

Do IT Yourself Document Series

To assist the

COLLEGES TO ESTABLISH AND BENEFIT FROM EDUCATION GRID SERVICES

Document Serial No. 2k3-2

Document Title: Education Grid Objectives and Support for Quality Education in the Colleges.

Author: K.R. Srivathsan

Date: Sept. 2003

Contact: K.R. Srivathsan, Project Coordinator, Kerala Education Grid

Indian Institute of Information Technology and Management – Kerala

Park Centre, Technopark, Thiruvananthapuram – 695 581, India

Email: director@iiitmk.ac.in

ABOUT THE DOCUMENT SERIES

This document series is intended for the colleges who wish to benefit from the Education Grid services. The documents under the series are intended to assist the colleges, teachers and the higher education systems management at various levels and thereby gain from the **Technology Enhanced Learning and Teaching [TELT]** environment that is being set up under the Kerala Education Grid project.

DOCUMENT ABSTRACT

This document serial no. 2k3-2 together with an earlier one [1] gives an introduction to the vision, mission and approach of the Kerala Education Grid [KEG] and its role in enhancing the quality of education provided in the colleges supported by the higher education system. The parameters at the core of quality education are delineated in some detail. An overview of the infrastructure requirements and the associated cost for each college are indicated. It recommends the setting up of a college level Education Grid Management team. The document also indicates what kind of information its benefits the KEG will bring to the colleges.

1. INTRODUCING THE KERALA EDUCATION GRID

Kerala Education Grid (KEG) is a project of the Government of Kerala. The spirit and approach of the project are given in an earlier paper by the author [1]. *The vision of the Education Grid is to provide “Quality Education to all Independent of Geography”*. This is being addressed through collaborative knowledge and best practices sharing, and effective application of Knowledge Management in the higher education system. The processes that need to be put in place in the colleges to achieve this objective will require implementing advanced Technology Enhanced Learning and Teaching Environment in each college.

The web-enabled services are becoming increasingly sophisticated with seamless access to computational and digital library services, Learning Management Systems [LMS], chats,

discussion board facilities and collaboration tools. Today, the total environment is provided by information – communication technologies, computing and information services, is best inducted through course-specific knowledge and collaboration services over web and Internet. Such content adds considerable value to the teachers and students in the colleges and institutions. These web-enhanced resources and learning support framework are built in the form of Information - Communication Presentation - Interaction – Collaboration environment for the teaching and learning of regular courses and different kinds of learning programs management. This environment is being referred to as the **T**echnology **E**nhanced **L**earning and **T**eaching, or **TELT** for short.

For the regular colleges, TELT is best developed to provide the teachers and students much of the supplementary learning resources and as rich web-facilitated leaning processes for much of the regular courses. There are a whole range of functions and services in TELT that are of central relevance to education. They may range from Digital Library with personalised access to documents and media files. Course of Learning Management Systems, threaded discussion boards and chat for groups, access to relevant backend computation and simulation tools, interactive self-evaluation system, etc. A major objective of the Education Grid project is to make available all such tools and facilities to all the teachers in the colleges and through them to the students. The total TELT environment includes the collaboration framework across the colleges and premier institutions. In the KEG project we propose to this in stages. As a first step the colleges will be linked to the KEG's Education Grid Resource Centre (EGRC) in NITC, CUSAT, colleges of Engineering Trivandrum and IITM-K over the education grid network across Kerala.

The target group is the set of colleges, institutions and universities that constitute the higher education system. This is proposed to achieve through modernising and equipping the colleges to make TELT methods a way of life in the colleges. The core issue of Education Grid is quality education. Here we state the two major issues addressed by the Education Grid to achieve its objectives. The first is to review *the parameters that address quality in Education*. The second concerns with *the infrastructure, programs and processes to be supported by the Education Grid project*. The details related to both these issues and how we go about addressing or implementing them are elaborated in the rest of the manual. Well-organised TELT will help the teachers to teach better, colleges to administer better and students to learn better.

