A study of the introduction, application and utilization of information technology in higher educational context in Kerala, Thesis, Department of Library and Information Sciencce, University of calicut, 2008.

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DECLARATION

I, Abdul Salam M P., do here by declare that this thesis, “A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDUCATIONAL CONTEXT IN KERALA” has not been submitted for the award of any Degree, Diploma, Title or Recognition before.

C.U. Campus
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INTRODUCTION

Information is a dynamic and unending resource that affects all disciplines and all walks of life. It supports higher education in all its activities such as teaching, learning and research. It is an indispensable resource for development and improving the quality of life as well. Recent technological advances in electronics devices have caused great impact on modern society. These advances have provided a capability previously not known or resulted in improved efficiency. All the developed countries are now moving from the industrial to the post industrial or Information society. Some of the changes in fields such as computer applications are so fast that the packages become outdated within 2 to 3 years and new technologies/applications offer more economical, generalised and integrative solutions to current issues. In fact, the speech of changes in making any long-term visualisation is very difficult. The vision of the 21st century, therefore, cannot go far beyond and, therefore, it has to be restricted to the first quarter of the 21st century that networking with broadband communication with integrated multimedia can afford. (University Grants Commission, 1996)[1].

Educational Systems around the world are changing rapidly as a result of technological advancement. The sphere of education has been influenced by the twin phenomena of globalisation and liberalisation. The rapid technological changes affect many aspects of human lives, including the way one learns. Therefore the socio-economic development of a nation is dependent on the quality and type of education that is offered from the school level to the University level. While basic primary education is to be deemed as every individual's right, as has been stressed by the various committees that have looked into the educational scenario of the country, higher education and its problems have received less of attention. The present day higher education needs to be more comprehensive, innovative and quality oriented.

Higher education is bound to go for the unavoidable shift from the culture of print to a culture of digital technology, which affects not only teaching, learning and research but the whole of university life (Srivastava, 1998)[2] . The new technologies are dominating the education scenario in the developed countries. However, there are some limiting factors in their wide-spread use in the less developed countries. The need of the 21st century will be to exploit the information highways to the fullest possible extent. Economic development will depend to a large extent on creating and optimal use of the technological infrastructure. Countries which would harness the power of multimedia communication for education and training purposes will be the economic powers of the next century (Gandhi, 1998)[3].

The much needed transformation in higher education – the learning, teaching and research process – may utilize the information technology devices/services that have become available nowadays. Computer, CD-ROMs, networks, Internet, E-mail, Telefascimile, Teleconferencing Edusat etc. that help to acquire, sort, process and disseminate information come under the ambit of Information Technology (IT). Information technology is a combination of computers, telecommunications, reprography, microforms including CD-ROMs, online, networking, database technologies. IT is being considered as one of the key factors in shaping the present higher educational system and formulating policies for the future.

Information Age

The world is entering into an Information age and developments in information and communication technologies will open up new and cost-effective arena of education which will reach the youth as well as those who need continuing education for meeting the demands of explosion of information, fast-changing nature of occupations, and lifelong education. The explosion of knowledge made many problems in the utilizing the appropriate information in the educational context.

The current era is hailed as “The age of information explosion”. The impelling force behind such an explosion is the exponential growth of literature in all fields of human knowledge and ever increasing number of documents in each subject area, due to the laudable advancement of science and technology during the last few years. Such growth has been creating problems for selection, acquisition, organization and services in libraries as well.

Mere conventional methods and old educational technologies such as radio, television, tape recorders and overhead projectors, slide projectors, etc. are quite incompatible with the tempo of publications erupting every years. Naturally, in order to cope with the rapid ascendancy of publication, application and utilization of modern technological devices/services become mandatory.

Information Technology

Information technologies are tools used to build information systems. Information technologies include computer hardware, software, database, networks, and other related components such as Internet, e-mail etc. Information systems use and integrate these technologies to meet the information needs of different users. The information technology must support the goal of the information system, which is to provide accurate, timely, relevant, complete, well formatted information that users value.

UNESCO defined, Information technology as ‘Scientific, technological and engineering disciplines and management technique used in information handling and processing, their application, computers and their interaction with men and machines and associated social economic and cultural matters’.

Information technology represents an assemble of technologies. These technologies are computers ability to store and processes information, the communication technology which represents transmitting information to locations where it may be needed Information technology is in fact a convergence of three strands of technologies – computer, micro electronics and

communications. Information technology is a term used to describe products and services created by rapid changes in Computer and communication technologies and their fusion together (or converging).

The fast expanding capabilities of computers spurred by developments in sophisticated data storage facilities have led to rapid development of "computerised information systems". The generation of broad databases and the revolution ushered in by the electronic communication technologies have made it possible and feasible to have information networks at local, national, regional, and ultimately global levels. Internet, database services and on-line information retrieval are the most important components of any efficient information system.

Components of Information Technology devices/ services

Computer Technology

Like books, computer based systems are reservoirs of information and human intelligence. Unless the reservoirs are accessible and generally available, the information so stored has little or no value, or is useful only to an enfranchised few. The campus system will become accessible through information technology, allowing people to interact with the information in varying ways to achieve their mission. Perhaps more important are the ways that information technology will allow people to interact with each other, serve the clients, exchange ideas, and collaborate efficiently

Communication Technology

The basic advantage of computer technology coupled with communication technology is that it can improve the quality of service for customers. However, the application of communication technology needs rather big investment. The merging of telecommunication technology which started in 1970s was accelerated in the 1980s with the rapid growth of micro computers and communication software. The fall in the cost of computer systems and telecommunication facilities and their enhanced ease of operation

brought them within the reach of virtually every branch of education and even to individual teachers and students. This has caused fundamental changes in the social and economic structure of the society also (Bohiller, 1979)[4]. The telecommunication networks enable institutions and individuals to exchange information with high sped and accuracy by electronic means.

Internet

Today, the Internet is increasingly making its presence felt, not only playing an important role in research and education but also serving as a catalyst to a country's socio–economic, cultural and political development. It is therefore not a surprise that the Internet has become a development of the highest significance.

Internet and Intranet have become a source of vast quantity of information and interactive tools. An example of Intranet could be a school campus network where students and teachers share to local information such as teaching materials and course schedules while at the same time accessing the Internet. The Internet is a set of linked computers characterized by protocols that allow it to be used across a wide-range of hardware platforms. Each machine on the Internet contains information to be shared across the globe. Information on the Internet could be accessible from any location regardless of the type of computer system being used. It also means one can have access to and/or publish information regardless of the subject, location, age and race and time limitation. Internet is thus an empowering tool for all that are involved in education.

Electronic Mail

An electronic mail or e-mail system is a method for a person to person communication of text messages. It is an example of "store and retrieve" communication technique. Electronic mail system allows two or more subscribers to communicate with each other using electronically transmitted text messages from only standard alphanumeric terminal including PCs for international communication across time barriers. It can also be used for single

to multi-point communication (Swaroop Rani, 1992)[5]. E-mail is the most widely used Internet facility among the academics for communicating academic matters with greater speed and ease.

Multimedia

A multimedia system makes an integrated use of visual data such as images and animation, audio such as speech and music and textual matter. Technology has enabled man to communicate such data through copper wires, optical fibres or as radio or optical waves. They can be received in fixed or mobile terminals, TV screens or notebook PCs (Kaur and Singh, 1998)[6]. The developments in software technology have immense potentialities in professional education, especially in technical and management education. Computer aided learning using multimedia has effected drastic changes in the learning pattern of students both at school level and in higher education. Developments in CD-ROM technology and the popularization of Internet have caused a shift of emphasis from group learning to individualized learning (Power, 1996)[7]. The recent developments in multimedia will also result in adaptive computing tutorial systems and will have a major impact on distance education. A multimedia work station would be a helpful and interactive device for educating the physically handicapped learners.

Tele Conferencing

In the classroom sites, remote for the instructor, a receiver/ transmitter is connected to the telephone line, and interconnection of student micro-phones, allowing each student to make comments or asked questions. When the instructor permits it such comments can be heard at all connected size.

Teleconferencing is by nature synchronous form of communication in which all participants must be connected to the network during the same time period. In some applications a second telephone line is used to remote sites. In other applications, duplicate sets of visual materials are sent in advance to each site and then displayed locally when called for by the instructor.

E-learning

E-learning refers to interactive learning in which the learning content is available online and provides automatic feedback to the student's learning activities. Online communication with real people may or may not be included, but the focus of e-learning is usually more on the learning content than on communication between learners and tutors. E-learning could be viewed as an online descendant of *Computer-Based Training* (CBT) and *Computer-Aided Instruction* (CAI).

Online Education

There are many terms for online education. Some of them are: virtual education, Internet-based education, Web-based education, and education via computer mediated communication (CMC). Online education is characterized by the use of a computer network to present or distribute some educational content and the provision of two-way communication via a computer network so that students may benefit from communication with each other.

Teaching Via Satellite in India

Kasturirangan (2003)[8] is of the opinion that television began in India on September 15,1959 as a pilot project funded by the Ford Foundation, with the transmission of one hour educational programmes twice a week. Satellite Instructional Television Experiment (SITE 1975) is an example of extensive application of Satellite for Education and Development. After launching, the Indian Nation Satellite (INSAT) series, INSAT 1A (April 10, 1982) to INSAT 3A (April 10, 2003) it had become possible to reach the remotest and far flung areas of the country and expand its capabilities to provide enhanced services in the fields of telecommunication, broadcasting, education, extension education etc. India continues to forge ahead in its space programme, which provides benefit to the country in all aspects of human activities.

There is a growing demand for an interactive satellite based education system in the country. With the launch of Edusat which is exclusively dedicated to education, India acquires a fresh perspective ways to educational

reforms, in which new technologies will contribute to equalise the access to learning opportunities and to improve the quality of education for all (Beena Shah, 2004)[9].

Edusat

Edusat is the first exclusive satellite for serving the educational sector. It is specially configured to meet the growing demand for an interactive satellite-based distance education system for the country through audio visual medium, employing Direct To Home (DTH) quality broadcast. (http://www.isro.org)[10].

Edusat was launched by Indian Space Research Organisation (ISRO) on 20th September 2004. The successful launch of Edusat weighing 1960 kilograms into a geostationary orbit, from Satish Dhawan Space Centre, Sriharikota, marks an important mile stone in ISRO's effort to use space technology for providing high quality education across the country. Edusat can establish the connectivity between urban educational institutions with adequate infrastructure imparting quality education and the large number of rural and semi-urban educational institutions that lack the necessary infrastructure.

Education Multimedia Research Centre (EMMRC)

UGC has initiated an educational television transmission, earlier named 'Countrywide Classroom'. Its original one-hour slot transmission today, has grown into a 24 hour dedicated educational channel, 'Vyas'. Not only this but the programmes generated by the centres are shown on various other channels, which includes Education International on DD Bharti. Interactive classroom to receive and uplink the live lectures of eminent professors through EDUSAT-Satellite Interactive Terminal which is part of CEC-UGC network of more than 100 SIT/ROTs is also introduced now.

EMMRC is producing programmes on varied subjects like Science, Economics, Technology, Sports, Culture, Archaeological Heritage, People,

Places and so on. Additional to this there are various multiple part series on subjects such as Entrepreneurship and Media, Girl-Child Education and Architectural Sites. The advent of multimedia provided an environment in which texts, pictures, graphics, tasks, sound and video are amalgamated.

Information Technology Indian Scenario

In the field of computer, India has dramatically entered in the 'Computer Age' by exporting computer software and sophisticated technology, though at a much lower scale than the advanced counties such as U.S.A., Canada, Japan, West European Countries and the U.S.S.S.R.

In the telecommunication technology field, India has achieved a high degree of self sufficiency through indigenous production of telephone, telex, microwave, radar, etc. In the highly sophisticated satellite technology, the Indian Space Research Organisation (ISRO) has made remarkable advantages enabling India to enter the exclusive club of few advanced countries in this field with NIC NET, INDONET (Commercial Network for the country as a whole) RAILNET, ORNET, EDUNET, ERNET, EDUSAT etc.

Reprography in India was introduced in 1941 and reprographic services were started by INSDOC in 1952 for various users. Lucknow University Library was probably the first among Indian University to organize reprographic unit in 1954. With the emergence of Indian Electrostatic copies, almost every University and departments have started their own reprographic services. Now almost all universities, institutions of higher learning and research centre are equipped with the reprographic units to facilitate the supply of duplicate copies of documents on request.

IT Initiatives in Kerala

Information Technology (IT) is the world's fastest growing economic activity. The IT industry has been found to be ideal for Kerala in terms of its potential to generate opportunities and employment with little pressure on land,

environment and other resources. This is one of the most people-friendly and environment-friendly industries of modern times. The Government understands the enormous potential of Information Technology not only as a tool for improving governance and creating more jobs, but more significantly, as a means to greatly enhance the standard of living of the people. Use of IT in enhancing the delivery of Government services leads to a very responsive and transparent administration facilitating the empowerment of the people and satisfying their right of information.

Kerala's Information Technology Policy (1998) Statement addresses the following components.

- Increased application of Information technology in all walks of life
- Enhancing the IT industry base so as to make Kerala a very fertile location for ventures in Information technology
- Creating a robust state information infrastructure
- Human resource development for information technology.

Human Resource Development is a very critical aspect in the development of Information Technology. The Government is seized of the urgency for consolidating and strengthening the core competence of the state on the human resources front to propel the development of IT industry. The proposals in this regard include establishment of an Institute of Information Technology, introducing Information Technology as a specialized branch of study, development of Centres of Excellence in Information Technology, creating a fund for up gradation of training/educational infrastructure and introduction of a system for accreditation.

The State Information Infrastructure (SII) will be a major factor for the economic prosperity and competitiveness of the state. In Kerala, with its high literacy levels, high information awareness, and the sizable population of educated youth who can be rapidly trained, the information infrastructure will

turn out to be the ideal mechanism for reducing the information gap in the society, promoting transparency, facilitating an efficient and responsive administration and ensuring rapid and sustained industrial and commercial growth.

The State Information Infrastructure comprises three essential elements namely, communication infrastructure; computing platforms and Data warehouses and networks.

Information Technology and Education

Education is regarded as the foundation and root-cause of man's state of development and underdevelopment. The use of computers, CD-ROM databases, satellite communications, Internet Web Pages and Browsers even with the present pattern of education will go a long way in making the information that is available in higher education more easy and less confusing.

Education and information technologies (ITs) are interrelated to each other. Education has a decisive role to play in tooling society as well as allowing individuals to reap the benefits of new information technologies. But it is observed that education itself is being deeply transformed by the information and communication technology revolution in terms of quantity, quality, organization, management and purpose.

In the educational system, the use of information technology is not so widespread in India. With the emergence of World Wide Web (WWW) in 1969, the world of teaching and learning has adopted e-training as one of its main innovations (Mishra and Sharma, 2005)[11]. However in spite of extensive use of the web in education, varieties of terminologies are used to depict this field of knowledge. E-learning has become popular amongst educationists because of its inherent strengths and advantages it provides to the instructional process. E-learning plays an important role in accessing to education resources from outside the institution on a global and instant basis. It also helps in quick

and easy way in creating and updating, revising the course materials through low cost off the shelf software.

The preparation of quality lectures and teaching material requires sophisticated and specialist knowledge. E-learning makes new knowledge and skills available immediately, and reduces the learning time required to master even the most complicated topics. Advanced e-learning technology provides a high degree of interactivity that ensures results. E-learning is an effective way of training a wide range of individuals, since it can be tailored to meet the needs of individual learners. Studies show that people retain significantly more information through E-learning than traditional training.

Information Technology and Higher Education

Higher education is bound to go for the unavoidable shift from the culture of print to a culture of digital technology, which affects not only teaching, learning and research; but the whole of university life. IT has arrived with a big bang. The very nature of teaching, learning and research has to depend also on electronic data, over and above the print material. Conduct of research now requires co-operative resource sharing and networking of local, national and global resources. Universities and colleges shall have to share the resources and change their nature of depending exclusively on their own limited resources.

Information technology has been playing a vital role in higher education for decades. It has influenced in depth all components of higher education and research. Television started sending instruction to campuses and homes during the 1950s, before that, radio and film were used in a wide range of courses; and computers have populated labs in Universities since the late 1990s. But only recently has interest in educational applications of information technology, which now includes the Internet and the World Wide Web, reached nearly universal proportions. In the past, discussion of Information technology was limited mainly to academic and teaching journals; now, almost every major

newspaper has devoted at least a series of articles or a Sunday supplement to "Learning in Cyberspace," touting technology as a savior for education.

