

An Integrated Web-based Information System for Open and Distance Learning Institutions in India

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Abstract

This paper presents the design concept of an updated Integrated Web-based Information System for Open Distance Learning (ODL) institutions in India. The web system's design includes a web server, application server, middleware, data warehouse, http (Internet) network, and etc. In addition the system has been structured with the most suitable newly developed modules which would help the users to navigate easily through the various support services being provided by the system. The major categories of services that would be provided by the system have also been discussed. As such the system would be quite helpful for the large distance student population in India to learn their assigned courses of study easily and successfully. Such a system would not only significantly solve the problem of students' isolation from the faculty and other fellow students, but would also provide time and location independent access including pacing of studies. As a result the proposed integrated web system would support institute's management with regard to planning, developing and controlling the various activities and operations pertaining to the concerned institute. It would also improve favorably the success rates of students pursuing their studies in the ODL institutions. Subsequently linking all the ODL institutions of India to the headquarters (Distance Education Council) of the ODL system in the country would help to achieve the mission of providing equity and quality education to distance learning on national basis.

Keywords: Information management, database management, distance education.

Introduction

The ODL system in India serves to the educational needs of millions of its students and is one of the largest educational systems in the world. Presently it comprises 14 open universities and about 200 ODL institutions in the country, offering distance education to about 3 million students. However, to provide better and quality education to these learners a suitable educational system is required to be evolved. It has been seen that at most places in the world successful distance learning is taking place through the various web based educational models. As such the distance education sector is embracing the web as an excellent instructional medium which can also provide distance education courses with flexible delivery methods. In addition the web based education can help a large proportion of student population to learn relatively easily and successfully and also has the potential of reaching a large number of students without commensurate increase in staffing costs. Thus, with a view to provide quality education to the

distance learners in our country, it is suggested to set up an integrated web based system for various services in its ODL institutions. However, it is found that in most of these institutions, such a web system either does not exist at all or does not cover all the major features required for providing proper support services. It has also been found that distance education students typically are isolated from the faculty and other fellow students resulting in inadequate feedback, motivation and also reduced access to student services. These concerns become typically more of a challenge for distance education students. It can impact both students' learning and the capability to respond to personal challenges. Eventually this can lead to frustration, reduced motivation and thereby reduced student retention. So these concerns would impact off-campus students such that they may be dislocated from the student services. However the establishment of such a web based system in ODL institutions would provide time and location independent access to student services. Also the web system would ensure that the learners do not suffer from isolation. Thus it may be mentioned that such provisions of the web based system would help to solve these problems and address the above mentioned concerns of the institute.

Also, it has been observed that during the present times educational opportunities are increasing for distance learning students. This increased opportunity is largely due to increased competition between ODL institutions. As such these institutions are now faced with the challenge of marketing so as to attract more and more students. However, through the use of web-based system the prospective students and other users can be made to know fully as to what services are available for them in a particular institution. So, an accessible and good quality web based information system in an institute would make it quite popular and would attract more students as it would help to make a preferential choice for prospective students to join that institute.

The present paper describes the design and concept of an integrated web-system for ODL institutions. Such a web system would be comprised to provide a group of support services along with three layers of networks namely networks of People, Systems and Infrastructure. In addition to this, the applications of this system to the various activities of the institute and benefits obtained by its various users have also been described.

It may also be mentioned here that the proposed web system would not be a replacement for the existing student support services, rather it would complement to the existing services. Such a system would be based on the presumption that the existing methods of providing student services are the main vehicle and as such it would compliment and extend the support. In a similar way it can be said that the proposed web-system would not replace the existing help desk system, rather it would act as compliment to the Help Desk System.

Characteristic and Usages of the Proposed Web System

The proposed web system for ODL institutions would prove to be one of the most effective and efficient institutional mechanisms to provide the required help to its learners in various academic and administrative matters concerning the institutions. The main objective of the web services would be to motivate its learners, keep them on the right track and encourage them to make use of the facilities provided by the institute and above all to facilitate their learning. The regard for face to face interaction, even though being limited in distance education, is patently superior to all

other forms of interaction, will be taken care of significantly with the use of such a system. It may also be mentioned that just as a web-system has the capabilities to transform the instructional methods it would also transform the method of providing support to distance learners. As such it would provide both academic as well as non-academic services to its students not simply as an administrative function but as a significant support and also for quality improvement to the learning process that the students go through. Thus, such a web-system would be extremely helpful for vast majority of learners to work through their chosen courses successfully.