1.1 TELT AND THE TEACHER

Very often the author has been asked whether 'TELT' will replace the teacher. In the teaching of any course, there are several activities to be carried out besides the classroom lectures and homework. In every course, we need to have a learning environment for both the teachers and students. The web-enabled courseware posted over a Learning Management System [LMS] or Course Management System [CMS] is of great value to both. It provides a base not only for rich media content, but also for serious asynchronous interaction between the teacher and the student or student and the student. In addition CMS may support course-specific tools and interactive components for that help the student to reinforce his/her understanding. There are any numbers of reasons to show that TELT can never replace quality teachers. If anything it will promote the capacity of the teacher to teach better. TELT will also add newer challenge and opportunities (to earn as well)

The KEG project stands to gain a great deal from the National Program on Technology

Enhanced Learning (NPTEL) that is sponsored by the MHRD and jointly executed by all the IITs and IISc. NPTEL aims to create quality content in more than 100 courses for the Engineering Colleges of the country. The learning materials will be developed as both web based material and as recorded video lectures of experts in the field. KEG will complement this exercise by putting in place across the Kerala's colleges the necessary infrastructure, intra and inter institutional processes and orientation of the teachers and the educational administration system.

This report is in the form of approach and technical requirements paper and outlines what each college needs to do to build the essential infrastructure, put in place an effective management framework and orient the teachers to benefit from the application of TELT in their regular courses. First we review below the stages through which the Education Grid is being executed.

1.2 THE OBJECTIVE OF THIS MANUAL AND EDUCATION GRID

Kerala Education Grid [KEG] project proposes to address the problem of providing quality education in the colleges and universities through TELT facilitated processes. The TELT processes will involve the concerned teachers as much as possible. The teachers and the colleges will be supported by the KEG project to develop quality content through its services and invoke such educational processes that effectively apply TELT methods. In this endeavor, the project will draw from the large volumes of content available or getting generated over the Internet or by the national level projects such as the National Programme on Technology Enhanced Learning [NPTEL].

While there have been any number of workshops and short courses being held in the area of using IT in Education, there are no serious formal efforts within the country in making TELT a part of the educational system. *This manual is being written as a guide to all interested teachers in the colleges and their administration to understand, implement and manage the different components of infrastructure, processes, training and orientation needed to leverage upon TELT to promote quality education.* There is a wide variety of issues to be addressed and several innovations to be made in the Higher Education system to benefit from the potential offered by the Education Grid. In the different chapters of this manual the different aspects of these issues and the components that help drive TELT facilitated quality education are explained. This manual will be maintained over the Education Grid website (www.edugrid.ac.in), grow with feedback from different quarters and be available online.

1.3 QUALITY COMPONENTS IN EDUCATION

Our present higher education system consisting of the colleges, universities and institutions is governed by a system of government bodies such as the MHRD, UGC, AICTE, state-level education bodies such as the departments of higher education, directorates of technical and collegiate education, other councils. Much of what these bodies do is more in the nature of regulations. Regulations are necessary but hardly sufficient to touch upon quality issues. Whatever mechanisms exist in enhancing quality (such as the academic councils in the universities, etc.) have degenerated to adding more regulations than enabling or empowering the teachers, the students and the system. Other mechanisms such as Quality Improvement

Programmes, or, the activities of societies for education, etc. are too feeble and passive to be of direct assistance to the teachers or the students. *Education Grid attempts to fill this void in our education system by providing such knowledge and computing resources, content development and maintenance and processes that help sustain quality in the system.*

There are four facets to the different components that sustain quality in education. They are illustrated in Fig. 1.1. When properly nurtured, the four parameters of quality mutually reinforce each other. The TELT framework that we are delineating in this manual has the potential to reinforce all the four parameters. The four quality parameters are described below.

