.

Conclusion:

The increasing use of information and communication technologies (ICTs) has brought changes to teaching and learning at all levels of higher education systems (HES) leading to quality enhancements. Traditional forms of teaching and learning are increasingly being converted to online and virtual environments. There are endless possibilities with the integration of ICT in the education system. The use of ICT in education not only improves classroom teaching learning process, but also provides the facility of e-learning. ICT has enhanced distance learning. The teaching community is able to reach remote areas and learners are able to access qualitative learning environment from anywhere and at anytime. It is important that teachers or trainers should be made to adopt technology in their teaching styles to provide pedagogical and educational gains to the learners. Successful implementation of ICT to lead change is more about influencing and empowering teachers and supporting them in their engagement with students in learning rather than acquiring computer skills and obtaining software and equipment. ICT enabled education will ultimately lead to the democratization of education.

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Promoting the use of information and communication technology in teaching learning process and teacher education

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Abstract

In the present scenario teacher needs to help their students in: How to learn, how to grow in future, how to develop study skills, how to conduct fundamental research, how to examine, evaluate, access information etc. This is necessary if the teacher really wants to survive in the communication technology (CT) Savvy world of education. This is possible only when traditional system of Teacher Education is sophisticatedly and technically integrated. For this purpose the workshops, seminars, symposia, house discussions, orientation courses should be organised appropriately and on firm pedagogical scaffolding. The teacher educator and individual teacher ought to be sincerely and persistently work hard towards this goal.

Introduction

Nowadays the role of Information and Communication Technology (ICT), especially internet in the education sector plays an important role, especially in the process of empowering the technology into the educational activities. Education sector can be the most effective sector to anticipate and eliminate the negative impact of ICT. Technology in another side can be the most effective way to increase the student's knowledge.

Being aware of the significant role of ICT in our life, especially in the educational activities, education authorities should be wise enough in implementing the strategies to empower ICT in supporting the teaching and learning process in the classroom. ICT is not just the bloom of the educational activities, but also it will be the secondary option to improve the effective and meaningful educational process.

In the present scenario teacher needs to help their students in: How to learn, how to grow in future, how to develop study skills, how to conduct fundamental research, how to examine, evaluate, access information etc. This is necessary if the teacher really wants to survive in the communication technology (CT) Savvy world of education. This is possible only when traditional system of Teacher Education is sophisticatedly and technically integrated. For this purpose the workshops, seminars, symposia, house discussions, orientation courses should be organised appropriately and on firm

pedagogical scaffolding. The teacher educator and individual teacher ought to be sincerely and persistently work hard towards this goal.

On internet many website are available which may be utilized by teacher and students for understanding different concept, improving vocabulary, developing reasoning and thinking etc. The information is transmitted to the user not only the textual but also through audio, video or any other media has opened new avenues, like, online learning ,e-learning ,virtual university ,e-coaching, e-education, e-journal etc. The ICT brings more rich material in the classroom and libraries for the teachers and students. It has provided opportunity for the learner to use maximum senses to get the information. It has broken the monotony and provided variety in the teaching-learning situation. The ICT beings the latest addition in the teaching learning process can be used both at school and higher education levels in the following areas:

- ✓ Teaching
- ✓ Diagnostic testing
- ✓ Remedial teaching
- ✓ Evaluation
- ✓ Psychological testing
- ✓ Virtual laboratory
- ✓ Online tutoring
- ✓ Development of reasoning and thinking
- ✓ Instructional material development

Integration Of (ICT) Communication Technology In Teacheing Learning Process

By integration of communication technology in teacher learning process we meant that the integration of electronic networks embodying the complex hardware and software linked by vast array of protocols. Communication technology (CT) stands for communication of information with the usage of electronic devices. Communication technology (CT) allow us to get information, to communicate, includes browsing and surfing, designing or authoring, communicating or teaching by using digital or electronic equipment's in teaching learning process. Communication technology is electronic or computerised devices and associated human interactive materials that enable the users to employ them to wide range of teaching learning process.

Communication technology is very powerful resource which can bring drastic changes in teaching learning process only then, when it is successfully integrated with curricular aspect of teacher education. Parents, teacher's students have a right to expect that teaching of all subjects in the curriculum should be taught through the best possible use of communication technology (ICT).

Communication Technology and Teacher Education:

The emergence of technology has been further applied to information which has revolution the process of the transmission of information. In the communication technology at present the wealth of information that is being transferred across the internet is impressive. Various mechanism like World Wide Web (www) browsers Email and news groups have been established to allow people to

access send or retry information across the world. The internet browsers like net scope and MS internet explorer enable searching viewing and displaying the information to any person interested in anything. Communication technology represents the current technology of application in the field of teacher education. In 1998 UNESCO in its world education report "Teacher and teaching in the changing world "describes the radical implementation of communication technology in conventional teaching learning process. Now in the present information &communication technology (ICT) is the integral part of the curriculum of teacher education.

Essential Conditions for the Effective Use of Communication Technology

1. Students and teachers must have sufficient access to digital technologies and internet in their classrooms, schools and teacher education institutes.
2. High quality, meaningful and culturally responsive digital content must be available for teacher educators.
3. Teachers must have the knowledge and skill to the use the new digital tools and resources to help the teacher educators for the achievement of high academic standards.

The use of ICT in teaching learning process can make remarkable changes and in training mainly in two ways: Firstly; the rich representation of information changes learner perception and understanding of the content. Secondly, the vast distribution and easy access to information can easily change the relationship between teacher and educator; it also can provide better strength to teaching learning process.

Use of Communication Technology for Teacher Educator and Teaching Learning Process

1. Communication technology in teacher education enhances the initial presentation by giving good teaching and training materials use of simulators, recording and feedback in teacher training.
2. With the help of advanced communication devices teacher educators and trainers can establish contact with other institutions, schools, and universities for rich resources in cyber space.
3. Modern communication technology makes interaction possible with students over a physical distance.
4. User friendly software and intelligent instructional strategy can definitely reduce the cost of teacher training.
5. Teacher Educators can develop professionally by providing instruction in a virtual situation, and through orientation and video conferencing.
6. IT can helps and facilitate the teacher educators for sharing of ideas, experiences as well as collaborating on projects and exchange information through virtual teaching learning Process.

ICT Benefits For Students And Teachers In Teaching Learning Process

- ✓ Computers can improve independent access for students to education.
- ✓ Students with profound and multiple learning difficulties can communicate more easily.
- ✓ Students using voice communication aids gain confidence and social credibility at school and their communities.
- ✓ Increased ICT confidence among students motivates then to use the internet at home for school work.
- ✓ Supports reflection on professional practice via online communication
- ✓ Improves skills of staff and a greater understanding of access technology used by students.

Present Status of Modern Communication Technology in Teacher Education

As far as the present status of communication technology and its integration with teacher education or with the colleges of teacher education, it is found that in most of the colleges unsatisfactory number of personal computers are available for teacher educators and these personal computers are not upgraded properly as according to the modern concept and requirement of communication technology in teacher education. Multimedia packages, internet facilities LCD projectors are not available in most of the teacher education institutions. No facilities for video conferencing network assessing are available in these institutions, even technical staff is not available in the teacher education institution to cater the needs and concept of integration of communication technology in teaching learning process. These are the basic issues of concern to integrate communication technology in teacher education. It is really subjected to the fillings of deep grievances that some of the institutions provides these facilities but are not in reach of poor students due to the heavy requirement of funds, most of the universities in India who awarding the degrees and diplomas in teacher education from university premises and also through the medium of private institutions and collects heavy funds have not been made basic provisions for the integration of ICT in teacher education. It springs the feelings of anxiety when we found that some of these universities even not have their ICT labs in their departments. Most of the teacher educators are computer illiterates, in most of the college's teacher educator are not concerned with integrating ICT in teaching.

Suggestions for Further Development and Better Integration of Communication Technology in Teaching Learning Process And Teacher Education

1. Qualified and well acquainted staff with modern concept of ICT should be appointed.
2. Proper resources should be generated for the better integration of advanced communication technology in teacher education, for example regulatory bodies of the university should provide multimedia packages, LCDs, other related resources to the private institutions.
3. Regular visit to private institution in order to verify the proper operation and establishment of university personals by the university, NCTE and UGC personals.
4. All the private and government institutions should be connected with internet facility
5. Technology integration team should be formed by every institution and sought out the basic errors and issues in relation to technology integration along with students and teachers.

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Use of Information & communication technology in Higher Education & Research: Need of the day

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Abstract

Technology touched and changed every aspect of our life very fast, Do you realize how dramatically world has changed? Can you remember, when was the last time that you use VCR or VCD, sent a film roll to be developed, use public telephone etc. and now you think about your class room and teaching methods, are they still old as before 40-50 years?. We have the students which starts using Facebook, twitter etc. at the age of 6-7 years in their routine lifestyle, but when they enter in classroom they found themselves in age-old situation. So it is the time to think about teaching methods, it is the time to know about ICT tools and techniques useful in teaching and research. We are now living in the era of technology and evolution of internet has affected all part of life dramatically. Also the area of education has not remained untouched. Previously, student used to spend their time in library searching for information in books and journals. Now a days required information is just a click away from them, they use web search engines such as yahoo, google, MSN, Yandex, etc and figure out the web sites containing the desired information. The information sharing has become very easy due to access on World Wide Web (www) as the world persons and their knowledge attach to each other by a web and can be transferred to each other. Technology-integrated education is still a dream at all levels of education in India. Though computers are available in most of the educational institutes, however these are mostly used to learn about computers. Rarely they are used as tools for the teaching and learning of other curriculum areas. With the evolution of computer, software's and internet the traditional education tools are going to change without affecting the basic goals of education. The opportunity to use computers for teaching and learning should not be a privilege. It should be a right, just as it is only right that children should have access to books, pens and paper.

This paper discuss how the commonly available technology resources (Computers, TV, Internet etc) of educational institutes can be used as a tool of eEducation to provide world class education and research. It also will explain how internet, computer, software and other IT based educational infrastructure are helpful to improve the quality of higher educational system including research.

Introduction

In the 21st century eEducation is on the priority list of all governments, college, institutions and University. In our present traditional system of education, the teacher takes the feedback by evaluating the students through examination or by the questions asked by the students, it consists of teacher, black board, chalk, books, students, classroom and laboratory and interaction between them. The teacher uses

this environment to create problems for student and then guides them through to experiences leading to desired learning. Here one important point is that all the components except teacher and students of an education system are dependent on technology and has evolved over the development of civilization. With the evolution of computer, software and internet traditional education and research tools are going to change without affecting the basic goals of education. Smart board, PRS, Digital Microscope, interactive pad are common tools used as a tool of eEducation.

ICTs have promised to expand the basic nature of education. Such as the ability to link written with audio and visual material that can enrich the full range of the learner's senses. The technology also creates a qualitative expansion in the means of education by taking a process rooted in the one-way delivery of knowledge and making it more participatory and reciprocal. Computer communication takes a system of learning based in narrow linear, narrative forms, and opens it up to a wide range of nonlinear, exploratory processes that allow the learner to make full use of his or her own multiple cognitive maps. The students mutually constitute their learning environments, which grow in the learning process.

Similarly the incorporation of ICTs in education and training programmes has profound influence in teaching and teacher preparation. The student accesses knowledge and information through Internet, TV, satellite and cable network and digital media to synchronize learning mediated through these multiple delivery mechanisms.

The important aspect of knowledge management is library which has changed its face in wake of the new technology. The library is the place where the information seeker can access information without restriction - the access role. The second role has been the world-wide effort of libraries to archive, protect and provide ongoing access to information and the world's cultural heritage for the long term - the preservation role.

India has 214 universities and equivalent institutions of seven open universities. The number of students has reached the level of 6.75 million and there are 0.321m teachers in the higher education system. But the future projection suggests massive requirement of infrastructure. There is a great hope from ICTs in finding answer to the problems. ICTs provide answer to the problem and can help to take the lectures of expert educators to remote area, which did not have the required facilities or human resources.

There is another factor which has to be discussed that is the GER of the higher education of our country is 12.4. We are far behind the developed countries average of 45 per cent and even countries like China (22 per cent). The GER for Dalits, educationally backward minorities and other socially and educationally backward minorities and other socially backward classes is even lower than the national GER. The Centre has set a GER target of 30 per cent by 2020 and for this, the number of universities and colleges would have to be increased many fold, quality of existing institutions to be enhanced and existing colleges and universities will have to be expanded. On the other side EMR (educational mortality rate) whereby of 100 children enrolled in class I, not more than 26 reach class X, barely 13 qualify for higher secondary education and only 6 qualify for college education, raises serious concerns with regard to the means adopted in the teaching-learning process and of accountability which is rarely addressed. For decrease GER and EMR many factors are responsible but two major reasons are that decreasing interest of student in higher education and poor student teacher ratio.

Both problems can be solved up to a limit by using New Information and Communication Technologies (ICT) which also provide alternative provisions for access to education without compromising the achievement of comparable goals through different and more appropriate arrangements and means, enable the expansion of the scope, scale and quality of learning. The students are also able to discuss their problems with the subject expert from anywhere in the world, teachers increase their knowledge so ultimately overall impact is that UP is also able to produce best students in higher education which results in to increase employment and ultimately overall growth and development results in sectors of our state.

In paper we discuss current state of education in India. This provides a context for the ensuing discussion of the extent to which modern computer-based ICT in India are integrated into primary, secondary, and tertiary teaching and learning. Indian constitution provides the right to education for all children between the ages of 6 to 14 is defined as a constitutional right.

If a child wants to go to school, the state must provide the opportunity. But it is not obligatory on the part of parents to send their children to school. Literacy rates are thus in some states sadly low. Technology presents a ray of hope, which as yet flickers fitfully like a short-wicked candle that is struggling to burn bright. But pilot technology based projects here and there in India are showcasing the way to what could be a glowing future for a country that is already very much a power to be reckoned with amongst the community of nations.

Growth of Higher Education in India

In its size and diversity, India has the third largest higher education system in the world, next only to China and the United States. Before Independence, access to higher education was very limited and elitist, with enrolment of less than a million students in 500 colleges and 20 universities. Since independence, the growth has been very impressive .The system is now more mass-based and democratized with one third to 40% of enrolments coming from lower socio-economic strata, and women comprising of some 35%of the total enrolments (Tilak, 2004). It is little more than half a century ever since the government initiated a planned development of higher education in the country particularly with the establishment of University Grants Commission in 1953. Thus early 1950s is an important reference points from which we could look back at our progress of higher education. Indian education system is also changing with time and start use of eEducation tools at various levels of education system in India but it require more attention from the government to keep pace with time. As early as in 1984 UGC launched countrywide classroom (CWCR) and Production facilities at 6 universities. Initially the coordination with these centers was done from UGC office with the support of a consultant. Subsequently an inter-university Centre named as 'Consortium for Educational Communication (CEC)was set up in the year 1993 for developing ICT based teaching learning programs suitable for Higher education and research. As a response target objectives the CEC coordinates the development of centers, ensuring the quality of software, coordination of telecasting of the selected films, inspiring and encouraging innovations. During the two decades of CWCR and a decade of CEC considerable progress has been made. Use of online exams system is started in our country, various online course started by Indian universities such as IGNOU.

Potential Benefit eEducation system-

- It brings a breakthrough in the education system
- It can minimise the need of subject/topic experts up to a limit by using online system.
- It change in pedagogical conceptions
- It Enabled experts of other field to be engage in higher education
- It help in the establishment of balanced education between rural and urban area
- It help teachers to aware them with the advancement of their subjects worldwide.
- It increase the attendance percent as the boring teaching replace by interesting method
- It increase the interest of student in the subject.
- It increases the enrolment of students
- It provide a variety of possibilities to deliver on campus teaching
- It provide better quality output and understanding of educational concepts through utilizing ICT
- as materials supporting class
- It provide equal higher educational opportunities which offers education at quality through the
- Internet and offers education at low cost with no limitation in time/space
- It provides an opportunity of high quality education economically, not only to the people in cities but also to those in the rural areas

Steps to be taken for Successful Technology Integration

- A non-dictatorial approach is always best
- Active support must come from the top
- Do not underestimate the on-going cost of technology- integrated teaching and learning
- Every school should have a core of teacher-computerists
- Everyone involved administration, teachers, parents and students must be committed to the ongoing change in teaching and learning methodologies that will accompany technology integration
- Parents and students must be involved in the evolutionary process
- Teachers must be given time and freedom to restructure the curriculum around the technology
- User-friendly technical support must be available, ideally onsite and on demand Teacher needs must come first

Government Initiatives in eEducation

- Fully aware the potential role of ICT in Fully aware the potential role of ICT in ensuring quality education to our student ensuring quality education to our student
- huge investment is being made on the huge investment is being made on the educational sector, output seems to be educational sector, output seems to be just satisfactory just satisfactory
- e-Government Master Plan of Government of India has identified e-Education as the priority Project
- The system of educational communication has grown to 17 Educational Media Research Centres and Audio Visual Research Centre, now known as Educational Multimedia Research Centres (EMMRC). Average number of educational programmes produced has increased to 1000 programmes per year from 25 in the beginning. CEC runs a 24hr higher education channel known as Vyas Channel on Gyan Darshan Bouquet now also available on DTH.

Constitutional Aspects of Indian Education

The framers of the Indian Constitution enunciated, in the Directive Principles of State Policy under Article 45, Free and Compulsory Education for all children in the age group of 6-14 years. The 73rd and 74th Constitutional amendments empowered local self-governments to manage and monitor primary education. The Supreme Court Judgment of 1993 declared education as a fundamental right, a new status in India.

Education and Five Year Plans

Since Independence, India has launched eleven five year programs. Each plan focus on for educational development, but the eleventh pan is centered on education hence commonly known as "Education Plan".

Commissions and Committees on Education

After Independence, the Government of India appointed various committees and commissions with the sole purpose of bringing about radical changes in the educational system of the country for the development of education. Here is a summary of the recommendations made. The UGC, NCERT, SCERT have provided grants to further the introduction and implementation of computer-based educational technology at all levels of education. The immediate goal is to increase access to this technology in order to improve the quality of education and to empower the people. The ultimate goal is to bring India to a place of prominence in the "global village." But, as might be expected, there are many disparities in the implementation of this directive around the country. Amongst these, the cultural, social, economic, regional disparities predominate. With regard to cultural and social disparities, for example, in some states early marriage of girls and the expectation that they will take care of the family, along with the priority given to boys education, result in obvious discrimination. On the economic front, there is huge disparity between the quality of education (including access to technology) from one school to another, both within states and nationwide.

The problem is that education can often afford to take its own sweet time about things, without fear of failure, without fear of losing students. Sometimes, even, schools gain cachet by being snootily anachronistic. "We don't use computers here. We believe education should be done the old-fashioned way." In India, the sense I have is that the state of technology-integrated teaching and learning is much like it was in the United States in the mid-80s. There is a lot of hype. A token number of computers are being purchased and installed in many schools at all levels. Training programs have been initiated for teachers, again at all levels. But certain key requirements for successful implementation are lacking.

- Teacher-training in the practical use of computerbased technologies is sporadic and far from ongoing. Indeed, there are but two government sponsored e- Learning centers for training teachers to integrate technology into the primary and secondary school curriculum nationwide.
- There are only a few computers (5-20) in those schools that have them. Hardly any students have computers for individual use, whether at school or at home.
- Where there are computers, they are often not connected to the internet. Where they are connected to the internet, the connection speed is slow.
- Almost invariably, the computers are clustered in a computer lab, to which students go for instruction in how to use them. They learn the basics. They do not have the opportunity to use the computers on a regular basis to advance their skills. Nor are the computers integrated into learning

across the curriculum. The state of technology integrated teaching and learning in India is nascent at best, notwithstanding a token introduction of computers in some of the schools. There are exceptions, so-called "Center Universities," such as the Indian Institutes of Technology (IITs) and other well-endowed schools, which are showcase universities funded by the federal government of India, one per state, and designed specifically to attract and train a technology-skilled workforce for the burgeoning high tech industry that is making India such an attractive place to do business.

Conclusion

Technology-integrated education is still a dream at all levels of education in India. While there are computers in the schools, they are mostly used to learn about computers. Rarely are they used as tools for the teaching and learning of other curriculum areas yet. But there is an advantage to Indias being behind the times, as long as the leaders in education keep their wits about them. They can skip wire-based technologies altogether. Wi-MAX, the latest generation broadband wireless medium, will be made available everywhere; its just a matter of time. Computers, too, continue to come down in price. This will enable schools to connect to the internet at speeds that will make internet use, inside and outside the classroom, a viable adjunct to chalk and talk and traditional textbook learningan adjunct, note, not an alternative. Traditional learning methodologies will continue to have an important place in education. Students who routinely use the computer for learning do so because they have come to value it as a tool for accessing and processing information, for communicating and collaborating, for building a community of learners in which ideas are shared, and for increasing their awareness of the world of knowledge to which they can gain access at the touch of their fingertips. Those who are lucky enough to have the computer as part and parcel of their academic experience would never be without it. The opportunity to use computers for teaching and learning should not be a privilege. It should be a right, just as it is only right that children should have access to books, pens and paper. There is a digital divide that separates the haves and have-nots with regard to access to technology. It is only right that the privilege of technology- integrated teaching and learning should be enjoyed by all.

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Role of ICT in higher education in special reference of R.U.S.A.

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Abstract

This paper is an attempt to focus on the role of ICT on higher educational development of India. Recently H.R.D. Ministry has launched Rashtriya Uchchatar Shiksha Abhiyan (RUSA). This Abhiyan emphasizes to promote reforms in the State Higher Education System by creating a facilitating institutional structure for planning and monitoring at the state level.

Indian higher education is one of the largest system of higher education found anywhere in the whole world. There are 320 Universities, of which nearly 131 are of Affiliating Universities. Besides there are deemed universities, institutions of national importance, institutes and over 15,500 colleges. Together they offer a wide range of degree and diploma programs across the length and breadth of the country. Inspite of we are unable to hold any position in top 100 universities of the world. There is need of Qualitative Framework which can turn or revive the whole educational system of India, in this direction R.U.S.A. is playing very important role. In the age of internationalization the whole world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century.

Introduction:

In Asian countries, like India is investing big amount to improve both the quality and quantity of higher education and research. In the developing countries like India the emphasis should be given on maintaining their edge in innovation and generation of knowledge. To maintain their competitive superiority, India should invest heavily in Research & Development both in the private as well as the public sector.

It is evident that use of ICT in education is increasing very fast in various states of India. One of the most common problems of using Information and Communication Technologies (ICTs) in education is to base choices on technological possibilities rather than educational needs.

Recently H.R.D. Ministry has launched Rashtriya Uchchatar Shiksha Abhiyan (RUSA). This Abhiyan emphasizes to promote reforms in the State Higher Education System by creating a facilitating institutional structure for planning and monitoring at the state level.

Indian higher education is one of the largest system of higher education found anywhere in the whole world. There are 322 Universities, of which nearly 132 are of Affiliating Universities. Also, there are

deemed universities, institutions of national importance, institutes and over 15,500 colleges. Together they offer a wide range of degree and diploma programs across the length and breadth of the country. In spite of we are unable to hold any position in top 200 universities of the world. There is need of Qualitative Framework which can turn or revive the whole educational system of India, in this direction R.U.S.A. is playing very important role.

In the age of internationalization the whole world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century.

This paper attempts to focus on the role of ICT in higher educational development in India. It also highlight on, how we can increase the quality and accessibility of higher education through the use of Information and Communication Technologies.

An Overview of India and China in recent years

"The re-emergence of China and India as major forces in the world economy is one of the most important developments in the early 21st century. Today we are living in a globally connected world. These connections are purely for business and economic purposes, but in coming years we will see global cooperation in the field of science, technology and innovations as well. But we should remember that such collaboration and cooperation are premised on political, strategic and economic interests. These new developments in the science and technology policies of India and China will change global perspectives in many ways in coming years. In such a scenario it will be interesting to see how science and technology innovations and all such collaborations will shape relations between India and China.

Suggestions for development of Higher Education

- Special Focus and Assistance should be given to twenty selected Universities to establish world-class Premier Universities in India.
- Every state and UTs of India should have a University at par with the best Central Universities with respect to funding and academic standards.
- Leading postgraduate teaching Universities and IITs should be encouraged to impart undergraduate science education In India, the IITs and some leading Universities have excellent departments offering M.Sc. programs in science subjects and also have a good ambience for research.
- At least 100 undergraduate Colleges in science, technology and social sciences be provided additional assistance to develop into Colleges of Excellence in India.
- Encourage interdisciplinary movement between Science & Technology streams and industrial R&D by establishing 10 Engineering colleges, Identifying talented, meritorious students and encouraging them through recognition is very important to attract students

into research and teaching. It will be very useful to provide teaching assistantships to the Schools that admit students with a Bachelor's degree in Sciences for a two-year B.Tech. degree in selected areas requiring strong science-technology interface.

- The Competitive Grant System for Research and Development should be further strengthened

We believe that active research is integral to faculty members work and enhances what the student learns. We propose the following measures for improvement in human resources.

- The scheme of summer schools for meritorious undergraduate and postgraduate students should be expanded to cover more and more students.
- Research fellowships for Ph.D. students need to be increase.
- Post-doctoral research (through P.D.F.) culture must be promoted for improvements in R&D
- Refresher courses need to be strengthened for improvement in quality of existing faculty.
- Incentives should be provided to teachers and researchers to make these professions more attractive for the coming generation.

