

OLIVE Framework for E-Learning Development at AIOU, Pakistan

NAZIR A. SANGI¹, MOIZ UDDIN AHMED²

^{1,2}Department of Computer Science,
Allama Iqbal Open University, Islamabad, Pakistan
drsangi@aiou.edu.pk
moiz.ahmed@aiou.edu.pk

ABSTRACT

New technologies have led to advanced approaches in education delivery at distance. Many models of e-learning and ICT (Information and Communication Technology) based educations are now in practice. Depending upon a good ICT infrastructure many activities of students and institutions can be supported. The Department of Computer Science at AIOU (Allama Iqbal Open University) initiated the ideas of online education. In this connection a concept of virtual university was presented which was later named as OLIVE (Open Learning Institute of Virtual Education). Over a period this conceptual model was converted into an e-learning framework for the purpose of implementation.

This paper presents process of converting conceptual framework of OLIVE into E-learning with relevant models. Detailed descriptions of their components along associated support systems were defined, which cover online academic development, deployment and assessment activities. The framework also provides an institutional model for student support, research and development and administrative tasks, specially needed by the institution. The progress of e-learning at the university has also been highlighted, and has been divided into four stages: The first stage discusses the experimental development when the new mode of online education was introduced at university. The second stage is the practical testing phase when a local LMS (Learning Management System) was developed and implemented. The developments of multimedia course instructions were also started at this stage.

During the third stage an Open source LMS “MOODLE” was customized according to needs and requirements of e-learning program with low Internet bandwidth.

At fourth stage, electronic assessment modes were conceived and experimented.

The paper also discusses the student survey result which was conducted during acceptance stage to evaluate technological and pedagogical parameters of e-learning mode.

Key Words: OLIVE, ICT in Learning and Teaching, E-Learning, Online Education, LMS, Synchronous and Asynchronous Interaction.

1. Literature Review

Distance Education is a mode of education which is characterized by physical separation between the learner and the instructor. Early distance learning system relied on postal communication mode where print media was used for academic correspondence including tutorials, study guides, assignments and homework. This communication was greatly influenced by the hardcopy study materials. It made use of specially prepared, easy to understand learning materials to reduce the effects of the geographical distance and interaction time gap between learners and instructors. A useful explanation of distance learning can be found in many references [1] [2] [3].

The ICT has emerged as a source of rapid and up-to-date information and its communication around the globe [4]. This current era of technology has affected all fields of life including distance education. As a consequence distance education has also transformed into e-learning, which refers to electronic mode of education using the internet, computers, and media technologies [5]. These may include: use of electronic content/instructions, web-based delivery and communications, online learning, virtual classrooms and digital collaborations etc. [6] [7].

E-learning comes in many variations and combinations of different activities. These activities involve online interactions, blended learning (combination of online and face-to-face), synchronous, asynchronous, self-study using multimedia lectures, web-based, computer-based and video/audio based lectures [6]. These different interpretations of e-learning converge to a basic model comprising of three elements i.e. Content, Services and Technology. The content developed in

multimedia format provides more interactivity and often employs self-paced control [8]. The learners can play or re-play instructions as many times as needed, at their offices or homes at any convenient time. The Wi-Fi networks and web 2.0 tools on Internet have opened new avenues for the placement and delivery of multimedia content [9]. It requires more creativity and interactivity in the construction and presentation of e-learning materials [10]. Reliable delivery services are very important for online distant delivery. Public ICT infrastructure plays a vital role as it defines service quality as well as technology to be used. Efficient and widespread services through a technology setup have a positive acceptance for teaching and learning. However it is imperative that communication is carried out through local public infrastructure and through popular widespread technological devices.

Another important aspect is design of pedagogy around available services and devices. Both synchronous and asynchronous learning activities can be devised for learners' variety [11]. Synchronous process provides a real time communication between learner and instructor. They can communicate via video/audio conferencing, mobile calls or LMS based synchronous sessions. However, during synchronous activities both instructor and learner join web based, or video conference based, live sessions. The questions are answered in live mode and even presentations are made during live presence in cyberspace. The asynchronous process comprises of offline communication, where learner and instructor communicate using emails, discussion forums or other offline web services. The recorded lectures and /or instruction can also be placed over the servers to be used by distant learners at flexible times. The format may differ from a simple text based tutorial presentation to a fully configured video/animated lecture. The blended proportion of instruction in synchronous and asynchronous is often decided by the instructor. Besides this the LMS also support e-learning activities e.g. schedules, announcements, attendance records or backup of lectures, presentations and quizzes [12]. Most LMSs are Internet-based and facilitate "anywhere anytime" e-learning [13]. A large number of LMSs are available with variable functions to facilitate/automate the student learning process and maintain records.

