Virtual University: Ways to Make it Real

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Abstract

Major forces such as encouraging the implementation of e-Learning in India, reduction in educational budget, competitive threats, changing profile of learner and the vast geographic area are in demand. With the rapid advancement in computer & software and convergence of it with telecommunication technology, it is possible to make education more accessible, more flexible and less expensive. It is not a distant dream that pockets of e-learning existing in India will be networked and Virtual University networks will be created. However, it is also true that educational projects are never better than the pedagogy they are based on. It is a fact that learning takes place in the brain of a learner and is greatly depends on memory retention and recall, thus, all our pedagogical approaches should attempt to enhance it. Virtualization of university is an internet paradigm which requires completely different technology oriented methodology with technology compatible pedagogical framework. This paper focuses on distance learning concept, then moves on to open and distance learning approach, furthermore it discusses the Information and Communication Technology enabled open distance learning concept which leads to virtualization process of universities. This paper also throws light on some of the important concepts related with information and communication technology enabled open distance learning based virtual university such as e-learning, online learning and flexible learning. Actually, e-learning implementation is the most effective way to achieve virtual university concept. Some of the e-learning applications such as e-content, learning objects, open educational recourses, and open courseware are also clarified in this paper. All these concepts pertaining to virtualization of universities are heavily dependent upon successful distribution and delivery of content. There are two types of delivery concepts in any open distance learning approach; synchronous and asynchronous. The paper suggests that it would be beneficial if virtualization process of any university adopts both the concepts of content delivery.

The problems associated with Indian universities and institutes, which can be addressed by information and communication technology enabled virtual university implementation, are also mentioned in this paper. It also discusses some advantages and generic elements associated with virtual university. Further, some essential implementation steps and requirements in the process of achieving information and communication technology based virtual university are formulated and given. This paper also comprises an e-learning based content development model and gets concluded with some of the limitations of information and communication technology based learning environment, and recent technology for virtual university.

Introduction

Knowing the unknown has been our basic instinct since time immemorial perhaps because of its close linkage with our survival. This instinct has laid the foundation of all revolution and has given birth to so many discoveries and new information. Further, to disseminate information as well as remain well informed and entertained, man developed printing technology, photography, followed by radio, television, computer and Internet. All these technologies have also been applied in educating people and thus, distance instruction delivery, apart from correspondence, also started through such media as audiotape, videotape, radio and television broadcasting, and satellite transmission. Now Microcomputers, Internet, World Wide Web, mobile computing, virtual reality and knowledge systems are shaping the current generation of open and distance learning, facilitated and enabled by Information and Communication Technology (ICT) and Information and Learning Technology (ILT).

Technology has really been revolutionizing the whole educational scenario and thus forcing the old pedagogical practices and beliefs, along with learning theories to be redefined. The most noticeable in this, is the transformation from teacher-centric formal classroom teaching, with more concern on teaching rather than learning, to learner-centric, open and distance education concept. Further, this transformation also gets reflected in the shift from Instructor-led learning to technology-led learning.

All this metamorphism has come up, apart from technological incorporations, mainly due to varied learning styles, changing and demanding learning preferences, increasing and diverse learning needs, excessive knowledge explosion, huge educational supply pressure and most importantly more awareness and clarity for education attainment amongst students.

These new emerging learning trends can be very well achieved in open and distance learning mode with the help of ICT and educational technology, by making virtual universities and virtual classrooms, by facilitating e-learning, networked learning and mobile-learning, by developing open educational resources (OER), open courseware, web based lectures, e-content, learning objects and so on. These approaches are fundamentally about creating wider and open access to educational materials in a virtual learning environment which is independent and free from time and space limitations. With these approaches, there is no need to match the simultaneous presence of teacher and students in the learning process. Learners can learn anything as per their requirements, at their own convenience, anytime and anywhere, with customized, interactive and self paced learning.

It is a fact that educational projects are never better than the pedagogy they are based on. It is also a fact that learning takes place in the brain of a learner and is greatly depends on memory retention and recall and all our pedagogical approaches should attempt to enhance it. In recent, Organisation for Economic Co-operation and Development (OECD) reports such as Brain research and learning sciences, "Learning Seen from a Neuroscientific Approach and Understanding the Brain: the birth of a learning science discusses these problems". It has also been identified that sensitive periods do exist, and could over time be useful for education and learning practices, as pointed out by Dr. Hideaki Koizumi, who suggests that "a reorganisation of the education system according to the sensitive periods of the brain", would be desirable. The most important goal in education seems to be to develop a learning capability suitable for each individual according to the sensitive periods of acquiring cognitive functions. Some basic education should be employed while the brain possesses a high plasticity; in other words, the early stage of education is important. The above research has made pedagogy a function of the age of a learner.