Higher Education in Transition

Keeping in view of the developments in teaching, learning and research on the one hand and growth of information technology (IT) devices/services on the other, all concerned with higher education today are attempting to grasp how information technology could help in modernizing teaching, learning and research processes of Universities. The ways of knowing have been transformed by information technologies and are no more restricted only to the medium of print and other conventional media. The nature and quality of Information technology, therefore, have to be familiarized by those who are involved in academic activity.

The definition of information has broadened due to the role of non-print materials including computer data electronically stored. Though the print material has not died out, books are on ASCII files, used through optical scanning and periodical articles are getting stored in electronic archives. The most important phenomenon to be noted by university administrators is that both printed text and digital images can be linked for remote viewing, allowing remote access away from the main frame location and/or at the library premises. In fact, electronically stored data can be viewed from any place in space. Components of relational databases and hypertext presently are structured only horizontally and not vertically. But the human mind is strong enough to deal with them vertically through analytico-synthetic techniques of knowledge classification and organization.

For the past few decades, most attempts to use technology in higher education have been very haphazard: systems have been designed only to automate existing processes, computers have been thought of as strictly computational devices, and desktop workstations have not accomplished much more than to replace the typewriter and the adding machine. Today, however,

Information Technology is creating a new educational platform for teaching, learning and research process and is reconfiguring the way a student learns, the teacher teaches and a scholar doing research. Network learning - and information worldwide, Internet, computer etc. are evolving. Since education is a discovery process and an exploratory process, its mission is to provide the widest repertoire of possibilities with which a student is faced when entering a learning situation. Technology can provide this learning expanse, and because of it a student educational experience will be immeasurably richer.

The most important potential of Information Technology devices/services in education is in the use of the worlds increasing amount of knowledge. In all disciplines there has been a tremendous implosion of data with no real way to disseminate it. This data requires technological resources to communicate it as usable information. This communication of usable information tends to be disseminated vertically; to be useful; it must also be disseminated horizontally, crossing discipline boundaries. Traditionally, higher education has organized itself along rigid boundaries of discipline which result in a ghettoization of thought; but technology forces teachers, students and research scholars to cross boundaries, to think comprehensively, to find ways to solve problems.

Concepts of Teaching, Learning and Research

The intelligent use of Information Technology devices/services in transforming higher education requires that there should be changes in the concepts and methods that are presently followed in research, teaching and learning in most institutes, universities and colleges of higher learning. The present top-down and traditional approach cannot be incorporated in the democratization of educational teaching and learning that is the realm of computers and networks. The course structure and their curriculum needs to become more flexible with the student having the control of mixing and matching to his taste and needs. This in turn requires that the administrative

machinery, the teaching community, the student group and the researchers, change their value systems on learning, education, and the social need of education. All this obviously cannot come about in a day. It needs time and more importantly the social and political will which alone can provide the economic wherewithal necessary for implementing and sustaining the use of the changing information technologies for transformation of higher education.

Technologies offer major opportunities to higher education to enhance the quality, accessibility and cost effectiveness of university teaching. Electronic mail, computer conferencing, and the World Wide Web are strengthening contacts between students and academic staff. Technologies provide increased opportunities for interaction which can usefully provide for joint problem solving, shared learning and enhance face-to-face contact. Educational technologies have the capacity to bring other considerable benefits to teaching and learning. Benefits include the capacity to illustrate difficult concepts with animated or video sequences, to provide simulations of corporate situations or scientific experiments, to allow new information search methods and new forms of teaching configurations and student/academic interchange.

Role of Information Technology in Teaching Learning and Research

Teaching, learning and research are the main functions of a University. If a University has to realize its objectives, the pursuit of research and teaching is essential. In fact these two functions are complementary to each other. However a small portion of the total research funding comes to universities. As a result high quality research generally takes place outside the University environment. However, there are efforts being made by several funding agencies such as CSIR and ICSSR which provide funds to teachers and researchers in Indian Universities to carry out research projects.

To day no University can function at its best unless its research activities are integrated with teaching. Moreover, teaching staff in higher education play a vital role in preparing better trained manpower. The UGC has been making

all efforts to keep the standard of teaching faculties by the introduction and application of modern technologies such as computer communication facilities.

In order to achieve excellence in higher education, quality research is very important. To do quality research it is essential to have a general academic ambience supported by modern technological aids besides interaction with industry. However, many of the Universities lack this ambience and the required support.

With the drastic change in the job market, learning process is tuned towards making the academic out put as most sophisticated. The traditional bookish knowledge has nothing to do with the dynamic social-economic and technological world.

Therefore modern technologies have considerable potential to enhance University teaching, learning and research and in creating a better learning environment.

IT and Teaching Process

Teaching is the process through which the various cognitive, soft and transferable skills are imparted to the students. The success of any education component depends to a great extent on the quality of teaching. Efficient delivery and attentive reception are the pillars of success of education system. In a higher education setup, the teacher has to be a ‘guide by the side’ rather than a ‘sage on the stage’ and lead the students to learn to practice the skills than just passively listen to the delivery of the lectures.

Technology encourages teachers to take on new and expanded roles, both inside and outside of the classroom. Within the classroom, technology supports student-centered instruction. Outside of the classroom, technology supports teacher collaboration. Instead of working in isolation, teachers can work together on school wide programmes. They can help find solutions to problems and act as peer advisors to provide information and feedback. Their

new roles may involve distance collaboration with cross-academic peer groups and study groups through telecommunications. Professional development for technology use provides opportunities for teachers to become comfortable and effective in these new roles

IT and Learning Process

With the increasing capacity of information and communication technologies, there is a rise in new learning opportunities beyond the traditional "book-teacher" model. Globally, the nature of learning and teaching is changing rapidly due to increasing interaction from more accessible global telecommunication networks driven by the content of the Internet. The shift from teacher-centered to learner-centered learning means teachers at all levels need to embrace new information and communication technologies and education and training need to keep up with the advances of new technologies. As new technology is being accepted as the catalyst for new learning environments, access to communication has become crucial.

The main benefits that students see with using technology in courses are the convenience of accessing course materials at any time or anywhere, and for managing course activities. Many different types of technology can be used to support and enhance learning. Everything from video content and digital moviemaking to laptop computing and handheld technologies have been used in classrooms, and new uses of technology such as broadcasting are constantly emerging.

IT and Research Process

The digital science and information revolution is rapidly transforming the ways one conducts research, collaborate, solve problems, and disseminate knowledge. The integration of computers, telecommunications, audio, video, multimedia, and other digital technologies creates a worldwide information environment that can be accessed easily from the laboratory, office, field, and home. Information technologies can be used to augment and magnify the

capabilities of the human mind across all disciplines and serve as agents of scientific and intellectual innovation for the academic community. Digital sciences, which include broad areas of the computational sciences, computational applied mathematics, digital libraries, telecommunications and multimedia, and related areas, have been identified as areas which help the researchers do their work most efficiently and effortlessly.

The increased use of data bases in research is leading to more interest in the field of informatics (information organization, storage, retrieval, processing, and visualization) as one that cuts across a multitude of discipline. This could be an area where groups in library science, computer science, and molecular biology, for example, could collaborate on real-time analysis using large data bases. Informatics could be used to access genomic databases in order to compare genes in healthy and diseased tissue, to identify new therapeutic targets, and to understand the impact of new drugs.

Multimedia aided by hardware and software advances is expanding the realm of applications of high performance computing into the arts and entertainment. Distributed multimedia technology is increasingly critical in highly content-driven creation and delivery applications, such as real-time news and entertainment, computer animation, navigation of image-intensive databases, and 3D virtual environments. New computing technology offers the opportunity to migrate creation and delivery applications to off-the-shelf systems, which offers significant enhancement in research productivity hither to not available.

In order to achieve excellence in higher education, quality research is very important. To do quality research it is essential to have a general academic ambience, supported by modern technological aids besides collaboration/interaction with industry. However, many of the Universities in the third world countries like India lack this ambience and the required support.

Application of Information Technology Devices/Services in University Libraries

The field of library and information service has undergone a revolutionary transition due to the modern technology. Thus, it makes easy the process of collection, storage, organization, communication of information for academic activities. With the advent of new information technology, libraries are now in a more conducive position to render more salutary service to the costumers. Besides each and every law of library science provides a sound background for applying Information technology devices/ services in the filed of library and information services. The motto of "save the time of reader/staff" can be achieved by way of application of information technology.

The advent of internet facilities and availability of electronic or digital libraries overshadow the existence of traditional libraries. It is also thought that at one click of the mouse, computers draw all information to one's doorsteps. Libraries adhere to their basic principle of providing services for the sake of recreation, education, aesthetic appreciation and research activities. Now India is actively participating in the increasing application of the latest developments in the field of computer, telecommunication, laser, reprographics and micrographics in information handling.

Information technology is not just concerned with new pieces of equipment, but with a broader spectrum of information activities. Information Technology has produced new dimensions to the handling of information. The introduction of microprocessor and mini computers have eased the procedure and precious time of the scientists and research workers can be saved to a great extent by the application of 'Online' system

Information Technology and Digital Library

The most precious contribution of Information Technology is the birth of digital libraries. Digital Libraries are structured storage environments of

digital data with a consistent format for index and content abstraction. A digital library is a system consisting of collections of information resources stored in digital form with its associated technical capabilities for creating, searching and accessing information. DLS are networked collections of digital texts, documents, images, sounds, data, software and many more that are the core of today's Internet and tomorrow's universally accessible digital repositories of all human knowledge. The contents of digital libraries include data and metadata.

Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily available for use by a defined community or set of communities (Digital Library Federation, 1998)[12]. Digital Library is an assemble of digital computers, storage and communication machinery together with the context and software, needed to produce, emulate and extend those services provided by conventional libraries based on paper and other materials means of collecting, cataloguing, finding and disseminating information. A full service digital library must accomplish all essential services of traditional libraries and also exploit the well known advantages of digital storage, searching and communication (Fox *et al.*, 1995)[13].

A digital Library has the important characteristics such as network accessibility, user friendly interface, advanced search and retrieval, supporting multimedia content, accessibility from anywhere, home, school, libraries, during travel etc., providing access to very large collections including access to primary and secondary information, availability for long time, greater opportunity for publishing etc. (Ramesh, 2006)[14].

In pursuit of its primary mission to support and enhance the University's teaching, learning, research, and public service programs by providing access to information resources and library services, a strategic plan of using computing and information technologies to enhance and extend this access. More must be done to meet the escalating information needs of students and faculty. Funds available for information resources, encompassing not only traditional library materials located on campus, but also the increasingly rich and diverse world of electronic information, have steadily fallen behind those of peer institutions.

NEED AND SIGNIFICANCE OF THE STUDY

The revolution in Information technology is influencing the concepts and practices of education system world wide. In the developing societies, more specifically in the societies of Asia Pacific, multi-technologies co-exist. On the one hand, there are traditional educational institutes untouched by waves of technological revolution whereas on the other hand there are also some educational institutions with state of the art facilities of education technology. There are still many institutes where the teaching /learning process is limited to chalk and blackboard based lectures where as there are institutes having Internet, and multimedia system. The broad disparity in teaching-learning process exists mainly due to lack of vision, interest, financial paucity and other factors among the educational institutions. There is a great need to develop a new policy relating the application of IT supported education for better delivery of education, easier access to a number of knowledge sources, sharing of opinions, views, attitudes etc. in the field of Education. The adoption of IT in all levels of educational institutions is necessary for personal and national growth. Education along with information and communication technologies can be viewed as an instrument of change, of growth and development of the country to cope up with the advanced countries of the world.

For the last 50 years, advances in the field of technology have been most spectacular. The advent of television, audio and visual recording equipment and satellite broadcasting have made the lives of individuals much richer by bringing into their home music, drama and entertainment, microcomputers have also brought fun and games to the home in addition to a range of talks which can be performed by a computer as a tool at greater speed.

Highly sophisticated information service ranging from elaborate abstracting and indexing services to computerized databases in almost all scientific disciplines are in wide use all over the world. The current developments in computer technology include minicomputers, microcomputers, personal computers, portable computers, supercomputers speaking computers, computers with IQ, seeing robots, microchip technology, artificial intelligence, software developments, CD-ROM technology machine readable databases etc.

The major revolution in the telecommunication technology area are audio technology, audio visual technology, teletext, video text, telefacimile, on line search, E-mail, satellite technology, Fiber optics, ISDN, Networking, teleconference, cellular telephones, voice mail, communications etc.

Information or knowledge recorded is static unless it is used. The use of information makes it kinetic and generates more knowledge. Thus new science and technology rest firmly on foundation laid by the information generated in the past effectiveness of future and efficiency of present information transfer. Further, the need of this technology arose partly due to the concept of multi-media documents, i.e. the conventional printed book also taking up other forms such as Microform, sound records/cassettes/films which require special equipment for their processing and partly to meet the requirement of fast and accurate information and it transfers over long distance.

The revolution in information technology is transforming the way the knowledge is stored and exchanged, touching the very core of culture. This is the age of information explosion in which large amount of information is being generated at every moment. The ability to collect, store, and disseminate the

large amount of information needs applications of new technologies. New information has become very vital tool or basis of power, possession of which reveals political, economic and social advantages over other groups. Technological advancement is also emerging equally fast as the expectation level to cope with the large amount of information or to meet the challenge of ever increasing amount of information.

The current era is hailed as “The age of information explosion”. The impelling force behind such an explosion is the exponential growth of literature in all fields of human knowledge and ever increasing number of documents in each subject area, due to the laudable advancement of science and technology during the last few years. Such growth has been creating problems for selection, acquisition, organization and services in libraries.

In the higher educational context, Universities are supreme authority for imparting advanced level knowledge and are considered as one of the major fields for the effective introduction and application of information technology with innumerable possibilities. Besides, advanced level teaching, learning and research, IT can be effectively applied for curriculum development; planning and management; and library and information services.

In these circumstances it is worthwhile to understand the application and utilisation of Information Technology in teaching, learning and research. Understanding the available IT infrastructure in universities will enable the academic community to decide on using the facility and to understand the level of under utilization. Hence, the study is aimed at understanding the type of Information Technology facility available in universities.

The availability of the facilities does not ensure its application. Only the effective and efficient application of available IT facilities will bring about changes in the academic scenario. As the study aims at understanding the level of application of IT devices and services for teaching, learning and research it is expected that the result will bring to light the how far the university education system is applying modern technologies for their activities.

The study also aims at understanding the utilization of IT devices and services in universities. Hence, it is expected that the result of the study will help the administrators and educators to take necessary steps to ensure optimum utilization of IT enabled technologies. Understanding the barriers in using IT devices and services also will help the administrators to make necessary corrections.

STATEMENT OF THE PROBLEM

Information Technology has become essential in all the human activities including teaching, learning and research. Information Technology devices/services are works tools for instruction and to support students, teachers and research scholars in their academic pursuit

The present study is entitled as **"A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDUCATIONAL CONTEXT IN KERALA"**

DEFINITION OF KEY TERMS

The important terms of the problem under study are:

1. Introduction
2. Application
3. Utilization
4. Information Technology
5. Higher Educational Context and
6. Kerala.

Introduction

The term “Introduction”, according to Oxford English dictionary (1970)[15] is, something introduced, a practice or thing introduced; a practice or thing newly brought in etc.

In the present study Introduction means newly brought in IT devices and services which are available for teaching, learning and research.

Application

The word “Application”, according to Oxford English dictionary (1970)[16] is putting of anything to use or purpose; specific use.

In the present study Application means putting the Information Technology devices/ services into use for teaching, learning and research.

Utilization

According to DK illustrated Oxford dictionary (1998)[17] the word “Utilize” means use effectively.

In the present study Utilization means using Information Technology devices and services effectively for teaching, learning and research.

Information Technology

According Webster’s new encyclopedia (1992)[18], Information Technology is the collective term for the various technologies involved in the processing and transmission of information. They include computing, telecommunication and micro-electronics. The dictionary definition holds good in the present study.

UNESCO defined Information Technology, as scientific, technological and engineering disciplines and management techniques used in information handling and processing, their applications, computers and their interaction with men and machines, and associated with social, economic and cultural matters.

Higher Educational Context

"Higher Education is defined as all types of education (academic, professional, technological or teacher education) provided in institutions such as universities, colleges, technological institutes for which: a) the basic entrance requirement is the completion of secondary education; b) the usual entrance age is about 18 years; and c) in which courses lead to giving of a named award (degree or certificate of higher studies)". (Encyclopedia Britanica, 15th ed.) [19].