A much detailed digital divide also plays a vital role in spread and use of education. Even though e-learning started late in USA, the growth in e-learning has been phenomenal, Most credit goes to the development of the digital communication infrastructure including wireless & mobile networks and Internet computing accessibility to people at large. Despite many efforts by institutions in developing countries, the progress of e-learning has not been wide spread with quality of learning. The effort of AIOU, the second open university of world [14]

is unique, not only has it been successful but also the quality continues to be maintained at par with international institutions.

This paper throws light on the historical perspective of this case along with the user experiences

2. Olive E-Learning Framework

Online learning at AIOU was initiated in 1999 when the concept of online education was presented in a national seminar [15]. Following the initiation the Academic Council, which is the highest statutory body of the university, approved the concept of OLIVE in 2000 to start the project. The OLIVE framework which was developed as a high level design focused on academic, administrative and services needs of online education at AIOU. The framework was modified with technological developments is shown in Figure 1[16]. Components of OLIVE are described in following paragraphs:

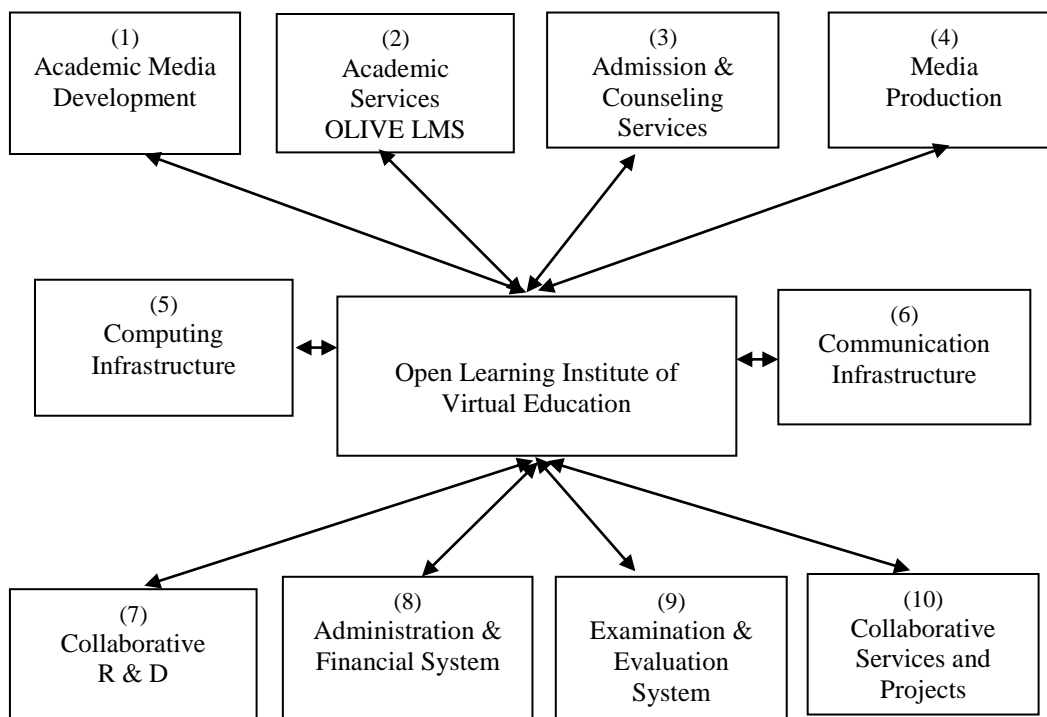


Figure 1: Elements of OLIVE E-learning Framework

2.1 Academic Media Development

Academic Media Development (AMC) is the main component for the success of E-learning. In AKC, faculty members can conceptualize their courses and identify/select the delivery model which may be used for any particular course. The academic staff may review their course objectives, contents and activities and can determine the most effective academic delivery model. Desired learning the academic course material can be identified, developed and stored in repositories, it includes: course materials, assignments, special instructions to students for performing various lab exercises or following certain standards or utilization of appropriate software tools. A corresponding assessment objects repository can be developed for future evaluation where needed.

