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Access Strategy for Blended E-learning: An AIOU Case Study

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Abstract

The use of Information and Communication Technologies (ICT) is growing in Distance Education Institutions (DEI). ICT has contributed to effective learning for rural/urban, male/female, ethnic, and remote student groups. In Pakistan, tertiary education is generally restricted to those who can afford it in urban areas. In addition, recent accessibility studies in Pakistan have identified that most students do have access to a range of ICT devices, but with limited Internet access due to problems related to the national ICT infrastructure. An ICT equipped DEI can, however, deliver tertiary education with high levels of interaction to females and underprivileged ethnic groups living in rural and remote areas. Therefore, DEIs need to uncover suitable education delivery models. Blended learning models with multiple access methods for content development and presentation, teacher student interaction, and e-assessment are needed. Blended e-learning is relatively cost effective, and can provide quality education to distant students.

Allama Iqbal Open University (AIOU) initiated e-learning in Pakistan about a decade ago, and the program has been continuously evaluated. Owing to its success and cost effectiveness, AIOU planned a major organizational change to incorporate ICT-based blended learning. In the present paper, these ICT-based access models for blended learning are described with multiple accessibility options to provide content delivery over TV, radio, Internet, and video conference-based communications. Progress to date is also highlighted.

Introduction

In many education programs, e-learning components are added to supplement student learning (Naidu, 2006). Similarly, in e-learning programs some face-to-face components are added to provide synchronous student and teacher interactions (Swan, 2002). Such blending for the purpose of better teaching and learning combines the benefits of traditional and online methods of education delivery and, therefore, it has often been considered a flexible, low cost, and effective method of learning (Alonso et al., 2005).

Distance Learning Institutions (DLI) with high student enrollments especially benefit from blended learning, because it facilitates the sharing of limited resources such as available classrooms, Internet, laboratories, libraries, and teachers. However, the accessibility of distant users (teachers and students) to such facilities sometimes is a common hurdle that may affect the quality of teaching and learning (Gill, 2005; Wikramanayake, Jamtsho, & Sangi, 2008). Student and faculty satisfaction may decline as a result, and many operational difficulties may be experienced.

Since DLIs traditionally offer open (anytime, anywhere, and flexible) education delivery, they often provide instruction (content and guidance) in multiple formats, including print, audio, video, and/or computer media. Similarly, different courses may be designed with an assortment of pedagogical methods and
delivery modes, both synchronous and asynchronous. Such combinations of input from teachers and students may be implemented using multiple ICT channels of communication, e.g. e-mail, video conferences, forums, Internet, TV, radio, or telephone. In certain cases, part of the instruction is also delivered through face-to-face tutorial sessions or workshops. These blended methods of education are increasingly being used by a majority of institutions (Allen & Seaman, 2007). Therefore, effective, reliable, flexible, and timely access to instructors, instructional content, and other information are considered key requirements for the design of successful blended e-learning systems.

Allama Iqbal Open University (AIOU) has historically offered distance, face-to-face, and online education. AIOU recently joined the club of mega-universities in the world with enrollment in excess of one million students. With a growth rate of 12-14% per year, AIOU was experiencing operational and quality problems. On one side, delays in operational logistics and academic delivery were significant in the areas of student services, instructional delivery, and student assessment. To combat these problems, AIOU implemented blended education using a combination of Internet (asynchronous and synchronous) and face-to-face laboratory sessions.

An analysis of this initial blended program was conducted. Additionally, a countrywide ICT accessibility and acceptance survey was conducted in schools, technical colleges, and universities during same period. Both surveys provided positive feedback concerning student accessibility to ICT devices, services, and the Internet. Therefore, blended learning was considered as a future requirement for AIOU with a flexible and open access model, allowing for blended teaching and learning using a variety of access methods, including TV, radio, computer & Internet, video conferencing, study centers, and mobile learning. In this paper, selected survey results are described. The results of these surveys are then used as the basis for outlining an access strategy for blended learning at AIOU for mass education. Typical ICT interventions and progress made are also described.