Excellent quality academic contents with interactivity generating measures, good examples that explain key-components in different ways, good faculty and environment to facilitate learning process for students are some of the weak areas of present e-learning environment.

Let's try to find out what other researches say about ICT enabled open and distance learning, e-learning and virtual university.

According to Moore et al. (2002), open and distance learning is one of the most rapidly growing fields of education, and its potential impact on all education delivery systems has been greatly accentuated through the development of Internet-based information technologies, and in particular the World Wide Web.

As use of ICT in education has matured, the focus of interest has now started to shift from an overriding concern, with the skills and competencies associated with the technology itself, towards an engagement with the potential for ICT to act as a catalyst for the development of new styles of teaching and learning (Denning et al., 2003). Each new wave of technology draws upon different media, different teaching styles, and different curricula, giving continuous rise to new applications and new instructional paradigms (Greenberg, 2004).

But according to Amirian (2003), using technology for technology-sake may not be the best strategy supporting good teaching practices. This view was further reinforced by Teo et al. (2006) in their paper that the bulk of today's e-learning systems still consist of simple conversion of classroom-based content into an electronic format, while still retaining its traditional distinctive knowledge-centric nature. In such a scenario there is generally too much focus on "Class Room Management" and too little on the learner and on general learning strategies. Whereas, a faculty should provide optimum learning opportunities and should foster self-reliance and critical thinking. Utilizing higher-level cognitive strategies to capitalize on the distributed nature of the web is still rare.

According to Cunha, Tavares and Ferreira (2005), we still can say that most of the developments towards virtual universities are experimental, and many times still do not address the needs of their potential clients. The market for virtual university (VU)

learning is being fragmented (as the markets for all sorts of goods and services), with niche learners, each time more demanding, rather than massified clientele, and this market is becoming more and more competitive even in a world-wide scale, with global providers acting through strategic partnerships.

The view of Aoki and Pogroszewski given in 1998 still seems very pertinent. According to them, the term, virtual university, has been overused without paying due attention to its meaning. Many have used the term referring to online courses, i.e., courses offered through the Internet at a distance. Some have used the term referring to online course catalogs, i.e., electronic databases of online courses.

Gulati (2008) has summarized present ICT based learning scenario by saying; 'learning, using technologies, has become a global phenomenon. The Internet is often seen as a value-neutral tool that potentially allows individuals to overcome the constraints of traditional elitist spaces and gain unhindered access to learning'.

In an attempt to summarize these findings, two clear opinions have emerged out; one, that technological applications have immense potential in the field of education and second one, that technology is not being properly used. Furthermore, hardly any extensive research has been found particularly in Indian context pertaining to; what would be the policy and prerequisites for virtualization of universities?; what are the opinions of students and faculty member regarding this ICT enabled open distance learning (ODL) concept?; whether technology is with us or against us?; what would be the appropriate instructional design and pedagogy for creating virtual universities? and so on.

Under the purview of these findings and observations, this paper seems to be worthwhile for writing, and further, the scope of this paper can be seen in terms of its useful suggestions, guidelines and framework for virtualization of university by implementing and deploying ICT enabled e-learning applications.

The Concept

Some define distance education as the use of print or electronic communications media to deliver instruction when teachers and learners are separated in place and/or time (Eastmond, 1995). However, others emphasize distance learning as "a system and

process that connects learners with distributed resources" (Filipczak, 1995, p. 113). When this distance education access becomes open, the resulted learning may better be known as open and distance learning. Furthermore, the elements of greater learner-centeredness and flexibility must be introduced in a true open and distance learning. Flexible learning expands choice on what, when, where and how people learn. It supports different styles of learning, including e-learning (http://flexiblelearning.net.au/).

E-learning is learning that takes place in the context of using the Internet and associated Web-based applications as the delivery medium for the learning experience (E-learning Advisory Group, 2002, p. 11). Normally, it is considered that e-learning grows only in online environment and gives the idea of virtual university, as if all e-learners are distant students but this is not the case every time. Online learning may also be offered to the regular enrolled students and on the other hand, distance learning is not always forced to embrace e-learning approaches. E-learning is naturally suited to distance learning and flexible learning, but can also be used in conjunction with face-to-face teaching, in which case the term Blended learning is commonly used.