The word "Context" is defined in DK illustrated Oxford dictionary (1998)[20] as relevant circumstances.

In the present study higher educational context refers to circumstances of university teaching, learning and research.

Kerala

Kerala is one of the constituent states of Indian Union which is famous for its literacy rate and as a model to the rest of India in the field of education and health and social awareness.

OBJECTIVES

OBJECTIVES

The following are the important objectives of the study.

1. To understand the availability of Information Technology devices/ services for teaching, learning and research in the universities in Kerala.
2. To examine the existing level of application of various Information Technology devices/services for teaching, learning and research process in the higher educational context in Kerala.
3. To examine the level of utilization of Information Technology devices/ services for teaching, learning and research.

4. To know the levels of barriers in utilizing the existing Information Technology devices/services efficiently and effectively among the teachers, students and research scholars of the universities in Kerala.

5. To examine whether there exists significant difference among the universities in Kerala in the availability, application and utilization of Information Technology devices/ services in teaching, learning and research.

HYPOTHESES

The hypotheses of the study are:

1. There is high level of availability of Information Technology devices/services for teaching, learning and research in the universities in Kerala as a result of the introduction of Information Technology.

2. The level of application of various Information Technology devices/service for teaching, learning and research process in the higher educational context in Kerala is high.

3. There is high level of utilization of Information Technology devices/services for teaching, learning and research.

4. The level of barriers of the utilization of existing Information Technology devices/ services efficiently and effectively among the teachers, students and research scholars of the universities in Kerala is high.

5. Significant difference exists among the universities in Kerala in the application and utilization of Information Technology devices/services in teaching, learning and research.

SCOPE AND LIMITATIONS OF THE STUDY

Scope

The present study is an attempt to explore the introduction, application and utilization of Information Technology in the higher education context in Kerala. Most of the Universities in Kerala are spending a huge amount towards the sophistication of teaching, learning and research especially with the assistance from University Grants Commission, State government, and the Government of India. Hence, the study aims at understanding whether academics get proper Information technology devices/services for their various academic activities.

To get good result from academic activities Information Technology should be properly applied. The proper utilization of Information Technology is to be ensured for reaping the results. The barriers in the optimum utilization of the IT infrastructure will result in the total failure of the system. All these things need to be studied for framing proper IT policy in universities and to ensure better utilization of the IT infrastructure for the benefits of the academics. Thus, the application, utilization and barriers to use IT devices and services come under the purview of the study.

Limitations

Any research will have some limitations**.** The present study is limited to the geographical area of Kerala. This is because of the special nature and status of education in Kerala.

The study is limited to three major universities in Kerala viz. Kerala University, Mahatma Gandhi University and Calicut University. The other universities in the state are either specialized in nature or newly born.

As it is neither possible nor feasible to take the whole teachers, students and research scholars in Kerala, the study is limited to a sample of 1025 respondents which is constituted by 245 teachers, 565 students and 215 research scholars.

In spite of these limitations, the investigator hopes that the study will reveal the required results.

ORGANISATION OF THE REPORT

The main body of the report is presented in six chapters. The preliminary part, bibliography and appendices are also given at appropriate places. The main body of the report is organised as detailed below.

The first chapter constitutes ‘Introduction’ which contains a brief outline of the problem, need and significance of the study, statement of the problem, definitions of key terms, objectives of the study, hypotheses of the study, scope and limitations of the study and organisation of the report.

The second chapter provides a short profile of the universities under study.

In the third chapter gives a review of literature, which are relevant related to the present study.

The fourth chapter is methodology. It presents the variables, objectives of the study, hypotheses of the study, tools used for data collection, sample used for the study, sampling technique, sample size, data collection procedure, consolidation of data and statistical techniques used.

The detailed analysis of the data by using different statistical techniques is presented in the fifth chapter under the heading ‘Analysis’.

The sixth chapter ‘Findings, Conclusions and Suggestions’ presents the methodology in retrospect, major findings, conclusion, tenability of hypotheses, implications and suggestions and suggestions for further research.

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OVERVIEW OF THE UNIVERSITIES UNDER STUDY

This chapter presents a profile of the three major Universities of Kerala namely University of Kerala, Mahatma Gandhi University and University of Calicut which are selected for the study. The other universities in Kerala are newly emerged or specialized in nature.

UNIVERSITY OF KERALA

The University of Kerala is an affiliating University located in Thiruvananthapuram in Kerala State, India. It was established in 1937, long before the birth of Kerala State in India. The university has sixteen faculties and forty-one departments of teaching and research. There are eighty-one affiliated colleges under this university. Of these forty, five are aided first grade Arts and Science Colleges, eight are unaided first grade Arts and Science Colleges, two are law Colleges, four Engineering Colleges, two Medical Colleges, seven aided Teachers Training Colleges, six unaided Teachers Training Colleges, one Ayurveda College, on Homeopathy College, two Fine Arts Colleges, one Music College and one College of Physical Education. Besides this, there is an affiliated institute conducting 2-year full time MBA course. The University has recently started an Engineering College in its Kariavattom campus. The area of the jurisdiction of the University of Kerala has been limited to Thiruvananthapuram, Kollam, Alappuzha Districts and some parts of Pathananthitta District. It is also ranked 3rd by the Outlook India magazine for the year 2007 in the top 50 government Universities in India.

KERALA UNIVERSITY LIBRARY

Kerala University Library started in the year 1942 and is the oldest university library in the state of Kerala. The 65th year of its existence was completed in the year 2007. The Kerala University Library is situated in the heart of Thiruvanandapuram city adjacent to the main campus of the university. During these years Kerala University Library has become the major centre of study and research for the academic community of the university departments and affiliated colleges of the university. The library is housed in a permanent and spacious building, and has almost all the most modern computer and communication facilities

Kerala University Library is offering a variety of services to its users, which includes circulation of reading materials, inter library loan, Internet, e-mail, CD-ROM search, OPAC search, compilation of bibliographies and indexes, reprographic services, referral service, micro film reader and print out service, publication of current contents, world book, e-library search, e-journal search and services, weekly publication of new additions, display of recent additions etc. A nominal charge is being levied for most of the information technology assisted services. User amenities like drinking water, dining hall, canteen and toilet facilities are also provided.

MAHATMA GANDHI UNIVERSITY

The Mahatma Gandhi University was established on October 2nd 1983 by the Government of Kerala through an Act of the Legislative Assembly. Spread over Kottayam, Ernakulam, Idukki and some parts of Alappuzha and Pathanamthitta districts, the M G University is the largest of the seven Universities in Kerala having affiliated colleges. Presently the University has 22 teaching and research departments/schools.

Mahatma Gandhi University has 10 inter disciplinary Schools of teaching and research and 12 schools of higher learning in applied science and professional studies, with academic autonomy. The courses in the departments are conducted in the credit and semester system. Mahatma Gandhi University offers research facilities and guidance in over 40 disciplines through its own departments as well as 114 approved research Centres. The University is in the process of setting up a dedicated Intellectual Property Facilitation Centre, in order to promote research, acquisition of IPR's and technology transfer.

MAHATMA GANDHI UNIVERSITY LIBRARY

Mahatma Gandhi University Library, popularly known as MG University Library, was established in the year 1989. It is housed in a permanent and convenient building at Priyadarshini Hills, Kottayam. The University is having a web-enabled Central Library and 21 Departmental Libraries, 4 Study Centres and 6 Information Centres. The Central Library is linked to the U.G.C. sponsored INFLIBNET enabling on-line subscription of over 2500 National and International research journals. The University Library is the first in Kerala, to set up the on-line information retrieval facility. The primary aim of the library is to cater to the information requirements of the academic community of the Mahatma Gandhi University and to the academic community in the state especially in the central parts of Kerala.

Mahatma Gandhi University Library is offering a variety of services to satisfy its clientele. The services are both conventional and modern in nature. Services it offer include, cataloguing, indexing, photocopying, inter library loan, current awareness, referral, e-mail, Internet browsing, online search, display of recent additions, CD-ROM search, information board, micro film/fiche and provision for electronic journals.

UNIVERSITY OF CALICUT

The University of Calicut, the second university to be set up in Kerala, came into being in 1968 with the objective of developing human resources in the northern districts of Kerala by extending the reach of higher education and by promoting research in all areas of development with particular emphasis on technology and art and culture of Kerala. The University made the beginning by taking into its fold the four postgraduate departments set up by the University of Kerala at Calicut and 54 constituent colleges spread across seven northern districts. The University has surmounted challenges to emerge as the largest residential cum affiliating University in Kerala. Its 25 post graduate departments and 191 affiliated colleges have now become a veritable light house beckoning lakhs of young men and women to benefit from higher education. The University has introduced integrated M.Phil/Ph.D programme from 2004-05 academic year. To meet the demand for the trained in the emerging areas, the University has launched new programmes in computer application and information technology, printing technology, computer hardware and automobile engineering.

C H MOHAMMED KOYA LIBRARY, UNIVERSITY OF CALICUT

The Calicut University Library was started in the year 1971 later the name of the library was changed to C.H Mohammed Koya Library as a mark of respect to the late Education Minister, C.H Mohammed Koya who took initiative to establish the University in the educationally backward area of Malabar. The library is functioning on the main university campus at Tenhipalam in a spacious building.

The University Library has 90958 books, 4617 non-book materials, 205 microforms, 36 CD-ROMs and 2105 bound volumes of periodicals in its collection. Recently the library has joined the UGC Infonet programme of the INFLIBNET to avail the journals via online. The users have access to around

2400 full text electronic journals under this programme. Library has recently created an exclusive section for providing this service with forty terminals.

The services offered to the users include, reference, periodical, cataloguing, bibliographic, indexing, photocopying, lending of books, inter-library loan, information board, display of recent arrivals, e-mail, Internet, online search, literature search and provision for electronic journals.

* * *

REVIEW OF RELATED LITERATURE

For a worthwhile study in any field of knowledge, the researcher needs to acquire adequate familiarity with the works that have already been done in his area of choice. The process of review involves identifying, locating and evaluating reports of relevant researches, study of published articles, going through related portions of encyclopedias, research abstracts, pertinent pages of books on the subjects, manuscripts if any and even non-book materials. A properly carried out literature review can help the researcher to formulate a sound research design and appropriate tools for the successful completion of the study. The variables, data collection tools and statistical techniques used in the present study have been selected after an exhaustive review of the available literature in this field.

Review of related literature enables the researcher to define the limits of his field, keeps the researcher up-to-date, avoids unfruitful and useless problems, helps to avoid duplication, gives the researcher an understanding of the research methodology and tools and instruments, gives an insight into statistical method and to know about the findings and recommendations of previous researchers (Koul,1984)[1].

Rout (1982)[2] presented a quantitative model for measuring users' satisfaction along with the results of a sample study undertaken to measure the users satisfaction with the important services offered by the Central Library, Sambalpur University. The three possible levels at which evaluation of library services may be carried out were delineated by the author. The criteria for evaluating retrieval system had been examined. The author considered the several possible viewpoints by which the performance of any library and information service can be measured. The services evaluated under the sample study covered the document acquisition policy, document delivery service, technical processing, documentation service and the delegated search offered by the library.

Strassmann (1985)[3] reported disappointing evidence in several studies. In particular, he found that there was no correlation between IT and return on

investment in a sample of 38 service sector firms: some top performers invest heavily in IT, while others do not. No relation between spending for computers, profits and productivity was found.

Biswas (1986)[4] conducted an investigation into the curriculum implementation for primary schools in Bangladesh. The main objective of the study was to determine the extent of utilization of local resources in implementing curriculum. Major findings were that the schools did not implement the curriculum appropriately on prescribed by the National Curriculum and syllabus committee by providing direct and living experience to students through utilizing local resources, the problems for the situation were related to lack of physical facilities, time table, non-availability of appropriate teaching aids in local areas and high work load as perceived by teacher.

Ramachandran (1987)[5] attempted to analyse the problems of higher education in India with special reference to Kerala. His aim was to identify vital problem-areas in higher education such as enrolment, expenditure, financing and planning, assess the total costs in higher education classified under different institutional categories and compare costs of higher education by components and the sources of financing these costs. The bulk of public expenditure on higher education was spent for the development and maintenance of the Arts and Science Colleges in Kerala and the salaries of the staff constituted the largest component in the total cost of education. He concluded by stating advantages and disadvantages of incorporating Information Technology applications, such as Internet, within the social work curriculum.

Devarajan (1988)[6] analysed the whole situations of IT in India and opined that utilization of IT in the dissemination of information at a faster rate would have high relevance in the present day education. The various aspects of education such as learning, training, and research which need a radical change were amenable to the application of IT. The government, educational institutions and all over the concerned should make use of IT devices/service in rejuvenating education.

Parsons *et al.* (1990)[7] estimated a production function for banking services in Canada. They found that the impact of IT on multifactor productivity was quite low between 1974 and 1987. They speculated that IT had positioned the industry for greater growth in the future.

Parthasarathy and Neelmeghan (1990)[8] suggested certain functions of human expertise to the design and development of computer based information systems and services. According to them, understanding of user's Information needs and information seeking behaviour through appropriate analytical studies, analysis and organization of structuring data, abstracting and extracting information, preparing information retrieval strategies, preparing suitable application software, interacting with computer specialists and software engineers require persons with knowledge and experience in documentation and information. Therefore the present curriculum in the library and information science courses should be restructured in tune with the application of modern Information Technology products/services.

Kemparaju (1990)[9] attempted to identify the role and impact of Information Technology on library and Information Science activities. He depicted the changing scenario in profession of Library and Information Science due to the impact of emerging Information Technology. The knowledge and skill requirements in Library and Information Science personnel to interact with the changing environment were identified and suggested the measures for development of the same to meet the present and future challenges in the profession in the context of emerging technology.

Younis (1990)[10] reviewed the historical development and factors affecting the library movement in Jordan and explored the extent of computer applications in 333 libraries in Jordan. Out of the 225 libraries that responded only 3.9 percent of them used computers for cataloguing, circulations, serial controls, acquisition records and correspondence. Problem, solutions and future plans were also pointed out by the investigator. Problems that obstructed the use of computers were the lack of trained staff, funds, physical facilities, software, user's indifference, and administrative factors. The study

also suggested solutions to improve libraries chances to adapt new computer technologies to improve their functions and services to users.

Prabhakar (1991)[11] recognized the importance of information source. The advent of computers, telecommunications, micrographics, micro electronics, printing and reprographic technologies brought about remarkable changes in the information field. These technological innovations revolutionized the information scene thus changing the world of information for a better future. The major changes were taking place at libraries, information centers etc. throughout the world with India making slow but steady progress.

Subramoni (1991)[12] highlighted the importance of communication in library. In his view the most important function of a library was to help the users by providing as much information as possible. Methods followed by librarians in order to achieve the objective of effective communication were distribution of brochures, user education, use of signs and guides, oral communication and non-verbal communication. The author pointed out user education as an important aspect of library communication, which is often neglected. The paper highlighted the importance of having good system of communication in a library. The author hoped that good communication could be achieved by willingness on the part of the library staff.

Swain and Cleveland (1991)[13] pointed out that access to bibliographic information greatly improved through the use of IT devices/services. The delivery of primary documents to end users remained largely dependent upon traditional methods. Users were able to find what they need quickly and easily but often experienced long delays in receiving the requested information. The disparity between information access and document supply potentially could be overcome through electronic forms of document and transfer media to automate the entire document delivery process.

Rosamma Joseph (1993)[14] presented the results of an evaluative study on the services provided by the Calicut University Library and the departmental libraries. Primary data collection was undertaken by making use of

questionnaire and interview techniques. The category under study consisted of research scholars and students from the Faculties of Science, Social Science and Humanities. The evaluation of the libraries was carried out and analysed under the aspects such as frequency of visit to the library, time spent in the library, adequacy of reading materials, non-availability of books, satisfaction of the users with regard to the arrangement of books, library timings and present library services. The study found out that half of the respondents were not satisfied with the services of both the central library and the departmental libraries. The investigator urged the authorities to take immediate steps to make the library services more effective. Dissatisfaction with insufficient light, frequent failure of electricity and lack of sufficient seating facilities were reasons for complaint from users.

Hadley and Sheingold (1993)[15] conducted a study involving known technology integrators at the 4-12 grade level. Their factor analysis identified seven themes which accounted for over 50 percent of the variance. The most cited barriers to technology integrators were poor administrative support, problem with time, access, space supervision, and operations, poor software, poor curriculum integration difficulties, teacher's attitude and knowledge towards computers, computer limitations and inadequate number of computers and lack of technical support.