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The Role of ICT in Higher Education

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Abstract

Information and communication technologies (ICT) have become commonplace entities in all aspects of life. Across the past twenty years the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavour within business and governance. Within education, ICT has begun to have a presence but the impact has not been as extensive as in other fields. Education is a very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centred learning settings and often this creates some tensions for some teachers and students. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow and develop in the 21st century. This paper highlights the various impacts of ICT on contemporary higher education and explores potential future developments.

Introduction:

ICT increases the flexibility of delivery of education so that learners can access knowledge anytime and from anywhere. It can influence the way students are taught and how they learn as now the processes are learner driven and not by teachers. This in turn would better prepare the learners for lifelong learning as well as to contribute to the industry. It can improve the quality of learning and thus contribute to the economy. It provides several tangible and intangible benefits for all stakeholders involved in the economic growth of the country. India, like any other knowledge economy, depends on the development of its educational sector.

Higher education drives the competitiveness and employment generation in India. However, research findings have shown that the overall state of higher education is dismal in the country. There is a severe constraint on the availability of skilled labor (Agarwal, 2006). There exist socio-economic, cultural, time and geographical barriers for people who wish to pursue higher education (Bhattacharya and Sharma, 2007). Innovative use of Information and

Communication Technology can potentially solve this problem.

Education is the driving force of economic and social development in any country (Cholin, 2005; Mehta and Kalra, 2006). Considering this, it is necessary to find ways to make education of good quality, accessible and affordable to all, using the latest technology available.

The last two decades have witnessed a revolution caused by the rapid development of Information and Communication Technology (ICT). ICT has changed the dynamics of various industries as well as influenced the way people interact and work in the society (UNESCO, 2002; Bhattacharya and Sharma, 2007; Chandra and Patkar, 2007). Internet usage in home and work place has grown exponentially (McGorry, 2002). ICT has the potential to remove the barriers that are causing the problems of low rate of education in any country. It can be used as a tool to overcome the issues of cost, less number of teachers, and poor quality of education as well as to overcome time and distance barriers (McGorry, 2002).

India has a billion-plus population and a high proportion of the young and hence it has a large formal education system. The demand for education in developing countries like India has skyrocketed as education is still regarded as an important bridge of social, economic and political mobility (Amutabi and Oketch, 2003).

The challenges before the education system in India can be said to be of the following nature: Access to education- There exist infrastructure, socio- economic, linguistic and physical barriers in India for people who wish to access education (Bhattacharya and Sharma, 2007).

Quality of education- This includes infrastructure, teacher and the processes quality.

Resources allocated- Central and State Governments reserve about 3.5% of GDP for education as compared to the 6% that has been aimed (Ministry of Human Resource Development, 2007).

Emerging Issues-A number of other issues have emerged from the uptake of technology whose impacts have yet to be fully explored. These include changes to the makeup of the teacher pool, changes to the profile of how are the learners in our courses and paramount in all of this, changes in the costing and economics of course delivery.

a. expanding the pool of teachers

In the past, the role of teacher in an educational institution was a role given to only highly qualified people. With technology-facilitated learning, there are now opportunities to extend the teaching pool beyond this specialist set to include many more people. The changing role of the teacher has seen increased opportunities for others to participate in the process including workplace trainers, mentors, specialists from the workplace and others. Through the affordances and capabilities of technology, today we have a much expanded pool of teachers with varying roles able to provide support for learners in a variety of flexible settings. This trend seems set to continue and to grow with new ICT developments and

applications. And within this changed pool of teachers will come changed responsibilities and skill sets for future teaching involving high levels of ICT and the need for more facilitative than didactic teaching roles (eg. Littlejohn et al., 2002).

b. expanding the pool of students

In the past, education has been a privilege and an opportunity that often was unavailable to many students whose situation did not fit the mainstream. Through the flexibilities provided by technology, many students who previously were unable to participate in educational activities are now finding opportunities to do so. The pool of students is changing and will continue to change as more and more people who have a need for education and training are able to take advantage of the increased opportunities. Interesting opportunities are now being observed among, for example, school students studying university courses to overcome limitations in their school programs and workers undertaking courses from their desktops.

c. the cost of education

Traditional thinking has always been that technology-facilitated learning would provide economies and efficiencies that would see significant reductions in the costs associated with the delivery of educational programs. The costs would come from the ability to create courses with fixed establishment costs, for example technology-based courses, and for which there would be savings in delivery through large scale uptake. We have already seen a number of virtual universities built around technology delivery alone (eg. Jones International University, www.jiu.edu). The reality is that few institutions have been able to realize these aims for economy. There appear to have been many underestimated costs in such areas as course development and course delivery.

The costs associated with the development of high quality technology-facilitated learning materials are quite high. It has found to be more than a matter of repackaging existing materials and large scale reengineering has been found to be necessary with large scale costs. Likewise costs associated with delivery have not been found to diminish as expected. The main reason for this has been the need to maintain a relatively stable student to staff ratio and the expectation of students that they will have access to teachers in their courses and programs. Compared to traditional forms of off-campus learning, technology-facilitated learning has proven to be quite expensive in all areas of consideration, infrastructure, course development and course delivery. We may have to brace ourselves for the advantages and affordances which will improve the quality of education in the near future to also increase components of the cost.

Benefits of ICT in education to the main stakeholders.

Student

- Increased access,
- Flexibility of content and delivery,
- Combination of work and education,
- Learner-centred approach,
- Higher quality of education and new ways of interaction.

Employers

- High quality, cost effective professional development in the workplace,
- Upgrading of employee skills, increased productivity,
- Development of a new learning culture,
- Sharing of costs and of training time with the employees,
- Increased portability of training.

Governments

- Increase the capacity and cost effectiveness of education and training systems,
- To reach target groups with limited access to conventional education and training,
- To support and enhance the quality and relevance of existing educational structures,
- To ensure the connection of educational institutions and curricula to the emerging networks and information resources,
- To promote innovation and opportunities for lifelong learning.

Potential drawbacks of using ICT in education

Although ICT offers a whole lot of benefits there are some risks of using ICT in education which
have to be mitigated through proper mechanisms. They are:

1. It may create a digital divide within class as students who are more familiar with ICT will reap more benefits and learn faster than those who are not as technology savvy.
2. It may shift the attention from the primary goal of the learning process to developing ICT skills, which is the secondary goal.
3. It can affect the bonding process between the teacher and the student as ICT becomes a communication tool rather than face to face conversation and thus the transactional distance is increased.
4. Also since not all teachers are experts with ICT they may be lax in updating the course content online which can slow down the learning among students.
5. The potential of plagiarism is high as student can copy information rather than learning and developing their own skills.
6. There is a need for training all stakeholders in ICT.
7. The cost of hardware and software can be very high.

Summary and conclusions

Changes in the curriculum do support fundamental economic and social transformation in the society. Such transformations require new kinds of skills, capabilities and attitudes, which can be developed by integrating ICT in education. The overall literature suggests that successful ICT integration depends on many factors. National policies as well as school policies and actions taken have a deep impact on the same. Similarly, there needs to be an ICT plan, support and training to all the stakeholders involved in the integration.

There needs to be shared vision among the various stakeholders and a collaborative approach should be adopted. Care should be taken to influence the attitudes and beliefs of all the stakeholders.

ICT can affect the delivery of education and enable wider access to the same. In addition, it will increase flexibility so that learners can access the education regardless of time and geographical barriers. It can influence the way students are taught and how they learn. It would enable development of collaborative skills as well as knowledge creation skills. This in turn would better prepare the learners for lifelong learning as well as to join the industry. It can improve the quality of learning and thus contribute to the economy.

Similarly wider availability of best practices and best course material in education, which can be shared by means of ICT, can foster better teaching. However there exist some risks and drawbacks with introducing ICT in education which have to be mitigated.

Successful implementation of ICT to lead change is more about influencing and empowering teachers and supporting them in their engagement with students in learning rather than acquiring computer skills and obtaining software and equipment. Also proper controls and licensing should be ensured so that accountability, quality assurance, accreditation and consumer protection are taken care of. ICT enabled education will ultimately lead to the democratization of education.

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Introducing a Virtual Classroom in a Master Course: Lessons Learned

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Abstract

The paper presents empirical research investigating the effect on the learning activity when the ordinary classroom setting in a university college master course is substituted with a virtual classroom supporting synchronous e-learning. To obtain good learning results in the virtual classroom, we hypothesised that changes to various aspects of the learning activity would be required. Applying activity theory as a framework, we identified such changes in the learning activity of our case in two virtual classroom test sessions: an ordinary lecture and a formal examination in the form of a student presentation. Our findings include a set of considerations that we suggest should be made if a virtual classroom is to be taken into use by a community of learners normally basing their learning activity on face-to-face interaction in a traditional classroom.

Introduction:

This paper reports from a virtual classroom experience at a university college in Norway, in which the web-based tool Centra was used in a master level course. The work was conducted as part of the Socrates Minerva project "Virtual Classrooms in European Provision" which aims to develop best practice-founded guidelines for the use of virtual classrooms in European organisations, public and corporate. A motivation for the Socrates Minerva project is that the knowledge and use of virtual classrooms in Europe is presently limited, comparing to the United States in which synchronous e-learning has been widely applied for many years.

In our research, virtual classroom technology is to be understood as web-based groupware environments designed to generally support *synchronous* e-learning. The tools allow for shared access to teaching material and support voice-based interaction. Virtual classroom sessions have a clear presenter/lecturer role and are pre-scheduled. Available tools are used for virtual meetings and training in various types of organisations.

Two crucial questions deserve further attention: How does the virtual classroom affect the learning process? How does the virtual classroom affect the teaching process? Our contribution is a small exploratory study with the aim of bringing more empirical experience into the research field of virtual classrooms. Out study was conducted at the Norwegian School of IT (NITH), which is a Norwegian university college delivering bachelor programmes in the area of information

technology. The school also cooperates with Brunel University (UK) in delivering master programmes within IT, in which we did the empirical part of our study.

The theoretical lens used for conceptualisation and analysis is activity theory, which we briefly outline in section 2. The tool for the virtual classroom and the research methodology is described in section 3. In section 4 we discuss our findings before concluding in section 5.

Theory

One way of conceiving the community of learners in a course, is as an activity system [3] . The theory of activity systems is founded in activity theory [5] and reflects a socio-cultural perspective on human endeavour. By applying the perspective of interconnected activity systems, the researcher receives analytic guidance by being encouraged to look into a set of factors defining each activity: The acting subject (e.g. the student), the object acted upon (e.g. the curriculum) and a related outcome (e.g. learning results), instruments used to mediate the activity (e.g. a virtual classroom), the community in which the activity takes place (e.g. the class), rules – formal and informal – that apply (e.g. not interrupting classmates or the lecturer) and division of labour (e.g. the students primarily listening, the lecturer primarily lecturing).

Activity systems are linked. One interrelated activity system in the case of the master course class at NITH is the school, conceived as an organization with a need for financial balance. Learning results as measured in the number of students passing each year can be seen as instrumental to the financial outcome of the school. Other aspects of course delivery having financial implications for the school are the costs of course delivery related e.g. to information infrastructure and lecturers' time (e.g. for travelling between campuses).

To account not only for structure and the state-of-affairs but also for development of the activity system(s), focus is placed on tensions that reside within and between activities and which trigger processes of development. Engeström denote these tensions as contradictions. If changes are made in an activity system, e.g. to one node, tensions are likely to occur and changes are likely to happen in other nodes as the system develops to cope with the contradictions. The theory of activity systems is thus helpful in explaining why activity systems develop as they do, to predict how activity systems are likely to develop in response to certain change, and – to some extent – how change in a certain direction might be prevented or encouraged.

In the case of the community of master course learners, any change which results in better learning outcomes on part of the students, are desirable. Changes which do not worsen learning outcomes and which simultaneously offer other advantages (such as cost savings in the interrelated activity system of the school), are also desirable.

The Case and Research Approach

The participation of the students in the learning activity is influenced by their backgrounds and the rules that apply, formally and informally, to the activity. The topic of the master programme course module of which the virtual classroom test sessions were part is organisational change and business improvement. The topic itself relates to the introduction of information

technology, which means the students have a conscious attitude towards the use of (new) technology, e.g. as represented by the virtual classroom.

The students hold bachelor degrees in information technology and are thus highly competent users of information technology.

The course is workshop-based, and assessment is based on a sum of credits earned from general attendance in class and (mostly) from group and individual assignments which are to be presented orally as part of the examination. The stress on active workshop participation is likely to be significant for the students' attitude towards their learning activity and the informal rules that apply to interaction. For instance, in a classroom session in which the lecturer or another student is the one primarily presenting, the student is expected to be relatively passive during the presentation but contribute with questions and comments during the session afterwards.

The students in the class were familiar with each other at the time of our experiment, having met face-to-face in learning settings on several occasions. This means that the class could reasonably be viewed as an already established learning community or activity system.

The lecturer is another important participant in the learning activity. In the case investigated, it was the first time the lecturer – who is also the co-author of this paper - taught the particular course. He was however familiar with the curriculum, and he is acknowledged by his students and colleagues as a competent lecturer. He was somewhat sceptical about the use of the virtual classroom, regarding the possibilities for technical failure as high.

In terms of functionality, virtual classrooms from various vendors are fairly similar, which makes it reasonable to draw conclusions about virtual classrooms in general based on the use of one of them. Without further elaboration on the differences, we will briefly describe the functionality of Centra, the virtual classroom application used in our research:

- The tool offers an environment for synchronous presentation and interaction over the internet. It is typically used for online meetings and e-learning. There is audio (voice) transmission but no video transmission integrated in the environment.
- There is a clear distinction between the roles and rights of presenter(s) and participants. The presenter may delegate presenter rights to other participants.
- There is a window for presentation. Typically, what is presented is a set of slides (powerpoint) which are preloaded onto the virtual classroom server. It is also possible for the presenter to share other applications run locally on his PC, including internet browsers. In addition, there is a tool for making online drawings and comments.
- There is a toolbar, different for presenter and participants. The presenter may change various settings in the environment. The participants' options are restricted to entering or leaving, raising their hand to have the floor (get the microphone), and responding to happenings in the session by selecting icons (smiley face or

clapping hands, green tick (yes), red cross (no))

- There is a list of participant names with information about participants' presence and status in the interaction (hand in the air, negative or affirmative answer to the presenter's question, comment in the form of laughter or applause, possession of the microphone), visible to all participants. The presenter is in charge of the microphone, delegating the right to speak. It is possible to allow several participants to speak simultaneously, or to restrict voice transmission to one person at the time.
- The presenter may launch surveys to have the participants' response to a question or check their knowledge. The survey questions may be of different categories: yes/no, multiple choice or open ended. A visual representation (coloured bars) is generated, showing the distribution of answers. The results may be displayed to the participants.
- Finally, there is an opportunity for text chat. It is possible to send private messages and public ones through the chatting window.

Our primary aim was to identify, on a short-term basis, changes of the learning activity that follow from the change of instructional/interactional medium. A related question is: which changes to the activity are necessary to make sure that the learning outcomes do not suffer from the transition from ordinary classroom to virtual classroom. Underlying these questions is the assumption that contradictions within and between activity systems cause change [3].

The particular class of the case was chosen because it represents a community of learners likely to benefit from flexibility in terms of students' geographical location. The class regularly meets for several days' workshops in Oslo. Some participants work part time besides being students, and some live in other parts of Norway and sometimes choose to attend the workshop lectures through video conferencing from the school's other campuses.

Experience with the same class in a normal classroom setting in other parts of the course provided a basis for comparison with the class in the virtual classroom setting.

Data were collected through a combination of passive observation, plenary interview/discussion with the class after the sessions, a questionnaire and interviews with the lecturer and the examinee. The final grades in the course in question were not used as part of the evaluation, as the test sessions comprise just a small part of the totality of the course.

We choose to co-locate the majority of the class in a PC lab during the sessions. The purpose of this was partly to reduce the chance of having unmanageable technical problems: we were trying out new technology in a real course, and requirements were strong not to cause delays in the teaching schedule or major inconvenience to the participating students. The setting made it possible for the observing researcher to convey information to participants and provide assistance e.g. on technical issues in the lab. Another effect of the setting was a resemblance to the ordinary classroom in that the students were able to communicate verbally and visually through the room and have an experience of being co-located as usual with mutual awareness of classmates' presence

and availability. On the other hand, the use of headset with microphone served to shield students from each other, partly simulating the learning setting of the virtual classroom which normally would be one with students geographically distributed.

The lecturer was situated in another room in the same building as the PC lab, which simulated the distance to the lecturer in a virtual classroom in normal use. Also, the examinee student of our second test session (to be elaborated below) was in another geographical location, which was realistic in terms of the virtual classroom: it was a real formal examination.

It was decided to collect experience from two very different pedagogical settings: one normal lecture with the lecturer presenting and the class primarily listening (Session 1), and one formal examination of a student presenting her assignment (Session 2); see Figure1.

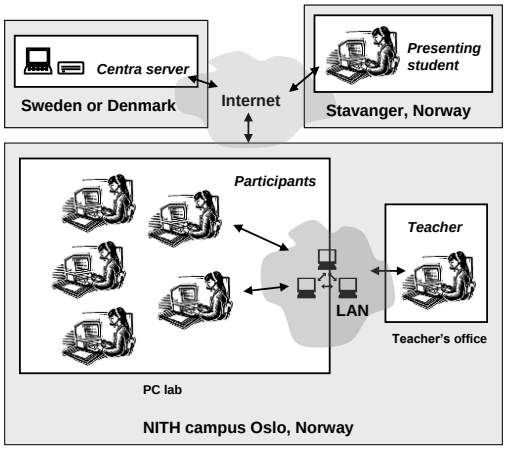

Figure1: Topology of the examination setting

Finding and Suggestions

In what follows, we use the structure of the activity system as a frame of reference when presenting our empirical findings and discussing them briefly. The guiding questions are:

- What were the changes in the instrument of the learning activity as the classroom was changed from ordinary to virtual?
- Were there indications that the change was detrimental to the learning outcomes of the activity?
- Which changes occurred in other parts of the activity system, and can they be explained as intra-activity contradictions resulting from the transition to a virtual classroom?

From the answers to the last question, it is possible to tentatively suggest which changes of the learning activity are likely to be required (and should be supported) in a similar case to maintain the learning outcome at the level of the ordinary classroom.The change made to the learning activity is a change of *medium of instruction.* The virtual classroom shares many characteristics with the traditional classroom lecture setting [2]. The lecture can be seen as the instructional model on which the virtual classroom is based: The slide set forms the core of the presentation, and the presenter has the leading role in the interaction. Along the constructivist – positivist scale of pedagogy, the virtual classroom is thus found at the positivist end [1] along with other presentation technology and computerised tutorials.

The lecturer in our case normally, in the ordinary classroom, makes use of the blackboard or whiteboard as a supplement to the slide set presentation. The whiteboard of the virtual classroom was however *not* used in our case because the lecturer wanted to avoid the simultaneous introduction and use of too much functionality. The students' reactions revealed that they perceived the channels of communication in the virtual classroom as much more limited than in the ordinary

classroom and that they would have liked to use the possibility to chat – an activity which bears some resemblance to informal side comments and passing of notes in the ordinary classroom. It is mainly a pedagogical issue how the functionality offered in a virtual classroom environment should be utilised in support of instructional techniques and learning objectives.

The transition to a virtual classroom was also, more generally, a change of *medium of interaction*, both formal and informal, among students and between students and lecturer. Looking at the virtual classroom as a shared workspace, an obvious difference from the ordinary classroom is the lack of perceptual information about other participants. Workspace awareness is generally much harder to maintain in groupware workspaces than in face-to-face environments [4], and awareness in the virtual classroom is limited even if some information about participants is conveyed through their voices and the participant list presented on the screen. The structured sharing of the microphone and the associated screen icon largely conveys only *intentional* communication.

The lecturer commented strongly on the problems of limited feedback. He felt the possibility to 'sense' the atmosphere was missing: *"To cut it short: the spatial experience of feedback is absent. Usually you get very much feedback during a [normal classroom] session with the class – body language, glances and the like. When you have finished the presentation, you have a pretty good impression of whether it was understood, liked, if you touched their hearts or if they remained stone cold…"*. The lack of two-way interaction can be seen as forming a contradiction between the instrument and a set of implicit activity rules of communication within the activity. To resolve this tension, which became apparent in the pre-testing of the first session in our case, the lecturer strived to consciously integrate elements of two-way interaction into the lecture, e.g. through online surveys. An implication for similar cases is that the lecturer's preparation of the course material must be slightly changed as compared to the normal classroom situation: As a starting point, we found that it is adequate to make use of a slide set originally meant for an ordinary classroom lecture. For the virtual classroom, elements of interactivity should be added [2]. Similarly, we identified a need to add graphical elements to achieve visual variation necessary to hold the students' attention. The lecturer commented that the attention span of the students (and himself) seemed more limited in the virtual classroom than he experienced in the normal classroom setting After the two virtual classroom sessions, the students commented that even more surveys and graphical elements would have improved the learning experience.

There were technical problems in the virtual classroom sessions, mainly relating to poor quality of audio transfer (causing occasional episodes of silence) and more general bandwidth limitations. These issues became more prevalent as the net load increased during certain times of the day. The problems were partly inherent to the tool (i.e. an intra-node contradiction) and partly related to the lecturer's competence (contradiction between instrument and subject), which was restricted to the basic functionality and based on limited experience. One implication is that the lecturer should be equipped with skills

sufficient to be able both to utilise the tool's possibilities and to work around its limitations. For instance, the possibility to efficiently make sketches, planned or spontaneously, in the online drawing tool, would add to the variation and amount of graphical elements.

Apart having from proficiency with the tool and generally in delivering training live and online, Driscoll [2] suggests that the best lecturer in live, online training is one that also

- is willing to try new technology
- is comfortable with his training skills
- has variety in voice and intonation

The importance of these factors was reflected in the interview with the lecturer in our case. On the issue of voice and intonation, we note that the lecturer in the case generally has a 'good voice' in the ordinary classroom. After the virtual classroom sessions, the students however commented that the lecturer's voice sounded more 'flat' there.

The other subjects of the activity, the students, need to know how to use the virtual classroom, both in terms of rules of interaction and tool functionality. We found that when technical testing is made by staff in advance to ensure that the session runs as smoothly as possible from a technical point of view, it is possible to include the class' tool training in the beginning of their very first tool session. The threshold to learn the necessary basics for participants turned out to be low, the tension between present and new set of skills (within the subject node of the activity) being small. A possibly useful change effort in terms of participants' background when the virtual classroom is to be introduced would be to promote a positive attitude towards the tool, stress its possibilities and form realistic expectations. The power of motivation and skill in combination was evident in the examinee student, who had a strong motivation to take her exam from her home and was not very concerned about the technical problems. She contended afterwards: "I am used to working from home and to attend virtual meetings at work. It usually takes time to get everybody up and going with virtual meeting room environments."

The object of the learning activity as defined by the learning objectives and curriculum was the same in the virtual classroom as in the ordinary one. Both lecturer and students thought that the learning objectives of the sessions had been met and that technical problems had not been devastating from an instructional/learning point of view. The students did however generally think that *learning would have been better* in an ordinary classroom. In other words, they perceived a contradiction between the instrument and the learning outcome. The students' reactions on this point suggest that a resolution of issues of variation and interaction within the virtual classroom may not be sufficient to resolve this rather fundamental contradiction. To some extent, learning results related to the test sessions could be measured: According to the lecturer, the knowledge level of these students on the topics of the test sessions as demonstrated in their subsequent assignment work, was good. The outcome of the examination performed in the virtual classroom in the second session, was excellent.

The rules of interaction in the ordinary classroom do not fully suit the virtual classroom, and this tension leads to changes

in the rules of interaction in the learning activity. The one-at-the-time regime normally imposed by the presenter through the tool is stricter than is normally the case in the ordinary classroom. Students in our sessions still believed that they had the necessary opportunities to participate when they wanted and that they had been participating actively in the sessions. They actively used the functionality to give response to the speaker (yes/no, laugh, applause, raised hand). The findings suggest that no special efforts are needed to make participants comply with the new rules of participation, perhaps because the rules seem inevitable: For instance, with only a voice and no supplementary visual cues about the speaker to relate to, it is *necessary* to let him speak alone and without interruption.

Turning to the formal (rules of) student assessment in the course used in our test sessions, they are partly based on student participation. There are formal criteria that the lecturer should look for, and one among these was no longer applicable in the virtual classroom: that of making eye contact with the audience during presentation. The transition to a virtual classroom thus makes it necessary to check the relevance of, and possible revise, the assessment criteria used in the ordinary classroom setting.

Looking at the division of labour, the lecturer's responsibility to ensure two-way interaction and generally facilitate the interaction is very clear in the virtual classroom. The management of interaction is reflected in visual cues in the virtual classroom interface as exemplified by the microphone icon associated with participant names. The tool imposes a regime of turn taking and session management that must be accepted by participants – which, as previously argued, happened without friction in our limited test sessions.