When ICT is bridged with open and distance learning, it may get the shape of e-learning and virtualization of the educational setup. The term "virtual university'" characterizes an organization that provides education and its learning opportunity on the Internet using computer programming and multimedia technologies to deliver its virtual classes, course modules, interactive tutorials, assignments and finally assessment and examination. It is meant normally but not necessarily only for those who can not pursue the regular course due to some compulsion. Studying in a virtual university is different from studying in a regular formal university. There are no buildings and no campus to go to because students study on the Internet. In most cases, only a personal computer and an Internet connection are needed. Through this connection students access the virtual university and then do the same as other students do: attend classes, solve exercises, discuss cases, take tests, ask questions, etc. Likewise they communicate with lecturers, tutors, administrative staff, etc., but it happens over the Internet.

The ODL and virtualization can be achieved by the concepts like open educational resources, open courseware, e-content, learning objects, and other e-learning applications.

Open educational resources are educational materials offered freely and openly for anyone to use, re-mix, improve and redistribute, under some licenses such as the intellectual property license. Actually, the OER movement is a technology-empowered effort to create and share educational content on a global level. Further, according to Hewlett (2005), one of the important initiatives in this OER movement is OpenCourseWare. An OpenCourseWare is a digital collection of freely available educational materials organized as courses (OCW Consortium, 2007).The National Programme on Technology Enhanced Learning (NPTEL) is another such initiative from MHRD, Govt. of India.

E-content is a kind of integrated learning experience in an electronic space where the stand-alone technologies are clubbed on a single platform and electronic content is retrieved through different modes of delivery systems. These open courseware and e-content normally try to serve a complete topic of about one hour or more duration. Learning objects are much smaller units of learning, typically ranging from 2 minutes to 15 minutes. They are small or elementary instructional components which are reusable in different learning contexts.

All these concepts pertaining to virtualization of universities are heavily dependent upon successful distribution and delivery of content. There are two types of delivery concepts in any ODL approach; synchronous and asynchronous. Synchronous instruction requires the simultaneous participation of all the students and instructors, which means that the interaction is done in "real time" and has advantage of immediate feedback such as chatting, and video-audio/audio conferencing in any form of broadcasting or multicasting or webcasting. On the other hand asynchronous instruction does not require the simultaneous participation of all the students and instructors, giving students the freedom of choice to decide the place, time and the content such as audio/ video cassettes/ CDs/DVDs, web-based lectures, e-content, learning objects, open courseware, interactive tutorials, simulation, discussion board, blogs and so on. Both the concepts are having some advantages along with few limitations, so it would be beneficial if virtualization process of any university adopts both the concepts in delivery of ODL contents and materials.

Some other terms that are used to refer to ICT based ODL include computer mediated learning, distributed learning, networked learning, virtual learning, Web-based learning, digital learning, and mobile-learning. These terms are often used interchangeably or with partly overlapping meanings.

Why Virtual University

ICT has already proved its potential in empowering education and has given rise to new educational perspectives, dimensions and approaches. Not only growing with the R&D technology but also meeting out the new educational challenges seems pertinent. The need of the hour for universities is to embrace the educational technology advancements for giving its education a new platform, like the virtual university with ICT enabled open and distance learning. This new virtual platform would also resolve the time, space, content material choices and education-at-ease kind of constraint of traditional universities. Some other problems and constraints associated with traditional university over the time would also get resolved with this virtualization process. This problem-solution equation can be seen in the following table:

Problems of traditional Universities	Solution offered through Virtual University
Mushrooming of educational institutes without having proper infrastructures.	No need to have a campus, classroom and building.
Requires a considerable amount of funding.	In long run, it is very cost effective and proves to be a good revenue model.
Unable to meet new educational and learning challenges like flexible learning, self-paced learning, customized learning. One of the examples of this is that students have no options to restudy the missing classes or concepts.	It addresses to new educational challenges like giving education-at-ease which is time and space independent. Students can learn at their own pace and also customize the Content as per their learning preferences. One of the examples of this is that students can visit the same (online streamable) lectures as many times as they wish.
Extra Administrative efforts are required to manage so many on-campus students and other campus activities.	Since the students are off-campus, minimal administration is required, that too for virtual education administration purposes.