Kumar (1993)[16] conducted a study to assess the application of Information Technology in health science libraries. The tools used to collect data were questionnaire and personal interviews. It revealed that the problems faced by the health science libraries in Delhi were not much different from those faced by similar libraries. The barriers for under utilization of Information Technology were, insufficient funds, lack of adequate trained manpower, lack of motivation from library professionals, lethargic attitude of authorities and poor communication system of the country.

Aina (1994)[17] stated that computer literacy is now widely accepted as an essential part of elementary education of an average citizen in most developed countries. Computer application in an automated information system and the

computer operating systems had developed to such a stage that operations of a computer could be completely managed by personnel with secondary school education. The article emphasized that the library profession requires knowledge of computer science and that the librarian should not be a computer illiterate. Computer literacy was found to be a must for the librarian to meet the challenges of information revolution.

Diewert and Smith (1994)[18] provided a case study of a large Canadian retail distribution firm. They found that the firm experienced an astounding 9.4 percent quarterly multifactor productivity growth, for six consecutive quarters starting at the second quarter of 1988. They found the large productivity gains were made possible by the computer revolution which allowed a firm to track accurately its purchase and sales of inventory items and to use the latest computer software to minimize inventory holding costs.

Abels *et al.* (1994)[19] examined the adoption and use of electronic networks by science and engineering faculty at small institutions in developing areas. They found that accessibility and the number of people sharing a workstation were important attributes that influenced the use of the network. For those scientists in developing countries, who had no easy access to computers with Internet connection would inhibit their use of this technology

Garg, (1994)[20] analysed the problem of Information Technology in India. Backward physical infrastructure of IT, problem of computer literacy and the high cost of computer hardware were the most important problems. Five measures were put forward by him- computers in very high schools, information foot path aimed at linking all the colleges in the country with ERNET and creating employment by way of bibliographic data base business, citizen based radio to serve as the poor man's communication facility, club in every school to generate the scientific spirit among the children.

Waston and Tinsley (1995)[21] suggested the ways in which IT could be integrated into education in a beneficial manner. They include the formulation

of specific Information technology education policies, in the allocation of important economic resources and efforts in human investment and also in the increasing number of international approach to exchange information, knowledge and experience.

Matheswaran (1995)[22] studied the utilization of the supporting service system by IGNOU learners. The objectives of the study were to analyze the utilization of self instructional material (SIM) by IGNOU learners. The investigator reported that majority of IGNOU learners were not viewing IGNOU programme regularly. The analysis revealed that only 14 percent of the learners were viewing the programme. Regarding the visiting and utilization of library facilities 14 percent of the learners were using the library and the rest of the learner were using the facilities very rarely Only 23 percent of the learners were attending counseling session and clarified their doubts and the rest of the learners were not attending the counseling sessions.

Steaven (1996)[23] made an investigation on assessing the support related needs of Information Technology uses in Higher Education setting. In his findings the assessment was conducted by a group of faculty, students and staff who drew an existing date to identify there fundamental needs namely need for effective training support, effective help and effective dissemination of information regarding availability and status of Information Technology related service programmes.

Walsh and Bayma (1996)[24] examined the use of computer mediated communication technology among scientists in four different fields: mathematics, physics, chemistry, and experimental biology. They found that mathematicians, who had traditionally worked alone, increased remote collaboration through the use of email. For physicists, who had traditionally collaborated with large numbers of other scientists, email was a helpful addition to the face-to-face interaction. Chemists and biologists reported that email provided more frequent communication than was available previously, resulting in coordinated experiments. Overall, they found that CMC increased

collaboration by overcoming geographical barriers, increasing the frequency of communication among those involved in a collaborative research project, and providing opportunities and resources to scientists who were new to the field or located at less prestigious institutions

Gill, *et al.* (1996)[25] found information as the most recognized resource for socio economic, scientific and technological progress of mankind as a whole. During the recent years, increase in information led to increase in the demands of the users. Libraries contributed much to information revolution. Due to prevailing financial and space crisis in almost all the Indian libraries, he viewed it reasonable to think of promoting IT to meet out the challenges posed by increasing information needs and exploding information. The author in his article presented the real meaning of IT, its past and current developments and its impact in the social sphere through its information centers. He gave a brief description about the various library networks and their need.

Rajashekar (1997)[26] made an attempt to draw an overview of the science and technology information resources on Internet. According to him, qualitative improvements in scientific and technological communication were being brought about by the Internet through global connectivity of computers and the development of tools and techniques for information provision and access. The WWW, integrating all other access tools, provides a very convenient means for publishing and accessing multimedia and hyper text-linked documents stored in computers across the world. These include electronic journals and newsletters, tables of contents, technical reports, software and scientific data archives, library catalogues, discussion forums and dictionaries etc. Trends in Internet based scholarly information and developments specific to the Indian context were also briefly discussed.

Khan (1997)[27] viewed web based instruction as a powerful, interactive and dynamic medium for delivering information. He found many applications for, the www (web) in combination with Information Technology (LAN, WAN, Internet etc.). One popular application was for educational use, such as web-based distance distributed or online learning. The use of the web as an

educational tool provided learners and educators with a wider range of new and interesting learning experience and teaching environments, not possible in traditional education

Vyas, (1997)[28] reviewed the information science field in India. According to him automation and networking of academic libraries were still in their formative stage. The constraints of networking in Indian academic libraries were lack of effective networking and communication technology, tardy implementation of proposed networks, lack of uninterrupted power supply, lack of foreign exchange for importing proper hardware and technological backwardness. He concluded that technological advances did not percolate to the grass root level, and so the rural community is denied the benefits of progress. Therefore, efforts should be made to remove the barriers, to make rapid strides in the field of Information Technology in India.

Sharma (1997)[29] made an attempt to analyse some of the aspects of globalisation of Indian business education. He highlighted the major constraints for falling the global standards of business education such as traditional curricula in the majority of the business schools and lack of suitable teachers, well equipped libraries, modern teaching aids, rich study materials, resources and infrastructure facilities, research facilities for teachers, collaboration of Indian business institutes with other business institutes outside the country, co-ordination between commerce and management streams, interaction between business schools and industries and the present liberal approval policy for business schools. In the light of the constraints, he suggested globalisation of Indian business education. In order to enrich the quality of teaching at this level the institute should have modern teaching aids, like audio/video cassettes in related areas, overhead projector, slide projector, TV and VCR etc. In addition to this, the institute should have computer laboratory with state-of the art hardware, software and statistical packages relevant to the students, teachers and researchers.

Kumar and Tripathi (1997)[30] made a survey regarding the constraints in the use of electronic devices in teaching and learning process in agricultural

education. The investigators employed survey method through questionnaires containing both structured and open ended question to gather information. They identified 12 problems related to personal, media, infrastructure facilities and administration. The identified problems were listed and respondents were asked to rank each of the problems on three point continuum of most important, important and not important. The investigators identified major constraints such as lack of own media production facility, paucity of funds for infrastructural facilities, lack of knowledge of media potential and lack of training in media. Lack of administrative support inversely related to teachers motivation. The teacher who put his effort in thinking preparing and using media to make his teaching effective was never rewarded. Due to this, teachers generally gave undue recognition to research at the cost of teaching, including full exploitation of these technologies. The study concluded with possible recommendation, such as training the teachers with available equipment, providing timely unbiased expert recommendations and providing incentives to motivate teachers to use electronic devices for teaching learning process.

Passey and Samways (1997)[31] found that despite teacher training programmer, increasing ICT resources in schools and the requirements of national curricula, there had been a disappointing slow uptake of ICT in schools by the majority of teachers.

Anderson *et al.* (1998)[32] identified widespread barriers in integrating technology such as lack of computers, lack of quality software, lack of time, technical problems, teacher attitudes towards computers poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skills, lack of incentives, poor training opportunities, and lack of vision as to how to integrate.

Jefferies and Hussain (1998)[33] conducted a study on the use of internet in teaching. The main objective of the study was to examine how the Internet used to support learning and teaching. The tool used was questionnaire. The investigators sought to identify the students' perceptions of the usefulness of the Internet as recourse in support of their studies. The study found out that

internet could provide enormous potential for collaborative working and learning. It could provide a global faculty for providing virtual environment and real time simulations.

Munshi and Malhan (1998)[34] highlighted some of the common problems of adoption and absorption of information technology in developing countries with special reference to India. Some of the developing countries had already started developing their facilities to improve their information accessibility using IT. Many other developing counties strengthened their facilities. The developing countries faced several problems in providing quick access to relevant information to their people. Human resource development, information literacy, telecommunication and power and bureaucracy were found to be the most important problems in administering IT in India.

Munshi (1998)[35] made a study about Information Technology and the curriculum process in developed and developing countries. The changed role of the North American Teacher, the inter relationships among Information Technology, the curriculum process, student exposure to Information Technology and the role of the teacher in developing countries and in the developed world were studied. The study provided highlights about the tremendous amounts of information readily available and accessible through computer networks around the world. The study revealed that students exposure to Information Technology and computer networks varies, ranging from little or more in developing countries. The study discussed the changed role of North American teacher and highlighted implications of classroom practices and teacher qualities. The study suggested collaboration between teacher in the developed world and the developing world to reduce the ever widening gap with regard to Information Technology.

Garg and Namasivayam (1997)[36] made a study about the development of information technology infrastructure at the international level. The study was

aimed at analyzing the development of information technology infrastructure in the 21st century. The study revealed that high income nations were in the most advantageous position since they have the material and manpower resources to establish IT frame work suitable to their requirements. The IT scenario in the developing countries was found to be very much discouraging and they fell far away from the mainstream. This situation warned the middle and low income nation to reorient their IT policies in such a way to make available a full range of IT services to support the reintegration of their countries into the world economy.

Malaiswamy (1998)[37] highlighted the importance of computers in education. It made learning for the student easy and teaching by teachers interesting. The greatest advantage was that the excellent study material prepared by one good teacher could benefit thousands of other teachers and millions of students who were separated by oceans. He viewed that the much needed transformation in education: the learning, teaching and research aspects should utilize the tools of IT.

Mathew (1998)[38] in his article "*Role of information technology for the sustained development of Kerala: strategies and policies*" highlighted the importance of information technology in the economic development of Kerala and proposed an action plan to derive benefits of the emerging international information economy. The superior brain power and the human resource with high knowledge absorption capabilities were sure to enable Kerala to achieving this. The proposed action plan includes restructuring of educational system from primary to university level, marketing of unique bio- resources of Kerala, establishment of a school of informatics and future system studies, starting of super speciality medical care and educational services, entering into tele-education and establishment of a software technology centre. He opined that this would enable Kerala to become the world centre of knowledge based industries and services.

Bansal and Kiron (1999)[39] conducted a study on interactive radio for supporting distance education. IGNOU started on interactive radio project

with the objective of interacting with students in their own languages and sharing experiences with them. Findings revealed that students appreciated the interactive radio sessions for helping accomplish course effectiveness and that students participation in the sessions was higher than in teleconferences and face to face session.

New House (1999)[40] in a longitudinal study built around a portable computer program stated that many of the common barriers associated with the adoption of the innovation were still present. Some of the barriers preventing teachers from integrating technology were poor computer literacy, lack of time, lack of confidence and hardware malfunctions. Though access as a barrier had been overcome, others still remained.

Sooryamoorthy (1999)[41] made an empirical study of 23 schools in a selected region and explored the dimensions of school education in Kerala and offered some insights in to the linkage between infrastructure and performance. Schools in Kerala did not have adequate facilities to meet the minimum requirements of the students. It affected the academic standards and pathetic condition of the schools. The study also revealed the inter relationship between three important component of a school system, namely infrastructure, academic standards and performance.

Dulle *et al.* (2000)[42] made a study aimed at assessing agricultural researchers access to information technology facilities. They also examined to what extent Information Technology facilities were used in facilitating researcher's access to scientific information. Data were collected through questionnaire survey from 321 agricultural researchers. The study revealed that 170 (69.7 percent) reported having access to Internet-email facilities, while 79.3 percent of the respondents having access were using facilities frequently for information search. CD-ROM technology was not readily available to many respondents. The study concluded that along with a low level of Information Technology development in the country, the existing Information Technology facilities had not been fully exploited to facilitate agricultural researcher's access to information. Some measures to improve Information

Technology infrastructure and its use for improvement of research productivity were recommended.

Karim *et al.* (2001)[43] investigated on the role of radio and TV Programme in distance and open learning taking the case of Bangladesh Open University. The main objectives of the study were to asses the effectiveness of Bangladesh Open University radio and TV Programmes. The findings of the study were the radio sets were available to more than 80 percent of the total participants while only 50 percent found it effective and helpful.

Soman (2001)[44] conducted a study of the scientific productivity and information use pattern of scientist in the context of Information Technology with special reference to Universities in Kerala. The study was an attempt to asses the scientific information productivity of physical scientists in the Universities in Kerala to find out the factors that affect the scientific information productivity and to examine the role of Information Technology in augmenting the scientific productivity of scientists. This study also attempted to test the validity of the two theories of knowledge formulated by Mathew. The study had special implications in formulating national strategies and policies in higher educations, science and technology and application of new technology in this realm of higher education, scientific learning and research.

Williams (2001)[45] conducted a study to evaluate the development and implementation of web-based key skills material at the University of North London. Data were gathered from in-depth interviews with staff and students. One-to-one and some group interviews and E-mail correspondence were also carried out. The study revealed that the web could be a marvelous medium for information dissemination and interactivity, but it could only facilitate true learning if it genuinely met the needs of those for whom it was employed.

Monopoli *et al.* (2002)[46] conducted a study on the electronic journals service of the library and information service of the university of Patras, Greece. The study was concerned with users of the electronic journals service, how often they used, their reasons for use, their access points for use and which search methods and services they used. The overall objective of this study was

to enrich knowledge of the new digital information. An online questionnaire was used to collect the data. The questionnaire was made available on the e-journals service website for a period. The major findings of the study was that the users had no time to evaluate information accounts for the growth of online organised collections of digital information. The second most cited problem was the lack of time to search for information. In general users were well disposed to the general idea of electronic information resources.

Sing and Garg (2002)[47] conducted a survey regarding the impact of Information Technology is transforming the way, the health care delivered and biomedical research done. Computer based bibliographical, clinical, geographical, meteorological, physiological, information systems; community health information network, telemedicine etc. were found to be the new ways of distributing biomedical information to consumers. The study suggested that it is essential to understand the social impact of IT on information centres and libraries, users and professionals of scientific communication, information seeking behaviour, use of biomedical information system, to grasp the changing scenario of information centres, which are vastly different from traditional information and library science.

Reddy (2003)[48] attempted to identify the opportunities of information technology for governments. He opined that electronic governance is the application of information technology to the process of Government functioning to bring about simple, moral, accountable, responsive and transparent governance. Information technology contributed hitherto untapped possibilities to the government to increases its efficiency and meet the challenges in all aspects of its activity. Access, storage, processing, organization and transfer of information and data to various levels of administration and to people as well as cost effective and speedy discussions and meetings, quick and speedy action based on timely reliable information were regarded as some of the advantages provided by application of Information Technology in governance. Transparency was made possible

which enabled participation of the people in development and it made democracy meaningful.

Noushad Ali and Hasan (2003)[49] conducted a study on satisfaction and requirements of visually impaired students of Aligarh Muslim University, with the objective of finding out the degree of utilization of library resources by visually impaired students. The study was conducted on a sample of 32 visually impaired students who used Moulana Azad Library, Aligarh Muslim University using interview and observation methods. The study revealed that most of the students took the help of library staff to locate documents. The collection of the total section was found inadequate to meet the academic needs of the users.

Rajesh (2003)[50] examined the problems associated with Information and communication technology (ICT) adaptability in developing countries in the context of distance education. In his opinion the communication technologies had come to play a vibrant role in democratizing education not only in the developed but also in the developing countries. The problems associated with the growth of ICT that had been focused upon in his study were the political, economic, cultural and technological factors.

Arulsami and Sivakumar (2004)[51] conducted a study to know the usage of multimedia in teaching and learning. For the study survey method of research was employed. For collecting data questionnaires were distributed among the teachers. The finding of the study was that the multimedia mode of teaching stimulated the students' minds and encouraged learning through all sense. It crossed the traditional boundaries of school, work place and home and enabled learners to choose materials at their own time at their own place.

