

Distance Education Through Internet Based E-Learning

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Abstract: *Effective and low-cost communication system has the same importance to an Open University as blood has to life. In this regard, rapid growth of reliable Internet access at low cost, from almost all parts of India, has opened up innovative avenues for education through Open and Distance Education System (ODES).*

This paper aims to examine a web-based engineering education model for the ODES of India. It also presents practical experiences gained since 1992, during the implementation of "Electronics Engineering Diploma Programmes (EEDP)" at Yashwantrao Chavan Maharashtra Open University, Nashik, India, and examines how Internet, with its present technology limitations and costs, can be effectively used to simplify all stages of academic programme design and implementation.

Introduction

Efficient utilisation of all resources is essential to maintain good academic quality with cost effectiveness. Truly collaborative knowledge management system using Internet is naturally suited for ensuring this in ODES, due to its wide and low cost access without any geographic, distance or time barrier. With Internet, ODES can easily ensure quality education for all, with cost effectiveness, at the doorsteps of learners.

There are some specific requirements in India:

- Huge number of learners prefer engineering education due to better job opportunities. However, conventional educational institutions in India are not in a position to cater to this huge number of aspiring learners.
- Majority of learners belong to economically weaker sections of society. Hence expenditure for full time learning in conventional educational institutions is out of reach for many learners. Even "Learning while Earning" is essential for many learners. Only ODES provides this flexibility in India.
- Huge geographic distances along with poor communication and infrastructure till recent past resulted in very little or no interaction among the learners. Naturally, a sense of community does not get generated among the students of ODES, which results in low retention rates.

The world today is engrossed by the revolution called 'Web'. Web or Internet is strongly influencing all aspects of life, including business and learning. The new term called "E-Learning", describes the way the web is going to storm the education system. The growth of Internet is phenomenal in India. Just 5 years ago, Internet was a high tech word reserved only for very few privileged persons in India. Today, many newspapers include regular articles and even special supplements on Internet. Internet is becoming an important element of daily life in India. The growth of Internet in India, is a classic example of how quickly new technology is being absorbed by this country.

When the year 2001 begins, there will be around 4.5 million Internet users in India. This growth is taking place when the Internet access is mainly through computers. In the near future, access to the Internet will commonly be through telephones and TV sets. This can only lead to a further jump in the use of Internet and in the demand for institutions to provide education through it.

In India, due to weak economic conditions, majority of students cannot have Internet access individually from their residence or work place. Still they require academic programmes with good quality and cost-effectiveness. Naturally, mass education approach is essential to ensure and maintain low costs. Internet can help to significantly improve the quality of the present 'Open and Distance Education System (ODES)' of India and still retain its cost-effectiveness. Although individual Internet access is not economically feasible in India for each student, **shared Internet access** from the study centre is easier, cheaper and convenient for the students.

Open and Distance Education in India

Open and Distance Education System (ODES) is now growing in India. There are 10 open universities: one at national level and others at state level. About 235 different academic programmes and 2146 different courses (subjects) are offered through these universities. Every year, about 0.47 million new students are registered for various programmes, while total number of registered students on the roll is 1.35 million. About 87 regional centres and 3030 study centres provide various academic and student support services to these students distributed over an area of 3.28 million km². About 35,000 counsellors impart academic instruction in many major languages, which include Bengali, English, Gujarathi, Hindi, Kannada, Marathi, Tamil and Telugu.

Features of the Present Open and Distance Education System of India

Some of the features of the present Open and Distance Education System (ODES) are as follows:

Information

Till date, there is a heavy emphasis on print medium for delivery of learning material. The role of other media like audio, video, radio, TV, multimedia, etc. is still only supportive. Learners have to match place and time for using these other media for learning. Due to this rigidity and other serious delivery problems their "real" use is highly restricted. Hence, delivery of academic information is normally restricted to print medium. If delivery of textbooks is delayed for any reason, there is no backup

media through which an university can ensure access to academic information.

Self-study

There is a great emphasis on self-study by the student, using academic information provided by the university through various media. Due to reasons mentioned above, normally students do self-study using print medium only. As there is no backup to print, self-study at a right time is not possible, if delivery of textbooks is delayed.