Literature Review

Distance education is a special mode of education in which the learner and tutor are separated by distance and time. Written instructional materials (and/or guide books) and interactions methods are mostly used to support the learning needs of distant students (Gill, 2005; Neal, 1999; Taylor, 1999). Terms such as e-learning, web-based learning, computer-based training, computer-assisted learning, mobile learning, tele-conferencing, and video-conferencing describe various levels of ICT recently introduced into traditional distance education pedagogy (Gyambrah, 2007; Whitelock, 2005). To meet the demand for e-learning, particularly in Asia, a sizable number of higher education institutions are now using ICT tools to provide modern electronic learning facilities for the benefit of their off-campus and geographically dispersed students (Allen & Seaman, 2007; Baggaley & Belawati, 2007; Gyambrah, 2007), including collaborative e-learning programs (Sangi & Karamat, 2007). Many traditional distance education universities are converting to e-learning (Baggaley & Belawati, 2007; Daniel, 1996).

The exponential growth of e-learning has been made possible by the comparative ease and availability of low cost ICT devices and services. Security problems related to traveling and increased global acceptance of distance education will also help sustain such growth. However, there are problems, especially in Asia, with student accessibility to learning resources, teaching and learning processes, student services, and evaluation methods (Sangi, 2008; Wikramanayake et. al., 2008). Addressing these accessibility issues may also necessitate pedagogical changes.

Access to Learning Resources

Access to learning resources is a key requirement in all online education programs. In a recent survey, student access was rated as either important or very important by 92% of institutions that responded (Allen & Seaman, 2007). Automation of educational delivery has also been considered as very important for student interaction with online resources and instructors (Mariana, Shea, & Pennington, 2003). Strong accessibility mechanisms could provide a richer and more engaging educational experience than is
possible within the confines of the classroom (Mariana et al., 2003). However, less disciplined access could cause dissatisfaction among students or teachers. This may require creativity and innovation in the presentation of study materials and their associated delivery technologies (Gill, 2005).

Internet-based access to online learning is either synchronous or asynchronous. In synchronous access, the student and teacher are both online at the same time, and students have an opportunity to watch presentations, ask questions, respond to instructor questions, or give live presentations themselves. This is usually facilitated through shared presentations via electronic whiteboards, interactive chat sessions, live tele-conferencing, or video conferencing. In the asynchronous mode of instruction, students and teachers access the web at their convenience and respond to each other’s communications and work through e-mail messages, discussion forums, posting of assignments, and web-based reading materials.

Electronic accessibility methods depend upon common ICT devices used by students. Many different technologies are used by DLI. Each has its advantages and drawbacks. Low-cost, traditional postal technology is considered slow and requires considerable effort in outreach (Schramm, 1973), especially in communicating with remote students. Broadcast technologies have wide access to rural and remote areas, but do not provide any active participation of listeners/viewers, who cannot stop the flow of transmission to ask questions (Schramm, 1973). Often there is a competition at the user end between educational and entertainment uses of radio and TV sets. Multimedia course CDs are advanced forms of computer-based instruction which can be played and re-played as often as required to support learning. They are also cost effective and commonly used in distance education, but one of the limitations of such multimedia instruction is that it needs frequent upgrading. Mobile technologies are also emerging in education; however, they call for a re-conceptualization of teaching and instructional design (Swan, Kratcoski, & van ’t Hooft, 2007). A pilot e-learning survey conducted by AIOU (Sangi & Khattak, 2009) indicated that the use of mobile devices is growing among AIOU students, generating a demand for mobile devices to be used for interaction or instruction. Video conferencing can bring teachers and students together in virtual face-to-face communications; however they require high bandwidth and a group presence at the remote end. The role of learning objects and the electronic repositories are also emerging as important components in e-learning (Hardono et al., 2007), but all new technologies require student-end equipment, software, Internet connections, and training of students and instructors (Naidu, 2006).

Blended Learning

The success of both traditional distance and e-learning programs depends upon interaction (Swan, 2002) and social presence (Kehrwald, 2008) of the teacher. The needs and expectations of online learners constantly grow with the availability of new ICT services. This often requires the redesign of both instruction and access interfaces (Armstrong, 2004; Kenny et al., 2005; Power 2007). The application of innovative pedagogical methods used by face-to-face teachers, laboratory/fieldwork, or learning of physical or technical skills also requires the adoption of blended learning components in many online courses. Blended learning is the integration of face-to-face and online instruction in a planned and pedagogically sound manner.