Burd and Buchanan (2004)[52] examined the mode of teaching and learning through online. Different types of learning styles were examined in the study. The methodology used for the study was online interviews and mails. The study found out that online learning provided both the students and teachers with a fresh opportunity to engage in the learning process.

Prasad (2004)[53] in his article "Digital divide in India-narrowing the gap; an appraisal" presented a state of the art report on the attempts made at narrowing the digital divide in India. The various endeavors of the government and non government organizations in creating awareness in rural areas especially through information kiosks were also identified by the author.

The Hindu (2005, June 11)[54] in news report entitled "*smart class room project*" *piloted by the Malappuram District Panchayat"* highlighted the importance of the project. The project was expected to materialize through out Kerala when the 4600 odd primary, secondary and higher secondary schools in the state started using multi media projectors for teaching. Under this project in Malappuram all the 72 government high schools in the district got multimedia projector using digital light processing (DLP) technology. The students are no longer dependent on books and teachers alone. Their lessons were supported by audiovisual aids, including footages from history. Almost all subjects including mathematics were being taught with audiovisual assistance. The classroom would enter its second phase when educational content is broadcast digitally through 'Edusat'

The Hindu (2005, June 12)[55] reported the use of technology for spreading education through out the country. The report pointed out that the 'edusat' the countries exclusive satellite educational service, was expected to give a fillip to distance education; experts had emphasized the importance of utilizing technology based education facilities to ensure that they cater to the needs of the eligible and the needy.

Rajana Bhatia (2005)[56] in her article on ICT enabled teacher education expressed that new Information and Communication Technologies (ICT) were helpful to improve the learning. Students and teachers must have sufficient access to digital technologies and Internet in their classrooms, schools and teacher education centres. Teachers must have the knowledge and skills to use new digital tools and resources. The author suggested short foundation courses on ICT to teachers.

Dineshan Koovakkai and Hanna Noor (2006)[57] studied the information use among the faculty. The study was carried out among 50 university teachers in Kerala. A pre-structured questionnaire was used to collect the data. The study revealed that the availability of electronic information and the satisfaction of the teachers in the available resources are not high. Non-availability of full text, lack of time and lack of system speed were the most important barriers for the teachers in using the electronic information.

Mc Clellend and Hawkins (2006)[58] conducted a study on perception on the use and developments of a broad range of e-books in higher education and their use in supporting virtual learning environments. The purpose of this study was to examine the problems, tensions, contrasts and complementaries surrounding the use of e-books in developing learning environments for students in UK higher education. The methodologies selected by the authors were four case studies and a questionnaire to highlight developments. The study found that users wanted some features of paper books to be preserved in the electronic medium, while also preferring electronic text to be written in a scannable style.

Ramlogan and Tedd (2006)[59] conducted a study on the use and non-use of electronic information resources of the undergraduates at the University of the West Indies. The purpose of the research was to gather some empirical baseline information on the use/non-use of selected, subscribed electronic information services among full time third year graduates. The other broad objectives of the study were to present the survey findings, evaluate the survey's findings and propose any necessary recommendations. The research design involved a mixed quantitative and qualitative approach: a user survey using semi-structured questionnaires and face-to-face semi-structured interviews. The major-finding of the study was that over half of the total respondents had not accessed any of the Electronic Information service. Lack of awareness of the services availability was revealed as the over riding factor

for non-use. It was concluded that undergraduates made infrequent or no use at all of certain electronic information services largely from lack of awareness.

Dineshan Koovakkai and Harifa Menakath (2007)[60] studied the role of EDUSAT as a source of information for the academic pursuit of the teachers. The study was conducted on a sample of 150 teachers in Kerala using questionnaire. The study revealed that the most important purpose of using EDUSAT by the teachers was to update knowledge. Teachers found the interacting facility as the most important merit of EDUSAT. However, the frequency of their interaction was not found high. Lack of clarity and noise were the important barriers in using this facility.

Wu and Tsai (2007)[61] made a study about information commitments to learners online searching strategies and the evaluative standards that students used to assess the accuracy and usefulness of information in web-based learning environments. The study aimed to develop an information commitments survey for assessing the information commitment of 1220 colleges and graduate students. A series of multivariate multiple regression analysis were also conducted to evaluate the ability of students' evaluative standards as well as their internet experience for predicting their online searching strategies. Gender differences regarding the participants' usage of certain searching strategies were found in this study. The multivariate multiple regression analyses revealed that both the students' use of sophisticated evaluative standards and their internet experiences significantly predicted the use of sophisticated searching strategies, while their use of less advanced evaluative standards significantly predicted the use of less advanced searching strategies.

Conclusion

The survey of literature reveals that there are several relevant or related literatures in the field of Information Technology application in education. The literature reviewed gave the investigator an insight into the problem to carry out the study in a systematic way by developing proper methodology and analysis of relevant data and also finally to reach the valid conclusions.

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METHODOLOGY

Research methodology is the system of models, procedures and techniques used to find the result of a research problem. It refers to the philosophy on which the research is based. Research methodology involves the systematic procedures by which the researcher starts from the initial identification of problem to its final conclusions. The role of methodology is to carry on the research work in a scientific and valid manner. The method of research provides the tools and techniques by which the problem is approached.

The present study is an attempt to examine the **Introduction, Application and Utilization of Information technology in Higher Educational Context in Kerala**. The methodology followed for the study is described under the following headings.

1. Variables
2. Objectives of the study
3. Hypotheses of the study
4. Tools used for data collection
5. Sample used for the study
6. Sampling technique
7. Sample size
8. Data collection procedure
9. Consolidation of data
10. Statistical techniques used

VARIABLES

The variables used for the study are broadly divided into two, namely study variables and classificatory variables. The variables are selected in accordance with the literature reviewed for the purpose.

Study Variables

The study variables used in the present study are:

1. Availability

With the introduction of Information Technology in higher education, computers and allied devices /services are more or less available for various academic activities in the universities in Kerala. The level of availability of such devices/services is studied as part of this research work.

2. Application

Mere availability of Information Technology devices/services will not produce optimum results in higher education. The Information Technology devices/services are to be properly applied for teaching, learning and research for getting the desired output suitable for the present information age. Therefore an important area of the present study is application of Information Technology devices/services.

3. Utilization

Optimum utilization of the available technology is essential for achieving individual as well as organizational goals. Under utilization of the existing facilities will cause wastage of money and effort. Hence, the level of utilization of existing IT devices/services is another major area of this study.

4. Satisfaction

The satisfaction regarding the available IT devices/services in teaching, learning and research is measured to find out the efficacy of the existing system as well as qualitative and quantitative deficiency of the existing system.

5. Barriers

There may be various barriers in utilizing the existing facilities at optimum level. The barriers will hinder the very purpose of the academic activity of the higher education system. The major barriers in the proper utilization of existing IT devices/services for teaching, learning and research are studied in detail in the present study.

Classificatory Variables

As the application and utilization of IT devices/services may vary according to University. It is expected that the variable University is expected to create maximum variation in the availability, application and utilization. Thus it is chosen as the base for analysis. Under each University category of academic community (teachers, students and research scholars) is taken as sub classificatory variables.

OBJECTIVES

The following are the important objectives of the study.

1. To understand the availability of Information Technology devices/ services for teaching, learning and research in the universities in Kerala.
2. To examine the existing level of application of various Information Technology devices/services for teaching, learning and research process in the higher educational context in Kerala.
3. To examine the level of utilization of Information Technology devices/ services for teaching, learning and research.

4. To know the levels of barriers in utilizing the existing Information Technology devices/services efficiently and effectively among the teachers, students and research scholars of the universities in Kerala.

5. To examine whether there exists significant difference among the universities in Kerala in the availability, application and utilization of Information Technology devices/ services in teaching, learning and research.

HYPOTHESES

The hypotheses of the study are:

1. There is high level of availability of Information Technology devices/services for teaching, learning and research in the universities in Kerala as a result of the introduction of Information Technology.

2. The level of application of various Information Technology devices/service for teaching, learning and research process in the higher educational context in Kerala is high.

3. There is high level of utilization of Information Technology devices/services for teaching, learning and research.

4. The level of barriers of the utilization of existing Information Technology devices/ services efficiently and effectively among the teachers, students and research scholars of the universities in Kerala is high.

5. Significant difference exists among the universities in Kerala in the application and utilization of Information Technology devices/services in teaching, learning and research.

TOOLS USED FOR DATA COLLECTION

Appropriate tools are necessary for collecting the required data. Hence constructing the tools is an important task of an investigator in every research

work. In the present study, the investigator with the assistance of experts and in consultation with the supervising teacher has constructed the following tools for data collection. Relevant literature in related fields and previous studies were also consulted for this purpose.

1. Questionnaire on Introduction, Application and Utilization of Information Technology for Teaching
2. Questionnaire on Introduction, Application and Utilization of Information Technology for Learning
3. Questionnaire on Introduction, Application and Utilization of Information Technology for Research

1. Questionnaire on Introduction, Application and Utilization of Information Technology for Teaching

The questionnaire is divided into six parts. Part I is intended to collect personal details of the respondents like name, category, institution, faculty, gender, and age. Part II consists of the questions regarding the availability of the infrastructure in computer, communication and reprographic/IT peripherals. Questions relating to application of IT devices/services in teaching are included in Part III of the questionnaire. Part IV of the questionnaire includes a five-point Likert scale to measure the level of utilization of IT devices and services in their field. The scale is prepared in such a way that the users can respond to each statement in five ways viz. **Very High, High, Average, Poor and Very poor** by putting a tick mark (✓) against the appropriate alternative. The score ranges from 1 to 5. (Very high = 5, High=4, Average = 3, Poor = 2 and Very poor = 1).

Arithmetic mean is used to represent the level of utilization of various IT devices/services among the teachers. For grading scoring below 1/3 of the

aggregate mean score is rated as low, 1/3 to 2/3 as moderate and above 2/3 as high.

- Score in the range of 01 to 1.7 (i.e. below 33 per cent) – low utilization of IT devices / services.
- Score in the range of 1.7 to 3.3 (i.e. 33 per cent to 66 per cent) – moderate utilization of IT devices and services.
- Score in the range of 3.3 – 5 (i.e. 66 per cent to 100 per cent) – high utilization of IT devices and services.

Part V consists of questions relating to satisfaction with existing IT devices/services. Part VI of the questionnaire includes questions to examine the various barriers faced by the teachers in utilizing the existing IT devices/services at optimum level. Space is also provided for giving suggestions of the respondents.

The questionnaire is given in Appendix I.

2. Questionnaire on Introduction, Application and Utilization of Information Technology for Learning

The questionnaire for students is divided into six parts. Part I is intended to collect personal details of the respondents like name, category, institution, faculty, gender, and age. Part II consists of the questions regarding the availability of the infrastructure in computer, communication and reprographic/ IT peripherals. Questions relating to application of IT devices/services in teaching are included in Part III of the questionnaire. Part IV of the questionnaire includes a five-point Likert scale to measure the level of utilization of IT devices and services in their field. The scale is prepared in such a way that the users can respond to each statement in five ways viz. **Very High, High, Average, Poor and Very poor** by putting a tick mark (✓) against the appropriate alternative. The score ranges from 1 to 5. (Very high = 5, High=4, Average = 3, Poor = 2 and Very poor = 1).

Arithmetic mean is used to represent the level of utilization of various IT devices/services among the teachers. For grading scoring below 1/3 of the aggregate mean score is rated as low 1/3 to 2/3 as moderate and above 2/3 as high.

Part V consists of questions relating to satisfaction with existing IT devices/services. Part VI of the questionnaire includes questions to examine the various barriers faced by the teachers in utilizing the existing IT devices/services at optimum level. Space is also provided for giving suggestions of the respondents.

The questionnaire is given in Appendix II.

3. Questionnaire on Introduction, Application and Utilization of Information Technology for Research

The questionnaire for research scholars is divided into six parts. Part I is intended to collect personal details of the respondents like name, category, institution, faculty, gender, and age. Part II consists of the questions regarding the availability of the infrastructure in computer, communication and reprographic/IT peripherals. Questions relating to application of IT devices/services in teaching are included in Part III of the questionnaire. Part IV of the questionnaire includes a five-point Likert scale to measure the level of utilization of IT devices and services in their field. The scale is prepared in such a way that the users can respond to each statement in five ways viz. **Very High, High, Average, Poor and Very poor** by putting a tick mark (✓) against the appropriate alternative. The score ranges from 1 to 5. (Very high = 5, High=4, Average = 3, Poor = 2 and Very poor = 1).

Arithmetic mean is used to condense the perception regarding utilization of various IT devices/services among the teachers. For grading scoring below 1/3 of the aggregate mean score is rated as low 1/3 to 2/3 as moderate and above 2/3 as high.

Part V consists of questions relating to satisfaction with existing IT devices/services. Part VI of the questionnaire includes questions to examine the various barriers faced by the teachers in utilizing the existing IT devices/services at optimum level. Space is also provided for giving suggestions of the respondents.

The questionnaire is given in Appendix III.

SAMPLE USED FOR THE STUDY

The present study is intended to analyse the application and utilization of information technology in higher educational context in Kerala among the teachers, students and research scholars. The response of the teachers, students and research scholars in three major universities have been taken as a unit of study. It is not practical to study the whole population to arrive at generalisations though the result of the research is to have universal application. The process of sampling makes it possible to draw valid inferences and generalisations on the basis of careful observation of variables within a relatively small proportion of population.

In the present study the population consists of teachers, students and research scholars of the science and non science faculties of respective university. This population is too large in size to collect data from the entire population. Hence the investigator selected a representative part of this population to conduct the study.

The sample of teachers category consists of 245 members from three universities. The sample of students category consists of 565 members from three universities. The sample of research scholar category consists of 215 members from three universities.

SAMPLING TECHNIQUES USED

The population consists of different types of respondents groups with different characteristics. There fore the sample of the study is heterogeneous in nature. In order to get samples from all groups, the investigator has grouped the respondents into three, based on the type of characteristics and the nature of the category. As a knowledge agency, the basic aim of the University is an imparting knowledge and satisfies the information requirements of the students, teachers and research scholars. Hence prominence has been given to these three categories. The groups thus obtained are:

1. Teachers – consisting of permanent teachers who teach in the respective university departments/faculties.

2. Students – include regular students of the University teaching departments/faculties.

3. Research scholars – consisting of those doing full time and part time research in the university departments and recognized centres of the universities.

Due representation is given to science and non-science faculties and male and female respondents.

Stratified random sampling technique has been used to ensure representation of all the identified categories.

SAMPLE SIZE

The sample of the respondents consisted of 245 teachers, 565 students and 215 research scholars. Questionnaires to the respondents were personally handed over to them. The following are the details of questionnaires distributed and returned: Among the teachers 260 questionnaires were distributed, 245 of them were received back. Among the students category 600 questionnaires were distributed, 565 of them were received back. Among the research scholars 230 questionnaires were distributed, 215 of them were received back. For the present study the investigator decided to limit the size of sample to a total of 1025 respondents from three Universities. The break up of the sample is as follows:

Number of Universities = 3 (University of Kerala, Mahatma Gandhi University and Calicut University).