Increasing student-teacher ratio, lack of quality faculty and unattractive salary structure	No need to recruit regular faculty, VU may have a panel of good faculty from other institutes on consultancy basis since faculty need not come to traditional class. A very few, but well qualified faculty may serve to a number of students.
Number of students enrolls as per the availability of classrooms, teachers and infrastructure.	Enrollment of students is open and can be increased to a large extent.
Every teacher teaches as per their own pedagogical beliefs & practices.	Standardization of well tested pedagogy and well suited instructional design.
It mainly relies on instructor-led-learning and teacher-centric approach and thus follows linear approach in learning.	It is basically a technology-led-learning and believes in learner centric approach. Because of this, it follows non-linear approach in learning which allows learners to skip the topics which they have already covered and go to some other topic that they want to learn.
The concepts of collaboration and cooperation missing.	Collaboration and cooperation are essential precondition of any VU.

Advantages of Virtual University

The virtualization process of universities has been offering so many advantages over the traditional university setup. Some of the advantages are:

- ♦ It is advantageous for those who can not pursue the regular course due to some compulsion like in service, financial incompetency.
- ♦ Educational opportunities are close to home
- ♦ Students receive exposure to telecommunication technologies.
- ♦ Access to media-rich learning environment.
- ♦ Opportunities to develop technology competencies.
- ♦ Contact with students in other locations in the region
- ♦ Access to global resources and experts

- ♦ Learning-on-demand
- ♦ Anytime, anywhere, anything at learners' choice and ease.
- ♦ Customization of content
- ♦ Interactivity in content
- ♦ Self paced learning.
- ♦ Cost effective

Generic Elements of Virtual University

Before going further in virtualization process of university and its implementation, let's have a look at some important generic element of virtual university:

♦ **Flexibility in Delivery:** Learners must be provided both asynchronous and synchronous delivery systems and environments. VUs must allow students to work at their own pace, at their own time.

♦ **Learner's Friendly Technology:** As the system of delivery is flexible, so the technology being used to deliver the learning must be as possible as learner friendly for using the materials provided in the VU environment.

♦ **Redefining Pedagogy:** Related to the above, there is no point in transposing traditional models of teaching to virtual environments without considering the pedagogical implications. Staff may need state-of-the-art pedagogic training for dealing with new systems of delivery and instructional design training for the creation of e-materials.

♦ **Computer & IT Training for Staff:** Institutions need to establish a model 'set' of skills that staff should have in order to contribute to and participate in the VU. Computer and IT training should be provided to the staff for adapting the virtual environment.

♦ **Learners Support Mechanisms:** Strong systems of support will be necessary for all aspects of the VU. Technical support is essential for various activities of the university and requires different strategies rather than traditional support systems. Although technical support is of obvious importance, so is administrative support,

pedagogic support to develop and adapt teaching materials and more 'traditional' university student support networks such as counseling services, personal tutors, etc.

♦ **Appropriate Software Infrastructure:** The software should include flexible material design tools and elements used in the software be easily understood to a non-technical audience. The design tools used should be flexible enough to change or re-use course modules and able to incorporate either the Instructional Management Systems (IMS) standard or widely accepted equivalent interoperated system. The software should also include interface for managing the VU and tools for course management such as student grading and tracking, assessment tools, online quizzes, and perhaps even teacher tracking.

♦ **Robust Hardware Infrastructure:** It would not be appropriate for the VU's to go offline for a minute. Therefore, Institutions must be prepared to spend money to establish a reliable uninterrupted system, and continue to support the ongoing costs of maintenance and updates thereof. The process of support can help to prevent downtime of the system. Additionally, back-up methods of delivery must be available in case of problems. Systems for transmission of data also need to be evaluated in terms of cost and based on the audience requirement.

♦ **Assessment Methodologies:** Institutions need to ensure that assessment processes are practical and easy to follow. Software utilized should allow easy tracking of students and flexible statistical manipulation. Quick student assessment is particularly important for a remote audience and should be important feature of the VU.

♦ **Adequate Legal Policies and Procedures:** There are a host of legal issues that relate to VUs. These include the issues of copyright of materials, as well as intellectual property rights. It is advisable, however, that the commercial aspects of learning material in some way benefit authors. This will encourage staff to expand and improve their work. There are also security issues in terms of protecting online materials.

Virtualization of University

Implementing virtualization process in university cannot happen overnight, it requires lot of strategy, planning, research, manpower and infrastructure. Still the concept of ICT based ODL and VU is evolving. Most of the developments towards VUs are experimental and in initial stages, where many time lakes to address the learner's requirement. Merely providing the text and video is not the true virtualization. The biggest hesitation of the VUs are of deploying ICT based ODL program particularly for science and technology in the domain of scientific experiments and lab works since the curriculum enormously based on the practical works.