Blended learning was practiced at about half of the US institutions that responded to the Allen & Seaman (2007) survey on blended learning. A study in Pakistan also indicated that online students preferred to interact with their teachers either in synchronous or in face-to-face workshop sessions (Shamaila, 2007). Indeed, acknowledging such preference, AIOU has made face-to-face workshops or weekly tutorial sessions a compulsory requirement in almost all distance education programs.

AIOU’s Blended Learning Program
E-learning education was started at AIOU in 2000 with the initialization of the Open Learning Institute of Virtual Education (OLIVE) Project. Progressively, capacity for digital content development, instructional delivery, Internet access, and e-assessment services was developed (Sangi, 2008; Sangi & Ahmed, 2007). AIOU launched a one-year diploma program in Computer Science in 2005. The program consisted of 10 courses (out of 11 being offered) that were to be completed in one year. Three courses were completely laboratory based, three courses were completely theoretical (lecture based), and the remaining courses were mixed. Course credits were accordingly accrued in a blended manner through asynchronous multimedia instruction, synchronous online sessions, and face-to-face workshops.

A survey of this pilot blended learning program was conducted. Out of the 476 students enrolled in the program, 127 responded to the survey, resulting in a response rate of 26.7%. As was envisaged, once exposed to ICT-based education, students clearly favored both online and blended education delivery. A clear majority (77%) of students favored online education, while 71% of students favored blended online education (Figure 1).

The survey also revealed that only about 7% of students did not own a computer and a little less than 40% of students were using Internet connections at public Internet cafes. Fifty eight percent of students...

Figure 1: Student Satisfaction with Online and Blended Online Education (AIOU E-learning Program 2006-2007)
were accessing the Internet from their office or home, but only 8.66% student had Digital Subscriber Line (DSL) connectivity with adequate bandwidth. In addition, 55% of the students had nearby easy Internet access, but about 33% of the respondents stated they had to travel 2-5 kilometers to get Internet access. The most frequent problems reported by students were associated with frequent disconnection, power breakdowns, or low bandwidth. Despite the reported obstacles, AIOU website accessibility was rated high (Figure 2). The quality of learning materials was rated very high (with 80% of the responses in the “good” and “excellent” categories) and so was program implementation (75% of the responses rating it as “good” or “excellent”). The respondents also found specially developed multimedia instruction CDs, face-to-face workshops, and books quite helpful in their learning.

![Website Access is:](image)

**Figure 2: AIOU Online Education Website Access (AIOU E-learning Program 2006-2007)**

**Accessibility Survey in Pakistan**

After analyzing the initial responses of students in the pilot program, work on the development of access strategies for blended learning was initiated. Further studies were also conducted to get additional input from students in other institutions. A survey by Wikramanayake et al. (2008) provided additional feedback on the use of computers, TV, radio, and Internet in education by a sample of 1,527 students enrolled in schools, technical colleges, and universities all over Pakistan. This recent accessibility survey indicated that despite low average family incomes, about 81% students in Pakistan were using some sort of ICT devices in their education (Figure 3), while 50% were using computers without Internet access. Web based training was used by 12% of the respondents, whereas TV and radio were used by 21% and 29% of the responding students respectively.
The authors also concluded:

“The study has shown that students are motivated to use ICT in pedagogical and other activities, but due to availability, affordability and accessibility issues, they are unable to enter into the ICT age and to gain maximum benefit from it. Several major initiatives exist in the region to promote ICT-based DE, which are creating a vast range of new possibilities for teachers and learners. A paradigm shift is beginning to be observed in the region from teaching to learning, giving the student greater control over the learning process.

Most students find ICT-based learning a significant advantage for them, saving time, helping them to learn more efficiently, to understand concepts/theories, to find relevant information easily, and to make the educational process more interesting.” Wikramanayake et al. (2008).

Wikramanayake et al.’s survey also identified student difficulties in accessing learning materials and interaction with instructors. Since the majority of the rural population in Pakistan is poor, they need locally available, reliable, and shared Internet and computing facilities. Female students need to use such facilities in a culturally acceptable environment. Therefore, the need for local ICT facilities was, and still is, considered important in education delivery.