Number of category = 3

Sample form each category = Teachers 90+70+85= 245

Students 190+175+200 =565

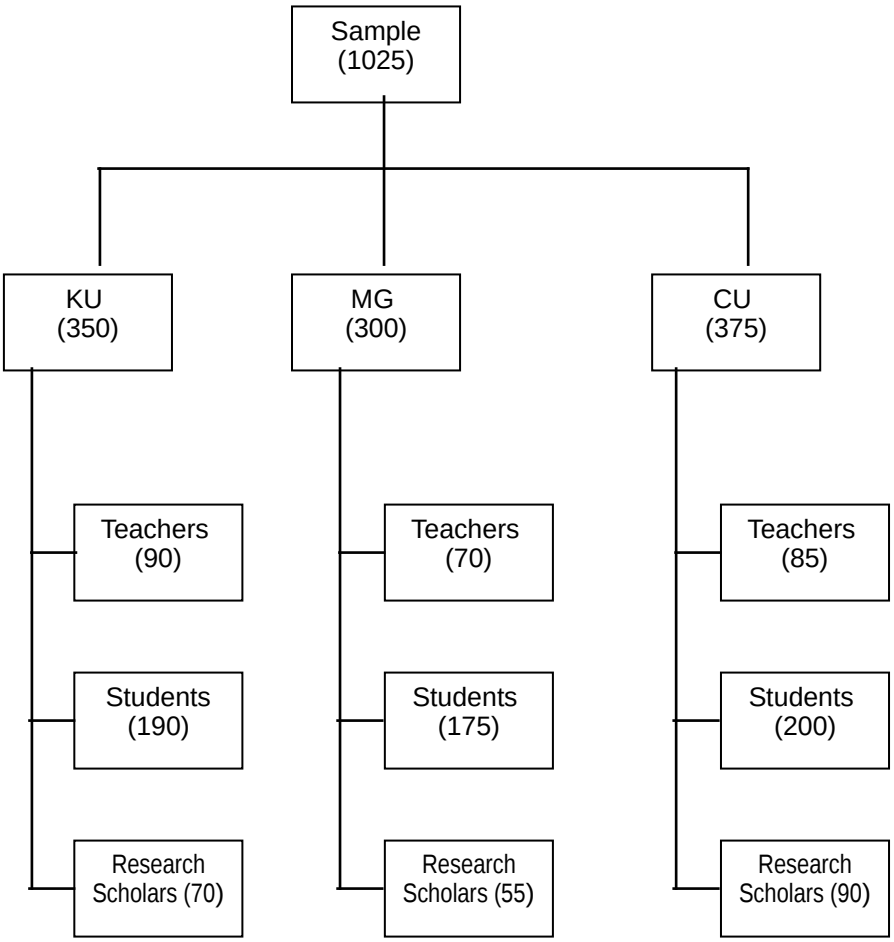
Research scholars 70+55+90= 215

Sample from each university = 350+300+375= 1025

Total sample = 1025.

Break up of the Final Sample

Figure clearly shows the break up of the final sample.



Institution wise Distribution of the Sample

The sample selected from each university and categories are shown in Table 1.

Table 1

Institution Wise Distribution of Sample

Name of the Institution	Teachers	Students	Research Scholars	Total	Percentage
Kerala University	90	190	70	350	34.15
M.G University	70	175	55	300	29.27
Calicut University	85	200	90	375	36.59
Total	245	565	215	1025	100.00

The Table 1 shows that relatively equal number of samples have been drawn from all the three stratas. The number of students is greater than other two categories because, the population of students is higher than other two groups.

Category Wise Distribution of Sample

The sample selected from each category (teachers, students and research scholars) is shown in Table 2.

Table 2

Category wise distribution of sample

Category	Sample Size	Percent
Teachers	245	23.90
Students	565	55.12
Research Scholars	215	20.98
Total	1025	100.00

Subject wise Distribution of the Sample

The percentage of the sample of teachers taken from science and non science faculties is shown in Table 3.

Table 3

Department /Faculty Wise Representation of Sample (Teachers)

Institutions	Department /Faculty		Percent
	Science	Non science	
Kerala University	44.44	55.56	100.00
Mahatma Gandhi University	42.86	57.14	100.00
Calicut University	47.06	52.94	100.00
Total	44.90	55.10	100.00

The percentage of the sample of students taken from science and non science faculties is shown in Table 4.

Table 4

Department /Faculty Wise Representation of Sample (Students)

Institutions	Department /Faculty		Percent
	Science	Non science	
Kerala University	52.63	47.37	100.00
Mahatma Gandhi University	54.29	45.71	100.00
Calicut University	50.00	50.00	100.00
Total	52.21	47.79	100.00

Table 4 shows that relatively equal importance has been given to both science and non- science faculties which having the representative sample.

The percentage of the sample of research scholars taken from science and non science faculties is shown in Table 5.

Table 5

Department /Faculty Wise Representation of Sample (Research scholars)

Institutions	Department /Faculty		Percent
	Science	Non science	
Kerala University	57.14	42.86	100.00
Mahatma Gandhi University	54.55	45.45	100.00
Calicut University	55.56	44.44	100.00
Total	55.81	44.19	100.00

Gender Wise Distribution of Sample

The gender-wise distribution of the sample selected from each category (teachers, students and research scholars) is shown in Table 6.

Table 6

Gender wise distribution of sample

Category	Male	Female	Total
Teachers	73.88	26.12	100.00
Students	44.60	55.40	100.00
Research Scholars	57.21	42.79	100.00
Total	54.24	45.76	100.00

It can be observed from Table 6 that 54.24 percent of the respondents were males and 45.76 percent of them were females.

DATA COLLECTION PROCEDURE

Sufficient copies of the questionnaires were prepared initially. The investigator then personally visited all the three university departments and took permission from concerned to administer the questionnaire among the teachers, students and research scholars. The questionnaires were distributed personally among the teachers, students and research scholars and most of them responded positively by filling up and returning the same. The experience was encouraging.

CONSOLIDATION OF DATA

Data pertaining to classificatory and study variables were consolidated separately by using spreadsheet package ‘Excel’. The data were then subjected to further statistical treatment by using the statistical package ‘Statistica’. After interpretation, inferences were drawn and recommendations were made.

STATISTICAL TECHNIQUES USED

The researcher has used mainly three statistical techniques at different stages of the study to draw the conclusions. They are:

1. Percentage Analysis

2. Chi-square test

3. Arithmetic Mean

4. Analysis of Variance

For the purpose of analysis data are presented in Tables based University (Kerala University, Mahatma Gandhi University, Calicut University) and category of users (Teachers, Students and Research scholars). The values of the statistical tests are also presented in Tables. Conclusions are drawn from the results extracted from the Tables.

ANALYSIS

This chapter presents the analysis and interpretations of the data collected by making use of the questionnaires distributed among the teachers, students and research scholars of the three major universities of Kerala State, namely, University of Kerala, Mahatma Gandhi University and University of Calicut. The collected data are analysed and presented in the form of Tables with necessary interpretations.

Application and utilization of existing information technology based devices/ services for teaching, learning and research activities are studied by assessing the responses of the teachers, students and research scholars. The study was carried out with the objective in mind and considering the variables. The names of the institutions are indicated as 'KU' for University of Kerala, 'MGU' for Mahatma Gandhi University and 'CU' for University of Calicut in the Tables for convenience.

Break-up of sample on the basis of University

The details of the sample selected for the present study based on institution (University) and category of the respondents are presented in Table 7.

Table 7

Category wise Distribution of Respondents

Category	KU	MGU	CU	Total
Teachers	90	70	85	245
Students	190	175	200	565
Research scholars	70	55	90	215
Total	350	300	375	1025

The study has been conducted among the teachers, students and research scholars of the science and non science faculties of the three major Universities

in Kerala. Table 7 shows that the total sample of teachers in the three major Universities in Kerala has been limited to 245 for conducting the study. Among the total sample 90 teachers are taken from University of Kerala, 70 from Mahatma Gandhi University and 85 from University of Calicut.

The total sample size of the students is 565. Among this 190 students are from University of Kerala, 175 from Mahatma Gandhi University and 200 from University of Calicut.

Samples of 215 research scholars are also taken for the study. Among this 70 are from University of Kerala, 55 are from Mahatma Gandhi University and 90 are from University of Calicut.

Faculty-wise Distribution of Sample

The distribution of the sample on the basis of their faculty and category are shown in Table 8.

Table 8

Faculty wise Distribution of Sample

Category	Science	Non science	Total
Teachers	105 (42.86)	140 (57.14)	245 (100.00)
Students	295 (52.21)	270 (47.79)	565 (100.00)
Research scholars	120 (55.81)	95 (44.19)	215 (100.00)
Total	520 (50.73)	505 (49.27)	1025 (100.00)

The figures in brackets show the respective percentages

Table 8 shows that the break up of the sample of teachers in terms of faculty is 105 (42.86 per cent) from science and 140 (57.14 per cent) from Non science. Among the students 295 (52.21 per cent) are from science and 270 (47.79 per cent) are from Non science. Among the research scholars 120 (55.81 per cent) are from science faculty and 95 (44.19 per cent) are from non science faculty.

Availability of IT Devices/Services for Teaching

Availability of Information Technology based devices/services for the purpose of effective and efficient teaching among the teachers of the universities is presented in Table 9 and Figure 1.

Table 9

Availability of IT Devices/Services for Teaching

Devices/Services	KU	MGU	CU	Total	p-value
Computer	90 (100.00)	70 (100.00)	85 (100.00)	245 (100.00)	--
Network	72 (80.00)	59 (84.29)	63 (74.12)	194 (79.18)	0.291529
Internet	82 (91.11	66 (94.29)	85 (100.00)	233 (95.10)	0.022887
Video conferencing	11 (12.22)	19 (27.14)	9 (10.59)	39 (15.92)	0.009511
Edusat	0 (0.00)	0 (0.00)	85 (100.00)	85 (34.69)	0.00000
EMMRC	0 (0.00)	0 (0.00)	85 (100.00)	85 (34.69)	0.00000
Printer	90 (100.00)	70 (100.00)	85 (100.00)	245 (100.00)	--
Scanner	55 (61.11)	52 (74.29)	49 (57.65)	156 (63.67)	0.082170
Photocopier	72 (80.00)	70 (100.00)	53 (62.35)	195 (79.59)	0.000000
LCD Projector	42 (46.67)	48 (68.57)	36 (42.35)	126 (51.43)	0.002668
OHP	69 (76.67)	59 (84.29)	62 (72.94)	190 (77.55)	0.234391
CD/DVD Writer	79 (87.78)	64 (91.43)	53 (62.35)	196 (80.00)	0.000003

The figures in brackets show the respective percentages

Information technology includes both computer, communication and reprographic technology. Here the term computer is broadly used for computer hardware and software. Table 9 shows that cent per cent of the respondents in all the three universities taken for the study get the computer facility in their department/university.

Network is a collection of terminals, computers, servers, and

components that allows for the easy flow of data and sharing of resources between one another. Data given in Table 9 reveals that a great majority of the respondents (80 per cent in Kerala University, 84.29 per cent in Mahatma Gandhi University and 74.12 per cent in Calicut University) have the network facility for sharing the information resources. The p-value (0.291529) shows that there is no significant association between level of availability of network services and universities at 5 per cent level of significance.

Table 9 also shows that 91.11 per cent of the teachers in Kerala University, 94.29 per cent from Mahatma Gandhi University and 100.00 per cent of Calicut University have the Internet facility. The p-value (0.022887) shows that there is no significant association between the level of availability of Internet facility and the university at one per cent level but significant association can be seen at 5 per cent level. The availability of Internet is somewhat high in Calicut University.

A videoconference is a set of interactive telecommunication technologies which allow two or more locations to interact via two-way video and audio transmissions simultaneously. Table 9 reveals that the application of technological innovations such as Video conferencing facility for teaching process is not widespread. Only 12.22 per cent of the teachers in Kerala University, 27.14 per cent in MG University and 10.59 per cent in Calicut University have this facility. The p-value (0.009511) shows that there is significant association between level of availability and university in this regard. Comparatively higher level of availability of video conferencing facility is seen in Mahatma Gandhi University.

Edusat, developed by the State Institute of Educational Technology aims to collect, process and disseminate educational content developed by identified resource persons. It provides interaction/feedback/guidance tools to academic community and explores the possibility of using the network established for educational system in the State. Kerala University and Mahatma Gandhi University are not having the Edusat facility. In Calicut University all the

teachers are getting the Edusat facility. Educational Multimedia Research Centre (EMMRC) also is not available in Kerala and Mahathm0 Gandhi Universities. In Calicut University all the teachers are getting the services of EMMRC.

The printer facility is available to all the teachers in all the three universities taken for the study. However, the scanner facility is available to 61.11 per cent of the teachers in Kerala University, 74.29 per cent of the teachers in Mahatma Gandhi University and 57.65 per cent of the teachers in Calicut University. The p-value (0.082170) indicates that there is no significant association between the level of availability of scanner and university. The photocopier facility is available to 80 per cent of the teachers in Kerala University, 100 per cent of the teachers in Mahatma Gandhi University and 62.35 per cent of the teachers in Calicut University. The p-value (0.000000) shows that there is a significant association between the level of availability of photocopier service and university. The level of availability is the highest in Mahatma Gandhi University.

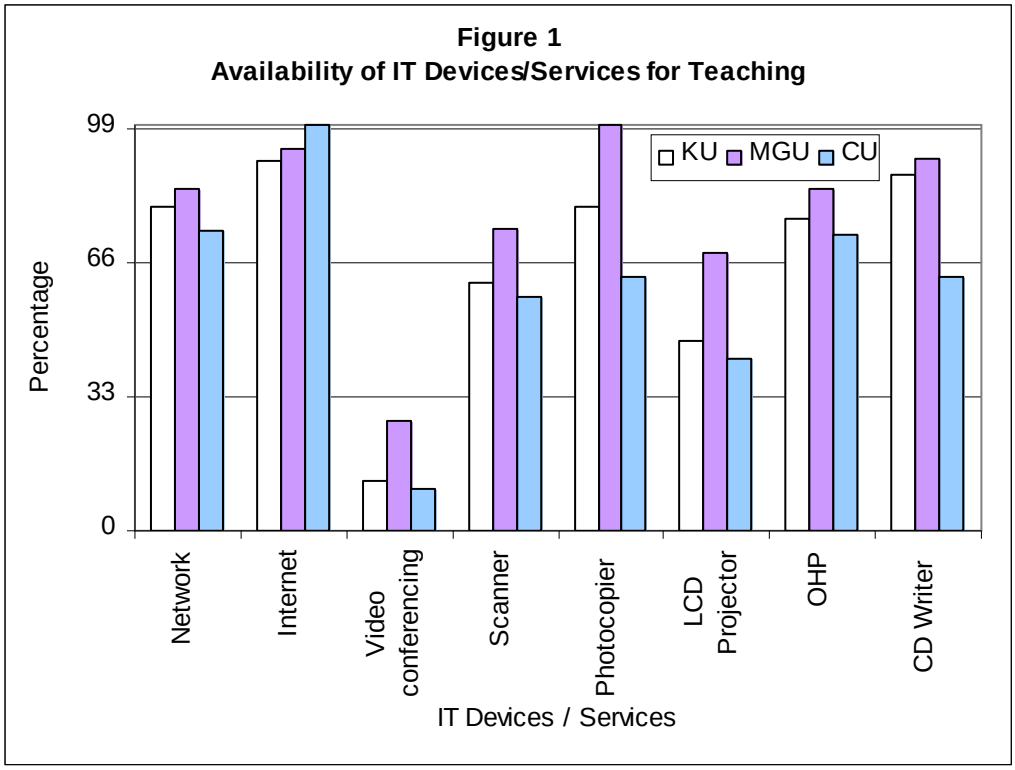
In the case of availability of LCD projector 46.67 per cent of the teachers in Kerala University are of the opinion that they get LCD projector for teaching. At the same time 68.57 per cent of the teachers in Mahatma Gandhi University and 42.35 per cent of the teachers in Calicut University also get this facility. The p-value (0.002668) shows that there is significant association between the level of availability of LCD projector for teaching and university. The level of availability is the highest in Mahatma Gandhi University.

Though the over head projector (OHP) is an almost outdated technology, 76.67 per cent of the teachers in Kerala University, 84.29 per cent of the teachers in Mahatma Gandhi University and 72.94 per cent of the teachers in Calicut University get this facility. The p-value (0.234391) indicates that there is no significant association between the level of availability of OHP and university.

The CD/DVD writer is available to 87.78 per cent of the teachers in Kerala University, 91.43 per cent of the teachers in Mahatma Gandhi University and 62.35 per cent of the teachers in Calicut University, the p-value (0.000003) shows that there is significant association between the level of availability of CD/DVD Writer and university. The availability of CD/DVD writer is the highest in Mahatma Gandhi University.

It can be seen from Table that the availability of computer, network, internet, printer, scanner, photo copier, OHP and CD/DVD Writer is high in all the three universities. The availability of internet is the highest in Calicut University. The availability of network, photocopier, LCD projector and CD/DVD writer is significantly high in Mahatma Gandhi University. The IT devices/services like, Edusat and EMMRC are not available in Kerala and Mahatma Gandhi universities.

Figure 1
Availability of IT Devices/Services for Teaching



Availability of IT Devices/Services for Learning

Availability of information technology devices/services for the purpose

of effective and efficient learning among the students of the universities is presented in Table 10 and Figure 2.