Interaction and Counselling

Academic help in the form of limited counselling (about 15-30% of the conventional face to face education) is provided to the students to solve difficulties on local weekly off days at the study centres. Students perform practicals at study centre laboratories on local weekly off days. Students are allowed to complete Project-works either at their workplace or study centre laboratory. This limited face-to-face interaction and counselling at the study centre has following major problems:

- *Poor Quality:* Not all counsellors at various study centres are academically sound and have superior communication skills. Hence, counselling at the study centres in the present system is less effective and thus learners cannot enjoy it. Learners also require more time and efforts for effective learning due to this.
- *Poor Time Utilisation:* Most counsellors cannot effectively utilise available limited time to provide proper academic support on all difficult topics in the course (subject).
- *Rigidity:* A student simply loses the counselling, if he or the counsellor cannot attend the session for any reason. As there is no backup media, the university also cannot provide counselling in such an event. Learner cannot reinforce his learning, as counselling cannot be repeated, in case he needs it later.
- *Poor Cost-effectiveness:* In the present counselling system, the learner has to invest substantial resources in terms of travel, time and cost. This factor keeps many prospective learners away from the ODES.

Formative Feedback about Learning

For delivery of learning materials and communication with students and study centres, this system largely depends upon regular postal service, which at times may be quite slow. Continuous or self-assessment of students, with good quality and reliability, is quite difficult due to slow communication. There is very little or no interaction among the students due to large geographic distance. Naturally, lack of community sense among the students, coupled with the above-mentioned problems of counselling, results in low retention rates.

Because of the above considerations, there is an increasing pressure on education system of India to incorporate the Internet into teaching and learning. But this is unlikely to result in a major change in the basic teaching learning methodology of conventional institutions. However, the Internet does provide major alternatives to many of the delivery and student support methods being used in ODES of India. Hence, web based "E-Learning" is already viewed as an important tool to improve academic quality, effectiveness and efficiency of ODES. At this point it may be quite pertinent to briefly

discuss the different generations of ODES.

The evolution of ODES may be grouped in the following 5 generations, wherein each successive generation offers better quality of features outlined above.

- **Zero Generation:** External Students
- **First Generation:** Correspondence Education
- **Second Generation:** Self-instructional materials and a small component of face-to-face (that is, about 15-30% of conventional education system) counselling help at study centres.
- **Third Generation:** All features of second generation and additional audio-video support with cassettes, radio, television and teleconferencing. *This is where ODES of India today belongs.*
- **Fourth Generation:** All features of second generation and following additional features offered through CD or Internet with an access at 28.8 kbps speed. This mode is **not truly “Online Education”** but may be called a **“Web-Enabled Education”**. Here, face-to-face counselling help at study centres is **enhanced and enriched** with CD based pre-recorded “Virtual Classroom Modules (VCM)” from master trainers. Internet is primarily used as a back-up media for CD and to provide (1) text based interaction with students or counsellors, (2) formative feedback about learning effectiveness and (3) additional learning resource. Infrastructure required for this generation is highly cost-effective and hence it is suitable for mass education. As use of video is kept to minimum possible, it is easy to design, develop and maintain this system. *Hence, model for only this generation of ODES will be discussed in this paper.*
- **Fifth Generation:** All features of fourth generation and the additional features offered through CD or Internet with an access at very fast speed (128 kbps or better) using ISDN or other emerging technologies. This mode will be truly **“Online Education”**. Here, face-to-face counselling at study centre may be **totally replaced by** truly distributed **live** Virtual Classroom with two-way video Interaction. Internet will be primary media for delivery of all features of the fourth generation and two-way video Interaction, while CD will act as a back-up media for pre-recorded VCMs. *It is estimated that, at least 5-10 years will be required to make this generation practically feasible in India.* As two-way video interaction will be used, it will be quite difficult to design, develop and maintain this system.

In 1992, Yashwantrao Chavan Maharashtra Open University (YCMOU), offered electronics engineering diploma programme. It was the first technical programme offered through distance mode in India. Naturally, it was quite hard for the people to believe that quality technical education can be imparted through distance education mode. Thus, till 1996, student enrolment was hovering at 100-200 students every year.

An experiment kit was developed with a view to allowing learners to perform many different electronic experiments at their convenient place and time. Programme implementation effectiveness was substantially improved with introduction of various managerial innovations. The curriculum was totally revamped to ensure its relevance.