2. EDUCATION GRID ROLLOUT PLAN

KEG is being rolled out in several phases, each phase built on top of the previous one. These are

- a) Establish the EGRC infrastructure in the four Resource Centres and the Education Grid Operations Centre (EGOC).
- b) Commence quality content development in identified courses conforming broadly to local syllabus requirement in the basic sciences and engineering disciplines initially for the Engineering Colleges.
- c) Conduct teacher training and orientation programs on effective application of TELT.
- d) Conduct courses-specific Content Development workshops in different courses where teachers and experts jointly assess and build quality content meeting local needs.
- e) Commence uses and practice of TELT in the Resource Centre institutions. They in turn provide apprenticeship in TELT for interested teachers from the colleges.
- f) Establish E-Learning infrastructure and facilities in each participating college.
- g) Help the colleges with getting cost effective quality Education Grid network connectivity.
- h) Orient the college administration and teachers to manage the Education Grid and TELT services.
- i) Put in place best practices and knowledge sharing in each subject area for all concerned teachers and students in the subject.

The overall KEG project management will be carried out by the EGOC in consultation with the EGRCs and the colleges. Already we have the following works under progress. Parts (a), (b) and (c) of Section 2 have commenced and their scope are being expanded soon. Parts (d) and (e) are expected to start shortly once the current efforts of EGRCs getting their E-Learning and content development facilities are set in place.

KEG is a cooperative attempt to fill a major void in the Indian institutions that have largely been cut off from the ongoing silent world wide revolution that attempts to use the power and potential of state-of-the-art information systems and internet in the education system. Our aim is to equip the colleges and universities with the necessary infrastructure and service that support TELT processed of their courses. All colleges and institutions have much to

gain by employing TELT in their courses.

The parts relevant to the establishment and commencement of Education Grid services in the colleges are explained in the following sections of this document.

3. HOW DOES EDUCATION GRID ADDRESS QUALITY IN EDUCATION?

Our present higher education system consisting of the colleges, universities and institutions is governed by a system of government bodies such as the MHRD, UGC, AICTE < state-level education bodies such as the department of higher education, directorates of technical and collegiate education, and other councils. Much of what these bodies do is more in the nature regulations and assessment. These are necessary but not sufficient to touch upon quality issues. Other mechanism such as Quality Improvement Program or the activities of societies for education etc. are too passive to be of direct assistance to the teachers or the students. Education Grid attempts to fill this void between necessary and sufficient processes in our education system by providing such knowledge and computing resources, content development, training and processes that help sustain quality in the system.

To understand the way KEG is being guided and how the colleges will benefit from the same, firstly we explain the necessary conditions that will help address quality issues in education. Such quality education issues are centered on quality learning processes over quality resources and people base. There are four components of quality infrastructure and processes that are shown in Fig. 1 below. Each of the four quality parameters is briefly explained below.

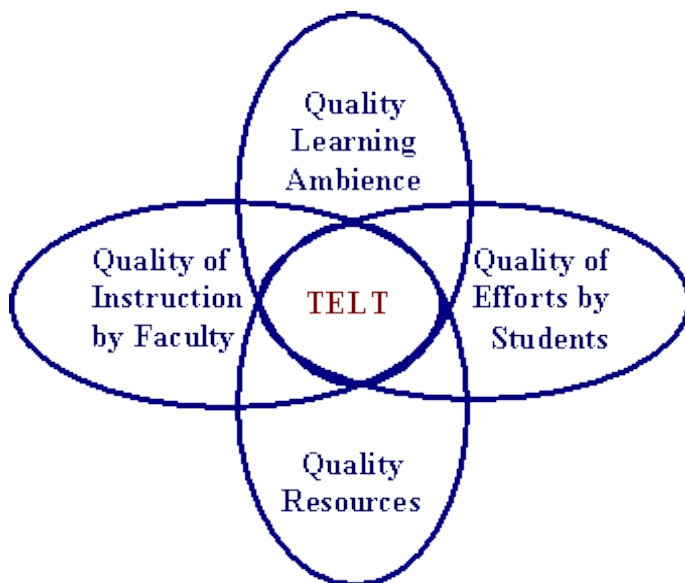


Fig. 1: TELT and the Four Parameters of Quality in Education

3.1 Quality Resources

Every college needs a number of resources. Besides buildings, classrooms, blackboards and traditional library, we need quality labs, computing services, Internet and communications. Today the computing resources are essentially general purpose. Often, these computing and information resources detract the students from focused efforts and study. This is more because the Internet and information systems do not provide focused content and interaction as relevant to the courses of study. ***The coming years will see the emergence of Knowledge Campuses.*** Here, the information space and computing systems will be customised for each course. ***Under the TELT processes of the Education Grid, there will be plenty of scopes to customise the information and computing services that add immense value to the education system.***

A college typically provides the buildings, classrooms, library, labs, lecture theatres and similar facilities. These are supportive infrastructure to the learning. The Internet, computer labs, LAN, servers, software or the audio-visual aids add some quality resources to a limited extent in today's environment.