How did the introduction of the virtual classroom affect the learning outcomes? In our case, the limited proportion of the course delivered through the virtual classroom makes it difficult to draw conclusions on this point. Based on students' evaluation of the sessions we hypothesise that if a class is to use the virtual classroom *regularly* and not only as part of a research experiment, technical issues would have to be better resolved. We believe that patience with technical problems would have been smaller if students felt they *depended* on the virtual classroom for the instruction / interaction of the course. The slight fall in positive attitude (as measured in the questionnaires) from the first session to the second one supports this, as does the general opinion in class that the virtual classroom could serve as a good *supplement* to the ordinary classroom but not a substitute. Tentatively, we suggest that this finding is relevant at least for cases in which the learning activity is already established with an ordinary classroom as the primary instructional and interactional setting,

As a supplement to the curriculum-based lectures of the course, our students envisaged that the virtual classroom be used as a medium for workshops focusing on particular topics, preferably scheduled after working hours and facilitated e.g. by the lecturer. Research on the use of real-time voice groupware technology to support students in a similar manner indicates that such sessions would have to be carefully prepared and tailored to a time limit [6], which implies a significant associated cost.

Improvisation in the virtual classroom with multiple participants geographically dispersed is unlikely to be successful.

The success with the formal examination in our case suggests that under certain conditions, formal examinations in the form of students' presentations can be arranged in the virtual classroom.

Conclusions

This paper presented an exploratory study from Norway on how the use of a virtual classroom affects learning and teaching. A student Master class was for two sessions exposed to the use of the Centra, being observed during the sessions and interviewed afterwards. We used activity theory to frame our study. This enabled us to identify the changes in the activity system, and to analyse the effects on learning and teaching.

The main finding is that the same learning outcomes as in the ordinary classroom may be achieved for students using virtual classroom technology under certain conditions.

When considering the introduction of a virtual classroom as a full or partial substitute for an ordinary classroom, our findings suggest that the following major issues should be taken into account:

- Lecturer and students must accept that virtual learning sessions generally are more structured and predictable than learning sessions in the ordinary classroom
- Students who already base their learning activity mainly on face-to-face interaction are likely to see the virtual classroom as an inferior substitute for 'the real thing'. This means that there is a challenge in convincing the students of the advantages of the virtual classroom relative to their learning needs. For communities of learners that are established with the virtual classroom as a primary medium of interaction *from the start*, conditions may be different.

The study also documents that using a virtual classroom greatly affects teaching, particularly due to the loss of face-to-face contact with students. Given the present functionality of virtual classroom tools, the lecturer will have to live with these constraints on interaction.

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The Role of ICT in Higher Education

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Abstract

The present age is called as "Era of Information Technology". It has revolutionized the field of education. The demand of computer technology in education and training has enhanced the quality of education in various educational organizations and training Institutions. Communication is the basic key between teacher and student and it has been observed that students pay more attention to visual aids than verbal teaching. Within education, the impact of ICT has not been as extensive as in other fields. This is mainly due to lack of training among established teachers, a lack of motivation and need among teachers to adopt ICT as teaching tools. But in recent times, a growing need to explore efficiencies in terms of program delivery, the opportunities for flexible delivery provided by ICTs, the capacity of technology to provide support for customized educational programs to meet the need of individual learners and the growing news of individual learners and the growing use of the Internet and WWW as tools for information access and communication, have strengthened and encouraged moves to adopt ICT into classrooms and learning settings. The future trends of internet and multimedia will change the traditional methods of teaching and learning. It will enlarge the sphere of dissemination of knowledge and information.

Introduction

With the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important. ICTs have fundamentally changed many aspects of life during the past two decades .It has completely changed the functioning of many fields like banking, engineering, medicine, tourism, travel etc. But in the educational-systems, particularly in higher education, extensive use of ICT into classrooms and learning settings is still lacking. There are a number of factors eg.,lack of funding to support the purchase of the technology, lack of trained teachers, lack of motivation and need among teachers to adopt ICT as teaching tools, which impended the wholesale uptake of ICT in higher education. But in recent times, the use of ICTs into classrooms and learning settings is increasing day by day particularly because of growing need to explore efficiencies of program delivery, the opportunities for flexible delivery provided

by ICTs, the capacity of technology to provide support for customized educational programs to meet the need of individual learners, and the growing use of the Internet and WWW as tools for information access and communication.

The concept of moving the traditional classrooms of desks, notebooks, pencils and black-boards to an online forum of computers, software and the Internet intimidates many teachers who are accustomed to the face-to-face interaction of the traditional classroom. The numbers of on-line Universities are increasing rapidly in the present decade. On-line education is a boon for those who could not come to campus due to employment, family responsibilities, health issues and other time constrains. Computer multimedia offers ideal opportunities for creating and presenting visually enriched learning environments. Professional institutes are already using the technology for collaborative group work, problem solving and decision making. No doubt, technology based tools can enhance student's cognitive performance and achievements if used appropriately, in accordance with knowledge learning and as part of a coherent educational approach. Enhancing and upgrading the quality of education and instruction is a vital concern, especially at the time of spreading out and development of education. This can be done by the use of ICT_S. ICT_S can augment student$^{'s}$ enthusiasm and commitment, make possible the acquirement of fundamental skills and improve teacher training. Web Based setup tools, resources and techniques are more helpful for peer-to-peer type of learning and interaction. The use of on-line pedagogy within universities and professional institutes is increasing. The introduction of Wi-Fi system too has led to the growth of hi-tech education system, where accessibility and accountability of subject matter is made readily available to the students. The students can now study and comprehend the information according to their need.

Benefits of ICTs in higher education

The emergence of ICTs as learning technologies has coincided with a growing awareness and recognition of alternative theories for learning. The most popular and recognized theory of learning to-day is based on constructivist principles. It is based on the fact that learning is an active process of constructing knowledge rather than acquiring knowledge. In conventional process of teaching learning revolves around teacher's planning. It involves planned transmission of a body of knowledge followed by some forms of interaction with the content as a means to consolidate the knowledge acquisition. In contemporary learning theory, instruction is the process by which knowledge construction is supported. Contemporary learning settings have changed the way of learning. Students are now promoted to take responsibilities of their own learning. Students too have now started to appreciate the capabilities of ICTs to undertake education anywhere, any time and at any place. This flexibility has heightened the availability of just-in-time learning and provided learning opportunities for many more learners who previously were constrained by other commitments.

With the application of ICTs on a large scale, a need had been felt to change the existing curricula. As students and teacher gain access to higher band-width, more direct form of resources, the capability to support these quality learning settings will continue to grow. Already a need has emerged for educational institutions to ensure that their graduates have not only skills and knowledge in their subjects but they also have general attributes and generic skills. Here, generic skill stands for an ability to reason formally, to communicate effectively, to solve problems, to be able to negotiate outcomes, to manage projects, time management and collaboration and team work skills. The growing use of ICTs in everyday life have expanded the pool of generic skills and its future developments and technology applications will increase more

The new technology-facilitated competency and performance –based curricula has changed the way students are learning. The learning now is more student-centered. Students are now promoted to take responsibilities of their own learning. Students using ICTs for learning purposes become immersed in the process of learning. They understand that ICTs offer potentially less expensive ,more convenient, and richer ways of becoming educated, and coming into contact with more diverse groups of fellow learners than ever before.

The emergence of online education is not only a matter of social and economic change, but also of access. Through its increasing reach and simplicity of use, the Internet has opened the door to a global market where language and geographic barriers have been erased. All institutions, research institutions, regulatory bodies, professionals, academicians and students can be integrated on regional, state, national and international level. Sharing of knowledge, experience, infrastructure and technology will enhance the effective and efficient utilization of available resources. Students can have an access to unlimited information at any hour and at any place. Difficult or dull subjects can be made more interesting, easier and more appealing by the use of ICTs.

With the application of ICTs, institutions are offering many options and choices to students. The students can choose the place of their learning. Previously off-campus delivery was an option for students who were unable to attend campuses, to-day many more students are able to make this choice through technology-failitated learning settings. ICTs also allow on line access to a huge array of resources-the libraries and museums of the world and much more. Students also benefit from timely feed-back and electronic submission of assignments eliminates delays in transmission. A rapidly expanding array of open educational resources (OERS) is available on- line as people contribute elearning material to on-line repositories. These materials can be freely used and adapted, resulting in time and cost savings.

ICTs and teaching

Academics have used computer in teaching much more readily than they adopted earlier audio-visual media. This is because the strength of computers is their power to manipulate words and symbols - which is at the heart of the academic endeavour. There is a trend to introduce eLearning or online learning both in courses taught on campus and in distance learning. ICTs in general and eLearning in particular have reduced the barriers to entry to the higher education business. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, for example, may be accessed 24 hours a day, 7 days a week. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. UNESCO's principles on ICT in education can be summarized as follows:

- Old and new technologies need to be used in a balanced way. On-the-air and off-the-air radio/radio-cassette, television and offline video-assisted technologies are still considered valid and cost-effective modes of education delivery, as important as more interactive computer/Internet-based virtual education or online distance learning.
- Meeting the international education goals by 2015 will require huge investments in teacher training institutions.
- The demand for higher education cannot be met in both the developed and developing world without distance or virtual modes of learning.
- Vocational training needs cannot be met without virtual classes, virtual laboratories, etc.
- Educational goals cannot be met without gender sensitivity. Wherever possible, the proposed indicators will address the need to measure the gender gap.

Conclusion

While ICTs may not have a large impact to date, their use will grow to play a significant role in many aspects of design, development and delivery of educational programs in coming years. It is believed that the use of ICT in education can increase access to learning opportunities. It can help to enhance the quality of education with advanced teaching methods, improve learning outcomes and enable reform or better management of education systems. Extrapolating current activities and practices, the continued use and development of ICTs within education will have a strong impact on: What is learned, how it is learned, when and where learning takes place, & who is learning and who is teaching. The continued and increased use of ICTs in education in years to come, will serve to increase the temporal and geographical opportunities that are currently experienced.

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Role of ICT in Quality Improvement of Higher Education and Research

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Abstract

An information and communication technology (ICT) has become common place entities in all aspects of life and is one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of research and education, alongside reading, writing and numeracy. There is a widespread belief that ICTs have an important role to play in changing and modernizing educational systems and ways of learning. Within education, ICT has begun to have a presence but the impact has not been as extensive as in other fields. Education is very socially oriented activity and quality education has traditionally been associated with strong teachers having high degrees of personal contact with learners. The use of ICT in education lends itself to more student-centered learning settings and often this creates some tensions for some teachers and students. But with the world moving rapidly into digital media and information, the role of ICT in education is becoming more and more important and this importance will continue to grow for centuries. This paper highlights the various impacts of ICT on quality improvement of education & research in various universities and institutions. This paper also highlights the issues which are yet to be undertaken in order make education as technical equipment so that it can reach to everyone in the world.

What is ICT means?

ICT stands for Information & Communication Technologies. There is no universally defined definition of ICT. According to United Nations Development ICT is defined as "information-handling tools- a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information."

Earlier Radio, Television & telephones were used as ICT tools but in today era these old ICT tools are integrated with new tools as laptops, desktops, internet, satellite and wireless technology forming "a network world" consisting of a massive infrastructure of interconnected telephone services, standardized computing hardware, the internet, radio and television, which reaches into every corner of the universe.

ICT tools can be broadly classified into two categories – an analogue media (consisting of simple audio visual aids such as the transparency and slides, tape and cassette recorders and radio; video cassettes and television; and film.) & a digital media (internet, satellite and wireless technology).

Role of ICT in the field of education & research

The role of ICT in national development can be attributed from activities to operations, from research to development, from health services to amusement, from education to governance; ICT has become an essential component of basic life. But the major role of ICT is in the field of education. It has the ability to address illiteracy and improve the quality of education in all sectors through multimedia capabilities such as simulations and models. ICT has given learners access to concepts that they previously could not grasp. The acquisition of ICT skills in educational institutions helps knowledge sharing, thereby multiplying educational opportunities.

Integrating ICT with education is crucial as it means harnessing technology to perform learning skills. ICT helps to manage complexity and solve problems by thinking critically, creatively, and systematically towards the goal of acquiring thinking and problem-solving skills.

For the students, this can be used for making assignments, collecting data, documentation, and conducting research. It can be a medium for teaching and learning. This can act as the medium through which teacher and learners can learn. Here in order to introduce and understand the need of ICT in educational institutions, teachers or students undergoing teacher education must first comprehend and be at ease with ICT. They must be given opportunities for acquisition of new knowledge. This can be made possible by promoting ICT-based training programs introduced in their curriculum.

No generation is more at ease with online, collaborative technologies than today's young people—"digital natives", who have grown up in an immersive computing environment. Where a notebook and pen may have formed the tool kit of prior generations, today's students come to class armed with smart phones, laptops and iPods.

"ICT Technology allows students to become much more engaged in constructing their own knowledge, and cognitive studies show that ability is a key to learning success,"

Online degree programs and distance learning have gained a firm foothold in universities around the world. What was once considered as shallow channel for the delivery of educational content has rapidly become mainstream, creating wider access to education, new markets for content and expanded revenue opportunities for academic institutions.

New technologies are also affecting other areas of campus administration. Social-networking tools are helping to build connections with alumni and support career service activities. E-marketing campaigns expand the reach and success of recruiting and fundraising efforts, and drive down the cost of direct-mail campaigns. And automated, self-service programs reduce administrative requirements, streamline course registration and enhance academic life.

This paper examines the role of ICT technology in shaping the future of higher education.

The major searches are as follows:

A) Significant Impact of Technology on higher education & research

It has been studied that technological innovation will have a major influence on teaching methodologies over the next five years. In fact, technology will become a core differentiator in attracting students and teachers. Students and teachers are basically attracted because of two reasons- (1) it helps the course material be presented in a more representable way; (2) it gives them familiarity with the high-tech tools they might be expected to use in their future career.

Some universities have already started making changes to their curricula and making arrangements to be more inviting to students by introducing new methods of education. Most of the classes are held in computer labs and the topic of the lecture can be immediately simulated, programmed, or demonstrated on computers. It is not too far in the future that classrooms will be equipped with smart touch panels/screens, projectors, sound systems, video-conference systems, television and radio broadcast/receive systems and other high-tech equipment.

B) Online learning & distance education is gaining a firm foothold in universities around the world.

Many academic institutions, and especially those with a public-service mandate, consider online learning key to advancing their mission, placing post-graduate education within reach of people who might otherwise not be able to access it. "There are many people who desire certification or degree programs who simply cannot attend a residential program, be they single mothers, working professionals or non-traditional students. Distance education as a part of ICT has helped them to get their desired certification. It's part of ICT public mission to reach those people, and it can be seen e-learning as a vital tool in making that possible." Young as well as old generation consider online learning as a key for advancing their mission and placing advanced education within reach of people who might otherwise not be able to access it.

C) Corporate-academic partnerships

Corporate and academic partnerships are an important part of the university. It's found that Today's students are used to get what they need instantly. Universities have to respond to remain competitive, but those innovations may be costly. In case when funding and controlling costs are key concerns, then in today's trends universities look to the private sector to support and extend technological advances. So that research scholar can gain the most out of it.

D) Higher education and research is responding to globalization

With the help of ICT higher education is advancing to globalization. Institutions with advanced technology are planning to get there institution branch in foreign location also so that their knowledge and education can be shared with the world. Distance education is also becoming increasingly global, with universities in the US and overseas leveraging advanced technologies

to put education within reach of many more individuals around the world. With the advancement in technology researchers are also gaining the benefit to build better world.

The continued and increased use of ICTs in education in years to come, will serve to increase the temporal and geographical opportunities that are currently experienced. Advancements in learning opportunities tend to be held back by the ICT capabilities of the lowest common denominator, namely the students with the least access to ICT. As ICT access increases among students so too will these opportunities.

Upcoming issues yet to explore

A number of other issues have emerged from the uptake of technology whose impacts have yet to be fully explored. These include changes to the makeup of the teacher pool, changes to the profile of who are the learners in our courses and paramount in all of this, changes in the costing and economics of course delivery.

A. expanding the pool of teachers

In the past, the role of teacher in an educational institution was a role given to only highly qualified people. With technology-facilitated learning, there are now opportunities to extend the teaching pool beyond this specialist set to include many more people. With the advancement of technology, today we have a much expanded pool of teachers with varying roles able to provide support for learners in a variety of flexible settings. This trend seems to continue and to grow with new ICT developments and applications. And with highly educated teachers there will be change in responsibilities and skill for future teaching involving high levels of ICT.

B. expanding the pool of students

In the past, education has been a privilege and an opportunity that often was unavailable to many students whose situation did not fit the mainstream. Through the flexibilities provided by technology, many students who previously were unable to participate in educational activities are
now finding opportunities to do so. The pool of students is changing and will continue to change as more and more people who have a need for education and training are able to take advantage of the increased opportunities.

C. the cost of education

The costs associated with the development of high quality technology-facilitated learning materials are quite high. It has found to be more than a matter of repackaging existing materials and large scale reengineering has been found to be necessary with large scale costs. Likewise
costs associated with delivery have not been found to diminish as expected. The main reason for this has been the need to maintain a relatively stable student to staff ratio and the expectation of students that they will have access to teachers in their courses and programs. Compared to traditional forms of off-campus learning, technology-facilitated learning has proven to be quite expensive in all areas of consideration, infrastructure, course development and course delivery.We may have to brace ourselves for the advantages and affordances which will improve the quality of education in the near future to also increase components of the cost.

Conclusion

This paper has sought to explore the role of ICT in education. In particular the paper has discussed the role of ICT in quality improvement education. ICT has served As an agent of immense change, technology has heralded our present knowledge economy and given rise to a generation of students who have never known life without a computer. These advanced technologies have put education within the reach of many more individuals around the world, and will allow greater specialization in curriculum and teaching methodologies than ever before practiced. We have also shared the impact of ICT on educational practices to date in quite small ways but that the impact will grow considerably in years to come. It is needed that the university infrastructure and operations are in place to support the adoption of technology on campus. As ever, administrators will need to weigh carefully how budget funds are spent, decide what emerging technologies show the most promise, and determine how best to support these technological advances while avoiding the ever-present risk of obsolescence.

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Studies on Effect of Temperature on Biodegradation of Synthetic Phenolic Waste Water in an Up-flow Anaerobic Single Stage Fixed Bed Bio- Reactor

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Abstract

Biological treatment systems are supposed to be more important and advanced in the sense that they are more effective and involve a greater degree of stabilization of waste. The treatment of toxic and inhibitory phenolic compounds using biological techniques have been pursued vigorously as a promising and widely accepted treatment process due to its ease of handling and properly operated to prevent production of secondary pollutants. Up-flow anaerobic bio-reactors (UAFB) been widely used for the treatment of high organic load industrial waste water. The treatment of synthetic phenolic waste water by a single stage anaerobic fixed bed bio-reactor with granite stones packing at a temperature of 30^0C, 35^0C, 40^0C and 45^0C was studied. A recirculated single stage up-flow anaerobic bio reactor was operated at all the above given temperatures with initial BOD 1462 mg/l and initial COD 5720 mg/l for a digestion period of 25 days with a working volume of 1000 ml. Performance of the reactor was monitored after every five days and analyzed in terms percentage COD, BOD, TS, TDS, VS removal and bio gas production. The removal efficiency of BOD, COD, TS, TDS and VS could reach to maximum value of 63.20%, 61.24%, 44.88%, 47.67% and 53.12% respectively. The result showed that the maximum biogas production in the reactor reached 0.0077 litre/litre/day at temperature of 40^0C.

Abbreviations: BOD -Biochemical Oxygen Demand, COD - Chemical Oxygen Demand, TDS - Total Dissolved Solids, VS - Volatile Solids, UAFB - Up flow Anaerobic Fixed Bed Bio-reactor

Introduction

It has been reviewed that aromatic compounds are plentiful in the environment (Lettinga et al., 2001, Colleran et al., 2002, G. Collins, 2005). One group of these products is phenolic compounds. It has been demonstrated that phenol can be degraded, under anaerobic conditions, to methane and carbon dioxide as reviewed in several reports (Guieysse. et al. , 2001, Li and Fang, 1996.. However, at some concentrations, phenol may promote inhibitory effects in methanogenic bacteria, diminishing methane production and carbon degradation (Rebaca and Gerbens, 1999). Therefore, phenolic compounds are problematic for the anaerobic treatment of wastewater. One report (Hernandez, 2003) sets that various alternatives (dilution, ozonation, UV-H_2O_2) have been proposed to eliminate toxicity and improve phenol's anaerobic biodegradation. Previous works

on phenol anaerobic biodegradation have been carried out in batch (Banks and Wang, 1999) and continuous operation: fluidized bed (Mc Hugh et al., 2004.), UASB (Chang et al., 1995) and expanded bed reactor (Collins et al., 2005)

Treatment of phenol and cresols in up flow anaerobic sludge blanket (UASBR) has been reviewed by Veeresh et al. (2005). It has been reported that the anaerobic bacteria have the capability to degrade phenol as a sole substrate (Fang et al. 1996; Chang et al. 1995; Tay et al. 2000) and use of a co-substrate is not a prerequisite. However, the presence of a co-substrate retards/prevents the toxic effects of phenols during shocks, helps in complete biodegradation
of phenol (Tay et al. 2001) and facilitates fast recovery of the process. Pure substrates such as glucose (Hwang and Cheng, 1991; Tay et al. 2001) and volatile fatty acids (VFA) (Kennes et.al., 1997) have been used as co-substrates in the anaerobic treatment of phenols in UASBR. The use of pure substrates restricts the practical applicability of the process. Therefore, it has been deemed necessary to assess the potentials of a readily degradable wastewater as a co-substrate in the treatment of phenolic waste. The present technical note describes the performance of a (UAFB) up flow anaerobic fixed bed bio reactor treating synthetic waste water.

Materials and Methods

Synthetic waste water containing phenol was produced with COD: N: P ratio of 100: 2.5: 0.5, using urea and potassium dihydrogen phosphate as a chief source of nitrogen and phosphorous respectively. The phenolic waste water contained BOD (biochemical oxygen demand) of value 1278 mg/l and COD (chemical oxygen demand) of value 5000 mg/l. In this study synthetic phenolic waste water was prepared as and when required. The composition was maintained by diluting it with distilled water. To support the growth of micro-organisms, nutrients like nitrogen and phosphorous were added in a ratio of COD: N: P of 50: 2.5: 1. Synthetic waste water containing phenol was used as a sole carbon source. Urea and potassium dihydrogen phosphate were used as a chief source of N and P. Besides this inorganic ions like Na^{+}, K^{+}, Ca^{2+}, Mg^{2+} and Fe^{3+} were added in small quantities.

An anaerobic mixed culture was developed from cow dung in yeast extract media by digesting it up to two weeks at 35^{0}C temperature, which was further enriched in synthetic medium of acetic acid. Acetic acid was added to inhibit the growth of acidogenic bacteria. The methanogenic culture was enriched in acetic medium. This culture so obtained was used as inoculums for the batch process. As phenol is toxic to micro-organisms and is a good disinfectant, its higher concentration may prevent microbial growth in waste water may prevent microbial growth or at least make it difficult to sustain, so the mixed culture was thus developed was adapted to the phenolic waste water. For adaption the concentration of phenol was gradually increase from 100 mg/l to 1000 mg/l. This experiment was carried out for 14 days at 35^{0}C temperature.

The biogas production was measured each day to ensure the bacterial activity. Phenolic waste water and the developed adapted mixed culture was mixed in definite proportion and was introduced into the single stage attached film fixed bed bioreactor and was allowed to ferment anaerobically for a period of 25 days at four different temperatures 30^0C, 35^0C, 40^0C and 45^0C respectively. 100 ml seed material was used in each digester. pH was adjusted by adding lime when required.

The single stage anaerobic attached film fixed bed reactor with a working volume of 1000 ml was packed with granite stones of size 1.0 cm to 1.5 cm in diameter .The reactor consists of a jacketed column to maintain the temperature by flowing water in the outside jacket using a thermostat water bath. Reactor was initially fed at a rate of 25 ml/hr to maintain the HRT of 24 hours. Continuous recycle of the treated effluent (phenolic waste water) was done for the partial fluidization of the sludge by a peristaltic pump. These pumps ware calibrated for different flow rates. Reactor performance was evaluated on the basis of COD, BOD, TS, TDS, VS and bio gas production at four different temperatures 30^0C, 35^0C, 40^0C and 45^0C.

Results and Discussions

Phenols are known to be highly toxic to the micro-organisms. After the development of methanogenic culture, 100 ml inoculum was mixed with waste water having phenol concentration 100 mg/l. After two weeks 100 ml inoculum was taken from this experiment and waste water with 200 mg/l phenol concentration was inoculated. In this manner highest concentration of phenol i.e. 1000 mg/l was digested and % COD removal of 59.33% was achieved. This can be seen in the table- 1 and fig -1.

The characteristics of the treatment mixture viz. BOD, COD, TS, TDS and VS at different digestion time at four different temperatures 30^0C, 35^0C, 40^0C and 45^0C are show in table -2, table-3, table-4 and table-5 respectively. Fig-2, fig-3, fig-4, fig-5 and fig-6 represent effect of digestion time on %BOD, %COD,%TS, %TDS and %VS reduction respectively.

At 30^0C BOD and COD of the treatment mixture ranged between 1462 mg/l to 625 mg/l and 5720 mg/l to 2882 mg/l respectively. The total dissolved solids ranged from 254 mg/l to 160 mg/l , total dissolved solids ranged from 172 mg/l to 100 mg/l and volatile solids ranged from 128 mg/l to 68 mg/l , with the increase in digestion time from 01 to 25 days. The value of percentage BOD reduction varied from 23.05 to 57.25% while percentage COD reduction varied from 18.63 % to 49.61%. The value of total solids, total dissolved solids and volatile solids ranged between 12.59% to37.00%, 16.27 % to 41.86 % and 21.87% to 46.87% respectively.