These changes contributed to growth in student enrolment from just about 150 students in 1996, to about 2500 students in 1999. All over the state of Maharashtra, about 160 counsellors at 40 different study centres offer academic support to these students distributed over 0.3 million km² (about 800 km north-south and 600 km east-west). *Now, this will be the first technical academic programme in India, offered with web based learning methodology. With this, it is believed that, this programme will set the standards for academic excellence, with effective programme implementation systems.*

E-Learning

Sir John Daniel, Vice Chancellor of the UK Open University, observed at COL Forum in Brunei:

“The role of universities is to enable society to maintain an independent understanding of itself and the world. If this is the role of the university what must be the style of university learning? It must not stop at the transmission of information, nor at the communication of knowledge. It means development of understanding. Understanding is an iterative process involving a dialogue with oneself and others that moves towards a shared understanding. Knowledge alone is insufficient, university education implies an understanding of the nature of knowledge. Understanding means going beyond information, it means going beyond knowledge, it means knowledge acquired with the sense of responsibility for how it comes to be known that can make it a foundation for action.” (John Daniel, 1999)

The proposed ELearning model uses the above theme to achieve better academic excellence and effectiveness with ease of programme implementation.

Thus, for ODES of India, there is now a strong need to consider how the Internet, **with its present technology limitations and costs**, can affect the teaching, learning, expectations and employability of students. For, the Internet provides a new medium, which significantly reduces the problems of education at a distance and increases the opportunities for interactive communication. With many powerful features, web offers excellent possibilities to transform the present teacher-centric education system into **highly responsive and dynamic learner-centric personalised education system**. Elearning will be a giant step forward towards ensuring quality education for all, with cost effectiveness, at the doorsteps of learners.

Knowledge is expanding at lightening speed. Students need to learn more, better and faster. But, learning is a complex process. Teachers must use innovative methods for teaching so that learning becomes an enjoyable experience that sustains the interest and concentration of students. Active participation of students in the learning process is thus ensured. ELearning helps a teacher to focus on dissemination of knowledge, as a **facilitator and guide**. ELearning is a system that can empower both students and teachers. Teachers can clearly communicate more in less time using rich multimedia. Certain minimum uniform quality standards can be easily maintained at all study centres. It also creates a **knowledge resource for the nation** and any module can be easily shared by anyone, anywhere. ELearning provides much freedom to students regarding place and time of learning. This flexibility makes learning an attractive activity

particularly for housewives and employed students.

Components of E-Learning

E-Learning consists of the following components, which are created with the state of art Internet technologies for high quality, ease of use and effectiveness.

The Virtual Classroom

Virtual Classroom Modules (VCMs) are well-prepared high quality lectures from the master trainers, with multimedia colour presentations. VCM combines distance education instructional pedagogy with latest interactive multimedia Internet technology. VCM helps the counsellor to efficiently perform his basic job of providing information in less time, without compromising the quality. Thus, he can utilise his time for developing higher-level mental abilities like comprehension, application, analysis etc in students. Smaller time duration of each module (i.e. about 15±5 minutes) ensures better concentration. Highly compressed formats, about 200 VCMs, which are enough for about 2-8 courses (subjects) or 16-32 credit points, can be supplied on a single CD. Streaming media technology ensures simultaneous playing and downloading of a module from Internet, with negligible initial delay of about 15-30 seconds. Thus, Internet can be used as backup media for delivery of VCMs to provide 'Anywhere Anytime' learning. Use of video is kept to minimum possible level, and normally restricted to imparting of skills. Easy and fast production of good quality VCMs is possible. Discussion and/or tutorial in real time, with counsellors and fellow students are expected to follow these lectures at each study centre. Thus, VCM ensures better learning through distance system in the following ways:

- Better Time Utilisation: Through well prepared lectures from master trainers
- Clear Knowledge Communication: Through the latest multimedia and Internet technology
- Development of Better Understanding: Through discussion/tutorials in a group of fellow students with a counsellor
- Repeatability and Portability: Student can repeat the module (lecture) or its part, on any multimedia computer. University can even dispatch it through Internet / email
- Easy Quality Assurance through
 - Lectures of master trainers directly reaching the students
 - Use of multimedia for enjoyable and worthy learning experience
 - Same quality standards ensured at each study centre.