2.2 Academic Services

Academic services are concerned on delivery models looking at different communication mechanisms and needs of the course/program as well as distance delivery/interaction mechanisms, devices, infrastructure and technology standards. The instructor may select any one or more combinations of technology-based academic delivery models. These models may range from live/recorded telecast of lectures posting of material, playing power point presentations and providing white board or chat for interactive teacher students interaction. For this purpose TV, Video Conferencing or Online Sessions etc., methods of academic delivery may be used. Depending on a course needs, a faculty may define the preparation of each content component, assignments/projects, instructions etc. for each course.

2.3 Admission and Counseling Services

Through Admissions and Counseling services students should be provided information related to admission process as well as support in their known academic activities. This counseling service is very important for both students and online instructors as the mass handling of education cannot be properly sustained until information is accommodated in the infrastructure and to the point where information is readily available to the online students. The technology may provide well-structured LMS/website services, complaint registration and tracking mechanism, common communication web services and even 24/7 chat sessions and call centers etc. Both synchronous and asynchronous communications are essentially needed for admission and counseling services. They can also provide support for a student career counseling platform, if so desired.

2.4 Media Production

The media development activity takes place before delivery to the students. This may include: decision on standardization of file formats, times and topics of complexity/importance and defined use of integrated multimedia standards within OLIVE. The contents may include text, audio, video animation etc. The teacher in consultation with media development expert develops materials utilizing the ideal media. Properly designed instruction media when pedagogically delivered, can enhance the learning of students [17].

2.5 Communication Infrastructure

Communication Infrastructure (CI) is the backbone of e-learning frameworks. It should provide a seamless interaction at fast speed between students and teachers, students and university departments (e.g. Admission, Examination, Regional Services Departments) between teachers and department and other stakeholders. This communication should be available over public network services. Care should be taken to include both synchronous and asynchronous learning activities. This communication system should be reliable and flexible in order to provide requisite services to heterogenous technologies. It may use multiple technology services and devices e.g. fiber/VSAT, mobile etc. to enable different delivery models selected by University

2.6 Computing Infrastructure

The CI includes different servers, operating systems, communication software, applications and packages that may be planned in teaching and learning at the institution. It also includes storage of learning contents and assessment objects, and may be distributed at different locations for providing an efficient information processing and storage services for heterogeneous user groups. It may also have safety, security; information security plans for preventing any loss of data and for any unauthorized access to institutional records.

2.7 Collaborated Research and Development

Collaboration is often necessary for R&D (Research and Development). It will allow research students and faculty members to automatically record and share information and connect with collaborator's digital resources available outside of the OLIVE infrastructure. It is composed of access to distance learning, distributed databases, e-journals, open source software or authorized access to partner university digital resources as well as Internet resources. However, a well-

defined mechanism can be developed in order to avoid any problem with intellectual property misuse. Similarly necessary controls and access options can be defined and implemented for preventing viral, hacking or downloading harmful/unauthorized information.

2.8 Administration and Financial System

All university students need access to administration and financial services (e.g. student's rules and regulations, fee payment mechanism, scholarship, awards, career support, disciplinary mechanism and policies). All such information can be placed on servers and provided online to students. Many standard methods are publicly available for fee payment and admission confirmation.

2.9 Examination and Evaluation System

The Examination and Evaluation system is a very important component of e-learning frameworks. It has special needs and services where open access has to be restricted and even authorized access has to be recorded and monitored for unfair use. The evaluation of students includes at least three viewpoints; academic quality, secrecy and reliability maintenance of the whole system. The students, faculty, administration and standard operating mechanisms may be considered at policy, implementation and monitoring levels to include all three viewpoints mentioned above.

Looking at above needs examination and evaluation have been defined as separate components for OLIVE where special mechanisms need to be developed to automate as well as to facilitate the assessment process for large groups. Special considerations and policies are defined in another detailed paper on e-assessment [17].

2.10 Collaborative Services and Projects

OLIVE and its components, once developed, are expected to open many opportunities for e-interaction between various institutions and their research scholars/ faculty/ experts in industry etc. OLIVE will enable joint research projects, joint academic collaborations as well as work for developing content, software, and research information on International or National levels. It should address rules, regulations, policy and implementation matters related to form research contracts, work assignments, MOUs etc.

In following section selected experiences of development are shared.

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The architectural diagram of OLIVE e-learning framework concept is shown in figure 2. There are three layers. Layer-1 is composed of a multi-media content repository, financial data, admission profiles and assessment objects. Layer-2 is the Application Programming Interface, (API) which comprises of modules of authorizing rules and policies for admission and examination. Layer-3 is the delivery and communication interface for students, teachers and resource persons.