At 35^0C BOD and COD of the treatment mixture ranged between 1462 mg/l to 575 mg/l and 5720 mg/l to 2318 mg/l respectively. The total dissolved solids ranged from 254 mg/l to 152 mg/l , total dissolved solids ranged from 172 mg/l to 98 mg/l and volatile solids ranged from 128 mg/l to 62 mg/l , with the increase in digestion time from 01 to 25 days. The value

of percentage BOD reduction varied from 19.56% to 60.67 % while percentage COD reduction varied from 17.74 % to 59.47%. The value of total solids, total dissolved solids and volatile solids ranged between 11.02 % to40.15 %, 12.79 % to 43.02 % and 18.75% to 51.56% respectively.

At 40^0C BOD and COD of the treatment mixture ranged between 1462 mg/l to 481 mg/l and 5720 mg/l to 1957 mg/l respectively. The total dissolved solids ranged from 254 mg/l to 132 mg/l , total dissolved solids ranged from 172 mg/l to 78 mg/l and volatile solids ranged from 128 mg/l to 50 mg/l , with the increase in digestion time from 01 to 25 days. The value of percentage BOD reduction varied from 28.45% to 67.09 % while percentage COD reduction varied from 24.44 % to 65.78 %. The value of total solids, total dissolved solids and volatile solids ranged between 15.57 % to 48.03 %, 20.93 % to 54.65 % and 26.56 % to 60.93% respectively.

At 45^0C BOD and COD of the treatment mixture ranged between 1462 mg/l to 538 mg/l and 5720 mg/l to 2217 mg/l respectively. The total dissolved solids ranged from 254 mg/l to 140 mg/l , total dissolved solids ranged from 172 mg/l to 90 mg/l and volatile solids ranged from 128 mg/l to 60 mg/l , with the increase in digestion time from 01 to 25 days. . The value of percentage BOD reduction varied from 24.62% to 63.20% while percentage COD reduction varied from 20.69 % to 61.24%. The value of total solids, total dissolved solids and volatile solids ranged between 12.59% to 44.88%, 18.60 % to 47.67% and 20.31% to 53.12% respectively.

Results:

Results indicate that there was a steady increase in the percentage reduction of BOD, COD, TS, TDS and VS from 5^{th} to 20^{th} day but the rate of percentage reduction decreased after 20^{th} day at all the four different temperatures. Cumulative biogas production and rate of biogas production during the digestion process was also measured. The results indicate that there was a steady increase in the yield of biogas from 7^{th} day onwards and it attained a peak value on 20^{th} treatment then after it started decreasing. The decrease in the biogas production was because of decrease in organic matter in digestion mixture. The bio gas production and reduction in effluent characteristics at various temperatures observed can be depicted as-

Reduction at 40^0C >Reduction at 45^0C >Reduction at 35^0C > Reduction at 30^0C

It showed that optimum temperature for reduction in effluent characteristics and bio gas production was at 40^0C

The average composition of the biogas at the end of digestion at 40^0C was : CH_4 content varied from 63.0 - 63.8 %, CO_2 varied from 32 - 33 %, O_2 varied from 0.5 – 0.7 % and CO varied from 0.3- 0.7%.

Conclusion

This work studied the anaerobic degradation of phenolic waste water at four different temperatures 30^0C, 35^0C, 40^0C and 45^0C. Degradation of phenol, chemical oxygen demand (COD), biochemical oxygen demand (BOD), total solids(TS), total dissolved solids(TDS), volatile solids(VS)and biogas were evaluated. Phenol is not degradable under acidogenic conditions by acidogenic bacteria. There was a steady

increase in the percentage reduction of BOD, COD, TS, TDS and VS from 5^{th} to 20^{th} day but the rate of percentage reduction decreased after 20^{th} day. There was a steady increase in the yield of biogas from 7^{th} day onwards and it attained a peak value on 20^{th} treatment then after it started decreasing.

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Table:1 Percentage Phenol Removal During Adaptation of Phenolic Waste water

S.No	Initial Phenol Conc. (mg/l)	Initial COD (mg/l)	Final COD (mg/l)	% COD Removal
1.	100	804	699	13.05
2.	200	1627	1363	16.22
3.	300	2082	1620	22.19
4.	400	2877	2047	28.84
5.	500	3958	2493	37.01
6.	700	4495	2425	46.05
7.	800	5746	2722	52.62
8.	1000	6728	2736	59.33

Fig-1.Percentage COD Removal During Adaptation of Phenolic Waste water

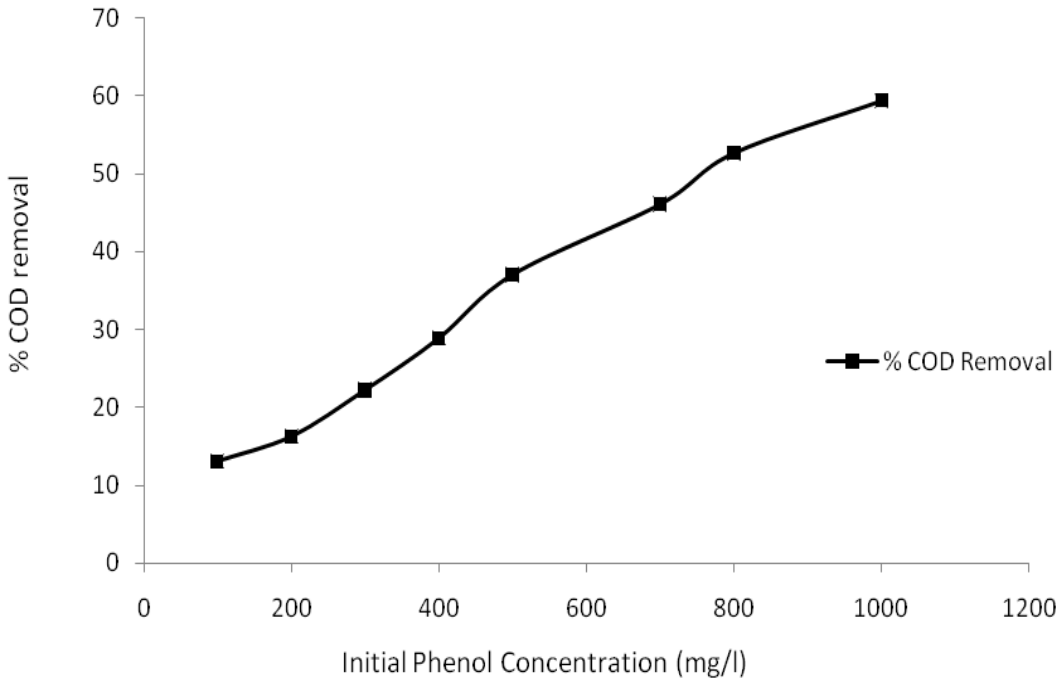


Table:2 Percentage Reduction of BOD at 30^{0}C, 35^{0}C, 40^{0}C and 45^{0}C Temperature

S.No.	Digestion Time(days)	% BOD Reduction			
		At 30^{o}C	At 35^{o}C	At 40^{o}C	At 45^{o}C
1.	5	23.05	19.56	28.45	24.62
2.	10	36.73	29.13	40.56	36.38
3.	15	48.29	42.81	49.52	47.87
4.	20	54.58	49.84	60.09	57.85
5.	25	57.25	51.50	67.78	63.20

Fig-2.Effect of digestion time on % BOD Reduction at four different temperatures

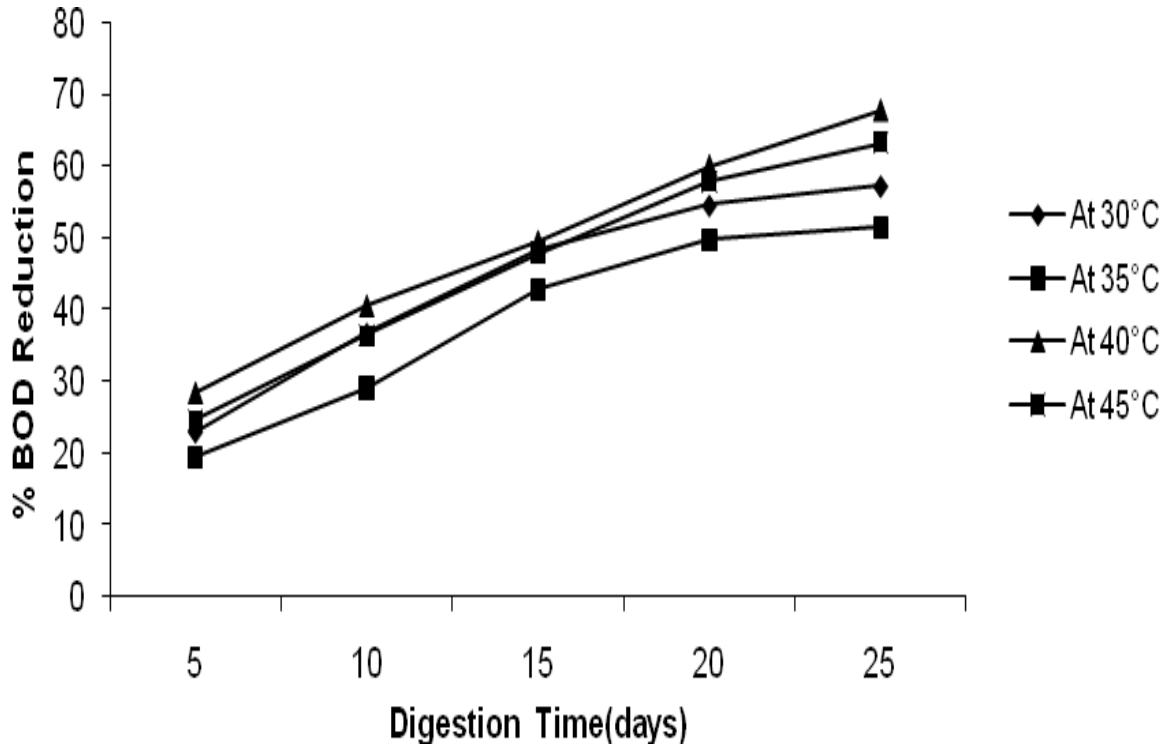


Table:3 Percentage Reduction of COD at 30^{0}C, 35^{0}C, 40^{0}C and 45^{0}C Temperature

S.No.	Digestion Time(days)	% COD Reduction			
		At 30^{o}C	At 35^{o}C	At 40^{o}C	At 45^{o}C
1.	5	18.63	17.74	24.44	20.69
2.	10	33.46	28.70	36.53	33.93
3.	15	42.36	40.85	46.76	42.79
4.	20	49.33	49.84	55.85	54.09
5.	25	49.61	59.47	65.78	61.24

Fig-3.Effect of digestion time on % COD Reduction at four different temperatures

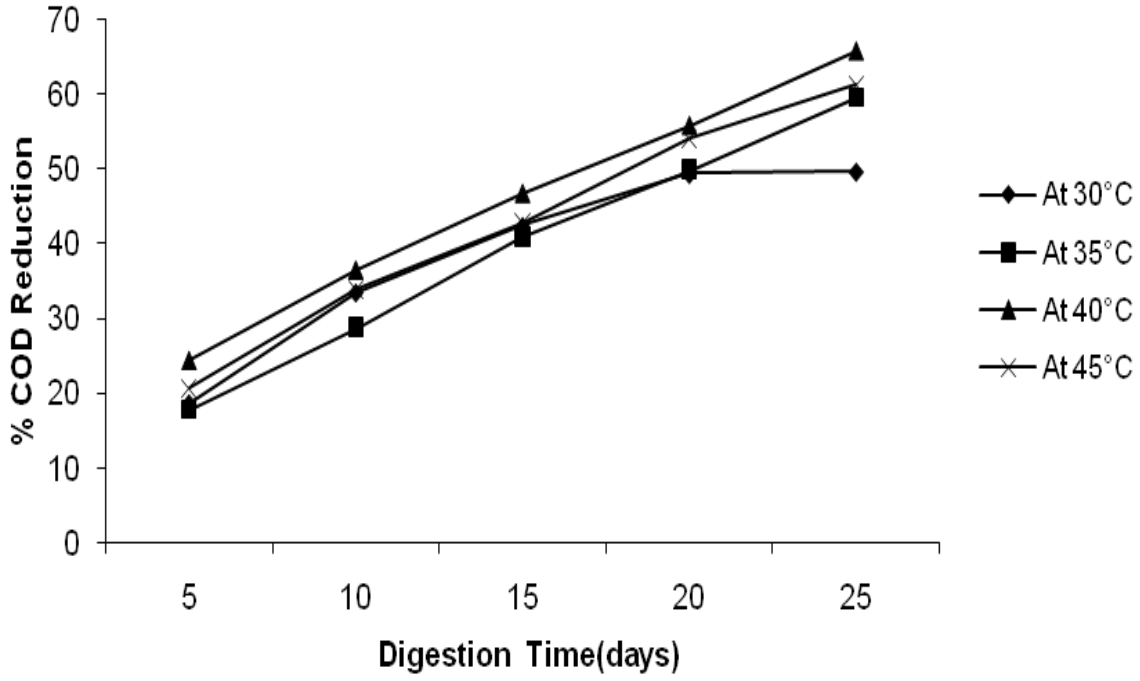


Table:4 Percentage Reduction of Total Solids at 30^{0}C, 35^{0}C, 40^{0}C and 45^{0}C Temperature

S.No.	Digestion Time(days)	% TS Reduction			
		At 30^{o}C	At 35^{o}C	At 40^{o}C	At 45^{o}C
1.	5	12.59	11.02	15.74	12.59
2.	10	22.04	22.04	28.34	24.40
3.	15	30.70	29.92	36.22	34.64
4.	20	36.22	36.22	42.51	40.15
5.	25	37.00	40.15	48.03	44.88

Fig-4.Effect of digestion time on % TS Reduction at four different

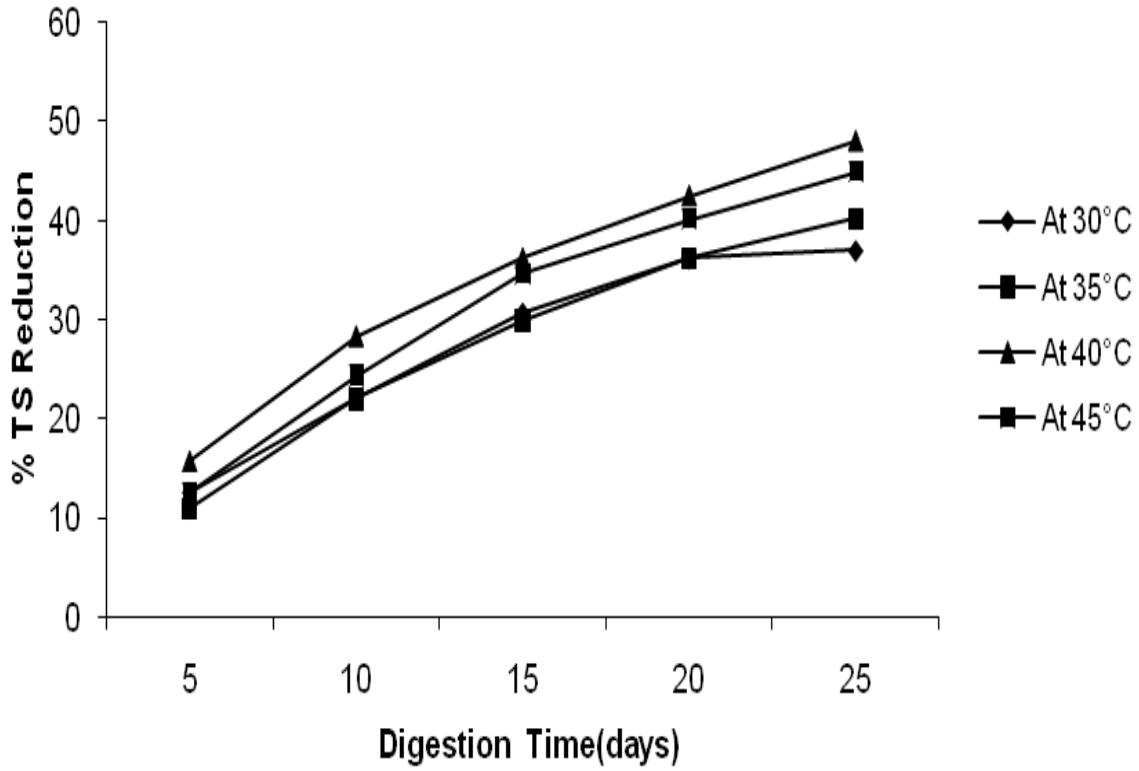


Table:5 Percentage Reduction of Total Dissolved Solids at 30^{0}C, 35^{0}C, 40^{0}C and 45^{0}C Temperature

S.No.	Digestion Time(days)	% TDS Reduction			
		At 30^{o}C	At 35^{o}C	At 40^{o}C	At 45^{o}C
1.	5	16.27	12.79	20.93	18.60
2.	10	25.58	22.09	31.39	26.74
3.	15	32.55	31.39	43.02	38.37
4.	20	40.69	38.37	50.00	44.18
5.	25	41.86	43.02	54.65	47.67

Fig-5. Effect of digestion time on % TDS Reduction at four different temperatures

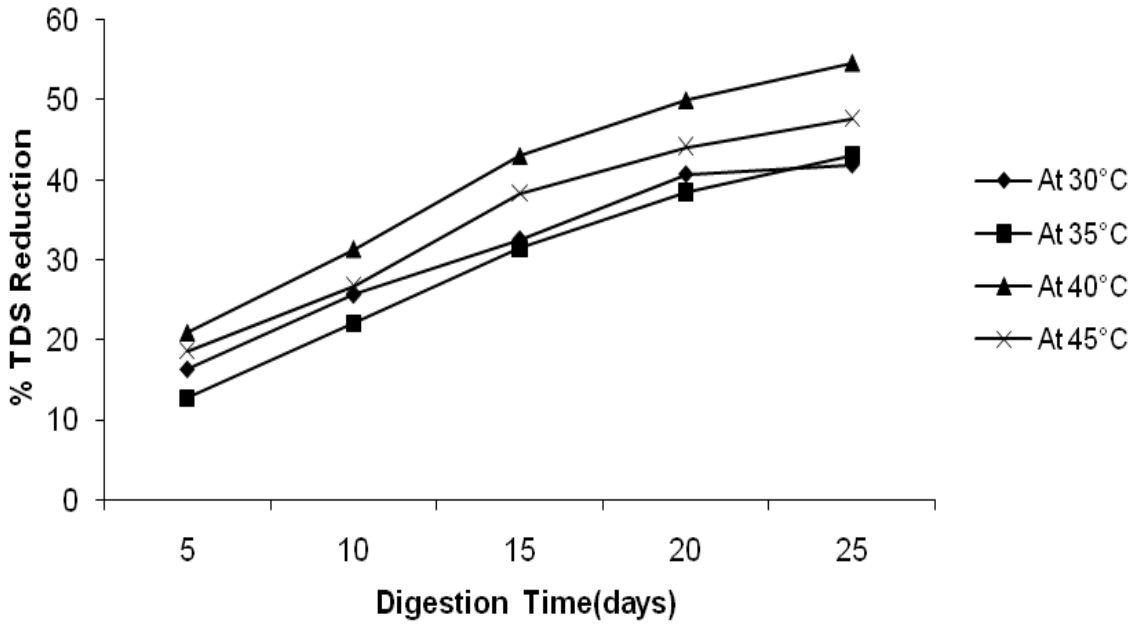
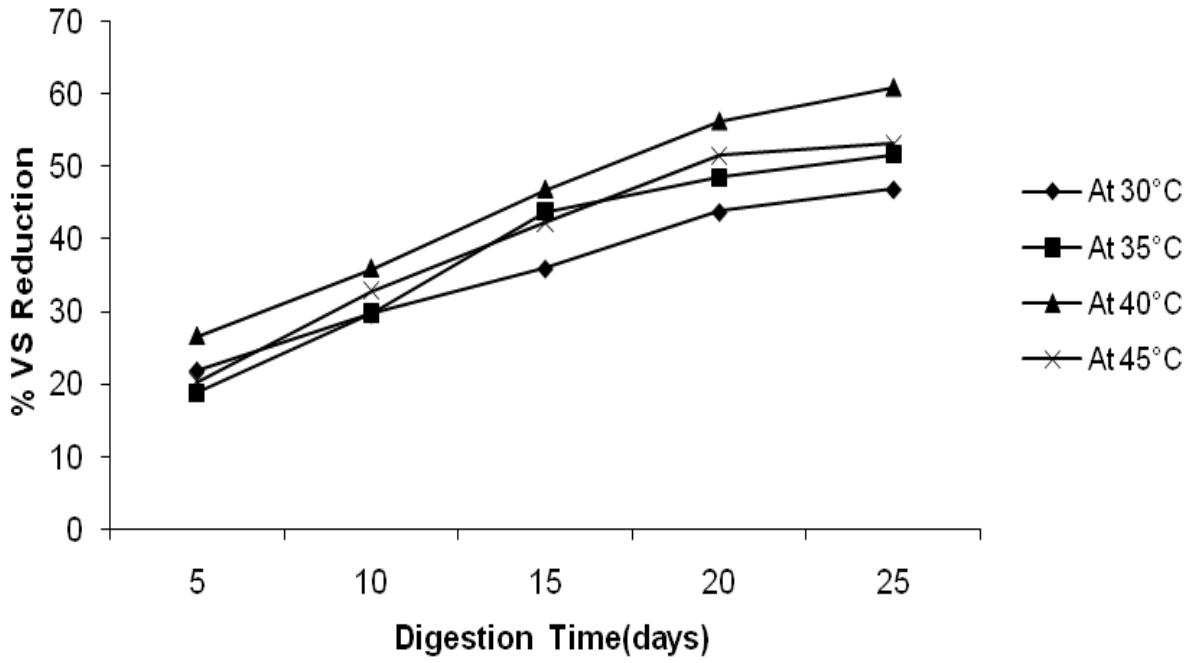


Table:6 Percentage Reduction of Volatile Solids at 30^{0}C, 35^{0}C, 40^{0}C and 45^{0}C Temperature

S.No.	Digestion Time(days)	% VS Reduction			
		At 30^{o}C	At 35^{o}C	At 40^{o}C	At 45^{o}C
1.	5	21.87	18.75	26.56	20.31
2.	10	29.68	29.68	35.93	32.81
3.	15	35.93	43.75	46.87	42.18
4.	20	43.75	48.43	56.25	51.56
5.	25	46.87	51.56	60.93	53.12

Fig-6. Effect of digestion time on % VS Reduction at four different temperatures



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Histopathological observations on *Dactylogyrus sp.* in Indian major carps *Catla catla* (Ham.)

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Abstract

Dactylogyrosis in *Catla catla* the disease is caused by a monogenetic trematodes, Dactylogyrus sp., which affected particularly the gills of the fishes. The present investigation carried out on Dactylogyrus parasitic effect on *Catla catla* under pond culture condition. It has been observed that gills of diseased fishes become very pale in color and showed hemorrhagic and inflamed areas had excess secretions of mucus. The histopathological changes founds in the gill tissue was the excessive proliferation of the secondary lamellar epithelium due to hyperplasia led to the fusion of adjacent lamellae. Epizootic condition due to this parasitic infestation in Indian major carps causing mass mortalities in rearing and large fish culture pond.

In present study revealed that histopathological examinations of the organ status of fish and presence of pathogens in them will play vital roles in disease control and health management in the aquaculture.

Introduction

Dactylogyrosis disease has been found to occur predominantly in the nursery and rearing ponds and also in the large fish culture ponds. The disease is caused by a monogenetic trematode, *Dactylogyrus sp*., which affected particularly the gills of the fishes and epizootic conditions due to this parasitic infestation in Indian major carps causing mass mortalities. The adult of this parasite was found attached to the gill tissue of the host by a characteristic structure having a row of hooks and sometimes suckers as well. These hooks caused much damage to the gill tissue by penetrating through it.

Studies by Wunder (1929), Layman (1951), Paperna (1964) and Kollmann (1972) have clearly shown that *Dactylogyrus sp.* is an important pathogenic parasite which may cause deaths even by itself, depending on the worm burden and the size of the host fish. Histopathology is the microscopic study of tissues affected by disease. The procedures adopted for the preparation of material for such studies are known as histological or histopathological techniques. Histopathology is an important modern tool

for quick correct and reliable diagnosis of fish diseases. It helps to identify and extent to damage in the organs of the diseased fish and also the etiological agents harbored in target organs of the fish. It play significant role for understanding the mechanism of disease processor and the course of diseases ranking from acute and chronic stages through fish level reactions in the host fish by the pathogens. Histopathology also plays very important role in fish quarantine and certification programmes for fish health monitoring.

Material & Methods:

Collected samples were comprised of fry/ fingerlings and adults of Indian major carps *Catla catla (Ham.), Labeo rohita (Ham.)*and *Cirrhinus mrigala (Ham.)*. Samples collected from ponds/ tanks / hatcheries of Darbhanga were brought to the laboratory to patho- morphological and anatomical examinations.

Small bits of tissues (3-4 mm thick) from the vital organs like, gills, kidney, liver, spleen, and, intestine etc. of moribund or freshly killed diseased fish samples were collected and fixed in 10% Neutral buffered formalin for 18-24 hours.