The Discussion Forum

A discussion forum is an interactive web site that lets site visitors discuss topics by reading articles that have been posted, replying to articles, and posting new ones. Visitors can also use a search form to find articles of interest. Discussion forum offers asynchronous mode of communication, where messages can be prepared with editing

and 'post' or 'replied' devices without waiting for the receiver to be ready. But it allows only text-based interaction among students, counsellors and the university. Any interaction on the discussion forum is visible to all. A discussion forum can have the following features:

- A table of contents that contains hyper-links to articles relevant for the discussion topics
- A search form that allows visitors to search the articles for a word or phrase
- An entry form in which a visitor types an article to post
- Threaded replies allow the visitor to choose whether the article they are posting is a new top-level topic for discussion, or a reply to another article. This feature creates **well-classified and well-organised knowledge base** on any academic or administrative topic in a short time. Frequently asked questions can be easily derived from this knowledge base.
- A confirmation page, which confirms that a visitor's article has been posted
- A registration form that lets site visitors log in to the Web site, if the discussion web is protected.

Discussion forums may be used in various situations. Topics of interest may be grouped as follows:

- Discussion forum for the university: This forum will indicate perceptions and expectations of the society at large about the university. Also, the following student services can be provided for all academic programmes:
 - Pre-enrolment counselling
 - Information on despatch and receipt of learning material
 - Feedback on counselling at each study centre
 - Information about any changes in the schedules
 - Counselling about various examination related issues, etc.

As any interaction through a discussion forum is visible to all, one answer may satisfy many other similar probable queries from other students, reducing frequency of communication. This is a much better alternative to email. This forum will also indicate at which stage of the programme the university needs to improve its implementation.

- Discussion forum for each project of design and development of new academic programme: Here, well-classified and well-organised record will be maintained on deliberations during the project, among members of each team of academic experts. This will be a valuable knowledge resource for taking decisions about any change in future, as it provides full historical context for it.
- Discussion forum for each course (Subject): Here, topics are classified for each unit (chapter). This forum is ideally suited for academic discussion among students and counsellors at all study centres. This forum will indicate where the university needs

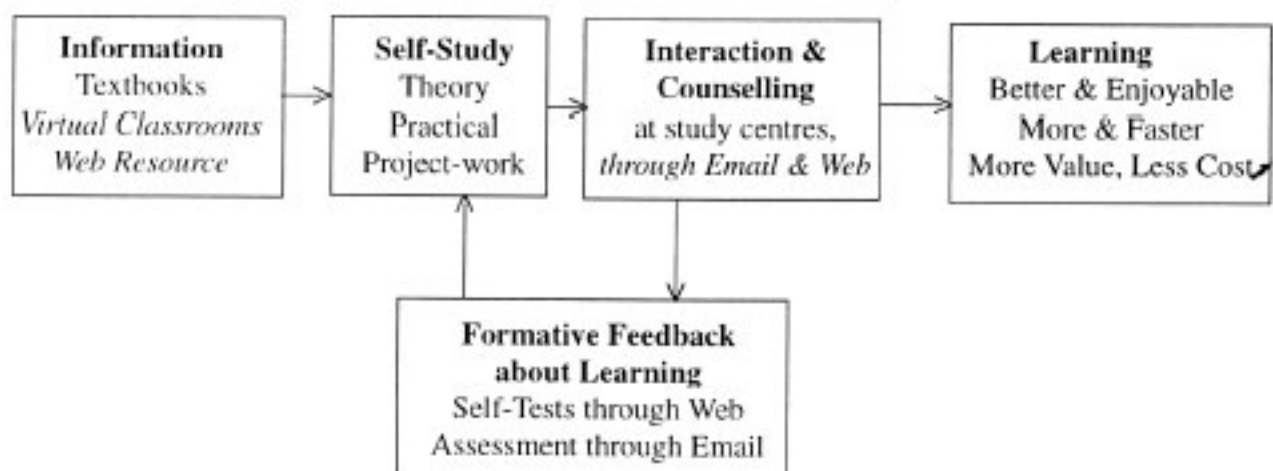
to provide more academic support to the students of the course (subject) by indicating all difficult topics in a course (subject).