The integrated web based information system should be considered not as an application that provides student services, rather as a system that would compliment and extend functionality offered by current student support services. In addition it may be considered as a system that can hold or integrate existing data and legacy systems together. As such this system would be instrumental in providing an improved and effective computer-assisted communication medium so as to transfer learning materials from the institution to the learners at their homes/workplaces. In addition a large part of the student-institutions transactions would also be carried out through this electronic medium, which includes securing forms, payment of fees, and submission of assignments and so on. Thus, the web would prove to be an effective vehicle for distributing course material including lecture notes and assignments etc.

The other main features of the web that would make it useful for its stakeholders and help it function as an appropriate and most suitable teaching-learning as well as course delivery mechanism (*Mason, 1998*) would be as mentioned below:

- Functionality for supporting animation effects, thus making documents more dynamic, meaningful and effective;
- Facilities for handling forms, and input to forms which are useful for course registration, evaluation and other kinds of questionnaires and test;
- Support for presenting tables, footnotes and mathematical symbols;
- Features to simplify page development and editing;
- Improvement to search facilities; and
- Greater functionality for the communication systems linked to web-page.

It may be mentioned that in addition to providing the detailed course materials etc. through WWW, other collaborative computing technologies like e-mail, list servers and Internet would further enhance the efficiency and effectiveness of the educational system (*Dede, 1996*). However, a critical success factor would require that staff members including instructors and counselors be properly trained in the use of such technologies.

The key areas of support services (*Manjulika and Reddy, 1999*) as can be provided by the web based system in an ODL institutions have been identified as follows:

- (1) Pre-enrolment Services, Pre-admission Counseling and Enrolment Procedures
 - Distance education Methods, Awarding Credits, Time management, and General Information regarding the institution.
 - Admission schedule and Fee structure.
 - Student Admission and Registration

- (2) Post enrolment, Practices of Teaching and Learning
 - Program Planning and Scheduling
 - Course Material and Online Content
 - Personal Contact Programs
 - Classroom lectures
 - Assignment development and preparation.
 - Teleconferencing schedule and Audio-video sessions.
 - Practical (Labs) schedule at Science labs, computer labs, Industry etc.
 - Library and book-store services.
 - Financial support (Scholarships, loans etc.)
 - Career counseling and guidance including placement
- (3) Course content, Curriculum and Instruction
 - Course content and learning materials including digitized SLMs
 - Computer managed Learning, Online Programs.
 - Delivery mode / strategy adopted for the programs
 - Communication and collaboration tools.
 - System for tracking learner's interaction.
- (4) Learning, Counseling and Tutoring
 - Advice / counseling and tutoring services.
 - Schedule pertaining personal contact programs, distribution of self-learning materials and provision of TV programs, radio broadcasts, and teleconferencing.
 - Calendar for practical at science labs, computer labs and industry.
- (5) Learner Assessment and Evaluation
 - Assignment evaluation (including feedback on assignment) and concerning assessment and progress.
 - Learner evaluation and assessment.
 - Term end examination schedules and results.
- (6) Personnel and Career Counseling.
- (7) Organization of Administrative Support (including general queries and administrative problem solving)

Identification of the Design Goals for the System

The Web-based model has been designed for the fulfillment of the following goals. These goals have been identified depending on the needs of the stakeholders.

- (1) The system should be able to improve access to student services. This includes time and geographic access through the World Wide Web and also methods to access non-web services or service departments. This goal may be achieved through the use of common and cost effective technologies.
- (2) The system should be able to support practices of effective teaching and learning. It includes proper distribution and access to course and program information and learning resources; integrating existing instructional and learning technologies and student

services into on-line course and programs. As such it would improve student-instructor and student-student communication as well as collaboration.