TELT addresses three levels of resources and processes that help enhance the quality of learning very substantially. The first level is the addition of infrastructure to support e-learning ambience. To support the Education Grid services, the colleges will have to add one Education Server that will host (i) the Learning Management System, (ii) Online E-Library facilities and (iii) reasonable quality Internet connection, (iv) online localized group collaboration and interaction services and (v) synchronous and asynchronous interactions through discussions, message boards, etc.

The second level of e-learning addresses cost effective access issues for students and teachers so that they are equipped to effectively use the e-learning resources and facilities that will be made available. A college may start with the first level and upgrade their existing LAN and PC facilities for supporting the second level.

At a third level, the college may go for enhanced e-learning infrastructure facilities that support multimedia streaming and synchronous e-classroom facilities. The synchronous facilities are rather expensive to own and manage. They are not needed immediately.

A major resource will be quality web-enabled focused content in the different courses that is rich in interactive components, quality exercises, linked digital resources. ***Education Grid plans to develop and maintain such content through a process whereby experienced teachers can help validate the quality and usage of such content in the different courses***

3.2 Quality of Instruction

Quality of instruction in a college is a function of several processes in place. At the core of this is the motivation, passion and the capacity of the teacher and the system concerned in managing and sustaining a vibrant learning environment. KEG plans to provide a Course Knowledge and Collaboration Space over the Web. This will help the teacher interact with teachers of the same subjects in other colleges and some experts in the subject. In addition, the course material supplied through the education servers will have contents specially

addressed to teachers and for special classroom needs. The server itself will support asynchronous discussion facilities that help both the students and teachers for diverse kinds of interactions. Classroom instruction is strengthened by capacity to monitor students' performance and alerts on students not doing well. In addition, KEG will conduct teachers orientation programs to provide subject specific participation and training on how to teach.

There is acute shortage of quality and experienced teachers in almost all the colleges. The bright student population in the colleges is not adequately motivated, directed or exposed to how they could apply what they are taught to real world problems. ***Instruction is a complex process.*** It is not adequately covered by the information in the texts, books or the blackboard based sermons alone by even a good teacher. Quality instruction should address the pedagogic processes as relevant to the world of the subject that is being taught. Later in this manual, we propose a model that explains in some detail the five dimensions of pedagogy that is addressed through TELT to support quality education. ***The teacher is the pivot around which these five dimensions of pedagogy are conducted.*** These five dimensions pertaining to instruction or pedagogy concern the following.

- (i) How we ***introduce the problem*** or the topic that we are going to teach in ***relation to the real world scenario?***
- (ii) ***Effective communication*** of the concept, the approach or the solution;
- (iii) Worked out examples, illustrations, case studies or ***demonstrations that illustrate*** what is taught;
- (iv) Make the students do ***quality exercises*** and group work that help them digest what is taught;
- (v) Enhance the ***capacity of students to apply what is taught in real life situations.***

Even the best of teachers get little time to address the above issues effectively for all the students in the class. Here is where the web-enabled content and recorded lectures from the best of teachers will help drive the teaching processes. Such content that drive the teaching process will also assist the teachers in learning how to teach effectively. ***Our challenge is to build in to the web-enabled course contents the instructional processes that help the colleges to conduct the courses effectively.*** Part of this manual will explain and guide the teachers how to do this.