Online Counselling

'Online Counsellor' is a well-qualified and experienced person who interacts with the students, **only through use of discussion forum**, for clearing their doubts/difficulties. Depending on the number of students, the university can appoint one or more 'Online Counsellors' for each course (subject). Once a week, each 'Online Counsellor' will answer all the questions posted on the discussion forum of the respective course (subject). He will also initiate academic interaction by posting: (1) Home Assignments, (2) Quizzes, (3) Critical Thinking Questions or (4) Any other interesting academic information about the course (subject). Online counselling will be a step forward towards 'Learner Centric' education, as it provide anywhere anytime counselling for those learners who can not regularly attend counselling sessions at study centre due to various reasons. **Online counselling cannot replace regular face-to-face counselling at study centre, but can act like backup for it, as email and discussion forums offer only text-based communication.**

The Framework of E-Learning

In simple words, "E-Learning" can be defined as enjoyable, quick and high quality learning that uses various learning tools of the Internet. With interactive E-Learning, students have much more freedom of when, where and how to learn. Internet retains individual privacy while offering global reach.



E-Learning

Fig. 1: Web Enabled E-Learning

Features of E-Learning

Some of the important features of the proposed web enabled fourth generation "Open and Distance Education System (ODES)", at different stages of learning (Figure 1), are as follows:

Information

In ELearning, the heavy emphasis on print media will be reduced but not totally eliminated in the delivery of learning material. Role for other media like audio, video, multimedia, etc. is substantially increased but is still only supportive. In ELearning, academic information will be provided in three major forms:

- *Self instructional texts*: Texts written in self-instructional format, which are suitable for self-study, are still the primary media due to their convenience of use.
- *Virtual Classroom Modules (VCM)*: These modules offer better effectiveness compared to self-instructional textbooks, due to many superior features and flexibility discussed earlier. These modules will be delivered on CDs, for use at study centres, which are then followed by discussion / tutorials in a group, with counsellor. These modules will be delivered also through the Internet, which provides reliable backup access when the student misses counselling at the study centre for any reason.
- *Web Resource*: Links to additional information about each course (subject) on web will allow learners to explore further related information.

Self-Study

Self-study by the student, using academic information provided by the university, through various media will still be essential. But in the proposed system, self-study of the student using print media is effectively supported by VCMs through web. If delivery of textbooks is delayed for any reason, self-study at the right time is still possible, as VCMs through web provide 'anywhere anytime' backup for print media. Self-study will be much more enjoyable thanks to multimedia technology and the master trainers.

Interaction and Counselling

Academic help in the form of limited counselling will still be retained but quality and effectiveness of counselling sessions at each study centre will be greatly enhanced and enriched with the use of VCMs on the CD. With this approach, university can easily ensure the same academic quality and standards at each study centre. Counsellors at each study centre will act as facilitators and guides. Utilisation of counselling session will be much better. In case students cannot attend the counselling session, they can still reinforce their own learning as follows:

- Direct online play of the respective virtual classroom module on the Internet, where 'real' speed of access to Internet is better than 22 kbps. Typically, cost of such an access for a single VCM will be about Rs. 10/- (=US\$ 0.22) only.
- Downloading and then off-line play of the respective virtual classroom module on the Internet, where "real" speed of access to Internet is less than 22 kbps. Typically, cost of such an access for a single VCM will be about Rs 16/- (=US\$ 0.35) only.
- Online threaded discussion with fellow students at other study centres and 'real' online counsellor who will help students to solve their difficulties / doubts using interaction through text mode only. Typically, cost of single access to 'online counselling service' will be about Rs. 10/- (=US\$ 0.22) only.

Cost of 'anywhere anytime' access to these online interactions and counselling service is negligible, if learner's savings are considered in terms of (1) Significant improvement in quality, accessibility and efficiency of education. (2) Substantial reduction in travelling time and cost. (3) Better chances of their successful completion and (4) Better employability due to additional Internet experience and skills.

Formative Feedback about Learning

Internet is a fast, easy and reliable communication media with a global presence. Active Server Page (ASP) technology offers excellent secured opportunities for interactive intelligent communication and on demand feedback about learning effectiveness, on the Internet.