- (3) The system should improve communication and coordination between individuals and the departments which are providing student support. This can be achieved by improving communication through contact information, e-mail enquiries, peer-to-peer discussion forums, and online forms.
- (4) The system should provide effective user support so as to minimize the need for such support. This can be achieved by having user support available online for applications, training on the web and related technologies and having contact information online for non-web technical support.
- (5) The system should facilitate responsive and integrated student support by connecting to appropriate services based on task or need such as through the provision of search facilities to search the site and by providing a vehicle for on-line access through an easy-to-use web interface.
- (6) The web based model should be able to create a flexible system infrastructure which can accommodate changes, additions and new technologies. This can be achieved by using open web standards, database standards and technologies, and creating information templates that can be filled in, edited and re-used.

After deciding upon the design goals to be achieved; the next step would be to decide on the major categories of services to be included in the model. Subsequently designing of the web-system is undertaken in which the big conceptual chunks of the main constituents of the system would be laid out. Then a view of how the general system is implemented would be outlined.

Categories of Services for the Web System

The web system designed for the ODL institution would provide six major categories of services. The following services would become available based on a various stakeholders needs or tasks:

User Support

Students and other users will need to know as to how to use the web system. As such this area of service will be tasked with:

- Helping users learn how to use the web-system and various applications (e.g. user help-line, enquiries, tutorials, documentation and so on).
- Helping instructors, counselors, tutors and support staff to better implement services (e.g. professional development about teaching and learning, professional development about educational technology, sharing and reflecting upon Institution projects and so on).

General Institutional Information and Student Admission

This category of service would mainly provide general information needed, pertaining to the concerned ODL institute. As such the web system would provide the general information needed by the aspiring students who are yet to get admission in a particular course/program of the institute, as well as information needed by those students who have already got admission. These have been referred to as the pre-enrolment and post-enrolment information packages.

Course content, Curriculum and Instruction

These services are those directly involved with instruction at both the course and program level. The greatest strength of these services lies in the realization that it is the people, goals, methods and effective practices of instruction and learning that are important, and not simply the technology only. However the different components used for effective practices of teaching-learning may include SIM (self instructional study material); radio and television broadcasts, fact-to-face counseling, teleconferencing, interactive radio counseling and Internet based learning. Also depending upon the nature of the program, target groups and financial resources of the institution, the following communication technologies may be deployed: Radio, Telephone, Computer, Mobile, Internet and satellite. This category of service will include:

- Effective practices of teaching and learning.
- Course content and learning materials.
- Curriculum and learning resources.
- Computer managed learning.
- Communication and collaboration tools.
- System for tracking student's interaction.

Learning, Counseling and Tutoring

Under this category students are provided supported services so as to overcome learning difficulties and to achieve satisfactory academic standards. However for counseling the distance learners the various types of media adopted by the institute may include; fact to face, telephone, teleconferencing, answer-phone, letters, handbook, Audio/Video tape, radio, television, computer and Internet/www. Out of these, Internet/WWW is most useful and highly suitable as it provides all the characteristics of interactivity and flexibility in education delivery and also covers both types of counseling i.e. problem solving and developmental counseling.

Learner Assessment and Evaluation

Learner assessment and evaluation is one of the most essential components of teaching learning process. Assessment is an activity which is involved in certifying the particular academic level of performance achieved by the student. It focuses on the learning of the students and the results (marks/grades) thus obtained can be used as source of information for evaluation. Thus, this category of service would inform students about the various arrangements made by the institution with regard to their assessment and evaluation, such as tools of assessment, methods of assessment, assessment of assignment responses, evaluation methodology, marking and grading for examination / test results, provisions of question bank and ideal responses (answers) for the assignments as well as term end examination questions etc.