Fixed tissue samples were then processed and paraffin embedded block of all the tissues were prepared using the standard histological methods (Luna, 1968) calcified tissues like skin and gills were decalcified is 10% Nitric Acid which helped in getting perfect and unbroken serial sections of these tissues during microtome. These blocks were cut into serial sections (5-7 think) by a rectory microtome.

For routine staining of the histological sections Ehrlich's Haematoxylin (H) and alcoholic Eosin (E) stains were prepared and used according to (Luna-1968)

Observation:

The present observations reported on the histphthological changes in some vital organs of the *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala (Ham.)* due to *Dactylogyrus sp.* infections.

Highly affected fishes showed growth retardation, weight loss, partial suffocation, lethargic swimming behavior, loss of appetite and tendency to take shelter near pond margins. Gills of fishes became very pale in color and showed haemorrhagic and had excess secretion of mucus.

Squash preparation of a portion of the affected gills showed the parasites attached to the gill tissue of the host by a characteristic structure having hooks and sometimes sucker as well. The gill is favorite sites of attachment of the parasites to the host.

Histopathology

Large numbers of the parasites were seen attached to the secondary lamellar tissue of highly affected (Fig.1). Significant histopathological change in lamellar epithelial cells due to hyperplasia around the site of attachment of the parasites and there was local tissue erosion at the site of parasite attachment, extreme hyperplasic in the lamellar epithelium in the adjacent regions. Excessive proliferation of the secondary lamellar epithelium due to

hyperplasia led to fusion of adjacent lamellae blocking the flow of water between the lamellae (fig.2). The secondary lamellae lost their identity totally and the whole gills appeared like sender rods. The cartilage cells also showed degenerative changes and there were multi-focal haemorrhagic areas in the cartilage.

Internal organs like kidney, liver, spleen, and intestine did not show significant gross pathology.

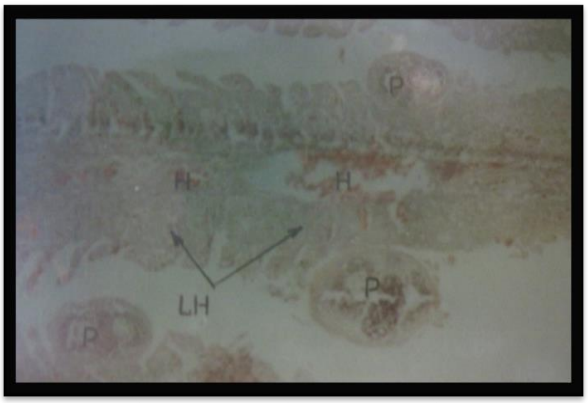

Fig.1. : Gill of *Catla catla* (Ham.) with *Dactylogyrus sp.* Infection showing the parasites (P) attached to the secondary lamellae causing lamellar hyperplasia (LH) and haemorrhages (H) in the primary lamellae.

Fig.2. : Gill of *Catla catla (Ham.)* with *Dactylogyrus sp.* Infection showing hyperplastic secondary lamellar fusion (LF) due to the parasites (P).

Discussion:

Molnar(1972) described histopathological changes due to gill parasitosis of the grass carp caused by the trematode, *Dactylogyrus lamellatus.* The local cells erosions, endothelial impairment and cell degeneration around the sites of parasite attachment. The general gill lesions included degeneration, tissue damage, haemorrhage, necrosis, atrophy and cell proliferation. The results of the present histopathological studies on Dactylogyrosis of *Catla catla* are in perfect agreement with those of Monar (1972).

The *Dactylogyrus* infection is common in fish cultured in tropics (Kabata, 1985). Bauer et al. (1973) described Dactylogyrus vastator as the most dangerous parasite of carp fry in the carp culture of warm climates. The fish through the damaged gills caused by *Dactylogrus* leading to septicaemia and caused mortality of fingerlings in the nursery pond (G. Sugumar, & I. Karunasagar, 2002). Paperna (1964) studied in detail the host reaction of infestation of carp with *Dactylogyrus* parasites. Fish fingerlings become more susceptible to pathogen because of their immature immune system (Anderson, 1974), which support the present findings.

In Dactylogyrosis the branchial epithelium is destroyed at places of attachment of the worms, and these follow tissue fissures. Proliferation of the bronchial epithelial is stimulated by mechanical and according to Bauer et al. (1954) possible also by chemical destruction. Scerbina (1973) the tissue proliferations appear when the young fish have overcome the acute form of

disease. The bronchial epithelial cells in the process are multilayered resulted the capillaries are surrounded by several layers of cells and the gaseous exchange becomes difficult. According to Uspenskaya (1961) diseased fish consume considerably less oxygen than the healthy ones. The results of the present histopathological studies on Dactylogyrosis of *Catla catla* are in perfect agreement with those of studies discussed.

Control Measures:

The value of water quality should be maintained properly to avoid the appearance of parasites in nursery pond.The disease could be effectively controlled in the affected ponds by adopting any one of the following treatment method: (Noga, 2000; Treves-Brown, 2000).

(1.) Formalin solution- 25 ppm. in pond.

(2.) Potassium permanganate solution - 0.5 ppm. in pond.

(3.) Malathion- 0.25 ppm. in pond.

Apply lime at the rate of 250-300 kg/ ha. Apart from liming give dip treatment in common salt (NaCl) solution at the concentration of 5%.

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EDUSAT: The Indian Satellite for Education

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Abstract

EDUSAT was launched in September 2004. Given a life span of about seven years, it would be available till 2011. In case the services need to be continued, a replacement of the satellite would be necessary. Given the requirement of a lead time of about two years for designing assembling and launching a spacecraft, the preparations should start latest by 2009 accordingly. It is therefore, it has been envisaged to the type and replacement required for EDUSAT including the associated changes involved according to the experience.

This paper is an attempt to briefly review the evolution of satellite based education system in the country and the achievements of EDUSAT. It examines the experiences with the present space and ground configurations and discusses the possible changes for improvement and continuity of services.

Introduction

EDUSAT is the first Indian satellite built exclusively for serving the educational sector and was launched successfully by GSLV-F01 on 20-9-2004. It is mainly intended to meet the demand for an interactive satellite based distance education system for the country. It strongly reflects India's commitment to use space technology for national development, especially for the development of the population in remote and rural locations.

The 1950 kg EDUSAT was launched from Satish Dhawan Space Centre (SDSC), Sriharikota, into a Geosynchronous Transfer Orbit (GTO) by ISRO's Geosynchronous Satellite Launch Vehicle(GSLV). The satellite is co-located with KALPANA-1 and INSAT-3C satellites at 74 deg East longitude. Compared to the satellites launched in the INSAT series so far, EDUSAT has several new technologies. The spacecraft is built around a standardized spacecraft bus called I-2K. It has a multiple spot beam antenna with 1.2 m reflector to direct the Ku band spot beams precisely towards their intended regions of India, a dual core bent heat pipe for thermal control, high efficiency multi-junction solar cells and an improved thruster configuration for optimized propellant use for orbit and orientation maintenance. The satellite uses radiatively cooled Ku band Traveling Wave.

Tube Amplifiers (TWTAs) and dielectrically loaded C-band Demultiplexer for its communication payloads. EDUSAT carries five Ku-band transponders providing spot beams, one Ku-band transponder providing a national beam and six Extended C-band transponders with national coverage beam. It will join the INSAT system that already has more than 130 transponders in C-band, Extended Cband and Ku band providing a variety of telecommunication and television services.

How EDUSAT works ?

- The Edusat satellite in orbit carries six KU-band transponders and six extended C-band transponders. The transponders are dedicated to specific regions of India.
- The satellite utilizes an antenna with a 1.2-metre reflector to direct the KU-band spot beams towards their intended regions. This enables information to be broadcast in all the officials languages of India.
- The educational programmes then can be viewed on any television set installed in schools, homes or community halls through a simple low-cost receiver costing about $65 (about Rs Rs 3,250).

EDUSAT Network

In the first phase of pilot projects, a Ku-band transponder on-board INSAT-3B, already in orbit, was used. In this phase, Visveswaraiah Technological University (VTU) in Karnataka, Y B Chavan State Open University in Maharashtra and Rajiv Gandhi Technical University in Madhya Pradesh were covered. In the second phase, EDUSAT is being used in a semi-operational mode and at least one uplink in each of the five spot beams will be commissioned. About 100-200 classrooms will be connected in each beam. Coverage will be extended to the whole of India through spot beams and the Ku-band national beam will also be used to connect a few national institutions.

The Hub for National Beam has been established at Ahmedabad. The National Beam is planned to be used for:

1. Indira Gandhi National Open University —100 terminals across the country and another 20 terminals in the North East for teachers' training.
2. National Council for Educational Research and Training — 100 terminals for Secondary and Higher Secondary Education and Teachers Training.
3. Indian Institutes of Technology at Kharagpur and Chennai— 70 and 5 terminals respectively.
4. Institute of Electronics and Tele-communication Engineers— 18
5. DST/National Council of Science Museums — 25
6. Centre for Environmental Education — 5

Regional Beams of EDUSAT are planned to be as follows:

- Southern Beam: Anna University, Chennai (260 nodes), Annamalai University, Chennai (57 nodes), Gandhigram Rural Institute, Dindigal(90 nodes), Bharathidasan University, Tiruchirapalli (22 nodes),Sarva Shiksha Abhiyan, Tamilnadu (442 nodes)
- *Western Beam: Gujarat Government, Department of Education (148 nodes), Maharashtra, Knowledge Corporation Ltd (50 nodes), July 2005 Department of

Higher Education, MP (50 nodes), Tribal Development, MP (50 nodes), BITS, Pilani (20 nodes), Technica Education Board, Rajasthan (91 nodes) and Blind People's Association, Ahmedabad (25nodes)

- Northern Beam: State Institute of Educational Technology (67 nodes), Guru Nanak Dev University (GNDU), Amritsar (40 nodes), Tapar
- Institute of Engineering and Technology, Patiala 10 nodes), Department of Training and Technical Education,New Delhi (40 nodes), UP Rajashri Tandon Open University, Allahabad (55 nodes)
- Eastern Beam: West Bengal University of Technology, Kolkata (40 nodes), Vidyasagar University, Midnapore, West Bengal (10 nodes), Netaji Subhas Open University, Kolkata (90 nodes), Jarkhand Education Project Council, Ranchi (192 nodes)

Need of EDUSAT based training

Contact based training though advantageous and beneficial, is not always possible for many to attend due to time limitations, financial constraints and importantly day-to-day commitments at work place. There are many types of training courses, which can be attended from a distance with different types of technology and tools. The first among them is the distance education (correspondence courses) supported either with or without study centres. The next one is “Internet based courses” replacing the conventional correspondence courses. The advanced type of courses are “e-learning” where the student can avail the content of the course through the internet, stream the lectures using the internet and have interaction with teachers on a specified date. They can be provided with FAQs (Frequently Asked Questions) and quiz materials for easy learning. The students can appear for examinations on a specified date and location.

The EDUSAT based training also follows more or less e-learning method and provides direct interaction with the teacher/expert when the lecture is delivered using EDUSAT satellite communication. It is advantageous because of its good quality reception and interactions are not constrained due to bandwidth problems of Internet.

Conclusion

The wider picture is that, EDUSAT will give a thrust to distance education. Education will be available at a fraction of its cost to a large number of students i.e. higher education. A large number of students can be educated by a very few extremely efficient teachers who can reach them from the studios located in the universities or education boards. Education can be taken to the students rather than students walking long distances to schools as in the case of rural India. Students can receive education at their own pace and at their own convenience especially those who are employed. This technology can be used to eliminate illiteracy in other parts of the globe especially countries in Africa & South America. Already there are talks about providing education to neighbouring countries like Bangladesh, Sri Lanka., Afghanistan etc. using the EDUSAT. The

satellite is scheduled to start beaming programs within a few weeks from now. Already a 'Janatha '(common man/people) computer is being developed so the impoverished multitudes can have access to information technology at low cost.

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The role of ICT and Education in Transforming India into Knowledge Society

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ICT
Education

Abstract

The paper deals with the aim and aspiration of developing India as a knowledge society and the role of ICT and ICT enabled education to fulfill this process. To respond the situation in which our country is, we have to make our education system more efficient and for this we will have to utilize the ICT fully. On the one hand, we are required to increase our research and development activities and on the other hand, we will have to equip our working force with the ICT capabilities to make them productive. Continuous development of ICT and best utilization of it in all sphere of life generally and in education especially can transform India into an inclusive knowledge society with more equal opportunity for development for all and with the capacity to face the global competitiveness.

Introduction

Human being is a creature as well as creator. Man is unique in the sense that he can create and use instruments to solve his problems and to fulfill his aspirations. He is special because he has tremendous learning capacity. To enhance the learning quantitatively and qualitatively of a learner as well as of society as a whole and to make the process of teaching and learning efficient utilizing inherent learning potential of a person is a prime goal of an education system. To fulfill this goal, different types of teaching aids and learning aids have been used for long time. Information and communication technology is relatively a new concept and new use in this context.

Information and Communication Technology (ICT)

Technology indicates application of scientific knowledge to solve human problems. It includes gadgets/instruments developed with the help of science as well as methods based on science. Information and communication technology is a term which includes various types of devices/gadgets. Information technology indicates devises and systems of devises which is used in acquisition, storage, manipulation, management and

transmission of data, information or knowledge, either in verbal or in non-verbal form – in voice, in pictures, in written words, or in any form. Communication technology indicates devises and systems of devises which is used to connect and communicate meaningfully between two persons or two parties – a person and a group of person or between two groups or among multiple persons or parties. There are some devices which can be conceived purely as a part of information technology, such as personal computer or pen drive. There are some devices which can be conceived purely as a part of communication technology, such as land-line telephone, fax, T.V., radio etc. Along with these, there are many devices and systems which cannot be categorized between these and which are used as information as well as communication technology such as, mobile, laptop connected with internet, email etc. The term Information and communication technology includes all these devices and systems.

Education

Education can be conceived as a teaching and/or learning process as well as a system of education which exists as a subsystem of society. Education is a cause as well as effect of social change. In the one hand, education system changes as social change takes place; in the other hand, social changes can be brought up by planned change in education system. Globally, Social and economic changes has been accelerated with time, especially after industrial revolution. Human society has been changing from agrarian society through industrial society to knowledge society.

Knowledge Society

Historically, the post-industrial society is called knowledge society. It is the result of information revolution and knowledge explosion. This society is different from industrial society and agrarian society. Major part of the population is occupied in primary sector (agriculture and mines) in agrarian society and in secondary sector (manufacturing industry) in industrial society. Large part of income generates in industrial society from secondary sector and in agrarian society from primary sector. Per capita productivity/income is very low in agrarian society and it is low in industrial society. But it is high in post industrial society i.e. in knowledge society. Therefore, knowledge society is a prosperous society, which is different from earlier scarcity societies. In this society, largest part of population is occupied in tertiary sector (service area) and most of the income generates from this sector. Production becomes more knowledge intensive. Percentage of scientists, engineers, doctors, teachers, managers etc. are highest in this society. Most of the developed countries have transformed themselves into knowledge society and India is moving towards it slowly.

Status of India

India is a developing country with more than 60 percent population still dependent on primary sector. Largest illiterate people of the world are living in our

country. In a competitive world, where advanced nations are trying to enroll almost all young people, of relevant age group, in higher education institutions, we are still struggling with literacy and hundred percent enrolments in primary school. We are lagging behind in the development criteria, whether we measure it in terms of per capita income or in terms of human development index. Because of this situation, to fulfill basic needs of our people is a challenge before us. We have huge natural resources. It is rightly said and it is still true that India is a rich country where poor people live. We are the second largest country in the world in terms of population. In this sense, we have a huge potential human resource. We are a youthful nation. To make this potential human resource highly productive one is the challenge for us. Salvation of this country from poverty and inhuman conditions depends on many factors; among these, role of education system and use of latest information and communication technology is crucial one.

Role of ICT and Education

Education is required to follow the social, economic and technological changes taking place in our country and in abroad, and at the same time, it is required to make planned change in education to bring desired progress at social and national level. In this context, transforming India into inclusive knowledge society is necessary as well as desirable. It is necessary to exist in a competitive world and it is desirable to make the lives of people of our country dignified and humane. India has the capacity to be a knowledge superpower. For this, first of all, it is necessary to make develop our country as a knowledge economy. This can be done by utilizing ICT in all spheres of economic activities. But, the most important aspect of it is the production of new knowledge, research activities. In a knowledge economy, most of the people are knowledge worker, who creates, disseminates and uses knowledge and information. New knowledge through researches, innovation and new technologies increases productivity. ICT is of a great help in facilitating research activities. There are two aspects in which ICT can play role in this context. One is to produce personnel for this purpose, and the other is to improve research facilities. Higher education performs this work. Higher education is meant to deal with complex and advanced knowledge and to develop higher cognitive and affective abilities among students. But, the most important function of higher education is the advancement of knowledge and to build a system to create personnel who can carry out the process of advancement and in this way, continuously enlarge the boundaries of human knowledge. By enabling students to use ICT for researches, higher education can promote knowledge production. Therefore, prime focus should be to develop ICT capabilities in students. The other way to facilitate is to provide improved resources for research. In this case ICT can be helpful in making aware the latest researches, the works done in different parts of the world. It facilitates in collaboration. ICT is also helpful in making calculation and statistical works easy. There are many research works which

is not easy to do in real laboratory or in the real world. It requires facilities which are not available in developing country like ours. ICT is helpful in facilitating experimenting in virtual conditions, in simulated conditions. It is done in less expenditure, less risks, and with high accuracy. In this way, engine of knowledge society, the knowledge production can be made powerful and we can make India a knowledge superpower, which is the necessary condition to make it an economic superpower and a real military superpower.

To make India an inclusive knowledge society, it is necessary to fill the gap between poor and rich. The fruits of development must reach to the disadvantaged groups. There is a new threat of digital divide. To strengthen democracy in our country, there must be equal opportunity for all to enhance their potentialities up to optimum level. It is not easy for traditional education system to tackle these challenges. With the help of ICT, by using open and distance learning system, this can be solved. ODL can be used to empower disadvantaged group of people. By incorporating ICT from primary and secondary education, students can be equipped with necessary ICT skills, motivations and attitudes so that they can use ICT resources for life long learning and for higher education through ODL system. .

Conclusion

It is clear that to respond the situation in which our country is, we have to make our education system more efficient and for this we will have to utilize the ICT fully. On the one hand, we are required to increase our research and development activities and on the other hand, we will have to equip our working force with the ICT capabilities to make them productive. Continuous development of ICT and best utilization of it in all sphere of life generally and in education especially can transform India into an inclusive knowledge society with more equal opportunity for development for all and with the capacity to face the global competitiveness.

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E- learning and Higher education : Issues and challenges

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Abstract

India with a population of 1.1 billion faces many challenges. Aside from the wide array of religions, there are 23 languages and 1,652 dialects which belong to four major languages (UNICEF, 2007) with statistics like this it is hard to believe that a country can even function let alone implement an affective e-learning strategy for the masses. India's higher education system is the 3rd largest in the world, next to the United States and China. The increasing influence of globalization and the emerging information society, set new requirement for all areas of social life, including to higher education. The life of knowledge and human skills today is shorter the ever, mounting the pressure to remain up to date with ones education and training throughout a career. The information and communication systems whether networked or not serve as specific media to implement the learning process. However India has many obstacles to overcome before it can offer its entire population access to an advance technology like e-learning. Large segments of the population live in poverty and many do not know how to read or write. Although with all the obstacles, the future looks bright for e-learning in India. In India, education through technology is way to irradiate years of castes oppression, poverty and at same time increase literacy. This paper concentrates on the Indian higher Education Scenario, pros and cons of e-learning and challenges of e-learning in India.

Introduction

Higher education plays a major part in shaping the quality of students in modern Indian society. Our colleges and universities not only educate each new generation of leaders in government business science, law, medicine the clergy and other advanced professions, but are also responsible for setting the curriculum standards and training the personnel who will educate the entire citizenry at the pre collegiate level.

The increasing influence of globalization and the emerging information society, set new requirements for all areas of social life, including to higher education. E-learning became an important instrument in the new higher educational environment in the digital age which creates student centered learning and educational practice, offering new more flexible learning methods. E-learning comprises all forms of electronically supported learning and teaching.

The term "E-leaning" came into regular use around 2000. It's precise meaning is not widely understood. The definition of E-leaning can be as simple as "the delivery of a learning, training or education programme

by electronic means, involving the use of computer or electronic device.

The concept of e-learning is still vague to many of us in India. E-learning is essentially electronic learning and is delivered through a computer. In different sectors and with different people the meaning of e-learning differs. In many Universities, the term is used to mean a specific method to convey contents of course or program to the students online. Many higher education systems now days are offering e-learning to their students. There are fundamentally two types of e-learning: Synchronous training and asynchronous training.

Synchronous, means "at the same time, involves interaction of participants with an instructor via the web in real time. Asynchronous, which means "not at the same time," allows the participant to complete the web-based Training at his own pace, without live interaction with the instructor. A new form of learning known as blended learning is emerging. As the name suggests it is an amalgamation of synchronous and asynchronous learning methods.

Indian Higher Education Scenario

Education has become indispensable not only for its own sake for making people literate and knowledgeable, but also as a means of empowering them and for the development of society. Without education, the technological revolution that continues unabated would not have been possible in our lives.

In India, the higher education has got both government and private players in the market. It consists of arts, science, and management, technical and professional education. Since the Indian knowledge industry is entering into the take off stage, the strategy of survival of the fittest holds good. In comparison to the western, advanced countries where about 40% of the relevant age group people go in for higher education, for India, the corresponding figures are relatively lower- about 65% people are literate and about 10% of the relevant age group population go in for higher education. Efforts are on to increase the latter to about double the present figure in the next ten years. The nature of education as well as the background of people seeking HE has also undergone vast changes. However the system has many issues of concern at present, like creating new knowledge, acquiring new capabilities and producing an intelligent human resource pool, through challenging teaching, research and extension activities so as to balance both the need and the demand.

There are a number of benefits of e-learning that are unique in the following ways:

- All institutions, research institutions, regulatory bodies, professionals, academicians and students can be integrated on regional state, national and international level. Sharing of knowledge, experience, infrastructure and technology will enhance the effective and efficient utilization of available resources.

- Students can have an access to unlimited storehouse of information at any hour and from any place.
- It helps removes the bias of sex, religion, colour, caste etc.
- It makes learning exciting, engaging and compelling.
- It is an active experience with the emphasis on interactivity and 'learning by doing'.
- Cost effective for both students and organization.
- Zero opportunity cost of time.
- It helps in the establishment of balanced education between rural and urban area.
- It provides better quality output and understanding of educational concept through utilizing ICT as materials supporting class.
- E-learning emphasizes continuous learning and promotes "just in line" and "just enough learning.

Challenges – To be faced by e-learning:

- E-learning is not, however, the be all and end all to every educational need, because computers cannot replace human being.
- The time invested to create, teach and maintain an e-learning course.
- E-learning's impact on the instructional process is just beginning and offers an analogy to the development.
- Generally the duration of the course also matters in this mode of lesson delivery.
- Measuring the level of success and the return on investment would be difficult.
- Some participants may be technologically challenged and are hesitant to participate in full.
- Some students, especially those for whom English is not their native language have difficulty communicating and being understood.
- The impersonality, suppression of communication mechanisms such as body language and elimination of peer-to-peer learning reduced social and cultural interactions are major drawbacks associated with e-learning mechanism.
- Majority of population staying in rural areas and making them aware about the concept of e-learning is a major challenge.

Future of e-learning in India:- E-learning in India has a very big potential and a bright future. At present many Indian students are going abroad for education with various demands. All those demands can be satisfied through commercial/private player's entry into the knowledge market in future.

Just as technology has become an intrinsic part of our lives, it has penetrated all areas of teaching and learning at the higher education level. From radio, films and television, we have entered the computer and the internet age. Computers and their varied and ever changing applications are becoming part of the educational scene today. Computers and internet have

brought in an astonishing change in the lives of most people across the world. According to Asha Gupta(2008), "We have moved from the industrial age to the networked age. We have moved from the agricultural and industrial revolutions to the information revolution." E-learning has not only become widespread in USA, Canada and Europe, it is becoming popular in India at the higher education level.

India has a major role to play in the international e-learning services industry. It is already one of the leading IT service provide countries, and it is now aiming to achieve the same position in the IT enabled services. On the domestic front, the government and private sectors have taken many e-learning initiatives. The government is taking various measures to improve the communication systems and new technologies like 3G in the telecom space have already started to be implemented to make things better. Funds have been invested in setting up Internet Kiosks in rural areas for the purpose of communication, which can be used for e-learning initiative as well and can help in providing informal and vocational training as well as formal education.

Theories related to E-learning:- Various scholars have suggested different techniques for promoting good and durable learning by students. Some of the prominent ones are given in brief, below:

Jerome Bruner (1960) showed through his studies that effective learning takes place through a spiral path rather than just linearly.

Vygotsky (1978) states: "Every function in the child's cultural development appears twice:

First, on the social level, and later, on the individual level, first between people and then inside the child. This applies equally to voluntary attention, to logical memory, and to the formation of concepts. Diana Laurillard (2004) focuses on some generic benefits of e- learning – cultural, intellectual and practical. She summaries them as follows:

- **Cultural:-** Students are comfortable with e-learning methods since they are similar to search and communication methods they use in their lives.
- **Intellectual:-** Interactive technology offers a new mode of engagement with ideas via online interactivity both social and material.
- **Practical:-** E-learning offers greater flexibility of provision in time and place.