Table 10

Availability of IT Devices/ Services for Learning

Devices/Services	KU	MGU	CU	Total	p-value
Computer	190 (100.00)	175 (100.00)	200 (100.00)	565 (100.00)	--
Network	138 (72.63)	136 (77.71)	122 (61.00)	396 (70.09)	0.001283
Internet	170 (89.47)	160 (91.43)	148 (74.00)	478 (84.60)	0.000001
Video conferencing	27 (14.21)	31 (17.71)	16 (8.00)	74 (13.10)	0.017873
Edusat	0 (0.00)	0 (0.00)	116 (58.00)	116 (20.53)	0.00000
EMMRC	0 (0.00)	0 (0.00)	116 (58.00)	116 (20.53)	0.00000
Printer	140 (73.68)	145 (82.86)	180 (90.00)	465 (82.30)	0.000133
Scanner	33 (17.37)	40 (22.86)	28 (14.00)	101 (17.88)	0.080566
Photocopier	164 (86.32)	162 (92.57)	173 (86.50)	499 (88.32)	0.108202
LCD Projector	44 (23.16)	50 (28.57)	22 (11.00)	116 (20.53)	0.000080
OHP	98 (51.58)	103 (58.86)	68 (34.00)	269 (47.61)	0.000004
CD/DVD Writer	114 (60.00)	122 (69.71)	97 (48.50)	333 (58.94)	0.000160

The figures in brackets show the respective percentages

Table 10 shows that 100 per cent of the students in all the three Universities taken for the study have the opinion that computer is available to them for learning. Network facility is available for learning to 72.63 per cent of the students in Kerala University, 77.71 per cent of the students in Mahatma Gandhi University and 61.00 per cent of the student sin Calicut University. The p-value (0.001283) shows that there is significant association between the level of availability of network for learning and University. The availability of the network for learning is the highest in Mahatma Gandhi University.

It can also be seen from the Table that Internet is available to 89.47 per cent of the students in Kerala University, 91.43 per cent of the students in

Mahatma Gandhi University and 74.00 per cent of the students in Calicut University. The p-value (0.000001) indicates that there is significant association between the level of availability of Internet for learning and University. The highest level of availability is in Mahatma Gandhi University.

The video conferencing facility is available to 14.21 per cent of the students in Kerala University, 17.71 per cent of the students in Mahatma Gandhi University and 8.00 per cent students in Calicut University. The p-value (0.017873) indicates that there is significant association between the level of availability of the video conferencing facility for learning and University at 5 per cent level of significance. Comparatively higher level of availability can be seen in Mahatma Gandhi University.

The Edusat facility is available only in Calicut University. The Table shows that 58.00 per cent of the students in Calicut University get this facility. The EMMRC also is available in Calicut University only. Among the students in Calicut University 58.00 per cent get this facility for learning.

The printer facility is available to 73.68 per cent of the students in Kerala University, 82.86 per cent of the students in Mahatma Gandhi University and 90.00 per cent of the students in Calicut University. The p-value (0.000133) shows that there is significant association between the level of availability of the printer and University. The highest level of availability is seen in Calicut University.

The scanner facility is available to 17.37 per cent of the students of Kerala University, 22.86 per cent of the students in Mahatma Gandhi University and 14.00 per cent of the students in Calicut University. The p-value (0.080566) shows that there is no significant association between the level of availability of scanner for learning purpose and university.

A great majority of the students in all the three universities get photocopying facility. In Kerala University 86.32 per cent of the students get

this facility. At the same time 92.57 per cent of the students in Mahatma Gandhi University and 86.50 per cent of the students in Calicut University get this facility. The p-value (0.108202) shows that there is no significant association between the level of availability of the photocopier service for learning and university.

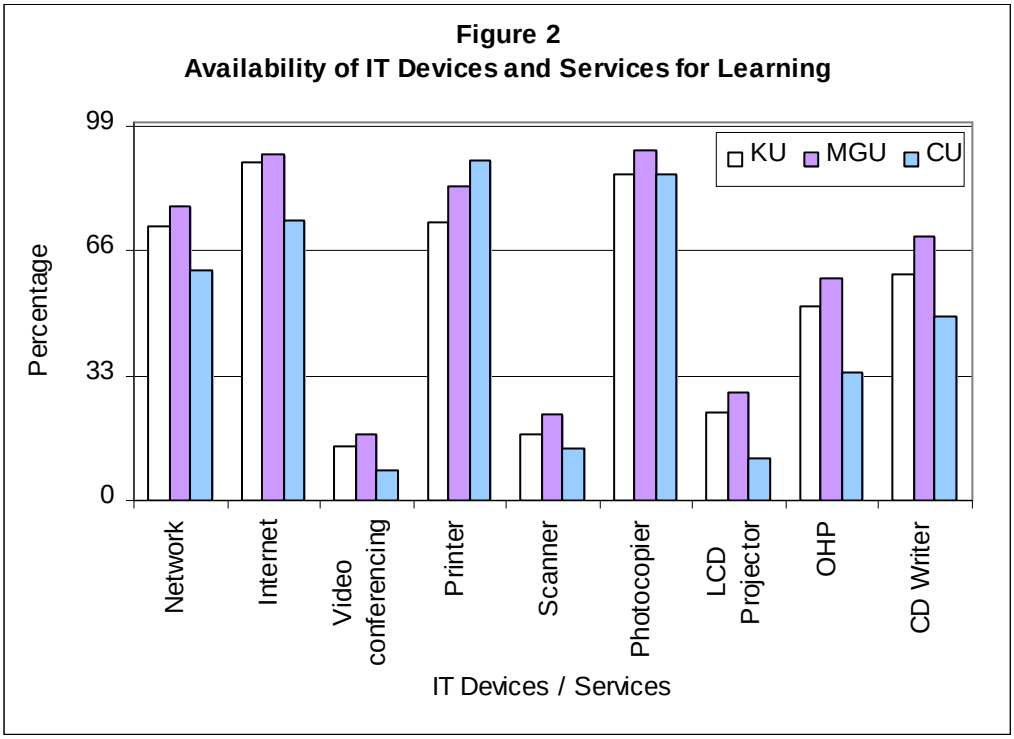
The LCD projector is available to 23.16 per cent of the students in Kerala University, 28.57 per cent of the students in Mahatma Gandhi University and 11.00 per cent of the students in Calicut University. The p-value (0.000080) shows that there is significant association between the level of availability of the LCD projector for learning and university. Comparatively higher level of availability can be seen in Mahatma Gandhi University.

The OHP is available for learning to 51.58 per cent of the students in Kerala University, 58.86 per cent of the students in Mahatma Gandhi University and 34.00 per cent of the students in Calicut University. The p-value (0.000004) indicates that there is significant association between the level of availability of OHP for learning and university. The highest level of availability is seen in Mahatma Gandhi University. The CD/DVD writer is available to 60.00 per cent of students in Kerala University, 69.71 per cent of students in Mahatma Gandhi University and 48.50 per cent of students in Calicut University. The p-value (0.000160) shows that there is significant association between the level of availability of CD/DVD writer for learning purpose and university. The highest level of availability can be seen in Mahatma Gandhi University.

It can be seen from the Table that the majority of students get computer, network facility, internet, printer facility and photocopier facility for learning in all three universities taken for the study. The availability of OHP and CD/DVD writer also is high in Kerala and Mahatma Gandhi universities. The level of the availability of network, internet, video conferencing facility, photocopier facility, LCD projector, OHP and CD/DVD writer is comparatively high in Mahatma Gandhi University. The level of availability of printer facility is the

highest in Calicut University.

Figure 2
Availability of IT Devices and Services for Learning



Availability of IT Devices/Services for Research

Availability of information technology devices/services for the purpose of effective research among the research scholars of the Universities is presented in Table 11 and Figure 3.

Table 11

Availability of IT Devices/Services for Research

Devices/Services	KU	MGU	CU	Total	p-value
Computer	70 (100.00)	55 (100.00)	90 (100.00)	215 (100.00)	--
Network	52 (74.29)	48 (87.27)	56 (62.22)	156 (72.56)	0.004269
Internet	64 (91.43)	52 (94.55)	79 (87.78)	195 (90.70)	0.383106
Video conferencing	16 (22.86)	22 (40.00)	12 (13.33)	50 (23.26)	0.001109
Edusat	0 (0.00)	0 (0.00)	42 (46.67)	42 (19.53)	0.000000
EMMRC	0 (0.00)	0 (0.00)	90 (100.00)	90 (41.86)	0.00000
Printer	70 (100.00)	55 (100.00)	90 (100.00)	215 (100.00)	--
Scanner	52 (74.29)	42 (76.36)	61 (67.78)	155 (72.09)	0.472642
Photocopier	50 (71.43)	41 (74.55)	74 (82.22)	165 (76.74)	0.250280
LCD Projector	61 (87.14)	39 (70.91)	41 (45.56)	141 (65.58)	0.000000
OHP	59 (84.29)	39 (70.91)	50 (55.56)	148 (68.84)	0.000477
CD/DVD Writer	52 (74.29)	41 (74.55)	62 (68.89)	155 (72.09)	0.673360

The figures in brackets show the respective percentages

Table 11 shows that cent per cent of the research scholars in all the three universities taken for the study get computer facility. Network facility is available to 74.29 per cent of the research scholars in Kerala University, 87.27 per cent of the research scholars of Mahatma Gandhi University and 62.22 per cent of the research scholars in Calicut University. The p-value (0.004269) shows that there is significant association between the level of availability of the network facility for research and university. The highest level of facility can be seen in Mahatma Gandhi University.

The Internet facility is available to a great majority of the research scholars in all the three universities (90.70 per cent). Among the research

scholars 91.43 per cent in Kerala University, 94.55 per cent in Mahatma Gandhi University and 87.78 per cent in Calicut University get this facility. The p- value (0.383106) shows that there is no significant association between the level of the availability of Internet facility for research and university.

The Edusat facility and EMMRC are available only in Calicut University. Among the research scholars, 46.67 per cent in Calicut University get Edusat facility and cent per cent of research scholars get EMMRC facility.

The video conferencing facility is available for research for 22.86 per cent of the research scholars in Kerala University, 40.00 per cent in Mahatma Gandhi University and 13.33 per cent in Calicut University. The p-value (0.001109) shows that there is significant association between the availability of video conferencing facility for research and university. The highest level of availability can be seen in Mahatma Gandhi University.

The printer facility is available to cent per cent of the research scholars in all the three universities taken for the study. At the same time the scanner facility is available to 74.29 per cent of the research scholars in Kerala University, 76.36 per cent of the research scholars in Mahatma Gandhi University and 67.78 per cent of the research scholars in Calicut University. The p-value value (0.472642) shows that there is no significant association between the level of availability of scanner for research purpose and university.

The photocopier facility is available to 71.43 per cent of the research scholars in Kerala University, 74.55 per cent of the research scholars in Mahatma Gandhi University and 82.22 per cent of the research scholars in Calicut University. The p-value (0.250280) shows that there is no significant association between the level of the availability of photocopier for research and university.

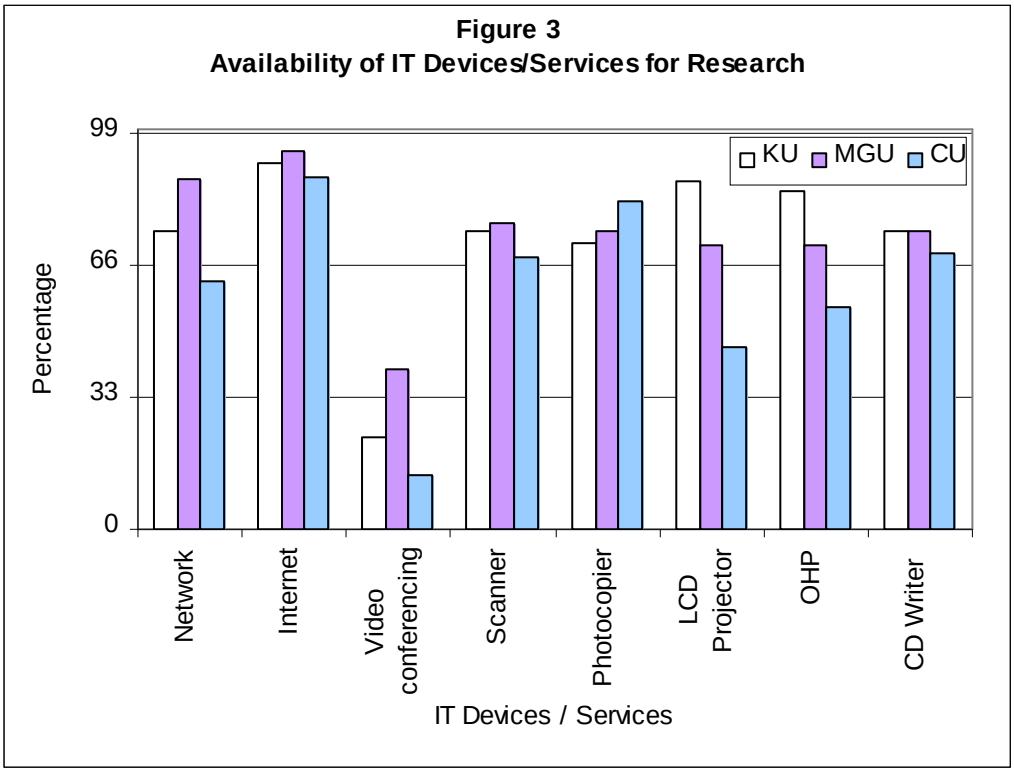
The LCD projector is available to 87.14 per cent of the research scholars in Kerala University, 70.91 per cent of the research scholars in Mahatma

Gandhi University and 45.56 per cent of the research scholars in Calicut University. The p-value (0.000000) shows that there is significant association between the level of availability of LCD projector for research purpose and university. The highest level of availability can be seen in Kerala University.

The OHP is available to 84.29 per cent of research scholars in Kerala University, 70.91 per cent of research scholars in Mahatma Gandhi University and 55.56 per cent of research scholars in Calicut University. The p-value 0.000477) shows that there is significant association between the level of availability of OHP for research purpose and university. The highest level of availability is in Kerala University. The CD/DVD writer is available to 74.29 per cent of the research scholars in Kerala University, 74.55 per cent of the research scholars in Mahatma Gandhi University and 68.89 per cent of the research scholars in Calicut University. The p-value (0.0673360) indicates that there is no significant association between the level of availability of CD/DVD writer for research and university.

The Table reveals that the majority of the research scholars in all the three universities taken for the study get computer, network facility, internet facility, printer facility, scanner, photocopier, OHP and CD/DVD writer for research purpose. The availability of network facility and video conferencing facility is comparatively higher in Mahatma Gandhi University. The availability of LCD projector and OHP is higher in Kerala University. This can be seen from Figure 3.

Figure 3
Availability of IT Devices/Services for Research



Application of IT Devices / Services

Making use of information and communication technology systems, peripherals and digitized library services to optimum outcome in teaching, learning and research is regarded as application of IT devices/services in the study.

Application of IT devices/ services for teaching

Application of information technology devices/services for the purpose of effective teaching among the faculty members of the universities is presented in Table 12 and Figure 4.

Table 12

Application of IT Devices/ Services for Teaching

Devices/Services	KU	MGU	CU	Total	p-value
Computer	90 (100.00)	70 (100.00)	85 (100.00)	245 (100.00)	--
OS (Windows)	72 (80.00)	59 (84.29)	63 (74.12)	194 (79.18)	0.291529
OS (Linux)	18 (20.00)	11 (15.71)	22 (25.88)	51 (20.82)	0.291529
Internet	82 (91.11)	66 (94.29)	70 (82.35)	218 (88.98)	0.044319
Video conferencing	11 (12.22)	19 (27.14)	9 (10.59)	39 (15.92)	0.009511
Edusat	0 (0.00)	0 (0.00)	85 (100.00)	85 (34.69)	0.00000
EMMRC	0 (0.00)	0 (0.00)	85 (100.00)	85 (34.69)	0.00000
Printer	90 (100.00)	70 (100.00)	85 (100.00)	245 (100.00)	--
Scanner	55 (61.11)	52 (74.29)	49 (57.65)	156 (63.67)	0.082170
Photocopier	72 (80.00)	70 (100.00)	53 (62.35)	195 (79.59)	0.000000
LCD Projector	51 (56.67)	48 (68.57)	36 (42.35)	135 (55.10)	0.004505
OHP	38 (42.22)	27 (38.57)	42 (49.41)	107 (43.67)	0.376159
CD/DVD Writer	79 (87.78)	64 (91.43)	53 (62.35)	196 (80.00)	0.000003

The figures in brackets show the respective percentages

In the higher educational context in Universities in Kerala, significant developments in the use of computers have taken place and have wide applications in the educational sectors. Table 12 reveals that cent per cent of the teachers are applying computer from concerned department/university for teaching purpose.