3.3 Quality of Efforts

While quality of efforts on the part of the teachers is enhanced by supportive content and processes, students efforts are considerably enhanced by interactive content, question banks, threaded discussions and linked context-specific course library. Students may undertake interactive self-test that will be designed by experts in the field. These tests help the student to focus his/her study and identify what knowledge gap(s) he/she has. They will also be helped by supplementary content to study and bridge such knowledge gaps. KEG aims to ensure that students' carry out focused study, not get digressed in superficial exposures and put in sufficient and purposeful efforts beyond the classroom hours so that they digest and master the skills and concepts.

A sine qua non of education is the quality of efforts put in by the students. This aspect is actually part of the instructional part explained in 2.1.2. It is stated separately to emphasize that the efforts the students put in after the classes or the preparation they do before coming to the class or practical is critical to ensure quality education. The web-enabled instructional processes as built into the content help achieve this. ***It is not just the quantity of effort that a student puts in so important as the quality of the effort they put in that raises the standard of education.*** A carefully developed pedagogically sound content will have components that help considerably in enhancing such quality of efforts. The teacher too needs to put in considerable quality effort in the preparation for each class and in organizing the different learning activities. A combination of quality content and course management helps achieve these objectives.

In addition, several resources such as simulation, virtual reality presentations, rich illustrations, animation and visuals add much value and provide for faster understanding of several kinds of complex concepts and scenarios in almost all subjects.

3.4 Quality Learning Ambience

The learning ambience is where good institutions like the IITs do fairly well. This happens by students discussing the topics beyond classrooms among themselves, group work, critical look at what is being taught and finding out what the world of the course is beyond the narrow confines of the syllabi. It is important that colleges nurture healthy discussion sessions and intense study sessions. Adequate time, say one day a week should be given to indulge in seminars, discussions, interactive study, etc. so that they develop confidence and develop a real world view of the subject.

The content proposed to be developed aims to assist in maintaining all the above four quality parameters of the educational process. KEG is adopting a Content Quality Metric (CQM) in guiding and assessing content that will help maintain the above four parameters. Some details on the CQM may be found in [1]. Next we consider how the colleges should go about interacting with EGRCs EGO and effectively manage the TELT activities to get maximum benefit from the KEG services.

The object of selecting similarly equipped students, placing them in a class and subject them to a campus life is to provide the very quintessential of the learning environment that constitutes the learning ambience. The students should be encouraged to discuss with teachers, with classmates, explore the library, surf the information space purposefully and expose to the subject-world in ways that enrich their understanding, appreciate the world of the subject they are studying, participate in group work and activities within and across subjects, listen to seminars by eminent experts, develop a sense of solving problems of the world, build things, add to their learning experience, etc. It is in these quality ambience parameters that most of our colleges fall woefully short of the minimum. The exams and marks oriented system discourages teamwork, or spending time purposefully outside the narrow confines of the texts and notes in the courses taught. For example, an Engineering student in electronics or material science has no idea of what the requirements of a medical appliance are so that he/she can understand a real world problem. This and several other lacunae in our education are best filled through TELT.

With imaginative management of web-enabled interactions across institutions, organizations

in other disciplines, industries and R&D, such stimulating environments that provide quality learning ambience can be built into each course space over the web. Education Grid plans to address this issue in a substantive manner.

KEG may itself undertake seminars organization in the colleges to motivate students and teachers and make learning fruitful and enjoyable. KEG will support initiatives by the colleges that help add value to themselves and help other colleges under the Education Grid.

4. SET UP THE TELT MANAGEMENT TEAM

First the college should become a registered member of the Kerala Education Grid. A Memorandum of Understanding between the college and the KEG will be signed. Assistance in this regard will be available on request by email to office@edugrid.ac.in. The EGO at IITM-K provides the overall project administrative services.

From the college's side, we need a team to liaise with the KEG and benefit from its activities and programs. The team will consist of

1. Principal or Director of the Institute – Chairperson
2. Two experienced faculty with one of them acting as the coordinator
3. Librarian
4. Systems and IT services Administrator
5. One IT savvy Technical Assistant

This team will manage the E-Learning and Digital Library services. It will assist the teachers and students in making effective use of the Education Servers. The team will also oversee regular orientation programs for users and maintenance of the college portal.