Finance and other Services including Help Desk Services

Information of available facilities and support services is required to be prominently displayed or flashed on the institute's website. As such under this category of services the following facilities/services may be provided by the institute:

- (1) To provide adequate access to the range of services appropriate to support the programs, including admissions, financial aid, academic advising, delivery of course materials, placement and counseling.
- (2) To provide information about the appropriate equipment facilities, technical expertise and finance involved to design and make the program sustainable over a period of time and also ensuring the quality of student learning experience.
- (3) To provide adequate means for resolving student complaints. Also the institute may provide a time bound policy for replying to student complaints and queries within stipulated time.
- (4) Institution to make arrangements for digital library facility to be accessed by enrolled learners.
- (5) The schedules for periodic webinars on contemporary or significant topics, to be conducted by the institution may be displayed / flashed on the website and e-mailed to all the concerned faculty and learners.
- (6) 'Help Desk' services would meet the various needs of students while pursuing the program. It includes both academic and administrative support services, such as dissemination of information, counseling and tutoring services, vocational guidance, multimedia support, library services, evaluation of assignment, feedback, guidance of project work, organization of seminars, conduct of online examinations, etc. It may also include providing timely assistance for technical problems, academic questions and billing questions etc.

Structure of the Integrated Web Based Information System

The web system designed for the ODL institutions would be component and module based. While designing such a system, its main constituents are first laid out. Then a view of how the general system can be implemented is outlined. As such the web based system (see Figure 1) would be composed of the following four major subsystems:

(1) Data Management Sub System

This sub-system would include databases which would contain relevant data for the situation and would be managed by a series of components and modules on software to be called the RDBMS (relational database management system). The data management sub-system would be interconnected with the central data warehouse, a repository for the institution's relevant web based system data.

(2) Model Management Subsystem

This is a software package that would include educational, management science, or other quantitative models that would provide the system's analytical capabilities and appropriate software management. Modeling languages for building custom models would also be included. This system which is often called MBMS (model base management system). This component may be connected to corporate or external storage of models.

(3) Knowledge Management Subsystem

It would consist of one or more intelligent systems and would provide the necessary execution and integration of the associated systems comprising the web based information system. As such this sub-system would support other sub-systems and would provide intelligence for augmenting the process involved in the system of student support (*Boreisha*

& Myronovych, 2007). This would be interconnected with organization's knowledge depository, which is also called organizational KB (knowledge base).

(4) User Interface Sub-system

Through this sub-system, the user would be able to communicate and command the Web-based system.

These components would form the basis of web based comprehensive application system with category of services (components and modules) and would be connected to the corporate Intranet, to an Extranet or to the Internet (see Figure 1).