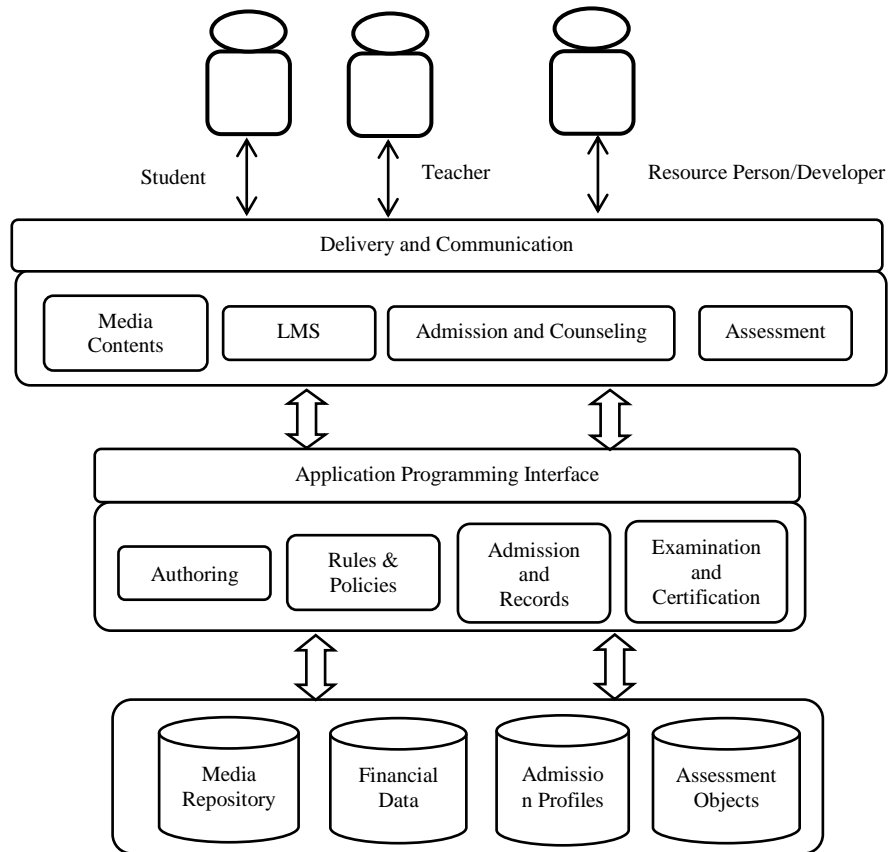


Figure 2: Olive E-learning Framework: Architectural Diagram

3. DEVELOPMENT HISTORY OF OLIVE

The development history of E-learning at AIOU can be categorized into the following stages:

3.1 Early Experimental Stage

AIOU started e-learning in 1999 when the OLIVE e-learning framework was conceptualized and approved by the university. It allowed the department of computer science to initiate the experimental stage of e-learning. Initially it was decided to experiment with e-learning on two post graduate courses, 3523 and 3519 in the Computer Science Department. The selection of post graduate courses was made because students were experts on using the Internet as compared to students at lower levels.

During the experimental stage open source technologies were used for online courses therefore no extra expenditures were faced. Students were also excited and comfortable with using free technologies of e-learning. Later on the offering of online courses was expanded in other cities including Islamabad, Rawalpindi, Mirpur, Azad Jammu & Kashmir (AJK) and Multan -- and the students for the first time participated in online activities from multiple cities at the same time. One of our student also attended online sessions from Europe when he was abroad for few days. The advantage of virtual presence was utilized and renowned teachers were hired to teach the online courses. The students also got access to qualified teachers and therefore attendance and interaction was high.

However, there were technology issues like Internet connectivity and low bandwidth in remote locations/rural areas. Sometimes students had to travel a few kilometers for local Internet facilities. Multiple sessions were conducted to accommodate all students. The limited size of file attachments via email also caused problems for the students and teachers when media rich files were sent to students. As a part of teaching policy, students had to attend workshops at the campus. This provided an opportunity to meet face-to-face with their teachers and IT experts to enhance their professional capabilities and motivation.

3.2 Enhancement and Localization Stage

The Enhancement and Localization phase started in 2001. Since initial success had already been experienced, it was realized that the technology infrastructure may be established. It was decided to add servers and Internet communications. The localized electronic materials were not available in all courses then. The university was using printed books and tutorials. In some courses video and audio lectures were available as allied materials. But due to low bandwidth issues, the video based content was not feasible for delivery over the Internet. Therefore a project of Multimedia Content Development was launched at the university. At the same time the university experimented with commercial proprietary LMSs such as “WebCT”, “Black Board”, and “IBM Learning Space” [19].