5. TYPICAL INFRASTRUCTURE AND COST OF EDUCATION GRID SERVICES

There are four components of infrastructure needed to install, run and maintain the KEG services. They are

- a) Education Server and associated server farm installation.
- b) Augmentation of LAN and associated access systems for the users.
- c) Internet connection to the college and associated Internet/KEG services.
- d) KEG programs related expenses.

We assume that each college has some minimal LAN and basic server. A typical installation is shown in Fig. 2 below.

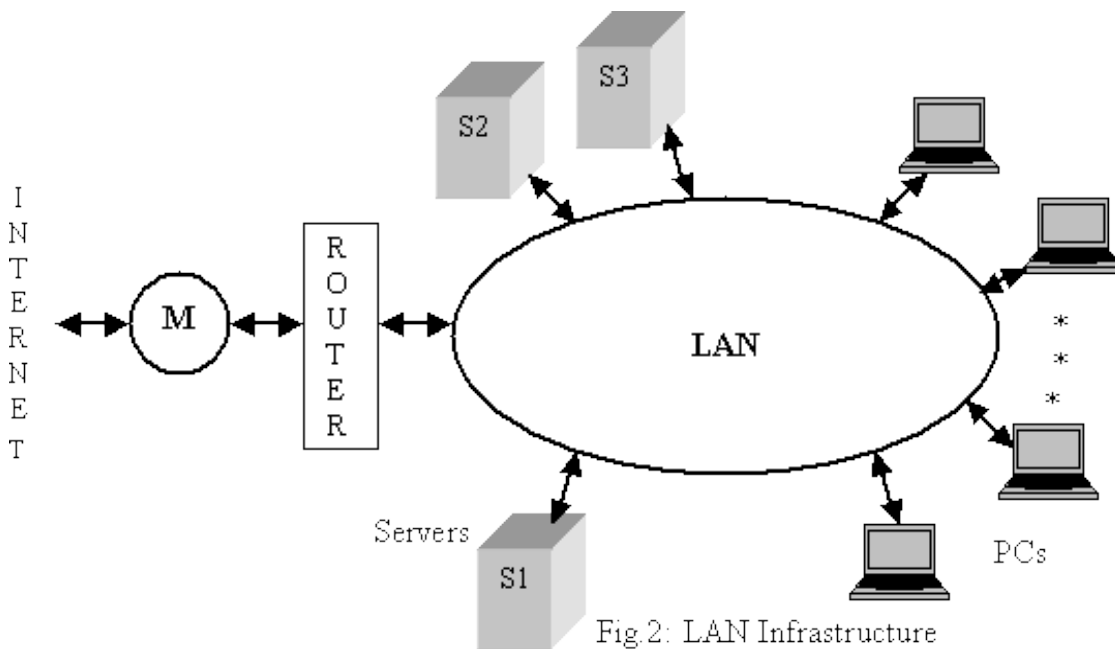


Fig.2: LAN Infrastructure

In Fig. 2 we have shown typically three servers. They may be (i) Education Server; (ii) Thin-client/DNS/DHCP server; and (iii) Streaming Multimedia Server. Education Server will also host the college portal. We may need a proxy, a firewall and a server for Campus ERP depending upon the level of services we offer.

However, we need not invest all at one go. The essential ones will be the Education Server, Streaming Multimedia and Thin-Client/DNS/DHCP Server. In addition, within the LAN it is desirable to set up a dedicated Cyber Café facility with photocopy and printing facilities added. We also recommend a separate access Cyber Café area for teachers. Initial starting investments will be about Rs 15 Lakh. Another Rs 15 Lakh will be needed in the subsequent year to complete the integrated installation. We may note that except for the Education Server and the Streaming Server, (the two together will cost Rs 6 Lakh) colleges will have to incur the rest of LAN and Internet expenses for routine services. The main difference is that KEG services will push up demand from students and teachers for more access systems.

5.1 KEG AND ERNET SERVICE

Besides the LAN, the Internet connectivity is being provided under ERNET license. This typically involves the college spending (i) annual charges for the link between the colleges and the KEG/ERNET backbone network that links the EGRCs at NIT Calicut Cochin, CET or IIITM-K at Thiruvananthapuram, plus(ii) an annual connectivity charges to ERNET for the national backbone . KEG will be part of the national ERNET backbone networks. This allows the colleges to get the benefits of AICTE and INDEST schemes of MHRD. The INDEST scheme will permit colleges to access international journals online under the Digital Library.