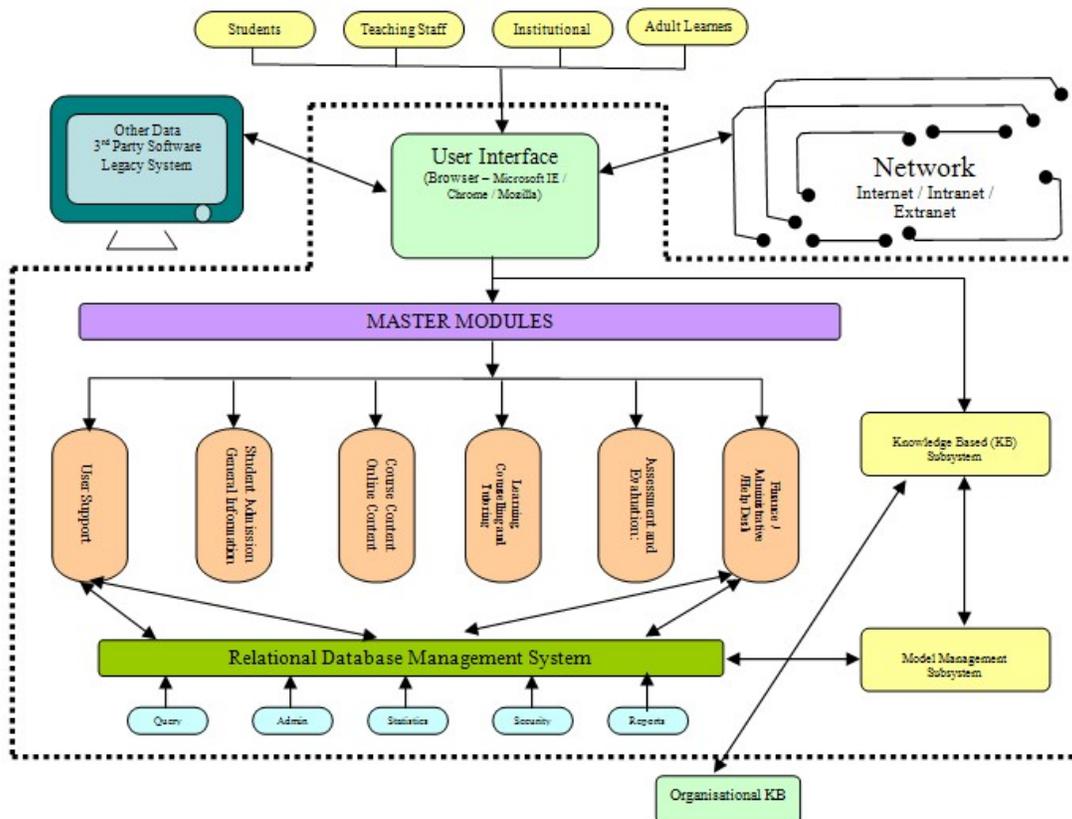


Figure 1. A Schematic view of web based information system

Technical Functionalities and associated components

The ODL institution services are a complex web of people, services and interactions. There are many individuals and groups that either use or provide learner support services. However, it is desired that any information system should need to be responsive to such diverse groups. As such the challenge lies in defining functionality and features for the electronic systems that are supportive of this diversity while remaining practical to implement. It may be further mentioned

that in ODL institutions, students come in many categories such as distance education students, part-time students, graduates, prospective upgrading professionals and students with a particular learning style etc. In the ODL system the students can log on to the databases of their institution and benefit from them in various ways e.g. be informed about the latest activities in their institution, navigate through one information topic to another, have an online status of different topics. To accomplish all these tasks successfully and efficiently, the web-system to be developed in the ODL institutions must be provided with some specific provisions such as intelligent software agents for performing the required functions already mentioned above (*Turban & Aronson, 2003*). The following is a list of some of the technical functionalities that must be incorporated in the web-system for its satisfactory implementation and operation:

Information Searching and Querying:

To traverse or navigate the web-and perform tasks such as information retrieval and discovery, validating links or HTML (Hyper Text Markup Language), Search engines (or indexing agents) such as Google, Ask.com or Hotbot may be employed, as these indexing agents are capable of carrying out a massive search of the web.

Information Publishing and Reporting:

Following technologies, software products may be considered for publishing and reporting:

- HTML (Hyper Text Markup Language) or PHP (Hypertext Preprocessor);
- “Canned” HTML reports to be developed through server side scripting;
- Documents, PDFs (Adobe Acrobat), PPTs (Microsoft powerpoint).

Communication:

The design of web-system should be such that it is capable of carrying big databases through which tremendously large amount of information can be stored and disseminated. As such this system would work as a powerful communication medium which would facilitate online information exchange, provide information on every topic and is available to students round the clock.

Security:

This is possibly one of the primary considerations in evaluating any technology / solution. The solution should address all important aspects of security in Internet transactions, at the transmission and application level. Transmission security may be enabled through SSL (secure socket layer) so that issues pertaining mutual authentication, message privacy and integrity can be maintained.

Technology Selection/Web Infrastructure /Servers:

The solutions should be component & module based which are to be built on leading open industry standard platforms such as J2EE (Java) and Dot Net (Microsoft) so that J2EE flavor of the solution can be offered on J2EE compliant Application Servers like IBM (International Business Machines) WebSphere, SunOne on different operating systems, along with the Dot Net

version on Microsoft Windows. The selection of technology is associated with selection of electronic systems, components, software packages needed in designing and operation of the web-system. The technology selection will include the development platform plus the development environment (language included). Following factors should be considered for technology selection:

- (1) *Stability of the platform:* All technologies J2EE (Java) and Dot NET (Microsoft) should be considered for the web system since these are stable and provide sustained platforms for execution of the Web System.
- (2) *Technology acceptance by professionals:* There should be wide acceptance of all technologies considered each having its evangelists and critics.
- (3) *Libraries and tools provided by the platform:* All platforms considered, may be evaluated for the tools and features that are required during development, deployment.
- (4) *Time to development:* Time required (Man days) for development of web system on different technologies.
- (5) *Cost:* All the major required features are available with Microsoft, Oracle and IBM and the technologies are matured enough with proven record of solutions implemented for all types of domains. However, the cost of the exact solution with the approved solution would play a major role in selection of technology.