 Some essential implementation steps and major requirements for virtual university are given below:

1. **Funding, Policy Issues and Legitimacy :** Thanks to the recommendations of National Knowledge Commission (NKC) of India, where the issues related to funding, policy and legitimacy regarding the virtualization of educational setups, and ICT based ODL have already been addressed and resolved to a great extent. Amongst the wide range of NKC's recommendation, few are; Supporting ODE with ICT infrastructure, Creating online OER: a web-based repository of high quality educational resources for utilization by all ODE institutions and launching a 'National e-content' to support OER by converting educational contents and knowledge into interactive electronic form.

But above all, while developing and deploying ICT based model for virtualization of universities, one should keep in mind the financial affordability/sustainability.

2. **VU research and Aadvisory Committee :** Formation of a virtual university research and advisory committee that will come up with the widely accepted format, by conducting a formative research or survey, and also evaluate the end product through summative research.

3. **Administration :** For overall administration of virtual university, a variety of administrative software tools can be developed for accounting, student record

maintenance, course catalog maintenance, curriculum schedule maintenance, virtual library maintenance, course development, lecture-on-demand, FAQ and auto reply, course selection and on-line registration.

4. Infrastructure : As a part of infrastructure Internet is needed for implementing virtual university. It would be ideal for the success of virtual university to connect through Wi-fi network with effective security. The approach will enable m-learning (mobile learning) with virual classroom to ad-hoc mobile classroom, whereas network will be accessible through mobile, PDA devices and handheld devices.

Further, a network architecture with proper design along with dedicated application servers, database servers and certain protocols need to be configured. Nowadays, many open source software, standards and protocols for development of ODL applications are available. Such standards are SCORM, AICC, CMI, IEEE, IMS and so on. Similarly some of the open source software are eduCommons, Moodle, and so on. We can also implement any relevant open source software and standard which uses metadata to tag learning materials in our virtual university implementation. But, this approach of using open source and standards is not supposed to be a good practice. Since, all the content are going to be hosted on a web based system, which would be prone to crashing due to its huge database and complex metadata, therefore it is suggested to design a program of a proper system and server architecture with the help of technology such as AJAX or Rich Internet Application like adobe flex builder, Adobe Captivate 3 (it automatically generates interactive content for easy online distribution and access), flash and relational database management. Some software for delivery of learning materials may also be developed for example Lecture-on-demand playback, Student notebook, Discussion board, Audio video conferencing, Chat room and White board.

5. Setup of Edusat Facility : Further to infrastructure is setting up of Edusat facility. Edusat is the first exclusive satellite which is completely dedicated to education but Edusat network is not a complete ODL solution because the facility is not available with internet. However through Edusat virtual classroom can be created. Actually

Edusat network is a closed group network and to access and interact with its multicasted lecture at receiving end i.e. classroom, a SIT terminal is essential. SIT terminal consists of an outdoor unit which includes dish antenna, LNB, trans-receiver, and an indoor unit which includes decoder/encoder and Ethernet/LAN output. Then we need PC preferably P-IV, Net meeting software or any other video conferencing software, VLC software for receiving and playback of the streamed video or lecture, Pal/video to VGA (VGA to Pal) converter card, Web camera, microphone, IP network and a classroom with sitting arrangement. For converting classroom end with SIT facility into teaching end we need a small studio with general lightings, professional camera, microphone, video switcher and a streaming media. Technical personnel and manpower is also required as per the minimum need.

6. Set up of V-Sat facility : Setting of V-Sat facility as a part of infrastructure is purely optional. This facility helps in delivering lectures and discussions in virtual classroom through video conferencing. It helps universities in tying up with foreign universities and industry experts for delivering expert lectures and enabling fruitful discussions through video conferencing.

7. Partnerships : Establish and maintain relationships and having partnerships with government and private institutions involved in ODL and ICT development. Furthermore, it also establishes a national education consortium for joint course development and sharing of the national ODL networks and facilitating ODL programs countrywide. Partnership should also be extended to industry experts for enabling industry driven learning.

8. Resources and Course Development Team : A panel of resource personnel along with course development staff should be formed. Resource personnel will provide the content and also design the instructions with the help of an instructional designer. The course development staff which may include technical writer or content developer, multimedia expert, computer animator, computer programmer, IT engineer and technician, will develop the ICT based ODL materials and e-learning applications. In case institutions want to use the Edusat facility for two way interaction and

develop web based lectures, then institution may need to have at least a producer and a cameraperson as a part of staff.