Context

It is evident from the above discussion that a range of ICT devices, technologies, services, and e-learning tools are available for use in Pakistan. AIOU students, in particular, have been using a variety of such devices. There is also an implicit need for blended learning, as some live interactions with teachers were preferred by the majority of students surveyed. Many questions remain, however, such as which access methods and technologies should be standardized, in which parts of the country, in which courses, and to which student groups? It would be difficult to find a single answer to such questions as many other factors such as instructional materials, pedagogy, course requirements, costs and benefits, etc. need to be considered. However, the need for appropriate access methodologies is clearly a common and perhaps the most important requirement.
Considering its socially and geographically heterogeneous distant student populations, the specific teaching requirements of its various courses, and the use of a range of access devices among its student populations, AIOU needed to devise a multi-method access strategy for course and program delivery utilizing a range of available technologies. This access strategy is discussed in the remainder of this article.

Case Study of AIOU

AIOU History and Students Statistics

Allama Iqbal Open University (AIOU) was chartered in 1974 as the first open university in Pakistan. The university has flourished and today is a very successful mega-university with an enrollment exceeding one million students. The university is financially sound and most of the operational expenses of the university are met directly from its tuition. The outreach of AIOU is nationwide, with 36 regional campuses or offices in large cities and 86 coordinating contact officials in smaller cities. AIOU provides educational services to a variety of students. Present statistics show that 51% of AIOU students are female, 58% are employed, and 55-60% of the total student population lives in rural areas. AIOU students are geographically distributed all over Pakistan, including the most remote areas of the country. The university offers more than 93 programs and over 1200 courses. Trends at AIOU reflect the futuristic national focus on the “Education for All (EFA)” low-cost education model.

Learning Models

AIOU is providing three basic models of education delivery: traditional distance learning, traditional face-to-face learning, and blended learning.

Traditional Distance Learning

In the traditional distance learning mode, students are sent specially written course books (or media cassettes where applicable), assignments, and learning instructions via the postal services. Depending upon course needs, tutorial sessions or workshops are conducted nationwide. Some face-to-face components are added to technical and postgraduate courses in the form of workshops or supervised laboratory sessions. Students’ assignments are evaluated by tutors and final summative assessments are conducted by the university. In a few courses, a limited number of radio and TV broadcasts are released through national television. This mode is the dominant form of delivery at AIOU, with more than 90% of its students learning in this manner.

Traditional Face-to-Face Learning

AIOU also initiated many science programs requiring laboratory based activities. In such cases, arrangements were made for regular classes and laboratory sessions at its main campus and in selected cities. Employed students were offered evening classes or weekend classes to complete required course credits. These courses are limited to only science faculty or students at institutions where laboratory facilities were arranged through collaborative efforts.

Blended Learning

E-learning work at AIOU was initiated about a decade ago. The computer science department developed a conceptual online education framework called OLIVE (Open Learning Institute of Virtual Education). OLIVE focused on integrating online teaching, research, and student support activities. It also included the development of the infrastructure needed for supporting blended activities. Three access models for instructional delivery (depending upon local Internet access availability) were originally considered (Sangi, 2005). As illustrated in Figure 4, Arrangement A represents a local collaborating institution where
laboratories and classes were made available. In Arrangement A, the Internet was used to provide digital multimedia instruction while a local instructor was used to assist students during lecture and laboratory sessions.

In Arrangement B students take full advantage of a typical learning management system (LMS) with digital content access, teacher interaction sessions, e-mails, forums etc. However, students in Arrangement B still attended weekly synchronous Internet sessions with local teachers. Additionally, a one-week, face-to-face workshop was also organized for laboratory sessions and performance assessments. The third arrangement, C, suited to a typical “girl-at-home” type of student, where Internet service was not always accessible. Students in Arrangement C were provided specially developed flash-based multimedia instructional materials by mail and were encouraged to use their home computers. However, workshop components were also compulsory for such students to perform laboratory activities.