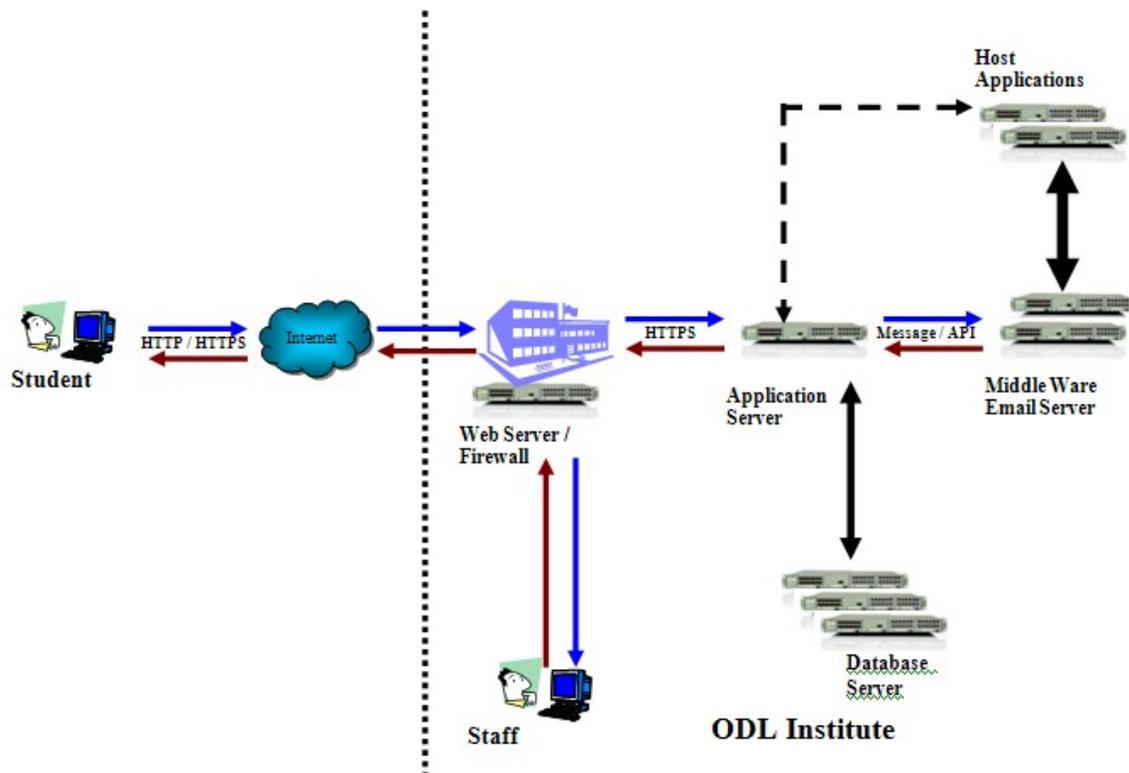


Figure 2. Web infrastructure architecture for web based information system

Working procedure of the proposed Web-System

The system would be developed on the World Wide Web (see Figure 2) and the ODL institute would provide the services through a web server accessing both the institute's data warehouse and potentially legacy system. The users would be able to access services through any web browser connected to the Internet.

Common web browsers available are Internet Explorer, Chrome, Mozilla and Netscape. These browsers would allow navigating in the world of Web documents also called pages. However, when the URL (Universal Resources Locator) address of the page is typed in the browser, the browser would search the document and would make it available that on the computer screen. It may also be mentioned that the documents on the WWW are connected through links, which means that any document placed on any site can be linked to any other document placed on any other site. These documents are called pages in the jargon of WWW. Also pages have links, which are pointer to other pages in the Internet and by clicking on the links, one can travel from one page to another pointed by it. Thus, it may be mentioned that the majority of functionality would likely be implemented through HTML (Hyper Text Markup Language) or PHP (Hypertext Preprocessor) and an adequate web server. Most programming / scripting would be designed to run on the server side (at the institute). This would improve the cross-platform delivery capabilities (depending upon the final configuration) and reduce the amount of the data/files that a user would need to access the system.