The usage of proprietary systems resulted in issues like high purchase cost, lack of compatibility on heterogeneous students’ equipments and local Internet access within country. After the analysis of these issues two important decisions were made. Firstly, develop a localized, simple and need-based LMS from scratch, Secondly, use of multimedia electronic courseware as substitute of video lectures. The development of initial computing infrastructure was also part of this initiative. It helped to lay the foundations of e-learning infrastructure at the

university. Additionally open access to computers was provided to all employees in order to prepare manpower for online support to students.

The multimedia electronic courseware methodology used flash based animated instructions. About 20 computer science courses were developed. Simultaneously, a unified version of OLIVE LMS was also developed keeping in view the university's requirement of synchronous and asynchronous activities through tools like chat and forum discussions. The other modules were assignments, where upload/download, announcements and group and individual messages were allowed for easy communication. The teachers interface provided class control mechanism, deadline fixation, content placement and discipline maintenance during the online sessions. The student interface provided the participation privileges as per program pedagogy. The assignment module enabled the teacher to post the questions on LMS. The students were able to download the questions, prepare solutions and upload them within the deadline fixed by the teacher. The system was also capable of allowing the teacher to grade the assignments online and post comments and suggestions. The session history module was made available with LMS which allowed students and teachers to view the previous history of online sessions. The LMS was capable to send collective and individual messages to students. The backup facility was also available to compile the record of completed semester activities for each class and each student.

The LMS facilitated the examination process. It helped the teachers to post question paper on OLIVE LMS which was downloaded by the students at the time of online test. They solved the paper and uploaded it on OLIVE LMS within specified time. The solved papers were also printed for signature of students and record of examination department. The online MCQ based quizzes and open book tests were conducted for selected courses. However, the descriptive question papers were conducted during the midterm and final examinations. The selected screen shots of the initial version of OLIVE LMS are highlighted in figures 3-5 and the photograph of final examination under controlled environment at special examination center is shown in figure 6.

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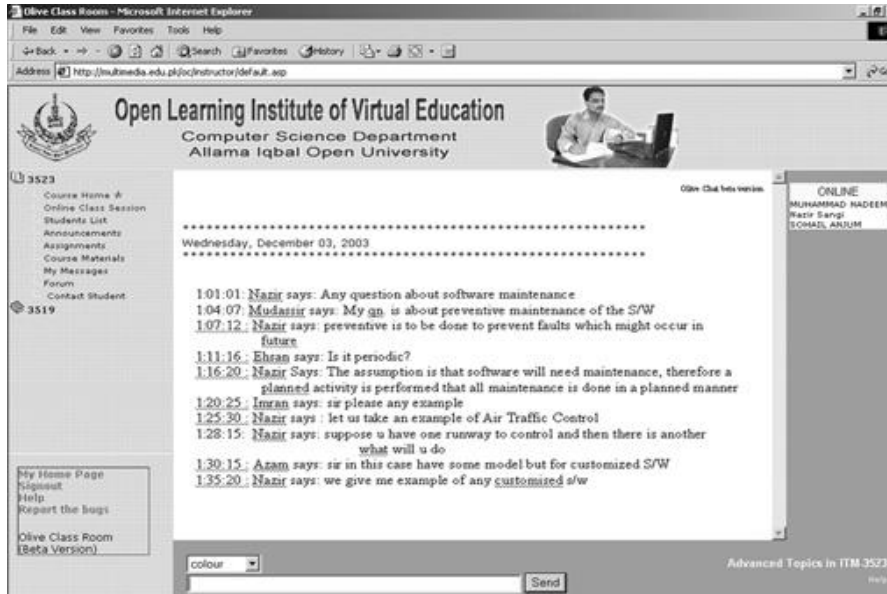