In Arrangement A, a full, four-year, high quality bachelor’s degree program was offered (Sangi, 2006), whereas in Arrangements B and C only a one-year diploma program was offered. Incidentally, Arrangements B and C were typically utilized by ICT-based and underprivileged traditional distance students typical of the AIOU student population. The success of these blended programs was mainly attributed to the blended mode of education where multimedia instruction was supported by online sessions and face-to-face workshops. These helped to resolve students’ learning difficulties, especially during laboratory sessions.
Strategy for Institutional Development

*Initial ICT Capacity Building*

Parallel to its pilot blended learning program, AIOU also initiated other technology transformation programs to build the university's ICT capacity and spread the benefits of ICT across the university. A brief outline of initial capacity development initiatives are provided in Table 1.

**Table 1: Initial ICT Capacity Development Initiatives**

<table>
<thead>
<tr>
<th>No</th>
<th>Initial Initiative</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Personal computers and printers were liberally provided to employees on simple requests. They were trained and were encouraged to develop digital information</td>
<td>Most employees learned to use a computer. A number of employees made progressive use of additional software in their work.</td>
</tr>
<tr>
<td>2</td>
<td>Multimedia instruction design capacity was developed with support from the Higher Education Commission. The Multimedia Courseware Design Centre was established.</td>
<td>Digital instruction was prepared in a number of CS courses. This flash-based instruction helped initiate blended learning. The design won many awards. Additional grants were easy to obtain.</td>
</tr>
<tr>
<td>3</td>
<td>The university started its website and students were provided with web-based information. The university also acquired an Internet Service Provider (ISP) license.</td>
<td>Students, teachers, and staff started using the Internet and web-based content. The university developed the capacity to effectively use and serve other Internet users.</td>
</tr>
<tr>
<td>4</td>
<td>First e-learning activity was initiated using a customized learning management system named &quot;OLIVE&quot;.</td>
<td>Students and faculty started experimenting with online educational activities. Two courses were offered.</td>
</tr>
<tr>
<td>5</td>
<td>University campus was networked with fiber optics. This network was also extended to five urban and four rural regions.</td>
<td>University staff was now able to get benefits of electronic communication. Internet, e-mail and other web services were used by staff.</td>
</tr>
<tr>
<td>6</td>
<td>Website was enhanced with more information on programs and courses. Students were provided some documents such as date sheets and roll number slips through regional office computers and the university website.</td>
<td>Demand for new web services increased. More computers were acquired and more employees required training. Digital content development work also started in other academic departments.</td>
</tr>
<tr>
<td>7</td>
<td>The Higher Education Commission sponsored Internet and inter-university networks became operational. Digital Library services were made available on campus</td>
<td>Better Internet bandwidth and academic resources such as digital library, electronic freeware, and other tools were available to students and faculty.</td>
</tr>
<tr>
<td>8</td>
<td>First complete blended program was launched in computer science.</td>
<td>Outreach to students was increased. Economic group size at study center was eliminated. The program was 33% cheaper than the one at the study center; especially girls and rural students were happy to communicate with highly qualified faculty members from urban areas.</td>
</tr>
</tbody>
</table>

**AIOU’s Access Model for E-learning**
The Pakistani government has de-regularized its TV, radio, mobile, wireless, telephone, and data communication businesses, and its national ICT infrastructure and services are rapidly growing. AIOU can now either establish or acquire the necessary communication services in various localities for educational delivery services. The university therefore planned a major transformation strategy from traditional distance education to ICT-enabled blended learning. After a wide discussion, a multiple channel ICT-based accessibility option was initiated as a continuation of the evolutionary practices already in place. This decision was based on large-scale implementation, heterogeneous student populations, and the nature of courses offered (technical and non-technical). Additionally, faculty members could benefit from a wide range of ICT-based communication options for their courses and could design most suitable methods for students, communities, and courses. An intensive training program was also designed to assist new faculty members in the conversion process. A flexible and open access model, as shown in Figure 5, was envisioned, which includes a variety of access modes (e.g., TV, radio, Internet, video conference, and mobile) for the very remote students in blended learning model C, as mentioned in Figure 4.

All the aforementioned initial development activities enabled AIOU to provide students access to educational materials and instruction in multiple delivery modes. To facilitate students, a “cheap laptop (or desktop)” initiative has been announced, through which students can purchase PCs on installments. However, there remain a number of students who may not have computer or Internet access, or still prefer learning using printed media. These services will continue for such student groups for the time being.
The evolutionary approach in ICT capacity enhancement helped overcome many operational and academic problems, and built management’s confidence. AIOU therefore decided to initiate a major shift towards technology-based education in all its traditional distance education programs. Many simultaneous decisions were made and some of the ones related to accessibility and ICT infrastructure are outlined in Table 2.