However not much research has gone into finding out student's response to e-learning in India. In general the authors report that where e-learning is coupled with established pedagogy, student have a positive response but where a different pedagogy to the traditional one is adopted ,student feel ill at ease and report an intensely emotional experience and have difficulty with time management.

Suggestions

While e-learning will not replace teachers, it will enhance the quality and reach of their teaching and reduce the time spent on administrative chores. In

introducing e-learning we must make sure that we balance it with other teaching and learning methods. E-learning should recognize that its value is linked to its suitability to individual learning and teaching styles and strategies. It must be very thoughtfully selected and integrated into educational planning and management. It is almost a truism that face to face contact encourages learning through social interaction. Thus e-learning must also include face to face student teacher contact and should supplement and not supplant trades.

Many sectors like Education, Banking, Medical, Agriculture or even the Entertainment industry can use e-learning to lure students and offer introductory courses that can explain the varied opportunities that those fields offer.

Conclusions

To conclude modernization of education in Indian colleges and Universities is a necessary attempt. In developing countries like India, e- learning can raise the level of education, literacy and economic development. This is especially true for countries where technical education is expensive, opportunities are limited and economic disparities exist. Last but not the least while e-learning has come to stay in today's educational environment, one should be careful in its use in order that teaching-learning becomes effective, interesting and encompasses the diverse range of student's back ground and abilities.

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Motivating factors for the Use of Information Technology in Higher Education

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Abstract

Studies indicate that teachers may not be inclined to take initiative to learn new skills and actively search for methods for improving their teaching practices. Therefore it is vital that teachers see a need to change their current teaching methods for a meaningful adoption of information technology in higher education. Most courses on the use of information technology focus on skills training without adequate focus on the pedagogical practices needed for seamless integration of information technology in the curriculum. Thus attending a course may not prepare a teacher to change his/ her teaching style. Unless course coordinators address this basic issue the chances of a long term impact on the adoption of information technology tools in higher education are poor.

Introduction

The technology acceptance model of Davis, Bagozzi and Warshaw suggests that perceived usefulness and ease of use are linked to attitudes, intentions and actual use of computers. External factors that may influence the use of information technology in higher education include a) Inclusion of information technology in the university curriculum b) Minimum skills requirements for recruitment / promotion c) Availability of funds for conducting training programmes d) changes in society attitudes towards the use of IT in daily life e) Policies of funding bodies, recruiters and parent institutions towards information technology f) Opinion of peers and students etc.

Most of the discussion about the use of IT focuses on problems in its adoption. We studied factors that might motivate teachers to increase the use of IT in their classes. The results are summarized in the table-1 below.

Our results suggest that making lessons more interesting and improving the presentation of material are important motivating factors for teachers. Teachers may also be encouraged by the fact that using IT can make them more proficient in the use of computers and other tools and

also increase prestige in the institution. These results suggest that there is likely to be a positive attitude towards IT among teachers provided basic challenges like access, training and infrastructure sufficiency are fulfilled.

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Table-1

Variable	Agree	Undecided	Disagree
IT makes lessons more interesting	66.67	23.33	10.00
IT improves presentation of material	60.00	13.33	26.67
Using IT increases awareness of its capabilities	80.00	3.33	16.67
Using IT increases confidence in using computers	76.67	3.33	20.00
Using IT increases prestige in institution	53.33	10.00	36.67

All values are in percentages

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Information and communication technology (ICT) tools in biology and education

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ICT tool,
Biology,
Education, Research

Abstract

Change is the law of time. Nothing is static in the world again everything changes almost every second of the day. Education has no exception in 21st century; we witness a speedy and dynamic change in education especially in higher education. With the advent of Information and Communication Technology (ICT) in last decade, there is a dramatic increase in e- education providing very rich, interactive and collaborative learning. Previously, students have to spend time in library to search their required information, but today, it is available instantly on World Wide Web (www) by press of a button. The advent of Science Blogs, E- portfolio, Instant Massaging, Podcasts etc. have heralded a new era in science education, research and communication. These are, therefore, an excellent way to keep the new generation informed of latest scientific research. Introduction of ICT in biology lessons can not only raise level of knowledge but also the attitude of students towards biology as well. Problems in practical can also be solved by using ICT in biology classes. Technology –integrated education is the need of the present generation.

Introduction:

The world we live in is constantly changing. In 21st century, the society has become a technological one and millions of people around the world are using new technologies for communication, work, business, pleasure, education and entertainment. The education sector has further gained momentum due to swift advancements in information and communication technologies (ICT). With the advent of internet technologies in past decade, it has brought a turbulent change in Indian education system especially in higher education. Books, Blackboard, writing with pen in notebooks have got new names and new identity. On line (e-learning) education has provided users with a unique opportunity to learn at their convenience and at their preference. In current information society, one has to access knowledge via ICT to keep pace with the latest developments. Therefore, ICT can be considered as a sub field of educational technology. Now, ITC has become indispensible and inseparable part of education processes and teaching, learning activities. Introduction of ITC in education

reflects and responds to present and future needs of people functioning in an intensely changing and challenging intellectual environment. The presence of it has actually transformed the teaching, learning and administrative environment in post secondary education worldwide.

But, science and technology have long been linked and so is with science education and technology. Science education is very important to technological developments of any nation because of its numerous benefits (Awolaju et.al.2010). Nowadays education undergoes the great progress. The end of time when Over Head Projector with slide was the latest equipments found at institutes, has been reached. The Information and Communication Technology integration is the topical requirement of everyday life and plays an important role in social globalization. When we integrate use of ICT in science classroom, we are introducing how to teach and learn Science and to present science concepts in new dimensions. Nothing is static in the world again everything changes almost every second of the day, so should be educational activities in science teaching and learning. Science is dynamic, new technologies and discoveries are coming up everyday. We can only benefit from these new developments when we are connected to world through ICT.

Science education is the study of biology, chemistry, physics or mathematics. Gone are the days when teaching and learning is only based on talk and chalk method. Now, the world is in the era of ICT where in not restricted by time, space and channel (Ajayi and Ojo,2010), teaching and learning are not restricted to time, space and channel. Use of internet gave advantages in science teaching as-

*Science literacy is connected to computer literacy. This term was introduced to distinguish between users and non users of ICT (Bawden,2001).Ability to work with ICT is recognized as one of the key competencies necessary for success in life. By this , we empower students with the tools necessary to engage in life long learning for responsible decision making.

ITC enhances the way we teach science providing new possibilities for teaching difficult concepts and ideas.

- By including ICT in science curriculum, we are able to connect the history of Science (things we'know') together with actual internet connections where science research is being conducted. ICT is available to keep science teaching, learning and research up-to-date. There is no need to talk about outdated works.
- To raise the quality of education with support of ICT.
- Students are comfortable with ICT today and keep abreast of new technological developments and science in a sound fashion.

Never before was information so readily available at press of a button. Nowadays, academicians do not need to spend time on library for research taking copious notes. World Wide Web (www) has provided the facility for faster, surer and up-to-date information only by a click, just not to read but to print or save or forward to others as suit their purpose. Over the past few years, on-line journals have now become as respected as any print journal. Researchers have facility to download the latest material on required topic. Many search engines are available to provide everything published in science. Students can participate in any seminar, interview or give exam. etc. on-line. The advent of Science Blogs and E- portfolio have heralded a new era in science education, research and communication. These are an excellent way to keep the new generation informed of latest scientific research (Agarwal, 2012).

Science research and development of technologies are crucial activities in a knowledge and information driven society and will become even more important in the future.

Application of ICT in Biology Education;

According to Kubioatko and Halakova(2009), introduction of ICT in biological lessons can raise not only level of knowledge but students' attitude towards biology as well. Computers help students visualize objects that are difficult and impossible to view e.g. to display human anatomy, internal structure of human and animal cells. Software are already developed which shows actions of viruses and bacteria which if teacher were to teach, such, apart from the danger poses to both teachers' and students' health.

Teaching biology is often faced with practical problems like keeping animals, ethical concerns about animal dissection etc.(Miller and Lock,1992). Law is already promulgated against animal killing for experimental purposes, thus use of models, biological settings and computer animation could solve the experimental purpose for students in life sciences. Many plants in Botany, animals in Zoology, insects in Entomology can never be found in India, some fossil plants and animals yet must be learnt by students, with ICT all these are made available to students as if they are in real forms. Different ICT tools may also be used in teaching Taxonomy of organisms, Ecological education, ecology and environmental protection projects (Potyrala, 2002, 2003,a; Potyrala and Kuczek,2003). Information Technology is also being used more and more in biology for data collection (e.g. Homeostasis; estimating the size of a population of plant species using quadrates, calculators, transects etc. ; measuring the rate of an Enzymatic reaction etc.) and data processing like graph, pie chart drawing, statistics calculations etc. Animations may be used to demonstrate various physiological processes in plant and animals. In biology practical, students may use e-skeletons to do comparative taxonomy of primates using brain size.

The rapid developments of ICT in past few years, allowed a revolution in overall education system including medicine, veterinary medicine and animal production field's involvements. ITC advancements in last years, gives news, opportunities and challenges for biological sciences and technologies, veterinarians, veterinary technicians, practice managers, veterinary students. The ITC are present as a tool in all science and technical fields like medicine, surgical, food safety, public health, bioinformatics, genetic research and many other areas.

Computer Assisted Instruction (CAI) tools like word processers, spreadsheets and data bases are used to collect, organize, analyze and transmit information. Tools like Computer Aided Design (CAD), Teleconferencing, and Library Communication System (LCS) also facilitate communication among students. These CAD and Computer Aided Manufacture (CAM) and auto fabrication technique have allowed prototyping and creation of physical models that represent biological molecules at all levels of complexity. By enhancing the information content of these complex physical models, the learning process in molecular biology can be greatly complemented and accelerated (Sankarannarayanan et.al. 2003).

A new era in science education, research and communication has begun through the creation of Science Blogs, E-portfolios, Wikis, Instant Massaging (IM), Podcasts and Vodcasts etc. Research students of biology may use science blogs for making them aware with latest scientific researches and contributing to the enrichment of thoughts of their topics (Mishra, 2010). E- Portfolio provide research

information such as documentation, references supporting specific research, academic and professional achievements, photographs etc. (Nair, 2009). Wiki is a collection of web pages that are
linked to each other and reflect the collaborative works of many authors. It felicitates the creation of shared knowledge, disseminating information and group interaction. The collaborative content development models, in form of ' Wiki books' as a digital alternative to traditional text books, could contribute to new models of knowledge development. Instant Massaging (IM) promotes collaborative learning and team work and communication skills. Podcasting and vodcasting provide an innovative way to improve communication, social networking during research. These new technologies improve learning in life science as well as research work.

Conclusion

So, new information and communication technologies offer a chance to gain momentum in biological research and teaching –learning methods and are providing a better educational environment. Today, ICT has become an accepted tool for learning and teaching in higher education and has emerged as one of the fundamental building blocks of modern society. Technology integrated education is need of the day.

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ICT and its Role in Mathematics Education

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ICT,
Mathematics
Education

Abstract

Information and Communication Technology (ICT) has spread in almost every facet of lives including in educational institutes. The education authorities have, over the last decade, taken concrete steps to encourage the use of computers to enhance teaching and learning. The use of ICT in the classroom needs initiative of teachers themselves to discover what is appropriate for their students.

Introduction:

Information and communications technology (**ICT**) is often used as an extended synonym for information technology (IT), but is a more specific term that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

The phrase *ICT* had been used by academic researchers since the 1980s, but it became popular after it was used in a report to the UK government by Dennis Stevenson in 1997 and in the revised National Curriculum for England, Wales and Northern Ireland in 2000. As of September 2013, the term "ICT" in the UK National Curriculum has been replaced by the broader term "computing".

The term *ICT* is now also used to refer to the convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. There are large economic incentives (huge cost savings due to elimination of the telephone network) to merge the audio-visual, building management and telephone network with the computer network system using a single unified system of cabling, signal distribution and management

Application areas

More and more application areas are becoming relevant to sustainable development in industry, health care, agriculture and the information society. And they have an impact on the perspectives of ICT, the environment, policy and science. More and more interest has been emerged as well to risk and disaster management, adaptation to climate change and resource use.

- ICT in Energy Consumption/Efficiency
- ICT in Climate Change[3]
- ICT and Sustainable Use of Natural Resources
- ICT for Biodiversity
- Eco-industrial Applications and ICT for Industrial Ecology
- ICT in Agriculture
- ICT for Landscape Ecology
- Personal Information Systems and Quality of Life
- ICT for Sustainable Urban Development
- ICT in Health Care
- ICT for Environmental Risk Management

Information and Communication Technology (ICT) has spread in almost every facet of lives including in educational institutes. The education authorities have, over the last decade, taken concrete steps to encourage the use of computers to enhance teaching and learning. Implementation of this is done through two phases of master plan (MP1 and MP2). Target of MP1 is how students would have access to technology in learning. In the mathematics classroom, the goals of the MP1 translate into a vision of "integration of ICT to enhance the mathematical experience". The aim of MP2 is to make effective use of a variety of mathematical tool in the learning and application of mathematics.

LOCAL RESEARCH ON USE OF ICT IN MATHEMATICS EDUCATION

In classrooms, there are technological change and increasing in the number of studies on the use of ICT in the teaching and learning of mathematics since implementation of MP1. The broad agendas of most local research directions are: ICT-use as a "better" way for teaching mathematics; ICT-use as a "better" way for learning mathematics and ICT-use in relation to other factors in the instructional environment.

ICT-USE AS A "BETTER" WAY FOR TEACHING MATHEMATICS

Some literatures that show how mathematics teaching can be better with the aid of particular features of relevant software when they are suitably harnessed:

1. Tay (2004), a fictitious lottery game designed using *Excel* where 4-digit numbers can be easily generated using the software's inherent random function. The use of Excel is better for the purpose of dispelling "near miss (a permutation of the same 4 digits)" myths in teaching because traditional equipment is incapable of producing quick and random generation of numbers afforded by the software.
2. Wu (20002), the power of random-numbers generating in *Excel* is advantageous for replicating experiment-like conditions. Features of software can help simulate data and demonstrate it using statistical graph, like a bar chart, table or diagram mode. This is important in strengthen the connection between different representational modes in teaching.
3. Wu and Wong (2007), design of computer-based activities for students help students to explore aspects of statistical graph. For example, Excel templates had helped the students extend their understanding of statistical graphs.

4. Ang (2006) described about graphing software can help students solve differential equations easier than analytic method.
5. Yu, Lam and Mok (2004) described about the use of hand-held graphing calculators in teaching the transformation of graphs and the sketching of polar curves. This can help students focus on the gestalt changes and features of the graphs.
6. Ho (2002) and Ong (2002), this study related to type of computer program in dynamic geometry software (DGS), especially about *sketchpad* that used widely in Singapore school. Sketchpad helps students see the underlying geometrical relationships, moreover when conventional static drawing is difficult to be applied.

ICT-USE AS A "BETTER" WAY FOR LEARNING MATHEMATICS

A number of experimental studies were conducted to study the effects of ICT in term of student's achievement scores.

1. The impact of the Logo software was studied in an intact Primary school 4 class. In the result of semester examinations, the percentage passes of students in the treatment class were ranked against those of other eight classes in the same grade level that did not have access to Logo.
2. The effects of computer use on students' learning of students' procedural knowledge and logarithmic curves. The result was the treatment class did significantly better than the control class.
3. The use of *Sketchpad* has been studied. Significant treatment effects were found which "seemed to indicate that computer-based mode were instruction appeared to enhance the learning of angle properties of circle in terms of achievement (score)".
4. Ng (2004) utilized the TI-92 CAS graphing calculator in CAS Intervention Program (CASIP) for Secondary 3 students under a quasi-experimental design. The study did not confirm any advantages or disadvantages in the use of CAS calculators over scientific calculators. However, post-CASIP data showed that students in the TI-92 group had heightened interest in exploring mathematics concept and were pleased to be able to utilize the calculator.
5. Several studies attempt to assess effects in the affective domain, for example at finding out students' interest level and emotional responses with respect to learning in computer environment. Study of Ong (2002) related this showed there was no significant difference about interest on mathematics in general. Study by Yeo (2003) also found that there was no significant difference between the control and treatment groups. However, there was a moderate positive effect towards the use of computers in learning. Other studies related observing of student's attitude in using features software are study by Ng (2005) and Ho (2002).

The obvious limitations to the studies reported above are mainly in the scale and the duration of research. These may partially explain why the researches gave mixed result. Nevertheless, while positive effects cannot be guaranteed, a common

finding seems to be that thoughtful ICT use does not adversely affect students' learning, at least in achievement scores and interest in Mathematics. Quality computer-based instruction certainly involves careful weaving of ICT tools together with other important components of successful teaching practice.

ICT-USE IN RELATION TO OTHER FACTORS IN THE INSTRUCTIONAL ENVIRONMENT

This part shifts the focus of inquiry away the technological tools and their effects to how these tools interact with other elements during the instructional process.

1. Leong and Lim-Teo (2003) studied the relation between *Sketchpad* use and the instructional approach adopted in the classroom. The students were taught the same topics in transformation geometry, but *Sketchpad* was used differently in the three classes. Although the test scores did not reveal any significant differences in conventional achievement, there were differences between the responses of students. Students who used *Sketchpad* in a guided-inquiry and exploratory setting tended to develop stronger concept images of the underlying geometrical ideas. In other classes where the method of classroom instruction did not suitably harness the advantageous features of the technology, there was a comparative lack of depth in student's learning.
2. Some writers have highlighted the problems when ICT is viewed against the backdrop of other complex instructional issues. Ang (2006) surmised that although there are many ways IT can be utilized in classroom teaching, teachers are required to look into other aspects of teaching, such as examination-relevance.
3. Technical glitches associated with ICT use is also not trivial problem. As in Chua's (2006) study of students using video conferencing, lapses in hardware or software can cause considerably frustration to students and impinge on their learning when they are unable to keep up with a disrupted lesson. Therefore, the stability and robustness of computer systems is another important consideration when implementing technology-based lessons.
4. ICT still be challenges for teacher. When they brings technological tools into the classrooms, there was more complex instructional than originally intended. Change in teaching learning activities can pose significant challenges for the teachers and the students too. Example related this case was study of Laborde (1999), Olive (1998), Yet, Leong and Lim-Teo (2002) about using of *Sketchpad*
5. The close relation between ICT use and other complex instructional elements in teaching could explain why there is yet little evidence to suggest a widespread integration of information in Singapore classroom. Study by Leong (2003) about the use *Sketchpad* gave result that 33 out of the 44 teachers indicated that they had used *Sketchpad* at some parts in their teaching. They preferred teacher-controlled demonstration than mode of *Sketchpad*. Thus, the full power of Sketchpad and its potential to transform classroom into lab-like places for students' inquiries were generally not realized among schools that participated in the survey. It leads to the general conclusion that ICT use may be less of "integration".

6. Another instructional element is the attitude of teachers towards ICT, as teachers' beliefs about educational change directly affect implementation of new initiatives. To ascertain teachers' attitude toward CAS, Ng (2003) developed a 40 item CAS Attitude Scale (CASAS). Ng also developed the Crucial Factors in the integration of ICT Survey (CFS). According to the result of his study, it gives some indications to the direction in which the overall environment for ICT integration needs to be developed. Ng also conducted a survey related to the importance of teacher's professional development.

Conclusion:

Growing of local researches on the use of ICT in the classroom also make growing of the use of ICT in mathematical education that have yet to be explored. Different results of researches are because of variety in contexts and specifics use of tools, group of students and teachers. Hence, there is still great potential for research in ICT implementation in actual classroom using wider contexts of other classroom variables. However, it's virtually impossible to cover every facet of the field exhaustively although further study may be investigated. The use of ICT in the classroom needs initiative of teachers themselves to discover what is appropriate for their students. The aim, therefore, is not to provide students with a new "technology toy", but rather to create opportunity for active learning that enable the development of a wide variety of content knowledge, skills, processes, and attitudes that they may bring with them into the real world.

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Cropping System in Indian Agricultural (A study of Post Reform Period)

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cropping,
agriculture,
land use, crops, soil

Abstract

This paper attempts to focus on the Indian cropping system & its role in development of Indian agriculture. It also highlights on land use pattern in India and also on the quality and accessibility of cropping pattern through the use of crop diversification. In the age of globalization the emphasis should be given on to adopt new technology and innovation in cropping system for the development of Indian agriculture.

Introduction:

Cropping systems of a region are decided by and large by a number of soils and climatic parameters which determine overall agro-ecological setting for nourishment and appropriateness of a crop or set of crops for cultivation, nevertheless, at farmers' level, potential productivity and monetary benefits act as guiding principles while opting for a particular crop system. These decisions with respect to choice of crops and cropping systems are further narrowed down under influence of several other forces related to infrastructure facilities, socio-economic factors and technological developments, all operating interactively at micro-level.

Cropping pattern is defined as the yearly sequence and spatial arrangement of crops or of crops and fallow on a given area. Growing two, three or four crops in a year is defined as double, triple and multiple cropping. The repetitive cultivation of an ordered succession of crops (or crop and fallow) on the same land is defined as crop rotation. One cycle may take one or more years to complete. It defines crop intensification in time dimension. The succeeding crop is planted after the preceding crop is harvested.

Land use classification based on different type of uses shows that of a total land mass of 328.73 million ha in the country; the reported area for land utilization has been 306 million ha. This includes 141 million ha (about 46 per cent of the reported area) net sown area, 70 million ha (23 per cent) under forest, 26 million ha under non-agricultural uses, 25 million ha fallow land, 17 million ha barren and un-culturable land, 13 million ha culturable waste land, 10 million ha under permanent pasture and other grazing land, and 3 million ha under miscellaneous tree crops and groves.

Over the years there has been a gradual increase in area put to non-agricultural uses. During the last forty years (1970-71 to 2008-09) the net sown area has remained, by and large, constant at 141 million ha. Area under non-agricultural uses has increased from 16 million ha to 26 million ha, while the area under barren

and un-culturable land has come down from 28 million has in 1970-71 to 17 million ha in 2008-09. However, the gross cropped area has increased from 166 million ha. in 1970-71 to 195 million ha in 2008-09. As a normal process of urbanization and development, the area under non-agricultural uses is increasing, but due to efforts of the government, land has been reclaimed for cultivation from barren and culturable waste land category.

The cropping intensity has increased from 118 per cent to 138 per cent during the same period. Owing to a burgeoning population, it is estimated that per capita total land availability which was 0.32 ha in 2001 against the world average of 2.19 ha will decrease to 0.23 ha in 2025 and 0.19 ha in 2050. Further, it is reported that about 120 million ha land is degraded in India, and about 5334 million tonnes of soil is lost annually through soil erosion. Out of 120 million ha degraded area, water erosion accounts for 68 per cent, chemical degradation 21 per cent, wind erosion 10 per cent and the rest physical degradation. Effective land management policies are required to address these issues in addition to other concerns such as small size and fragmented holdings, tenancy, ceiling limits, acquisition and diversion of productive land, land records and inventories, climate change and land use change. (**SIA**, 2011)

Multiplicity of cropping systems has been one of the main features of Indian agriculture. This may be attributed to following two major factors:

- Rainfed agriculture still accounts for over 92.8 million hectare or 65 per cent of cropped area. A large diversity of cropping systems exists under rainfed and dry land areas with an overriding practice of intercropping, due to greater risks involved in cultivating larger area under a particular crop.
- Due to prevailing socio-economic situations, improving household food security has been an issue of supreme importance to many million farmers of India, who constitute 56.15 million marginal (<1.0 hectare), 17.92 million small (1.0-2.0 hectare) and 13.25 million semi-medium (2.0-4.0 hectare) farm holdings, making together 90 per cent of 97.15 million operational holdings.

  An important consequence of this has been that crop production in India remained to be considered, by and large, a subsistence rather than commercial activity. One of the typical characteristics of subsistence farming is that most of the farmers resort to grow a number of crops on their farm holdings, primarily to fulfill their household needs and follow the practice of rotating a particular crop combination over a period of 3-4 years interchangeably on different farm fields.

India has a geographical area of 328.73 million hectares; of which reported area for land use is 306.04 million hectares. The net area cultivated is about 142.60 million hectares i.e. about 46.6 per cent of the total reported area. Since nearly 50 million hectares of area is sown more than once, the cropping intensity works out to 135.1. Forests account for about 68.97 million hectares i.e. 22.5 per cent of the total reported land area.

Also nearly 13.97 million hectares are cultivable wastelands and 9.91 million hectares are fallow lands. Only about 30 per cent of the total cropped area is irrigated and the remaining area is rain fed. The available statistics further shows that only about 66 per cent of the gross cropped area is under food crops and nearly 34 per cent area under nonfood crops. Cereals and pulses account for nearly 52.93 per cent and 12.64 per cent of the total area respectively. Fruits and vegetables occupy nearly 4.24 per cent of area. (**Haque** 1998)

Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative cops to more remunerative crops. The crop shift (diversification) also takes place due to governmental policies and thrust on some crops over a given time, for example creation of the Technology Mission on Oilseeds (TMO) to give thrust on oilseeds production as a national need for the country's requirement for less dependency on imports.