The colleges will be intimidated by the ERNET on the recurring cost for such scheme. The recurring cost for the KEG services that include reasonable Internet connectivity (that will be improved to a great extend over the next two years), programmes and Digital library services will be of the order of Rs.1000/student/year. Appropriate policy guidelines or

directives will be issued by the State's Higher Education Department on how we propose to meet this cost.

5.2 LOW COST ACCESS SOLUTION FOR KEG SERVICES FROM IITM-K

IITM-K is evolving fairly low cost access client systems solutions centered on Linux platforms. KEG is paying meticulous attention to ensure that web-enabled content and access service are as platform (i.e., Windows, Linux, Solaris or Unix) independent as possible. This will provide for both existing/legacy systems or access solutions and future system to support true terminal mobility for all users of its services. The access solution will be provided by a Service Pack that contains (a) a free Star Office/Open Office suite approved for free use by students and colleges from Sun Micro system, (b) an Adobe Reader for reading PDF documents. (c) Real Media Player for playing multimedia Files, (d) support for Tex documents publishing and viewing available under Free Software license and (e) a standard platform independent Web-Browser that is tuned to work with the Education Server. One Service Pack each will be provided for (i) Windows PCs, and (ii) Linux PCs. Later a pack for the Sun Solaris client/thin client system will also be released. Once the service pack is installed, KEG services will look alike for the user of any of these systems.

6.ON EDUCATION GRID SERVICES AND MANAGEMENT

The EGOE at IITM-K is taking every effort to ensure that the member colleges of the KEG install the education, streaming media and other servers and get linked to the KEG backbone. KEG aims to support the following services in the member colleges.

- (a) E-Course materials for the courses that conform to minimum quality standards and prepared by the EGRCs and the Course Expert Groups under the KEG.
- (b) Colleges may prepare their own course material, share with other colleges and use the same.
- (c) Course materials prepared and made available by the IITs and IISc under the National Program on Technology Enhanced Learning will be hosted in the college servers as and when they become available.
- (d) Screened content that available through Internet form major universities (like MIT open courseware, Other universities) and with due care taken for IPR.
- (e) Streaming media lectures prepared by IITM-K, the IITs and IISc under NPTEL of otherwise.
- (f) Journals access under the INDEST Digital Library scheme and necessary linked Library materials certified for local hosting under the KEG.
- (g) Participation in both online teaching programs and those conducted under the KEG.
- (h) KEG to empower good teachers from any college to contribute and get recognized for quality work related to instruction and pedagogy.
- (i) Building quality question and solution banking and computer tests that help the students.

(j) Capacity to launch tutorial services for students through a combination of printed and online content.

(k) Capacity to support distance learning under an open virtual university for teachers to get higher degrees.

Our effort is to build the capacity in the colleges to both establish the infrastructure and the processed in a holistic manner for effective uses of TELT in the colleges. Till date, there have only been fragmented efforts like providing Internet, setting up LAN and computing infrastructure, curricula development, QIP programmes, etc. We expect KEG to be a pioneering initiative being under taken collectively by the colleges of Kerala and demonstrated how we can address quality education through sharing, caring and building the processed that are at the core of quality education.

The e-course content and approach will definitely be of great value and assistance to teachers and students in their day-to-day classes and study.

7.EPILOGUE

We in India have a gigantic problem of providing quality education to the very large young students population of our country. We also need to address the increasing interdisciplinary educational requirements. The world is moving ahead rapidly and we need to do many things coherently to address these issued. We invite all the colleges, the premier institutions, the teachers, students and different bodies of the universities and the higher education system to come together enthusiastically and help build this KEG concept of providing high quality education through collaboration, Knowledge and best practices sharing and effective contributions in the content design and training over the Education Grid. Kerala as a state can do this as a state-level movement and thereby help the rest of India also to help raise the standards of education.

*****Ends*****