Table 2: AIOU Access Infrastructure Development

<table>
<thead>
<tr>
<th>No</th>
<th>ICT Infrastructure</th>
<th>Expected Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Phase III 2006-2008</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Video conference equipment was installed and Internet-based communication tools were acquired.</td>
<td>Live video conference lectures are being delivered by distant faculty members. Teleconferencing and presentation sharing methods are being used to improve quality of education.</td>
</tr>
<tr>
<td>2</td>
<td>The AIOU FM radio station was established and the Institute of Educational Technology was enhanced with digital media development and broadcasting facilities.</td>
<td>AIOU FM radio programs are broadcast with some live radio discussion in many professional courses. Recorded CD/DVDs are available to students as offline media.</td>
</tr>
<tr>
<td>3</td>
<td>The university website was converted into a web portal.</td>
<td>Staff, students, and teachers can effectively access admissions, employment, and examination records. Visitors can print or download forms and submit online forms.</td>
</tr>
<tr>
<td>4</td>
<td>OLIVE e-learning was extended to new programs. Digital instructional content was developed.</td>
<td>Collaborative online courses in English and Business are now being offered in a blended learning mode. More programs have been identified for conversion to dual mode delivery.</td>
</tr>
<tr>
<td></td>
<td><strong>Phase IV 2009-2012</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>AIOU will establish VSAT-based television and live communication channels. Its network will be extended to all AIOU regional buildings, selected community schools, and Interactive Learning Student Centers (ILSC). Current telephone and mobile service will be integrated with the AIOU network.</td>
<td>Video lectures and video conference facilities will be extended to regions local teacher training colleges, ILSC and selected schools. Thus, increased access to all students and teachers will be provided. Voice and Internet tools will support multiple methods of communication.</td>
</tr>
<tr>
<td>6</td>
<td>E-learning software and content will be acquired and delivered in a digital form and, where needed, in a local language. New learning technologies and tools will be continuously added.</td>
<td>U-OLIVE, an Urdu-language-based learning management system, is in the testing stage. It will enable e-learning in Urdu. This will extend ICT use to students who learn in their native language Urdu (Sangi &amp; Sabir, 2009).</td>
</tr>
<tr>
<td>7</td>
<td>Electronic assessment facilities will be provided</td>
<td>An initial version of e-assessment software called Generalized E-assessment Model (GEM) is in the testing stage. This software will help perform e-assessments in a variety of assessment situations (Sangi, 2008).</td>
</tr>
<tr>
<td>No</td>
<td>ICT Infrastructure</td>
<td>Expected Outcomes</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Establish an ICT Directorate</td>
<td>This new department will develop, guide, and provide technical support for the AIOU ICT infrastructure and will also train staff, faculty, and students in use of modern ICT devices.</td>
</tr>
<tr>
<td>9</td>
<td>Extend both communication network and content delivery services to students in all localities.</td>
<td>VSAT and radio programs will be extended to about 2,000 community locations through public and private networks. Mobile and Internet services already available will be enhanced and integrated for use in education.</td>
</tr>
</tbody>
</table>

**Planned ICT Services to Students**

AIOU’s new ICT models are expected to provide many e-learning services. However, all services will still require some supplementary face-to-face components for laboratory or project-based learning. These services have been planned through workshops and live video conference sessions at selected AIOU buildings and ILSCs. Some details of these services are outlined below.

**Communication System**

The communication system is planned to provide equal opportunities for students all over Pakistan. This would include the establishment of a multi-technology-based modern communication network using interactive, IP-based Digital Video Broadcasting (DVB) technology using a satellite. It will be integrated with the present education and research networks such as the Pakistan Education and Research Network (PERN-II), the Virtual University (VU) network, and the IT Services Network at AIOU. It will provide support for academic and service departments such as admissions, examinations, regional services, and student welfare.