9. Exploring the ICT compatible pedagogy and instructional design : Difference between pedagogy and instructional design needs understanding. Pedagogy is more of a theoretical concept explains teaching and learning processes comprehensively, whereas instructional design is more of a practical framework links learning theory and pedagogical practices. It is a way of arranging media and communication technology for transferring knowledge effectively on the basis of the learners and the learning situation.

When beginning to create content for VU, the pedagogical approaches and instructional models need to be evaluated because technology deployment is not the only indicator for successful learning. For this, a panel of educationists may be formed to suggest the ICT compatible pedagogy and instructional design which can address to all kind of learners and their diversified learning styles. The objective of any pedagogical framework and instructional design approach in this virtual environment is to inculcate well tested and effective learning concepts like collaborative learning (learning by supporting each other), constructivist learning (learning by construction of new concepts based on previous existing concept), discovery learning (learning through experiment), incidental learning (learning through case study), inductive learning (learning through example), deductive learning (learning through application), active learning (Learning by doing and instant action) and apprenticeship (learning through mentor-student interaction).

10.　Learning Management System : Learning Management System (LMS) may be developed to reach VU's e-Goals. An LMS is typically designed to handle courses by multiple publishers and providers. It usually doesn't include its own authoring capabilities; instead, it focuses on managing courses created by a variety of other sources. LMS is a suite of functionalities having features to deliver, track, report and manage learning content, student progress and student interaction.

11. Training : Along with capacity building workshop for understanding new pedagogical framework, faculty should also undergo ODL and ICT orientated training of media rich instructional design model. Faculty should also familiar with the learning management and course management systems designed to assist teachers and educators for developing quality online courses.

12. Pacing the Learning : In order to maintain punctuality and disciple in the pace of learning, VUs may apply the time management similar to the traditional universities such as programs divided into semesters and courses taught in a weekly rhythm, weekly homework assignment, etc.

13. Promoting Education Television Channel : Encourage and motivate distance learners for receiving education through educational television transmission such as Vyas, GyanDarshan, Eklavaya while providing them subject wise time schedule of lectures in advance.

14. Learner Support System : A well-designed learner support system should be the part of open and distance learning programs for supporting, guiding and satisfying the learners.

15. Quality Assurance System : VUs quality assurance system should have monitoring, research and evaluation of delivered content and its outcome for continual quality improvement.

16. E-learning Applications Development : In the process of virtualization e-learning plays an important role. All the methods and development concepts for ODL system will broadly come under one roof that is e-learning. E-content, interactive tutorials, learning objects, web-based lectures and its streaming, open educational resources, open courseware, virtual classroom, online digital library, discussion board, blogs are the basic tools and applications for enabling e-learning. Major chunk of virtualization process will fall under the e-learning development. So, e-learning development approach will automatically lead to the virtualization process of universities. Following concepts and guidelines may be adopted for e-learning applications development:

♦ Making e-learning applications media-rich by including audio, video, text, graphics and animation.

♦ Authentication of learners through login and password should be implemented for security purposes of the e-learning system. Privacy of learners with their grading will be maintained through this approach.

♦ Interactivity for making the learning process more enjoyable, effective and engrossing for the students.

♦ E-learning system should have facility of personalized customization of content for self paced learning. This will also enable repetition of content since multiple exposures is essential for the retention of the content.

♦ While developing the content, a balance between concrete information such as facts, data, real or hypothetical experiments, and abstract concept such as principles, theories, mathematical models, should be maintained in the instructional design. There should also have a balance between materials that emphasize practical problem-solving methods, with materials that emphasize fundamental understanding. Instructional designer should follow the scientific method in presenting theoretical material by providing concrete examples of the phenomena first, then should predict and describe underlying theory. Furthermore, daily assessment of learning attainment and achievement should be a practice and must be carried out in all ODL programs, since it will overcome the upcoming problems and shortcomings.

♦ Parallel instruction for varied visual representation in order to avoid misinterpretations along with reinforcement of the content among the students.

♦ To overcome the barriers of getting socialized in e-learning mode, student interactions and socialization can be enhanced by making discussion boards and online learning communities. Similarly, in a course setting, groups of students with special interests can set up blogs for representing those interests, sharing resources & ideas and having further discussion on it. These kind of e-group brainstorming activities are supposed to be very effective for collaborative learning.

♦ Unfolding the difficulty levels of content for intelligent, average and poor students. Content may be developed to target intelligent students, and if average and weak students find it tough, they would unfold the difficulty level and select some basic and elementary content. The best approach to this is that e-learning should be developed keeping in mind the individual user's strengths and weaknesses.