Market infrastructure development and certain other price related supports also induce crop shift. Often low volume high-value crops like spices also aid in crop diversification. Crop diversification and also the growing of large number of crops are practiced in rain fed lands to reduce the risk factor of crop failures due to drought or less rains. Crop substitution and shift are also taking place in the areas with distinct soil problems.

In the age of globalization, cash cropping has been become more important rather than subsistence farming and in this regard crop diversification plays vital role in the development of agriculture.

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Directorate of Economics & Statistics, Ministry of Agriculture, 2009-10.

Table: 1
Land use pattern in India
(In Thousand hectares)
Geographical Area- 328726

Year	Agri. Land/ Cultivalbe land/ Culturable Land/ Arable Land	Area under non-agricultural uses	Barren and unculturable land	Culturable waste land	Total cropped area
1980-81	185156	19596	19958	16744	172630
1984-85	185222	20458	20239	15882	176330
1988-89	185142	21299	19916	15167	182277
1992-93	184875	21771	19122	145S9	185615
1996-97	184121	22554	17964	14021	189502
2000-01	183506	23889	17590	13630	185340
2004-05	183007	24890	17578	13271	191546
2008-09	182385	26308	17017	12762	195104

Source: *Directorate of Economics & Statistics, Ministry of Agriculture*, 2009-10.

Table: 2
Agricultural Land by use in India

(Million Hectares)

S. No.	Classification	1970-71	1990-91	2003-04	2008-09
I.	Geographical Area	328.73	328.73	328.73	328.73
II.	Reporting Area	303.75	304.86	305.56	305.69
1.	Forest	63.83	67.81	69.65	69.63
	Percentage to the Reported Area.	21.01	22.24	22.80	22.78
2.	Not Available for Cultivation	44.61	40.48	42.23	43.32
3.	Other Uncultivated land excluding Fallow Land	35.13	30.22	27.11	26.51
4.	Fallow Lands	19.33	23.37	25.81	24.86
5.	Total Cropped Area (Gross Cropped Area)	165.79	185.74	190.08	195.10
6.	Area Sown more than once	24.93	42.74	49.32	53.74
7.	Net Area Sown	140.86	143.00	140.76	141.36
8.	Cropping Intensity	117.70	129.89	135.04	138.01
III.	Net Irrigated Area	31.10	48.02	56.96	63.20
IV.	Gross Irrigated Area	38.20	63.20	78.15	88.42

Source: *Directorate of Economics & Statistics, Ministry of Agriculture*, 2009-10.

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*i*Learning, *e*Education and online learning tools and techniques.

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ICT,
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Abstract

The world we live in is constantly changing. The main changes in the last decades are: computers gaining omnipresence; a society diverse in culture, education, and socio-economic levels; a high skilled workforce needed in the majority of work places; a highly competitive business market; the appearance of new educational technologies; and decreasing students' interest to such traditionally prestigious subjects as physics, math, and engineering.

Learning is changing as well, especially the technologies of learning. E-education (also known as e-learning and online education) is the process of learning where computers are used at each possible step of the process: enrollment, instruction design, content delivery, evaluation, assessment and support. This means that students and teachers do not have to sit in the classroom but instead they learn from anywhere in the world and in any time.

Introduction:

Nowadays, anyone who cannot speak English and is incapable of using the Internet is regarded as backward. - Prince Alwaleed Bin Talal Alsaud .

Commonly referred to as online education, e-education is the process of learning online. Whether you're a high school student or a graduate college student, a person looking to expand technical skills or a retiree who simply wants to learn more, Internet learning provides a boundary-free way to broaden your horizons. Many elite universities, offer online programs, as well as nationally ranked technical schools. This wide variety of schools offers a range of programs from Master of Business Administration to graphic design. Depending on the program you select, you can complete it entirely online, or combine it with a traditional "in-person" learning setting. The flexibility of online learning is particularly helpful for working professionals who want to return to school, but need to remain employed to support their families. Online education is the fastest – growing segment of the education field. Students are finding that they can improve their skills, finish their degrees, and improve their learning

potentials by taking classes from the comfort of home.

Adult e-education today is more popular than e-education for children. Thousands of modern companies, universities and colleges have online courses. It helps them distribute knowledge among learners in a broad and rapid way. Examples of such online activities are emergency drills, new company policies, knowledge about a new computer virus, etc. In addition, e-education includes other examples such as lectures of important speakers or courses about new company products.

However, e-education for children is not yet very popular today. Is e-education fit for children? We believe two things. First, we believe that our children know computers better than many of us. Research shows that middle school students have necessary computer skills for access to online programs (typing, mouse use, using search engine, word, Internet browser). They work with search engines and use online communication technologies such as e-mail, chats, blog, etc. And second, we believe that if the program is built according to the right psychological principles, it works well. These principles help explain the reasons why other e-education programs report problems with children dropping out from online course due to feelings of isolation, frustrations with difficulties, and a lack of social contact with peers and teachers. We believe that modern children are ready for e-education, and that e-learning is a good opportunity for a meaningful after-school activity for them and their parents.

Benefits of learning through the Internet.

Flexibility is one of the most attractive elements of online learning, but the benefits don't stop there. In fact, many online students find their educational journey is particularly rewarding. Benefits include:

- Virtual classrooms that can be accessed from anywhere
- Well educated, professional instructors just like traditional education
- Diverse programs in a variety of disciplines
- Accredited programs to complete college degrees
- Technical programs that provide real-time training
- Freedom to enhance skills –and resume – while still working full-time
- Financial aid possibilities
- Real-life application of classroom materials
- Greater comfort with interactive technologies.
- Work/life balance.

Usage of iLearning?

In today's fast growing world, as we are busy, we need a system of learning where we can stop, pause, and rewind at our own convenience. We will want to focus on certain subjects first, and others down the road. The i-LEARN Online program is designed with you in mind All through the click of a mouse you now have the ability to empower yourself, and your family, on the true meaning of "Internet Safety".

There are five options with five different users in mind.

LEARN-These training modules teach and/or train other educators on the ilearning curriculum. Internet safety concepts and instruction on implementing the Internet Safety Program are included.

FIFTY+-These modules will educate about dangers facing adult computer users. You will be able to work with kids, grandchildren, friends and families on being safe online. It is available, regardless of age, to those registered as parents, educators, and fifty+.

PARENT-These modules provide parents with tools to protect their kids/teens and family online. Those trained can educate other adults to protect their families. Access to these modules is made available to those registered as parents, fifty+, and educators.

MENTOR-These lessons are designed to teach students outreach methods so they can educate their peers, their family, their neighbors, their community and beyond. It is open to those registered as students and educators.

SHIELD-These modules encourage law enforcement and prosecutors to form Task Forces to proactively fight Internet crime in their communities. Task Force members are trained to educate citizens about online dangers. Only those registered as law enforcement have access to these modules.

WEB TOOLS AND TECHNIQUES FOR eLEARNING

What makes eLearning effective?

Successful web-based training (WBT) is built through careful analysis, user-centered design, and interative development and testing. These same principles apply to the design of any user interface or online information product, and are already familiar to many technical communicators. We'll discuss them briefly here as they apply to WBT.

The first question to ask when considering any training project is: What problem are you trying to solve? Typically, this is a performance problem in a work situation. For example, customer service representatives need to handle calls quickly and with a high degree of customer satisfaction. If you work for a product vendor, the problem may be product-centric: network administrators must install and configure our software without having to call support.

Whatever the problem, a complete understanding of it involves understanding the audience, the tasks they must perform, and the definition of success for these tasks. Investigation of these issues yields audience and task analysis documents and helps determine:

1. Is training the proper solution to the problem and
2. What kind of training intervention is needed?

In Designing Web-Based Training, William Horton offers this encapsulation of "50,000 years of instructional design:"

1. Show them
2. Tell them
3. Let them try
4. Repeat

While tongue-in-cheek, this description does present key guidelines for designing web-based training. Effective WBT

teaches by both describing and demonstrating. It provides learners with opportunities to practice what they learn, and it encourages repetition of both the presentation and the practice.

Guidance Communications, Inc. © 2003-2004, E-learning authority Michael W. Allen lists three priorities for the effectiveness of any training:

1. Ensure that learners are highly motivated to learn.
2. Guide learners to appropriate content.
3. Provide meaningful and memorable learning experiences.

The Techniques section of this paper will look at ways to implement these design principles in WBT projects.

WBT projects are best developed through a process of rapid-prototyping and testing. This allows you to test all aspects of the design with representative learners and to refine the product on an ongoing basis. Allen refers to this process as "successive approximation." He suggests dispensing with design specs and paper storyboards in favor of building and testing working prototypes.

TECHNIQUES

One venerable formula for instructional design reads as follows: "Tell me what you're going to tell me, tell me, then tell me what you just told me." This sequence of preview, presentation, and review helps reinforce learning and retention. WBT often needs pages that simply tell facts or present information. These include overview pages that introduce each lesson and list the contents. They may also include pages that explain or illustrate concepts, in a way similar to online documentation. These techniques help make overview and concept pages effective:

1. Keep text short. Write as concisely as possible. If more text is absolutely needed, present additional pages.
2. Illustrate ideas with pictures and diagrams. Learners are typically conditioned by the Web to expect graphics. If at all possible, hire a graphic designer for your project. If there is no budget for this, make optimal use of available artwork and clip art. When introducing a concept, strive to present it in both text and pictorial form.
3. For Overview pages, provide links to all topics. This is recommended in addition to the typical Next and Previous buttons, to let the learner choose the path through the content.
4. Show Them – Demonstrations. Demonstration pages allow learning by observation. For example, learners can watch an animation representing a task being performed in a software interface, or read and listen to an example conversation between a customer service representative and a customer.

Here are some guidelines for demonstration pages:

- Keep them simple. If the demonstration is long or complex, divide it over several pages.
- Test the timing of animations on various computers, browsers, and with as many learners as possible. This is particularly important if the animation includes text for learners to read, since people read at various speeds.

Guidance Communications, Inc.© 2003-2004 suggests:

- If using audio, provide a mute button for learners who may not be able to listen in their environment. Be sure to provide a text version for learners who may not have audio available.
- Let Them Try – Interactivity. A hallmark of successful WBT is a high degree of interactivity. Adult learners usually learn best by doing, and interactive exercises take advantage of this.
- Question-and-answer quizzes placed at the end of a lesson represent the most elementary form of interactivity. These may include multiple-choice, fill-in-the-blank, drag-and-drop questions or other methods. Done well, quizzes can reinforce the learning of concepts. However, they are not useful for teaching skills, are not particularly engaging, and are ignored by many learners.

Effective WBT uses other methods to foster interaction. These may include:

- Layering information on concept pages. For example, an illustration of a machine, a computer network, or a software diagram can include hotspots on specific components. When a learner clicks or points to the component, additional information pops up in a dynamic layer.
- Software simulations. For software application training, WBT often includes a simulated interface that allows the learner to enter data and perform transactions. This works best when the simulation requires the learner to solve a real- world problem and display realistic results.
- Problem-solving scenarios. For soft-skills training, scenarios present learners with problem situations and various options for solving them. Each option may lead to a different path for the learner to explore. While the development overhead of creating multiple paths can be a burden, the value in terms of learner success often makes this approach worthwhile.

Engage the Learner – Stories. Recall the first and third of Michael W. Allen's priorities for effective training:

1. Ensure that learners are highly motivated to learn.
2. Provide meaningful and memorable learning experiences.

The best recent examples of WBT I've seen answer these challenges by engaging the learner in stories. Stories engage the learner's emotions and make the learning experience memorable. Also, because the characters and situations relate to the learner's real-world challenges and problems, stories enhance motivation.

Here are some examples of WBT's that effectively use stories.

1. To introduce the various steps needed to implement a software system, a WBT employed the simple metaphor of a roadmap. The learner started each lesson by clicking a sign along the road.
2. To teach the use of a communication application, a story was created involving a space station. Surgeons on earth needed to treat a critically-ill patient on the station through telemedicine. But first the learner had to set up the communication apparatus.

3. To train technical support staff, a WBT was given the personality of a superhero. In each lesson, the learner identified with the superhero, coming to the rescue of different computer users. To teach corporate sales representatives to use the company e-mail system, a WBT was designed in the form of an interactive game. The learner was placed in the role of a spy receiving mysterious e-mails and had to learn the e-mail system to complete her mission. While some of these projects enjoyed big budgets and expensive production values, these are not necessary and are not the crucial point. With a little imagination and creativity, even very low cost WBT projects can involve learners through stories.

Provide Maximum Learner Control

Allen's second priority is to "Guide learners to appropriate content." This means making the WBT content easy to find. It does not mean providing only one path through the content. Horton recommends providing WBT courses with multiple access methods, which may include a table of contents or menu, an index, a course map, and even a search function.

Whether you find it feasible to implement all of these options, it is important to give the learner navigational control. Let the learner choose which topics to learn and in what order.

- Each page should provide Next and Previous links, as well as links to the start of the current lesson and the course home page or main menu. Each lesson overview page should allow the learner to jump to any topic in the lesson.
- If possible, allow learners to bookmark their place so they can return at a late time.

TOOLS

Despite a shakeout in the market in the past few years, many authoring tools are available that will help you create effective WBT. These range from general-purpose tools designed for presentations and web-authoring to dedicated e-learning applications. The tools cover a broad range in terms of price, sophistication, and how easy they are to learn.

Macromedia Dream weaver

- Dream weaver is an excellent starter tool for WBT and general web-page authoring. Essentially, Dream weaver automates the authoring of web content by generating HTML and JavaScript code through a WYSIWYG interface. Among its many capabilities, Dream weaver makes it easy to create animations and show/hide layers for WBT pages. If you have Dream weaver, you can download free extensions for e-learning. Once installed, these added modules become available through the Dream weaver interface. They allow you to create quizzes, including drag-and-drop exercises, and also to track learner results and output them to standards-compliant learning management systems (LMS).
- Dream weaver is fairly quick to learn and develop on. However, it is not as powerful for WBT as many other

tools. It's capabilities are limited to what can be supported through the of native HTML and JavaScript functionality of web browsers.

Macromedia Flash

Though it was initially designed for creating small and fast-loading web animations, Flash has evolved into an industrial-strength tool for web applications. More and more, it is becoming a development tool of choice for WBT. With Flash, you can do everything you can do in Dream weaver plus much more. While Dream weaver's output is limited to what a native web browser can support, Flash's output is practically unlimited. This is because Flash creates its own application file (SWF file) that runs inside the browser window but does not depend on the browser's native capabilities.

Flash is excellent for creating animations, exercises, and simulations of all kinds. It supports rich media, including audio and video. Added to this, its modest price makes it a very attractive tool for even low-budget WBT projects.

The only drawback of Flash as opposed to some other tools is its complexity. The learning curve can be steep. And, while many effects can be attained through the user interface, you need to write code to unleash Flash's full power. Flash's Action script language is very similar to JavaScript.

Other Tools

Depending on your project and budget, here are some other tools you might want to investigate:

- Demo Shield by Install Shield Corporation
- Robo Demo by e-Help
- Microsoft PowerPoint
- Macromedia Director
- Macromedia Author Ware
- Macromedia Breeze

Conclusion:

For organizations of all sizes, putting training on the Web has many well-known advantages in terms of accessibility, efficiency, and cost. The key to realizing these advantages is effective design that motivates learners and gives them accessible and memorable learning experiences. With their existing skill sets and the tools and techniques discussed in this paper, technical communicators have the opportunity to create effective e-learning.

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The Role of ICT in the improvement of Higher Education and Research

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ICT,
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Abstract

Information and communication technologies (ICTs) have become common place entities in all aspects of life across the past two decades. The use of ICT has fundamentally changed the practices and procedures of various fields dramatically. In the field of education the impact of ICT has not been extensive as in other fields. The role of ICTs in Education is becoming more and more important with the world moving rapidly into digital media and information.

Education is very socially oriented activity. ICTs are potentially powerful tool for extending educational opportunities, both formal and non formal, to scattered and rural population, groups traditionally excluded from education due to cultural or social region, girls and women, person with disabilities, as well as all others who for region of cost or because of time constraints or unable to enroll on campus. One defining features of ICTs is their ability to transcend time and space and make possible synchronized learning. It also helps in accessing the information that is remotely available.

ICTs provides the worlds class education and research and promote the acquisition of knowledge and skills and play an important role in quality improvement of higher education and will further improve with advancement in the method of learning.

Introduction:

One of the distinctive features of human beings is their ability to acquire knowledge, and what makes this knowledge an ever-thriving entity is man's ability to 'impact' this knowledge to others. Transfer of knowledge, which is one of the foundations of learning, is among the most fundamental social achievements "of human beings.

Higher education plays a pivotal role in the development of a country, as it is viewed as a powerful means to build knowledge based society In India, higher education imparted by universities is facing Challenges in terms of Access, Equity and Quality. The Government of India has taken several initiatives during the Eleventh Five Year Plan period To increase access to higher education by adopting specific strategies,. enhancing the relevance of higher education through Curriculum reforms, Vocational programs. Networking, Information Technology adoption and Distance Education along with reforms in governance. However in terms of Gross Enrollment Ratio (GER), India still lags behind the worldwide average and emerging countries like Brazil and China.

The Indian Higher Education System has established itself as the largest system in the world in terms of number of institutions and third largest in terms of student enrollment *(after China and USA)*. While several new institutions have emerged due to significant increase in private sector participation over the last few years, concerns remain regaeding the quality of education being imparted to students.

Some Quick facts about Indian Higher Education

- There are 14.6 million students undergoing Higher Education in India as of 2011.
- There has been a significant rise in enrollment from rural population in Higher Education. The GERs in rural areas have been rising steadily and expected to reach 12.84% by 2020.
- A growing number of women are expected to enroll in Higher Education Institutes. Currently over 6.1 million women are enrolled in Higher Education and is expected to grow to 12.15 million by 2020.

Challenges in Indian Higher Education

The 2011 Ernst & Young - FICCI report on Higher Education noted the following as some of the key challenges for India in terms of Access, Equity and Quality of Higher Education.

- Insufficient infrastructure to meet the growing demand for higher education. In 2011, 14.6 million students enrolled in higher education in India. By 2020, 40 million students will have to be enrolled if GER target of 30% has to be met. This implies an additional capacity of over 25 million seats would be required within the next decade.
- There is wide disparity in Higher Education GER across states, urban vs. rural areas, gender and communities that have to be bridged.
- Faculty shortage (45% professor and 53% lecturer positions were vacant in 2007-08), Deficient physical infrastructure, ill-equipped libraries and outdated curricula continue to plague our higher education system.

The following section will try to answer "how ICT is acting as an enabler and a catalyst to fuel the growth of higher education in colleges and universities.

- Information and Communication Technologies (ICTs) are referred to as the varied collection of technological gear and resources which are made use of to communicate. They are also made use of to generate, distribute, collect and administer information.
- Information and Communication Technologies consist of the hardware, software, networks, and media for collection, storages, processing, transmission and presentation of information (voice, data, text, images), as well as related services. ICTs can be divided into two components information and Communication Infrastructure (ICI) which refers to physical telecommunications systems and networks (cellular, broadcast, cable, satellite, postal) and the services that utilize those (Internet, voice, mail, radio, and television), and Information Technology (IT) that refers to the hardware and software of information collection, storage, processing, and presentation.

- Education is perhaps the most strategic area of intervention forthe empowerment of inrk and women in any society and the use of information and communication technologies (ICTs) as an educational tool in the promotion of women's advancement has immense potential. The application of ICTs as a tool for effective enhancement of learning, teaching and education management covers the entire spectrum of education from early childhood development, primary, secondary, tertiary, basic education and further education and training.

ICT is about the new ways in which people can communicate, inquire, make decisions, and solve problems. It is the processes, tools and techniques for:

- gathering and identifying information
- classifying and organizing
- summarizing and synthesizing
- analyzing and evaluating
- speculating and predicting

Enhancing and upgrading the quality of education and instruction is a vital concern-predominantly at the time of the spreading out and development of education. ICTs can improve the quality of education in a number of ways: By - augmenting student enthusiasm and commitment, by making possible the acquirement of fundamental skills and by improving teacher training. ICTs are also tools which enable and bring about transformation which, when used properly, can encourage the shift an environment which is learner centered.

ICTs which can be in the form of videos, television and also computer multi media software, that merges sound, transcripts and multicolored moving imagery, can be made use of so as to make available stimulating, thought provoking and reliable content that will keep the student interested in the learning process.

The use of online pedagogy within universities and management institutes is increasing. The introduction of the Wi-Fi system too has led to the growth of hi-tech education system, where accessibility and accountability of subject matter is made readily available to the students. The students can now study and comprehend the related information at their own convenient time.

The most straightroward use of ICT's in research is in data processing. The unprecedented growth in bandwidth and computing power provide opportunities for analyzing/processing huge amounts of data and performing complex computations on them in a manner that is extremely fast, accurate and reliable. Computer data processing not only frees researchers from the cumbersome task of manually nalyzing data but more importantly facilitates quick and accurate analysis of huge amounts of data from national samples or even multi-national samples covering tens of thousands of respondents.

Another important dimension of ICT's in research is the use of online full text databases and online research libraties/virtual libraries which are the direct outcome of the growth in telecommunications networks and

technology. These databases and libraries provide researchers with online access to the contents of hundreds of thousands of books from major publications houses, research reports, and peer-reviewed articles in electric journals.

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

ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, for example, may be" accessed 24 hours a day. 7 days a week. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety, of media can now be accessed from anywhere at any time of the day and by an unlimited number of people.

Use of ICT for promoting education and development has always been a part of policy and plan documents on education. Rollowng are a few case studies that clearly show the growing footprint of IT/ICT in Higher Education

- The National Mission on Education through information and Communication Technology (NMEICT) is envisaged as a centrally sponsored scheme to leverage the potential of IT/ICT, in teaching and learning process for the benefit of all the learners in Higher Education Institutions in any time anywhere mode.
- National Programme on Technology Enhanced Learning (NPTEL), a joint initiative of the IITs and IISc provides E-learning through online Web and Video courses in Engineering, Science and Humanities-streams aiming to enhance the quality of Engineering education in the country by providing free online courseware.
- The National Knowledge Network (NKN) and Connected digital has launched an initiative to cover 1,000 institutions besides providing digital campuses, video-conference classrooms, wireless hotspots,. laptops/desktops to all students of professional/science courses and Wi-Fi connectivity in hostels. A major development during the year has been the launch of Aakash - the low cost computing tablet on 5th October, 2011

Using the A-View software developed under the NMEICT, there has been a 14 day teachers' empowerment program conducted for batches of 1,000 teachers at a time by IIT Bombay contemplating on a plan to conduct a 2-week long teacher training program for a batch of ten thousand teachers at a time. This program, developed under NMEICT, could become the bedrock for successful implementation of the proposed National Mission on Teachers.

Under the N-List program of INFLIBNET, being run under NMEICT, lakhs of e-books and thousands of high wuality paid e-journals have been made available to colleges and universities with a view to inclulcating research culture in teachers and students.

Technology will play a bigger role in transforming higher education imparted by universities to the next level. The tools help to create a social, highly collaborative and personalized environment with innovative solutions that will enhance the way students learn, communicate & collaborate and study both on and off campus.

Digitalization of Books, Content Delivery using ICT, Open Education Resources, Virtual Technical University, Mobility, Social Learning

The emergence of Web 2.0 and social networking such as blogs and wikis, as well as new online video repository and delivery websites such as YouTube, iTunes U and Big Think is influencing a new trend in higher education. The emergence of smart phones such as the iPhone and other intelligent devices has enhanced mobile learning (referred to as m-learning) these technologies create new channels for content delivery, online video expansion and podcasting. Also the adoption of virtual reality websites such as "Second Life" has provided higher-education institutions with new venues for class gatherings and learning.

The innovative use of ICT is believed to be a game changer that can significantly strengthen India's higher education system and propel the country into becoming a "Knowledge Superpower". The innovative use of ICT in Higher education addresses the three fundamental challenges of Access, Equity and Quality.

The adoption of ICT in higher education facilitates the following: ..

- Improving the access to the system through online education.
- Improving the quality of teaching especially across remote locations.
- Increasing transparency and strengthening system processes and compliance norms in Higher Education Institutes ,
- Measure students learning participation and effectiveness.

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Size Characterization of Biodegradable Nanoparticles and their comparative stability

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Abstract

Studies were taken to synthesize the biodegradable nanoparticles (Transfersomes®) revealed that they can act as a carrier for low as well as high molecular weight drugs e.g. analgesic, anesthetic, corticosteroids, sex- hormones, anticancer, insulin, gap junction protein, and albumin. To analyze the stability of Transfersomes®, we use scattering measurements and resulted that if we increase amount of surfactant, the scattering would reduce as a bilayer vesicular structures are rearraying into micelles. The highly deformable liposomes i.e. Transfersomes® have many advantages over other biodegradable nanoparticles and therefore used for transdermal drug delivery. Ultra flexibility of Transfersomes® minimizes the risk of complete vesicle rupture in the skin during transdermal drug delivery. Transfersomes® are biocompatible and biodegradable nanoparticles.