Figure 3: Sample of synchronous Question Answer Session

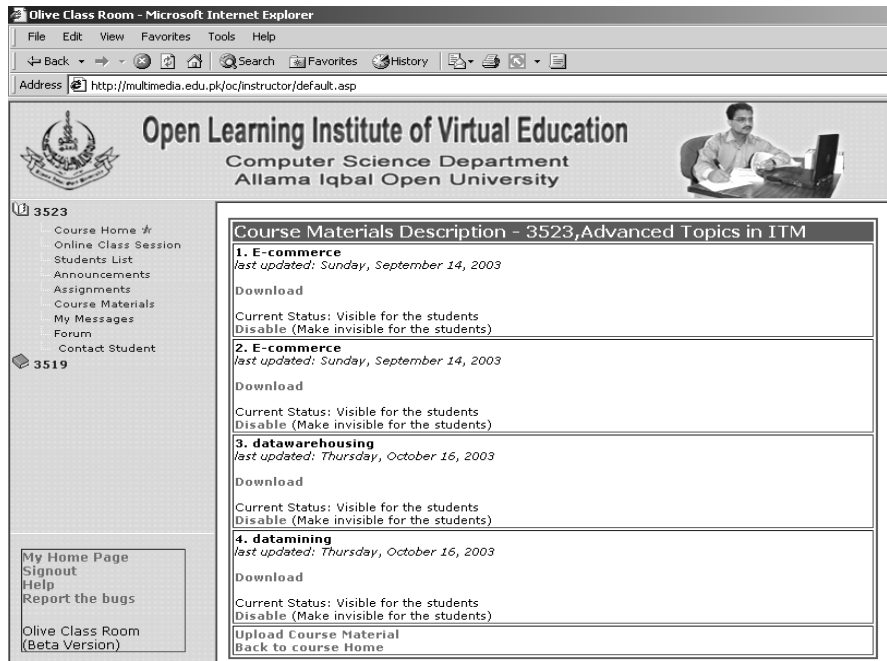


Figure 4: Course materials Access Page

The screenshot shows a web browser window titled "Olive Class Room - Microsoft Internet Explorer". The address bar displays "http://multimedia.edu.pk/oc/instructor/default.asp". The page header features the logo of the Open Learning Institute of Virtual Education and the text "Open Learning Institute of Virtual Education, Computer Science Department, Allama Iqbal Open University". A navigation menu on the left lists options like "Course Home", "Online Class Session", and "Announcements". The main content area is titled "Announcements 3523 - Advanced Topics in ITM" and contains a table with the following information:

Subject:	First Test
Announcement Date:	Thursday, October 23, 2003

Description:
Dear Students we have to conduct first test online. It will be from the e-commerce retailing , e-banking, data warehousing and data mining. It will be a one hour test which will be conducted online. It will be an open book/internet examination. You will be given a paper to down load at time and post within time. It will be your responsibility to download and upload using any Internet Service in any city. However in order to facilitate the test will be conducted online at CS lab where teacher and technical staff will be available to witness if there are any connection or electricity problems. We will not accept any such claim if you use any other connection at home or Internet cafe. Passing midterm test is compulsory and failure may lead to re admission in the course. Any queries may please be directed to Mr Ehsan at Ehsan3@hotmail.com or drsangi@multimedia.edu.pk Best wishes Dr Sangi

At the bottom of the page, there is a link: "Back to course Home".

Figure 5: A sample of Announcement Page



Figure 6: Final Examination under Controlled Environment

3.3 Application Stage

Over years of development and deployment of e-learning, the Computer Science (CS) department was confident to launch a complete diploma level program in e-learning mode. The one year Post Graduate diploma in Computer Science was selected for this purpose. The selection was made due to the professional nature of the program with ICT enabled courses. It comprised of ten courses with five courses in one semester offering. Meanwhile, the multimedia courseware tutorials were also available for this diploma program. Previously the same program was offered in traditional classroom mode through study centers of the university across different cities. The program was suffering from viable group formation at different locations resulting in less economic size and was difficult to manage. The e-learning mode promptly handled the issue of low enrolment and converted smaller groups into larger ones through the use of technology.

The launching of a complete program also highlighted the importance of more vigorous LMS than the existing one. The advanced features like multiple sessions handling, scheduling, white board and live text/audio conference were required to effectively manage the pedagogy used by different teachers. In this connection, the open source LMSs were evaluated and finally MOODLE (Modular Object-Oriented Dynamic Learning Environment¹) was designated for customization as the OLIVE LMS which replaced the in-house system. The customization was performed to include the desired features of MOODLE matching with the program pedagogy. The features that were customized were online chat sessions, forum discussion, calendar, assignment uploading/downloading, announcements and content placements on OLIVE LMS. The sample screen shot is shown in figure 7.