♦ Pop-up a relevant intelligent comment, quote or its visual symbolization in response to some mistake committed by the learner while attempting a task. It breaks the monotony of learning.

♦ Language translation for learner to access the content in their desirable language.

♦ For enabling e-learning and ODL, open educational resources, open courseware, streamable web-based lectures and digital libraries should also be developed besides other e-learning application development such as e-content.

♦ Creation of virtual classroom by giving computer simulation programs and virtual reality systems. The provision of exposing the learners with 3D visualization labs and VisBox may also be formulated.

Any attempt to develop a good e-learning application should include and also effectively deliver by the modes such as prerequisites, objectives, career prospects & outcome, glossary, FAQs, video and audio modules, IP TV, tutorials, simulation, learning objects, case studies, e-books, texts, powerpoint presentations, animations, images, assignments, quiz, references & recommended web links, discussion board, blogs, webliography, institutions offering the course, learning games, downloading of contents and so on. So when institutes plan to implement ICT enabled ODL concept, the e-learning application must be developed by selecting the appropriate modes along with adopting the above mentioned concepts and guidelines for delivery of content. Here a general e-learning application's content development model to guide the virtual university, is formulated and given below;

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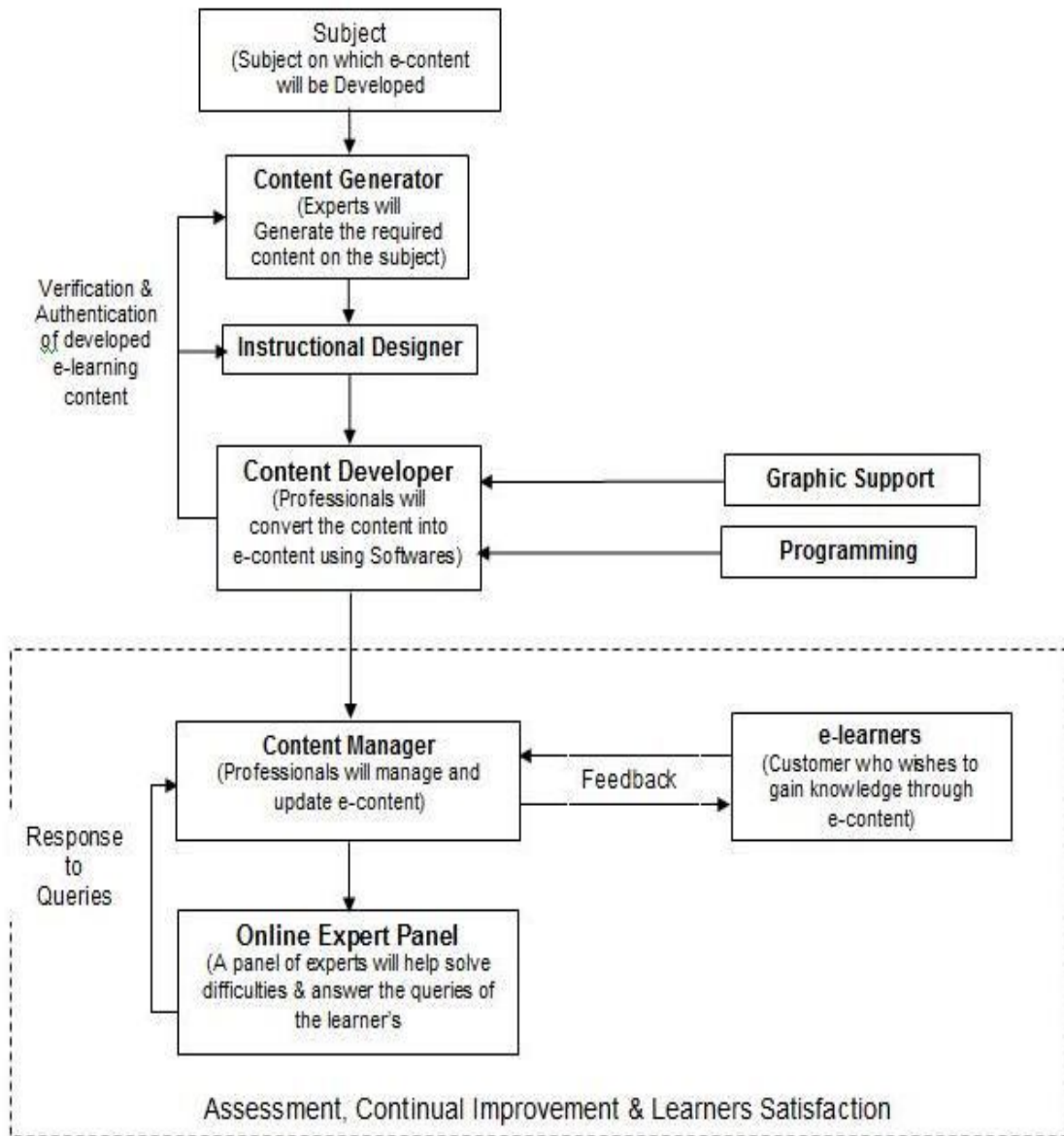
e-learning application's content development model