**Interactive Learning Student Centers (ILSC)**

ILSC centers will be established at all AIOU offices where it has its own buildings. Each ILSC center will have computer laboratories for computer-based training, digital teaching rooms for TV broadcasting or live video conference sessions, and open e-learning labs for individual learners to access multimedia or web content, or to interact with teachers in synchronous sessions. The labs will also be used by those students who do not have computing facilities of their own. The ILSC centers at AIOU campuses will have the capacity to provide video/audio and PowerPoint presentations and interactive sessions. A typical high-end ILSC, as proposed at ten different locations in the country, is shown in Figure 6.
In other areas, local community centers, teacher training colleges, and facilities at some private local institutions will be acquired through public-private partnerships to establish additional but smaller ILSCs. In all, about 2,000 such centers are being proposed to facilitate about 400,000 students on an average basis of two hours per day, per student. The AIOU ISP will also support additional dial up connection users accessing the AIOU website from their home connections or local Internet cafés. Therefore, even small community or home-based students will benefit from this connectivity to the campus e-learning and support services.

Content Delivery

The networks established above will be used for sending electronic course materials, multimedia computer instruction, study guides, and audio/video content to students. TV-based content will be delivered via the AIOU-VU joint video link. Other multimedia and HTML/Flash/Director-based media will be available through the OLIVE LMS via the Internet. In addition, CD/DVD copies may be sent to places where satellite or other delivery mechanisms are not available for direct electronic delivery. Until these changes are fully implemented, print-based content will also be supplied where needed.

ICT-Based Electronic Education Delivery

The abovementioned communication system will be mainly used for course delivery. Participating students will receive electronic materials and instructions from AIOU, listen to lectures and presentations via satellite, participate in video conferences, discussion sessions, and expert lectures, and communicate with instructors. Student groups nationwide will be interacting with instructors in scheduled, Internet-based, live lectures, Q &A sessions or remote workshop presentations. Digital libraries and Internet access will also be provided. An example of one such remote workshop organized between Kent State University, USA and AIOU is shown in Figure 7. A similar online presentation by students to a remote faculty at North Carolina University (USA) is shown in Figure 8.
Figure 7: A Typical Video Conference Session between AIOU and Kent State University.

Figure 8: An AIOU Student Sharing Presentation with Remotely Located Faculty at the University of North Carolina
Conclusions and Future Work

In this paper, we discussed scenarios of blended learning and similar developments in Pakistan. Common problems related to the national ICT infrastructure and e-learning in Pakistan were highlighted. Opening doors for education for all ethnic, religious, and social communities of both genders on an equal basis is needed. This can be achieved through the adoption of suitable blended learning models for appropriate groups of students. Tertiary education is restricted to urban areas due to a lack of facilities and other resources in rural areas; ICT could help resolve many of these problems. Blended learning is relatively cost effective as compared to formal education at urban university centers. It also provides a better quality of education to students in remote areas. Blended learning does not require any printing or traveling costs. In sum, it provides educational opportunities to a greater number of people, especially females who have less mobility. A blended mode of education is now accepted and practiced by pilot AIOU students. Its extension to other communities is needed.

Such an extension should be feasible, as recent studies in Pakistan have found that most students do have access to a range of ICT devices, the most common being computers, TV, CD players, and mobile phones. However, a sizable number of students are without Internet access, while one-sixth of potential students do not even have access to a computer. These students also require more interaction on a regular basis. Therefore, a blended model will provide access to educational services for most student groups, regardless of their level of ICT access.

Owing to common problems in ICT-based access, AIOU has developed multiple accessibility methods to facilitate faculty members and different groups of students living in different geographical areas. AIOU has initiated work on the development of alternate ICT infrastructures to provide multiple level accesses to students. Such ICT infrastructure is expected to provide content delivery via TV, radio, Internet, and video conference-based communications. Additional ICT facilities have been planned through public and private partnerships, especially in small towns and rural areas. Both synchronous and asynchronous activities will be supported. Additionally, for those who do not have ICT access, traditional printed content and postal service delivery will also be continued. An ICT Directorate had been established and significant training will be provided to instructors, students, and university staff for smooth change management. It is envisaged that AIOU will progressively extend ICT access even to its rural students. The current series of AIOU initiatives will further enhance ICT-based education delivery in Pakistan. However, this alternate model has to be enhanced with a reliable, open-ended, low-cost, and uniformly distributed national ICT infrastructure.

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