Introduction:

Generally, nanotechnology deals with structure sized between 1 to 100 nm. The particles which come under nanotechnology known as “nanoparticles”. Many types of nanoparticles have been discovered till now as micelles, liposomes, noisome, ethosomes etc. Recently, it became evident that, in most cases, classic liposomes are of little or no value as carriers for transdermal drug delivery as they do not deeply penetrate skin, but rather remain confined to upper layers of the stratum corneum. Intensive research led to the introduction and development (Cevc G *et al* 1992), over the past 15 years, of a new class of lipid vesicles, the highly deformable (elastic or ultra-

flexible) liposomes that have been termed Transfersomes®. Here we synthesized Transfersomes® which have many advantages over liposomes. Transfersomes® are ultradeformable vesicles and therefore used for transdermal drug delivery. The transdermal drug delivery is an interesting option and can be used to give a content, controlled, targeted drug delivery. Flexibility of Transfersomes® membrane is achieved by mixing suitable surface-active components in the proper ratio (Cevc G *et al* 1991). The resulting flexibility of Transfersomes®

membrane minimizes the risk of complete vesicle rupture in the skin and allows Transfersomes® to follow the natural water gradient across the epidermis when applied under nonocculsive conditions. Transfersomes® can deform and pass through narrow constriction (from 5-10 times less than their own diameter) without measurable loss (Cevc G *et al* 1991). This high deformability gives better penetration of intact vesicles. They can act as a carrier for low and as well as high molecular weight drugs e.g. analgesic, anesthetic, corticosteroids, sex-hormones, anticancer, insulin, gap-junction protein, and albumin. They are biocompatible and biodegradable as they are made from natural phospholipids similar to liposomes.

Materials and Method:

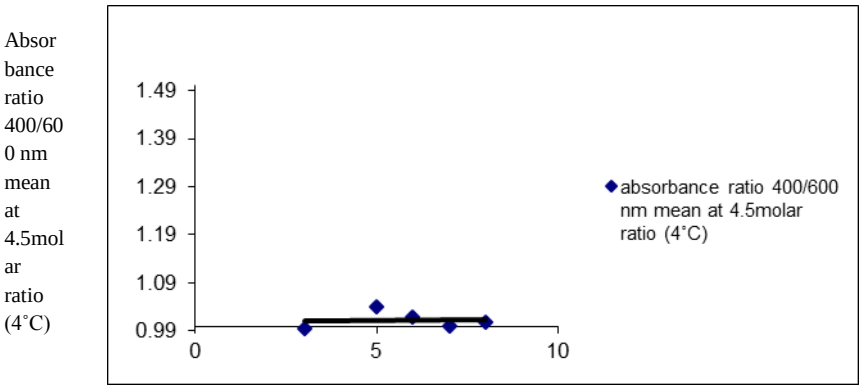
For the size characterization of Transfersomes®, we use following chemicals i.e. **Soybeanphosphatidylcholine (SPC)** Nattermann Phospholipids (Rhone-Poulenc Rorer, Cologne, Germany). Used as bilayer former, **sodium cholate** (Merck) used as surfactant, **ethanol** (Merck) used as a solvent and **phosphate buffer** (pH 6.5, 10mM) used as hydrating medium (Cevc G *et al* 1995, 98).

- In the present study we mix 10% weight of SPC (molecular weight =800, as basic bilayer former) and sodium cholate as surfactant in a series of selected SPC/SC molar ratio.
- SPC and surfactant were vortexed with ethanol.
- Suspending in 10mM phosphate buffer to make 10% wt.
- The suspension was then subjected to three cycles of freeze & thawing.
- The resulted suspension was passed through the extruder fitted with the sample was passaged across the filter six times (Cevc G *et al* 1995, 98).

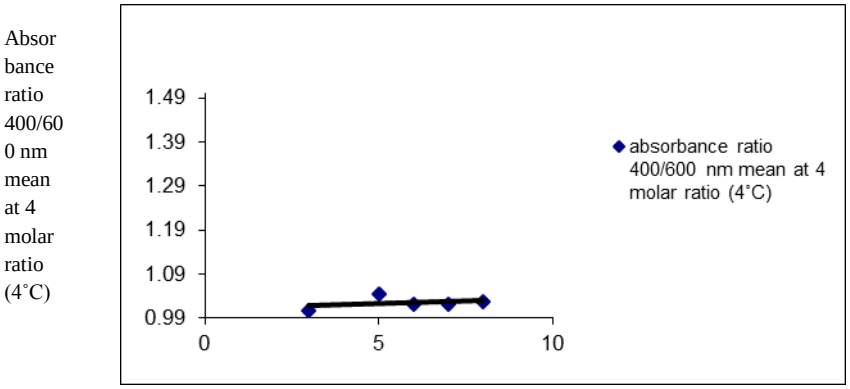
Results and Discussion:

Visible light has wavelength (400-600 nm). It is scattered by the particles that have different refractive index from that of surrounding and is suited to define the particle size above 10 nm. Turbidity is the optical property that causes light to be scattered and absorbed differently (Cevc G *et al*). Based on this principle the stability analysis of Transfersomes® was performed. Increasing amount of detergent will lead to decrease in the size of the vesicle, till it reaches at critical micellar concentration, and at this concentration mixture of phospholipid and the surfactant no longer can arrange themselves in bilayer rather turn into micellar formation. These micellar formations scatter much less, owing to the less turbidity hence the absorbance ratios will increase. Molar ratios well above the critical micellar concentration provide the thermodynamically stable state where phospholipid molecules can arrange themselves in the bilayer.

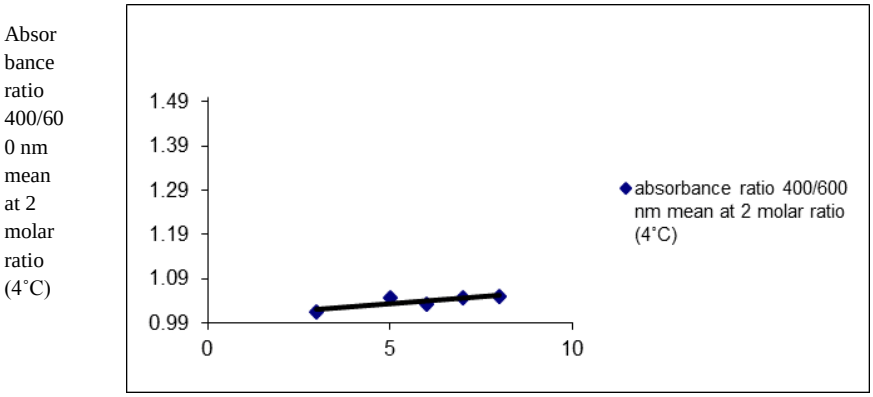
Turbidity measurements at 400/600 nm of Transfersomes® preparation at various molar ratio of Soybean phosphatidylcholine and sodium cholate by scattering method.



This graph shows the stability of Transfersomes® at 4.5 molar ratio when monitored till eight days. This pattern is further observed when the Transfersomes® were prepared with Soybean phosphatidylcholine and sodium cholate at molar ratio 4.0. Not much difference is observed in the absorbance ratios after incubation and the measurement was taken at day 3, 6, 7, 8.

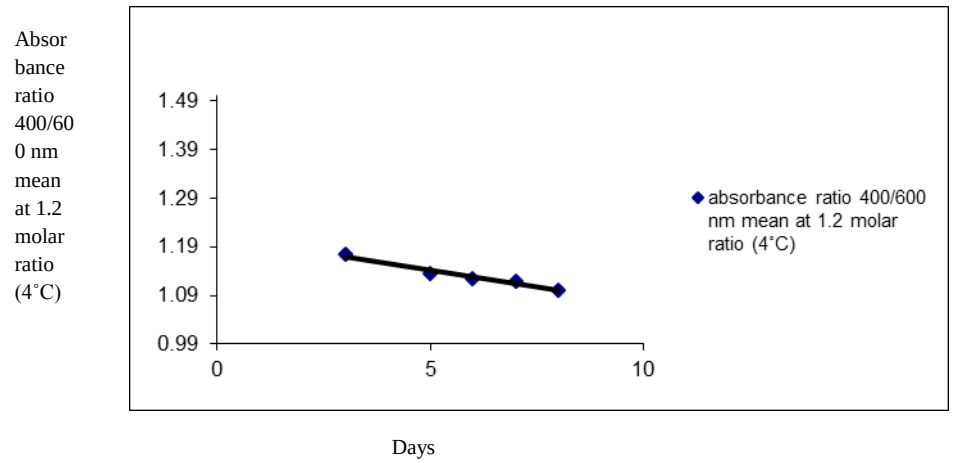


As the amount of surfactant is increased the relative stability of vesicles is compromised as the transition temperatures within the bilayer alter that drives the arrangement of molecules. When the molar ratio of soyabeanphospatidylcholine and sodium cholate is 2.0, there is still no difference in the absorbance ratios also.

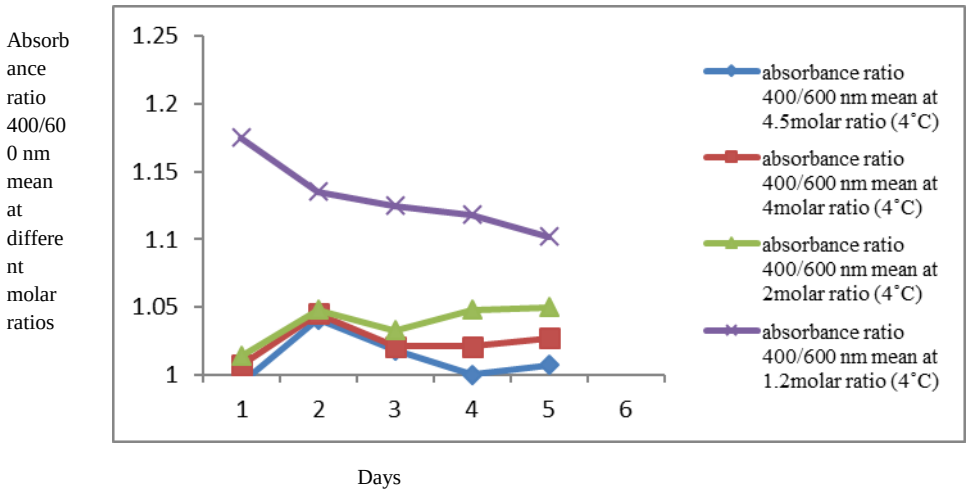


A significant difference in the absorbance ratio is observed when the molar ratio of the Transfersomes® preparation was 1.2 monitored till eight days after preparation. At this molar ratio

day 1 observes the formation of micelles with significantly higher absorbance ratio that gradually decreases indicating the aggregation of these micelles and contributing to the lamellar structures.



This next figure demonstrates the comparative stability of various preparations of Transfersomes® at different lipid to surfactant ratios. The absorbance ratio was monitored till eight days. Transfersomes® preparation with molar ratio 4.5, 4.0 and 2.0 leads to stable preparation while Transfersomes® preparation made with molar ratio 1.2 is unstable.



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Histopathological changes in fresh water *Heteropneustes fossilis* (Bloch) exposed to cadmium chloride

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Abstract

The aim of present study was to investigate the deals effect of cadmium chloride on the histological changes in gill, liver and kidney of a freshwater catfish (Singhi), *Heteropneustes fossilis* (Bloch). Fishes weighing 35-38 gm and 12-15 cm length were exposed to sublethal concentrations of Cadmium chloride 0.60 ppm for 30 days. During this period fishes were fed with artificially prepared food .On the 30th day fishes were taken out, sacrificed and the tissues of gill and liver were excised out. The total autopsy was completed in less than 4 mints. The result showed that the degree of distortion of the tissue of gill, liver and kidney was effective even short period and at low concentration exposure of the heavy metals.

Introduction:

Fishes are considered as vital indicators to the occurrence of pollutants in the aquatic systems (Sures, 2004; 2008; Al-Weher, 2008) due to the presence of dangerous pollutants such as cadmium and lead, which lead to undesirable changes in chemical, physical or biological properties of the aquatic systems, and hence cause damages in humans, animals and plants (Hodges, 1977; Eissa *et al.*, 2011). The aquatic ecosystems are extensively contaminated by heavy metals released from domestic, industrial and other man made activities (Voegborlo *et al.,* 1999; Dirilgen, 2001; Vutukuru, 2005). Heavy metal contamination may have gross biological impact on aquatic organisms (Ashraj, 2005; Farombi *et al.,* 2007) including fishes (Clarkson, 1998; Olaifa *et al.,* 2004). As a result the aquatic fauna and flora are adversely affected, which lead to bioaccumulation in aquatic organisms and bioconcentration in higher vertebrates (Ackerman, 2001). Bio-enhancement of Cd transfer along a food chain was studied by Seebaugh & Wallace (2005) and fish are reported to be used as biological indicators to assess water pollution (Rashed, 2001).

Among heavy metals, cadmium has been chosen for the present study because it is a wide spread metal pollutant of high toxicity not only to warm blooded vertebrates but also to aquatic animals including fishes (OSPAR, 2002). In general, cadmium is a biologically non-essential, non-biodegradable, persistent type of heavy metal and its compounds are known to have high toxic potentials. Further, continuous, low level cadmium exposure may have a

gross biological impact comparable to that of recurring exposures of much greater intensity. The accumulation of these pollutants has a toxic effect on the aquatic organism, and hence affects the balance of the ecosystems and the diversity of living organisms, including fish (Cicik and Engin, 2005; Farombi *et al.*, 2007; Eira *et al.*, 2009). In fresh water fish, cadmium uptake is taking place mainly through three routes namely, gills, skin and also from food via the intestinal wall (Karlsson-Norrgran and Runn, 1985). Cadmium is noted for its tendency to accumulate in the organisms of mammals for a prolonged biological semi- life. It is responsible for increased hypertension, emphysema, kidney tubule damage, impaired liver function, and cancer (Ribelin and Migaki, 1975).

The freshwater, air-breathing, stinging catfish, *Heteropneustes fossilis* (Order:Siluriformes;Family:Heteropneustidae) is a cherished table fish in India and is distributed throughout the Indian sub-continent in various fresh water ecosystems including muddy, marshy and derelicts ponds having low levels of water and dissolved oxygen. This paper is aimed at determining the gills, liver and kidney of the, *Heteropneustes fossilis* to sub lethal concentration of cadmium chloride.

MATERIALS AND METHODS

Healthy living specimens of , *Heteropneustes fossilis,* (approx. length 12-15 cm and weight 35-38 gms) have been brought from Darbhanga fish market, Bihar. They were brought to the laboratory in well-aerated containers, to avoid hyperactivity, physical injuries and stress to the fish. The fishes were screened for any pathological symptoms and washedwith1% KMnO4 solution. The healthy specimen was then transferred to glass aquaria (50 x 25 x 25 cm) containing tap water. The fishes were acclimatized to the laboratory conditions for 20 days prior to experimentation. Fishes were fed with artificial pellet diet; water was replaced with clean water whenever necessary. The Physicochemical characteristics of the water were analysed as per the procedure of (APHA, 2005), American public health association. The test fish was identified to the species level. Size and weight were taken the fishes were preconditioned to unpolluted tap water for 20 Days.

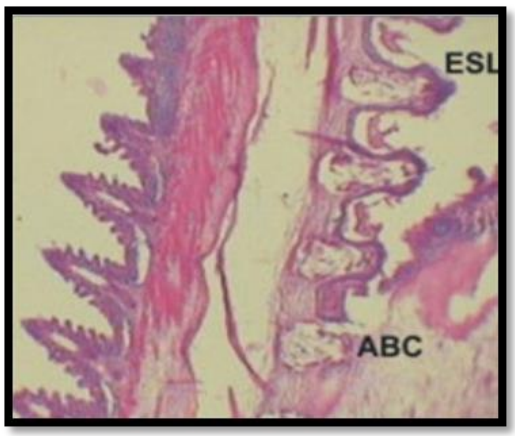
Preparation of stock solution: Cadmium Chloride was of reagent grade. Concentrated stock solutions was prepared by weighing correct amount of the salts and dissolved in water (1g/l). Aliquot volume of calculated stock solution to yield the desired concentration was added to the tank to give the exact required concentration of the heavy metal. In the present study 1/30 of the 96h LC50 were selected as sub lethal concentration and the fishes were exposed to each concentration for a period of 30 days. A control batch corresponding to each test group was simultaneously maintained. The experiments were repeated five times and concentrations supplied daily to maintain a constant toxic media. Fishes were taken out, blotted dry with soft absorbent paper and dissected to remove liver and gill tissue. The organ was preserved in labelled sample bottles containing formal saline, sectioned and slide preparations were made for histological investigation under the microscope.

RESULT

Effect of Cadmium on Gill

The histopathological studies indicated that the gill of *Heteropneustes fossilis* were treated by sub lethal concentrations of Cadmium various histopathological alterations are observed after. In 30 days treated fish, changes like distortion of epithelial cells, hypertrophy of gill filaments, hyperplasia of epithelial surface was evident. Reduction in surface are of the epithelium and detachment of epithelium from pillar system was noticed, as the duration of treatment increased, mucous cells increased along with distortion of gill filaments and lamellar regions. Severe edema, separation of respiratory epithelium and vacuolization alterations were observed (Plate 1.B).

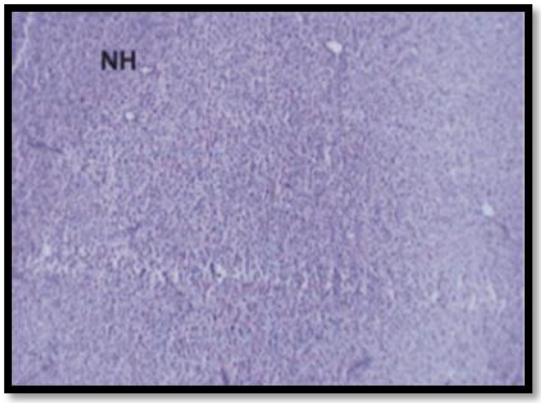
1A. Control.



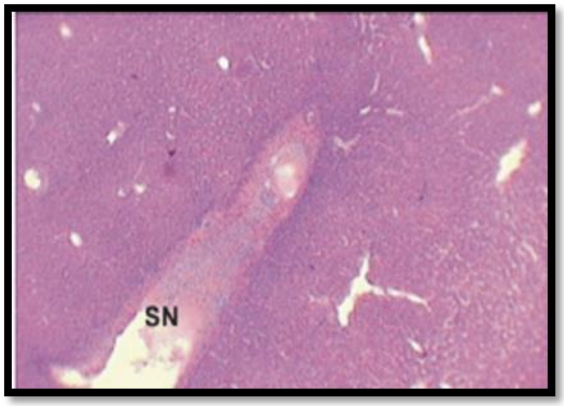
1 B Cadmium chloride treated.

Effect of Cadmium on Liver

In fish at 30 days of treatment the liver was highly damaged subcapsular vacuolization, necrosis, indistinct cell boundaries in many places and pyknotic nuclei were also observed. As the duration increased, severe degradation of the liver cells or hepatocytes and hypertrophy of hepatic nuclei and clumping was evident in many places (Plate 2.B)



2A. Control.

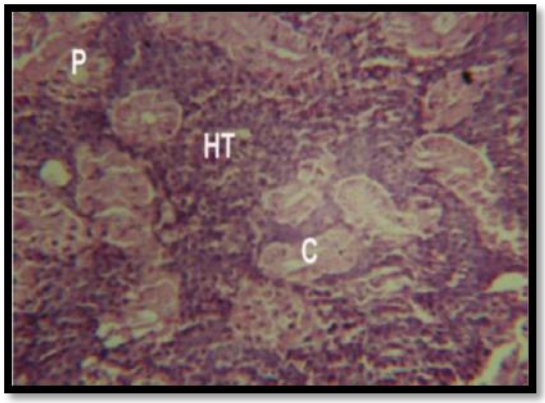


2 B Cadmium chloride treated.

Effect of Cadmium on Kidney

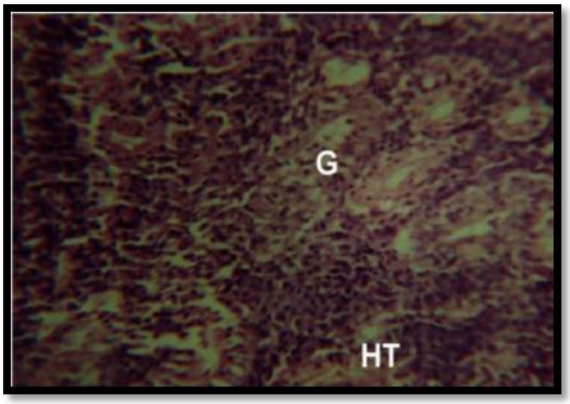
Histological structure of kidney of control fish exhibited functional units, the nephrons. Each of which consisted of a renal corpuscle and a renal tubule. The renal corpuscle of nephron consisted of glomerulus and Bowman's capsule followed by a tubular neck. Other regions of the renal

tubule were proximal distal and collecting tubules. The interstices of the tubules were enriched with hematopoietic tissue, which contained round to polygonal cells possessing hyperchromatic nuclei (Fig. 3.A.). In fish at 30 days of treatment the kidney was showed elongation of tubules, damage of haematopoietic tissue and disintegration of glomeruli, After the exposure for 30 days**,** vaculoation of proximal tubules and enlargement of basement membrane of



proximal tubules were observed. (Fig. 3.B.)

3. A. Control.(**H & E. X 280)**



3B Cadmium chloride treated.

DISCUSSION

Histopathological biomarkers have been largely used in fish to identify and evaluate the toxic effects of pollutants exposure. The presence of necrosis is in fact one of the most visible damages in tissues affected by a pollutant (Rabitto *et al*., 2005). Cadmium exposure induces the appearance of granular deposits in the liver, atrophy of the proximal renal tubules, and increases in chloride cell turnover at the gills (Pratap and Wendelaar Bonga, 1993). Stentiford *et al*. (2003) and Stehr *et al*. (2004) observed that toxicopathic liver lesions in fish species are effective biological markers of chemical exposures. Gill hyperplassia, necrosis of intestinal mucosa, fat infiltration of liver parenchyma cells, destruction tubules were observed due to ammonia poisoning in the intestinal tract, kidney and gills of juvenils *Sparus auratus* (Zaki et al., 1987). The microphotographs of gill of *C. batrachus* have been observed. In control fish, the structure of gills is similar to that of other fresh water cat fish as described by Laurent,(1989) where as the gills of the experimental fish exposed to cadmium and mercury (10, 20 and 30 days) show active secretion of mucous. More specifically, in the mercury treated gill the epithelial layer was disrupted. In few regions, disintegration and fusion of primary lamella were observed. In cadmium treated gill, marked hyperplasia of the branchialarch, pilaster cell vacoulizaton and congestion of blood vessels were well marked. Similar results have also been observed by Skidmore,(1972) in rainbow trout when exposed to zinc sulphate. Histological experimentations of the gills of rainbow trout by Lloyd, (1965) when exposed to zinc, lead and copper showed separation of the epithelium from the gill lamellae and cells sloughed off into the spaces between the filaments. These changes are in agreement with the present observation when the fish is intoxicated with the heavy metal

cadmium. The results are also in arrangement with the works of Kapilamanoj and Ragothaman, (1999) who have reported for *Boleopthalmus dumieric* exposed to sublethal concentration of cadmium. In fish, cadmium can cause a number of structural and pathomorphological changes in various organs. The highest cadmium levels were detected in the kidneys and liver of fish (Thophon *et al*., 2003).

In the present study extensive necrosis, pyknotic nuclei in cadmium treated liver were observed. The present observation gets support from the work of several researchers. Kabir and Begum (1978) reported cytoplasmic degeneration, pyknotic nuclei in liver tissues, vacoulation in hepatic cells and rupture of blood vessels; degenerate hepatic cells and necrotic nucleic when *Heteropneustes fossils* was exposed to *C. punctatus* to a sublethal concentration of endocrine and observed hypertrophy of hepatic cells and liver cord dis array, vacoulation of cytoplasm and necrosis, rupture of hepatic cell membrane and necrotic centrolbular area. These types of histological alterations were also noticed in the live tissue of *Labeo rohita* exposed to tannery effluent (Rana and Sudhir, 1999). The liver tissues of *L. rohita* showed histological changes due to aflatoxin given to fish intraperitoneally (Sahoo et al., 2001). It was noted that the concentration in accumulation of heavy metals varies depending on the mode of exposure, duration and physiological status of the organism as well as the physiological status, structure and effectiveness of the tissues and organs of the organism (Radhakrishnan, 2009).

Banerjee and Bhattacharya (1994) observed histopathological changes in the anterior and posterior kidney of snake head fish, *Channa punctatus* induced by mercuric chloride. Renal lesions consisted of marginal to slight multifocal acute tubular epithelial degeneration, karyolysis and dilation or shrinkage of Bowman's capsule and glomerulus in their studies. Schwaiger *et al.* (1997) found shrinkage in glomerular structure, reduced Bowman’s space and expansion in glomerular size in the kidney of *Oreochromis mossambicus* exposed to 0.5, 1.5 and 2.5mg/l copper sulphate for 30 days. Figueiredo-Fernandes *et al.* (2007) also found damaged haemopoietic tssue, uriniferous tubules, destruction in glomeruli with reduced Bowman’s space in the kidney of *Oreochromis niloticus* exposed to different concentrations of copper sulphate for twenty one days, which was also found in our investigation.

CONCLUSION

The present study indicates that the response of a heavy metal even very effective on the low dose and short duration of treatment. If such conditions persist in water bodies, it can lead to harmful effects in long run. Hence, an instant action should be taken to check the discharge of various hazardous toxicants to water bodies otherwise it will affect the aquatic biology directly and related population indirectly through food chain and may result cancer and also to the extinction of many species. Further research is recommended on the deleterious effects of hazardous heavy metals on the fishes.

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