Some other Virtual University Models

Three key stages are required for any VU implementation i.e. conceptualization, organizational and infrastructural. A few such models namely VU Reference Model was suggested by Aoki and Pogroszewski, whereas, Organizational Model and Technical

Infrastructure Model for VU were suggested by Pýnar Onay, Neþe Yalabýk, Gülser Köksal.

Limitations of ICT

At present, Information and Communication Technology has following limitations:

♦ It is very difficult to create a realistic, participatory learning environment in ICT based learning. Actually formal campus based educational setup is a culture which is very difficult to cultivate in a virtual mode. Virtual classrooms do not have the feeling of physical nearness among those doing a course of study. This nearness in a conventional classroom helps them understand not only the complex subjects but also the complex facts of life through frequent discussions and quiet observations. The social learning perspective is missing in the ICT enabled learning.

♦ ICT based e-learning lacks competitiveness amongst students, which inspires the good students to become better and the better ones to become the best.

♦ Serving the practical work requirement is still not the completely resolved problem in an ICT enabled ODL environment.

♦ Virtual learning is easier for students who are self-managing and well aware of their learning goals, which may mean that it is not easy for less mature and poorly self motivated students.

♦ A new, well tested ICT based comprehensive pedagogical framework and effective instructional design still remains to emerge out. Current pedagogic changes, to integrate educational technology, seem to be evolutionary rather than revolutionary (Hennessy et al., 2005; Cuban, 2001; Kerr, 1991).

♦ Presently, it does not provide placements and recruitments like the campus placements in a formal university set up.

♦ Lack of computer and information literacy which both refer to ability to use computer, ICT and explore the desired information.

♦ The ability to retrieve and present the right information at the right time to the right learners requires the principle of relevancy. More often than not, it is without

doubt that current ICT based e-learning systems, even with the most sophisticated search engines, fail the relevancy tests.

♦   Lack of infrastructure and professional competence in ICT enabled open and distance learning is a significant barrier. There is a shortage of qualified staff required for guiding and influencing the development of distance education policies, and for planning, developing, managing, and evaluating ICT based ODL programs. Due to a shortage of skilled or trained staff, ODL institutions lack systematic and need-based design and development of course materials. On the other hand, existing conventional system of education, which includes academia, is most conservative and resistant to change in terms of embracing new technological options in education.

♦   ICT based ODL has had trouble in conducting the on-line exams and controlling the students from cheating since its conception.

♦   This ICT based approach completely relies on information technology and internet network. If technology fails for sometime or is not able to deliver sufficient data transfer speed, the ODL will also get affected.

Recent Technology for Virtual University

Technological evolution is opening up new challenges especially in the realm of Internet. Today's Web has reached to the stage of Web 2.0 and researching for Web 3.0 concept. Web 2.0 is nothing but a new version of World Wide Web which describes the changing trends in the use of Web technology and web designing patterns. Web 2.0 offers a new web development culture often features to rich, user friendly interface based on Ajax, OpenLaszlo, Flex technology. Social networking sites, blogs, video sharing sites like YouTube, wikis are few of the examples of web 2.0, where user generates their own content and uploads on web.

With the web 2.0, the concept of e-learning has been changed and emerged out as e-learning 2.0, which requires an advance development approach. Placing either text based or video based learning material is not enough, but have to make it highly interactive, rich, dynamic, open, fast, scalable and reusable. With the advancement of Web 2.0 and e-learning 2.0, the concept of virtual university has changed accordingly and heading towards VU 2.0.

Conclusion

Today using ICT for implementing e-learning in the universities as a part of virtual university concept has become the global phenomena. Educationists and policy makers often get so fascinated with the features and advantages of ICT enabled e-learning that they often forget to see the proper combination of ICT resources to suit the learners' need and preferences. Many studies show that lack of understanding of the scope of an ICT resource leads to inappropriate or superficial use of VU implementation. Technology has always been with us until we use it strategically and wisely. Further, virtualization of university should remain really virtual in true sense.

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