Depth and Breadth of the Integrated Web based Information System

In addition to the group of category of services (see section 4) as the breadth of the web system, it would have depth of three layers of networks (see Figure 3) namely: network of People (Learners /Tutors), Systems (Web Systems/Application/System Software) and Infrastructure (Information Technology Infrastructure/Internet/Intranet).

- **A People Network:** The most obvious network is the one of people. Services are provided by groups of people (Teaching Staff -Tutors / Institutional Staff) working together towards a common goal. This includes the people network □ inside and outside the ODL institution.
- **Web Systems / Application / System Software:** The next level of network is that of the tools or applications that directly support people in providing services. In this case, it is literally a web of technology. The most common tool will be the web browser and the application modules / software.
- **IT Infrastructure /Internet / Intranet / Telecommunication Infrastructure:** Finally, there is the level of the electronic and telecommunications infrastructure. This includes such things as web server, application server, router, firewalls, and databases etc.

When people work in teams, especially when the members are in different locations and may be working at different times, they need to communicate; collaborate and access a diverse set of information sources in multiple formats. For groups to collaborate effectively appropriate communication methods and technologies are needed. The Internet and its derivatives, Intranets and Extranets, are the platforms on which most communications for collaboration can occur. Inter-organizational networked decision support can be effectively supported by an Intranet, basically an internal Internet. It allows people within an organization to work with Internet tools

and procedures. Specific applications can include important internal documents and procedures, corporate address lists, e-mails, tool access and software distribution.

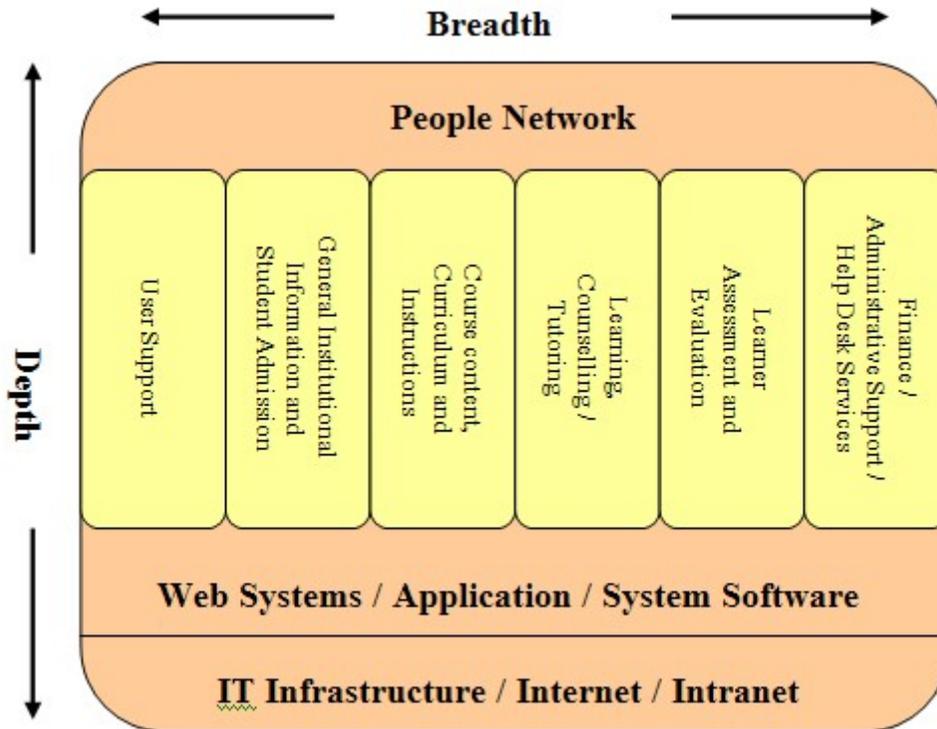


Figure 3: Depth and Breadth of Integrated Web based Information System

Benefits of the Integrated Web Based Information System

The users of the web based system are mainly students, faculty, administrators and staff including manager, executives of the concerned ODL institutions. The various benefits that such a system can provide to these categories of users are as follows:

- (1) For Students, the benefits are; increased access and awareness to the student services; increased effectiveness when doing administrative tasks or meeting personal needs; more efficient use of time in connecting to student services, development of technology and self-help skills among students and above all the Web-based system would be quite convenient and easy to operate for the students. Thus, it may be concluded from the above discussion that in other words, the benefits to students would include:
 - (a) Things to help students learn better
 - i) like assistance to learn writing skills, academic advising and learner assessment,
 - ii) advice on studying the course, tutorial times, assignment dates etc.,
 - iii) preparatory course advice,

- iv) advice on dealing with late delivery or incorrect study material,
 - v) advice on exam techniques,
 - vi) Advice on further course choice.
- (b) Things to help students solve their problems by counseling
- i) like counseling on course choice, course change or assignment difficulties;
 - ii) personal counseling i.e. counseling on personal difficulties, problems between tutors and learners,
 - iii) withdrawal counseling,
 - iv) return-to-study counseling,
 - v) counseling for results,
 - vi) counseling for failed learners,
 - vii) career advice and counseling.
- (c) Things to help students take right decision by proper informing them about various matters, such as
- i) on courses, entry requirements, registration procedures etc.,
 - ii) on course use-tutorial times, assignment dates etc.,
 - iii) on alternative instructions, regulations and procedures,
 - iv) on problems regarding delivery of study materials,
 - v) about time/place and conduct of examination,
 - vi) about further related courses,
 - vii) on other possible career options.
- (d) About other aspects (outside the course), e.g. summer schools and special supports available, e.g. extra time for disabled learners etc.
- (2) For the teaching staff such as instructors, and counselors the benefits include, increased effectiveness in linking students to student services and thereby providing student services more effectively. The other benefits include increased access and awareness to student services and also more efficient use of time by the institutional staff in finding out fully as to what services would be available to students. As usual the web based system would also be quite convenient and easy to use for the teaching staff of the concerned institution.
- (3) The benefits provided by the web based support system to the institutional staff and administrators of its service departments would include; increased provision and increased awareness of student services, more responsive to student needs, easier to publish up-to-date information, faster communication with all students and increased awareness of service model.
- (4) In an ODL institution, the adult learners are its one of the most important constituents. The web based system may be designed so as to provide increased access to student support for adult learning systems. As such there would also be potential sharing of some student support services or resources (e.g. online tutorials, services directory etc.).

So far as the benefits for the concerned institutions are concerned, the web based system would help to reach the student audience and stakeholders in a more effective way, and would provide increased awareness about its services. It would also improve marketing opportunities and above all would be cost effective to develop as compared to other alternatives.

In addition to this it may be mentioned that the establishment of the integrated web based information system in the ODL institute would provide tremendously large amount of support to the institute's management with regard to planning and developing, organizing and controlling, coordinating and motivating the various activities and operations pertaining to the concerned institute.

Concluding Remarks

The proposed plan discussed above is for the establishment of integrated web based information system in a hypothetical ODL institute in India. This proposed plan can work as a guide for existing ODL institutions and for those ODL institutions which would be established in the near future.

The establishment of the proposed web-system in each of the ODL institutions in India would help to provide quality education to distance learners in the country. However the successful implementation of such a system would need sufficient efforts to be provided by the concerned management of the institute as well as substantial support from the statutory (apex) organization at national level which in this case is DEC (Distance Education Council) of India. Included in such efforts would be the development of promotional and training material, on-site management consulting, and support for regular training sessions. However the implementation process would require training in the use of the web systems mainly for online teaching-learning services. Also in house technical consultations would be needed to assist in installing the system and in creating customized local linkages to the central authority at the headquarters of the ODL system in the country.

To realize the full potential of the system with regard to networking and sharing information at national level, resources must be made available to facilitate (a) sharing of online teaching-learning materials and (b) the standardization of data elements definitions and associated collection protocols. Once the consensus has been built, the most appropriate electronic system for linking all ODL institutions to DEC at headquarters would be put in place and thus the mission of providing equity and quality education to distance learning on national basis could be achieved.

Author's Note

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