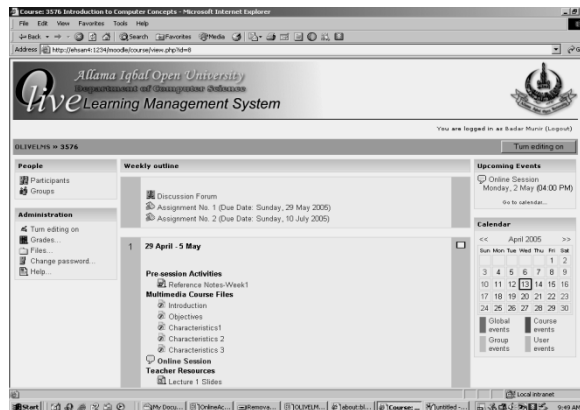


Figure 7: A Sample of OLIVE LMS based on MOODLE

The option of video lectures was dropped due to low bandwidth of Internet across public infrastructure. The multimedia electronic courseware was identified as an alternative to video lectures [10]. The multimedia instructions were then available for all ten courses. The course materials were found easily executable even on shared and dial up connections using streaming techniques. The PGD online program is currently running with no major problem being encountered regarding uploading and downloading of multimedia electronic courseware. The only problem that was found was slow delivery of video based lectures, therefore we kept the live video streaming option out to handle the problem of non-uniform delivery of lectures.

Currently, the program is in a stable state with sizeable numbers of students as shown in figure 8. It is now open for admission once a year only as per offering policy. A single enrolment from a city/town is no more a problem. The major problem is power failure in certain locations which is handled by scheduling extra sessions during power availability times

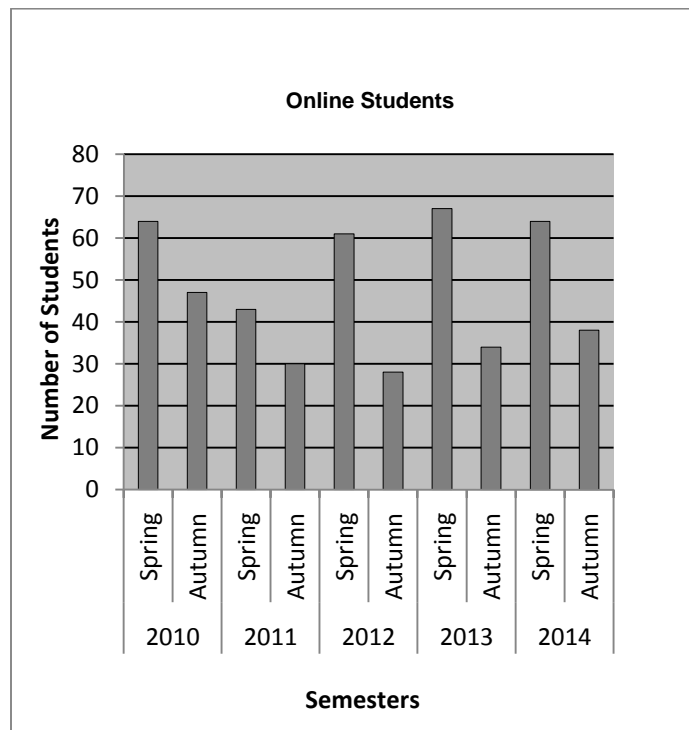


Figure8: PGD (CS) Current Enrolment

3.4. Testing Stage

During Testing Stage the design and development of e-assessment was the focus

3.4.1 E-Assessment Model

Electronic assessment was considered a vital and separate activity from teaching. Therefore the university also initiated work on development of e-assessment resources as a separate module. This research is described in detail in [18]. The open source tool was developed with a generalized assessment scheme which may be used in computer science or non- computer science courses. The Generalized E-Assessment Model (GeAM) software was developed as a research model. However; since the assessment scheme falls outside academic department scope and was being done by Controller of Examinations, this tool has been used at limited scale. The main reason was the availability of computer labs with ensured power supply at remote locations and secrecy and security controls issues typical to mass assessment activities.

3.5 Acceptance Stage

The Acceptance Stage was based on feedback analysis from the students. A survey was conducted from the e-learning students of three batches comprising of 127 students. The demographic results show that the respondents were in the ratio of male 80.3 % and female 19.7% as shown in table 1. The majority of the respondents (65.4%) were living in urban areas, whereas 14.9 % in semi urban, and 19.7 % in rural areas. A sizeable number of students were representing semi urban and rural areas of the country.

Table 1:Students' Demographic Profile

Variable	Frequency	% Frequency
Gender		
Male	102	80.3
Female	25	19.7
<i>Total</i>	<i>127</i>	<i>100</i>
Location		
Urban	83	65.4
Semi-urban	19	14.9
Rural	25	19.7
<i>Total</i>	<i>127</i>	<i>100</i>

The results have revealed their confidence on e-learning mode of education. Some selected survey results are given in figures. 9-12. The majority of students, as shown in figure 9, have validated the quality of multimedia contents.