Discussion forum on each companion web site for each course (subject) allows any student to interact with other fellow students and counsellors at other study centres. As these threaded discussions are visible to all, if a learner searches previously posted questions and answers, the need for communication itself is reduced. Learners can understand the same topic from a different perspective, by just exploring the well-organised 'knowledge base' in the form of questions and answers, already posted on the respective discussion forum.

Online '**Total Quality management (TQM) System**' will allow any registered student or the recognized Counsellor to directly assess all aspects of quality or retrieve quality information about each of the following components, directly from online quality database:

- Any academic programme
- Any course (subject) of an academic programme
- Any textbook / workbook of course (subject)
- Any recognized study centre of a programme
- Any recognised counsellor at any recognised study centre of any programme.

This will generate knowledge base for the quality of each important component. With this quality knowledge base, students can choose better study centres or may insist for recognised counsellors only. Thus study centres will have to offer better quality academic and administrative services.

"Online Examination Centre" allows any students to directly and immediately access:

- His own knowledge level, before studying any unit or VCM of the course (subject), by taking "Pre-Test" on any selected unit(s) or VCM(s) for the course (subject)
- His own learning effectiveness, after studying any course (subject), by taking "Self- Test" on any selected unit(s) or VCM(s) for the course (subject). This provides valuable formative feedback about his learning effectiveness. With this, each learner immediately knows about the weak areas and where he needs to concentrate in his learning process.
- His own learning effectiveness for the complete course (subject), by taking multiple

choice type of objective '**End Examination**' on any course (subject). Results of this type of end examination will be communicated immediately after its completion, to the learner.

Due to fast, easy and reliable communication media, interaction among the students and counsellors will be much better, even with large geographic distance. Naturally, community sense among the students coupled with much better counselling and VCMs will result in high retention rates.

Learning

Learning through this web enabled ODES will be a much simpler task. Learning will be better, enjoyable and faster, providing a better value to the student. Due to effective backup media of Internet, the university can ensure enjoyable learning with good academic quality and flexibility, even with the dependent model of study centre network.

Key Issues For Implementation

Internet may not always be cheap in terms of capital expenditure, expertise or staff time and training. Use of the Internet will result in reduced costs only when it:

- replaces existing student support systems rather than providing parallel solution;
- significantly improves quality, efficiency and retention rates;
- significantly improves probability of right processing at right time; or
- is believed that students will leave the university in large numbers because the competitors use it and the university does not.

Further, for the Internet based online academic programmes, all study centres and university staff will need training in the basic computer and Internet related skills to participate effectively. The time and energy required for developing these skills may initially distract many from the teaching/learning process. Therefore, sustained efforts would be required in this direction as the benefits of using Internet will outweigh the additional costs, if it is used on a large scale in the academic programmes and administrative services. From the students viewpoint, the more the university uses the Internet, it will be easier for students to accept the additional burden in terms of cost and training. Most students are likely to accept the use of the Internet if they believe that:

- Quality, accessibility and efficiency of their education will be significantly improved;
- Travelling time and cost will be substantially reduced;
- Chances of their successful completion will be significantly more; and
- The experience gained and skills learned will significantly improve their employability.

Thus, while introducing the Internet in academic programmes, it is important that

university should go public in its plans and time table for introduction of internet, so that students can assess the potential, long term gains rather than looking at short term benefits alone. It is very important to have a well co-ordinated approach for introduction of the Internet. It is also essential that Internet software be standardised across the university and its study centres. This will ensure minimum familiarisation time for the students. If the use of the Internet is planned on large scale, study centres and counsellors will have to be trained and motivated. Some means, other than compulsion, will be required to persuade them to accept the Internet based programmes. Normally, provision for financial gains and other incentives for study centres and counsellors, will be very successful.

Conclusion

Internet will have an impact on every aspect of how we learn and how we communicate. ODES of India cannot afford to ignore the Internet. Quality and efficiency of academic and administrative services of ODES will be significantly better, when compared to its present status. With rapid growth of the Internet, more and more students will come to ODES and will expect the university to make use of 'their' new communication tool, i.e. the Internet. ODES of India should rapidly plan and execute the introduction of the Internet and gear up to face the challenge of the new millennium.

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