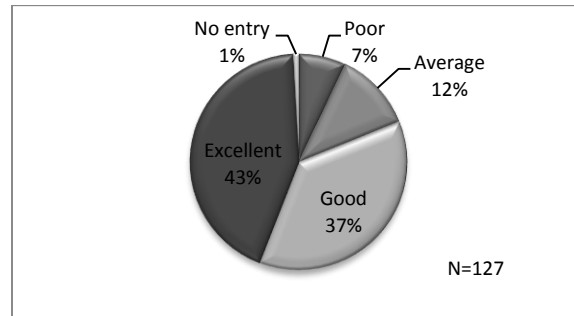


Figure 9: Quality of Multimedia Learning Materials

The majority were satisfied with the faculty members as shown in figure 10.

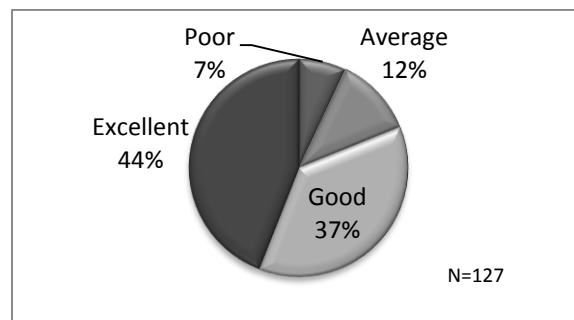


Figure 10: Faculty Quality

The majority for online education as shown in figure 11.

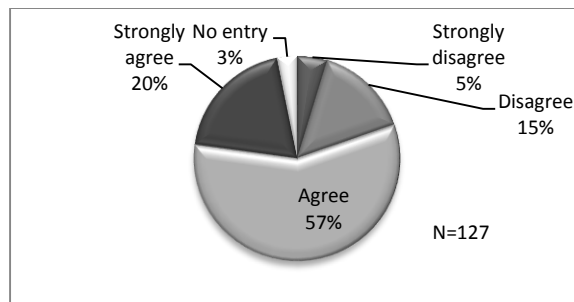


Figure 11: Response/You like Online Education

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The majority of the students would like to enroll in e-learning programs in future as shown in figure 12. The remaining students who enrolled, generally have problems due to access to the internet especially in remote areas of the country.

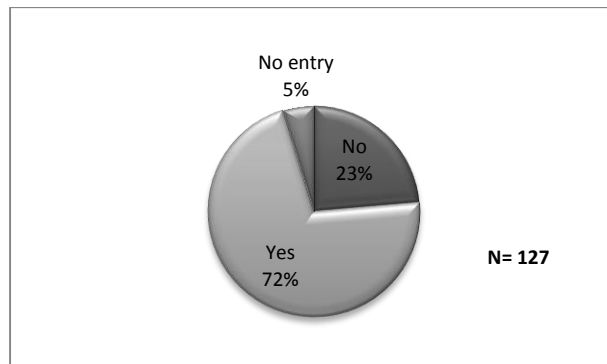


Figure 12: E-learning Preferences

4. Conclusion and Future Work

The OLIVE e-learning framework at AIOU has been successful since its inception. Students' outreach has increased and more students are attracted to e-learning programs. The survey results have revealed that students have strong confidence in online education and their preferences are high in this regard. The quality of learning material meets the expectations, and students are fully satisfied with the online faculty.

The selection of right courses, program pedagogy and e-learning tools has also played an important role in success of online education at AIOU. AIOU is currently planning to implement the OLIVE e-learning framework in other departments of the university. The future work shall address the enhancement of computing and communication infrastructure, development of a learning object repository, training of tutors and students and a centralized data center at the university. Another significant future enrichment is to design a vigorous e-assessment and adaptable e-learning model for AIOU. It is also an important research area which needs to be addressed under local conditions. Further significant developments are anticipated in the near future.

AIOU has also established university partnership program with SJSU (San Jose State University), California, USA. The goal of the partnership is to co-develop an effective faculty training model and institutional resources to empower online and hybrid instructors with state-of-the-art pedagogy and instructional design. The expected outcome may include: curriculum development, collaborative distant

educational research through faculty exchange programs, long distance teaching technique enhancements via Internet/DVC, sharing of resources to assist with data exchange and research.

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