Among the teachers who use computers, Widows Operating system is used for teaching by 80.00 per cent teachers in Kerala University, 84.29 per cent of teachers in Mahatma Gandhi University and 74.12 per cent of teaches in Calicut University. At the same time LINUX Operating system is used by 20.00

per cent of teachers in Kerala University, 15.71 per cent of teachers in Mahatma Gandhi University and 25.88 per cent of teachers in Calicut University. The p-value (0.291529) indicates that there is no significant association between the level of use of Operating system for teaching and university.

Internet application for teaching is found among 91.11 per cent of the teachers in Kerala University, 94.29 per cent in Mahatma Gandhi University and 82.35 per cent in Calicut University. The p-value (0.044319) shows that there is significant association between the level of application of Internet for teaching and university at 5 per cent level of significance. The highest level of use of internet for teaching is found Mahatma Gandhi University.

Video conferencing facility is used for teaching by 12.22 per cent of the teachers in Kerala University, 27.14 per cent in Mahatma Gandhi University and 10.59 per cent of teachers in Calicut University. The p-value (0.009511) shows that there is significant association between the level of use of video conferencing for teaching and university. Comparatively higher level of application of video conferencing is found in Mahatma Gandhi University. Edusat and EMMRC facilities are used for teaching by cent per cent of the teachers in Calicut University.

Printers are used by cent per cent of the teachers in all the three universities. Use of scanner for teaching is found among 61.11 per cent of teachers in Kerala University, 74.29 per cent of teachers in Mahatma Gandhi University and 57.65 per cent of the teachers in Calicut University. The p-value (0.082170) indicates that there is no significant association between the level of use of scanner for teaching and university.

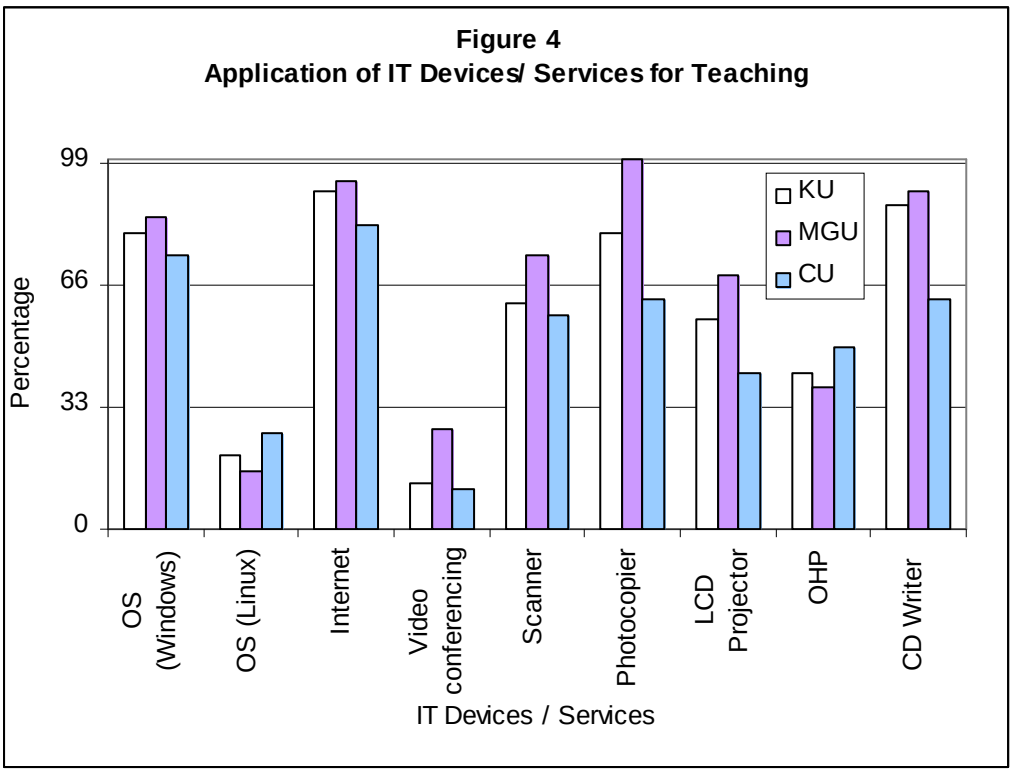
Among the teachers 80.00 per cent in Kerala University, 100.00 per cent in Mahatma Gandhi University and 62.35 per cent in Calicut University use

photocopier facility for teaching. The p-value (0.000000) shows that there is significant association between the level of use of photocopier for teaching purpose and university. The highest level of use of photocopier is found in Mahatma Gandhi University. The use of LCD projector for the teaching is found among 56.67 per cent of the teachers in Kerala University, 68.57 per cent of the teachers in Mahatma Gandhi University and 42.35 per cent of the teachers in Calicut University. The p-value (0.004505) shows that there is significant association between the level of use of LCD projector for teaching and university. The highest level of use is found among teachers of Mahatma Gandhi University.

The use of OHP for teaching is comparatively less in universities. Among the teachers 42.22 per cent in Kerala University, 38.57 per cent in Mahatma Gandhi University and 49.41 per cent in Calicut University are using OHP for teaching. The p-value (0.376159) shows that there is no significant association between the level of use of OHP for teaching and university. The application of CD/DVD writer for teaching is found among 87.78 per cent of the teachers in Kerala University, 91.43 per cent of the teachers in Mahatma Gandhi University and 62.35 per cent of the teachers in Calicut University. The p-value (0.000003) indicates that there is significant association between level of use of CD/DVD writer for teaching and university. The highest level of application CD/DVD writer for teaching is found in Mahatma Gandhi University.

The level of application of the IT devices/services such as computer, windows operating system, Internet, printer, scanner, photocopier and CD/DVD writer is high in all the three universities for teaching. Comparatively higher level of application of Internet, video conferencing facility, photocopier, LCD projector and CD/DVD writer is found in Mahatma Gandhi University. This is clearly shown in Figure 4.

Figure 4
Application of IT Devices/ Services for Teaching



Application of IT Devices / Services for Learning

Application of information technology devices/services for the purpose of effective learning among the students of the universities is presented in Table 13 and Figure 5.

Table 13

Application of IT Devices /Services for Learning

Devices/Services	KU	MGU	CU	Total	p-value
Computer	190 (100)	175 (100)	200 (100)	565 (100)	0.000000
OS (Windows)	120 (63.16)	125 (71.43)	126 (63.00)	371 (65.66)	0.154291
OS (Linux)	29 (15.26)	31 (17.71)	28 (14.00)	88 (15.58)	0.606406
Internet	155 (81.58)	151 (86.29)	149 (74.50)	455 (80.53)	0.014493
Video conferencing	28 (14.74)	31 (17.71)	16 (8.00)	75 (13.27)	0.016727
Edusat	0 (0.00)	0 (0.00)	22 (11.00)	22 (3.89)	0.000000
EMMRC	0 (0.00)	0 (0.00)	23 (11.5)	23 (4.07)	0.000000
Printer	66 (34.74)	82 (46.86)	50 (25.00)	198 (35.04)	0.000056
Scanner	49 (25.79)	54 (30.86)	48 (24.00)	151 (26.73)	0.305893
Photocopier	160 (84.21)	152 (86.86)	173 (86.5)	485 (85.84)	0.727715
LCD Projector	37 (19.47)	41 (23.43)	19 (9.50)	97 (17.17)	0.001008
OHP	16 (8.42)	11 (6.29)	9 (4.50)	36 (6.37)	0.284487
CD/DVD Writer	52 (27.37)	64 (36.57)	41 (20.5)	157 (27.79)	0.002434

The figures in brackets show the respective percentages

Table 13 reveals that cent per cent of the students use computers for learning purpose. Among the students who use computers, Windows Operating system is preferred for learning by 63.16 per cent students in Kerala University, 71.43 per cent of students in Mahatma Gandhi University and 63.00 per cent of students in Calicut University. The p-value (0.154291) shows that there is no significant association between the level of application of computers for learning and university. At the same time LINUX Operating system is used by 15.26 per cent of students in Kerala University, 17.71 per cent of students in Mahatma Gandhi University and 14.00 per cent of students in Calicut

University. The p-value (0.606406) indicates that there is no significant association between the level of use of Linux Operating system for learning and university.

Internet application for learning is found among 81.58 per cent of the students in Kerala University, 86.29 per cent in Mahatma Gandhi University and 74.50 per cent in Calicut University. The p-value (0.014493) shows that there is significant association between the level of application of Internet for learning and university at 5 per cent level of significance. The highest level of use of internet for learning is found in Mahatma Gandhi University.

Video conferencing facility is used for learning by 14.74 per cent of the students in Kerala University, 17.71 per cent in Mahatma Gandhi University and 8.00 per cent of students in Calicut University. The p-value (0.016727) shows that there is significant association between the level of use of video conferencing for learning and university at 5 per cent level of significance. Comparatively higher level of use of video conferencing for learning is found in Mahatma Gandhi University. Edusat facility is used only by 11.00 per cent of students and EMMRC facility is used for learning by 11.50 per cent of the students in Calicut University.

The printer facility is used by 34.74 per cent of the students in Kerala University, 46.86 per cent of the students in Mahatma Gandhi University and 25.00 per cent of the students in Calicut University. The p-value (0.000056) shows that there is significant association between the level of use of printer for learning purpose and university. Comparatively higher level of use of printer for learning purpose is found in Mahatma Gandhi University. Use of scanner for learning is found among 25.79 per cent of students in Kerala University, 30.86 per cent of students in Mahatma Gandhi University and 24.00 per cent of the students in Calicut University. The p-value (0.305893) indicates that there is no significant association between the level of use of scanner for learning and university.

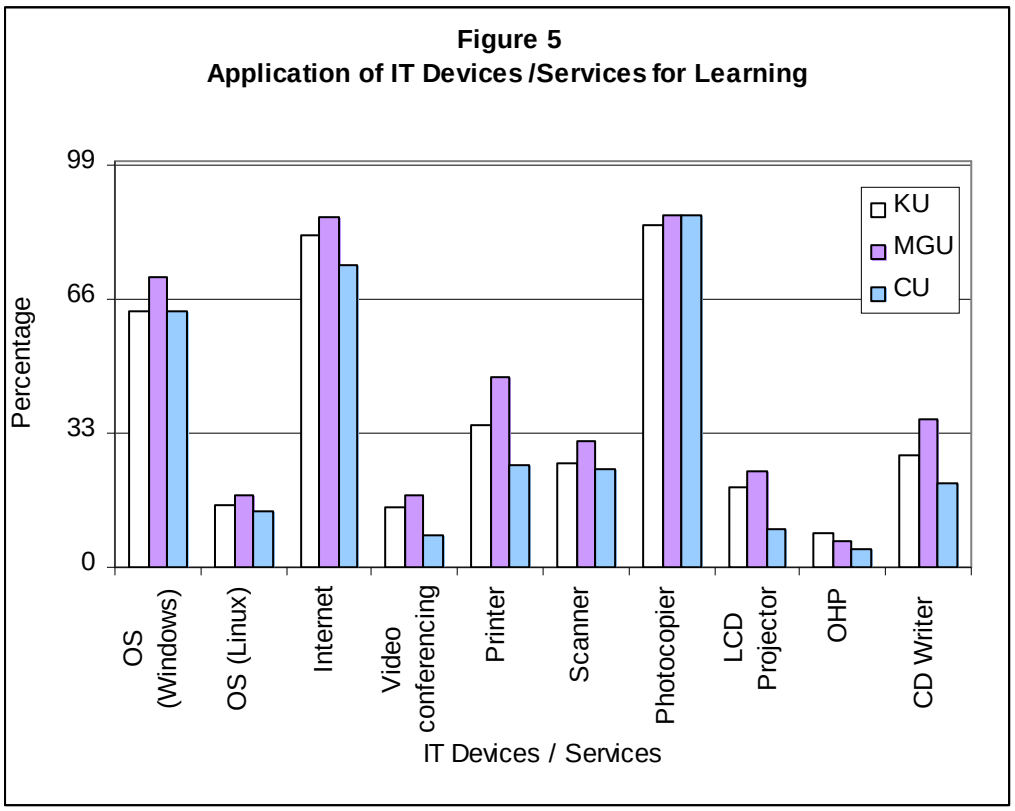
Among the students 84.21 per cent in Kerala University, 86.86 per cent in Mahatma Gandhi University and 86.50 per cent in Calicut University use photocopier facility for learning. The p-value (0.727715) shows that there is no significant association between the level of use of photocopier for learning purpose and university.

The use of LCD projector for the learning is found among 19.47 per cent of the students in Kerala University, 23.43 per cent of the students in Mahatma Gandhi University and 9.50 per cent of the students in Calicut University. The p-value (0.001008) shows that there is significant association between the level of use of LCD projector for learning and university. The highest level of use is found among students of Mahatma Gandhi University. The use of OHP for learning is comparatively less in universities. Among the students 8.42 per cent in Kerala University, 6.29 per cent in Mahatma Gandhi University and 4.50 per cent in Calicut University are using OHP for learning. The p-value (0.284487) shows that there is no significant association between the level of use of OHP for learning and university.

The application of CD/DVD writer for learning is found among 27.37 per cent of the students in Kerala University, 36.57 per cent of the students in Mahatma Gandhi University and 20.50 per cent of the students in Calicut University. The p-value (0.002434) indicates that there is significant association between level of use of CD/DVD writer for learning and university. The highest level of application CD/DVD writer for learning is found in Mahatma Gandhi University.

The level of application of the IT devices/services such as computer, windows operating system, Internet and photocopier are high in all the three universities for learning. Comparatively higher level of application of Internet, video conferencing facility, printer, LCD projector and CD/DVD writer is found in Mahatma Gandhi University.

Figure 5
Application of IT Devices /Services for Learning



Integration of IT Devices/Services in Curricula

Curriculum is a broad term which not only contains syllabus but the complete plan of action of teaching, learning, student evaluation, directed to achieve defined goal and objectives in a stipulated time frame. Therefore, curriculum of a course has been defined as an educational programme designed and implemented to achieve specified educational objectives (Indian Society for Technical Education and Continuing Education Programme).

Integration of Information Technology devices/services in the curricula in the opinion of teachers and students are presented in Table 14.

Table 14

Integration of IT Devices/Services in Curriculum

University	Teachers	Students

	Yes	No	Yes	No
KU	33.33	66.67	27.37	72.63
MGU	44.29	55.71	33.71	66.29
CU	30.59	69.41	24.00	76.00
Total	35.51	64.49	28.14	71.86

The data presented in the Table 14 shows that a great majority of teacher teachers of Kerala University (66.67 per cent), MG University (55.71 per cent) and Calicut University (69.41 per cent) are of the opinion that the IT devices/services are not integrated in the curriculum. Among the students category, 72.63 per cent from Kerala University, 66.29 per cent of Mahatma Gandhi University and 76.00 per cent from Calicut University have the opinion that the IT devices/services are not integrated in the curriculum.

It can be seen from the Table that majority of the teachers and students in all the three universities are of the opinion that IT devices/services are not integrated in the curriculum.

Application of IT Devices /Services for Research

Application of Information Technology devices/services for the purpose of research among the research scholars of the universities are presented in Table 15 and Figure 6.

Table 15

Application of IT Devices / Services for Research

Devices/Services	KU	MGU	CU	Total	p-value
Computer	70 (100.00)	55 (100.00)	90 (100.00)	215 (100.00)	----
OS (Windows)	64 (91.43)	52 (94.55)	77 (85.56)	193 (89.77)	0.190592
OS (Linux)	19 (27.14)	21 (38.18)	11 (12.22)	51 (23.72)	0.001241
Internet	61 (87.14)	52 (94.55)	71 (78.89)	184 (85.58)	0.030412
Video conferencing	6 (8.57)	11 (20.00)	3 (3.33)	20 (9.30)	0.003512
Edusat	0 (0.00)	0 (0.00)	22 (24.44)	22 (10.23)	0.000000
EMMRC	0 (0.00)	0 (0.00)	14 (15.56)	14 (6.51)	0.000031
Printer	43 (61.43)	40 (72.73)	37 (41.11)	120 (55.81)	0.000511
Scanner	31 (44.29)	27 (49.09)	31 (34.44)	89 (41.40)	0.184894
Photocopier	70 (100.00)	55 (100.00)	90 (100.00)	215 (100.00)	--
LCD Projector	51 (72.86)	43 (78.18)	53 (58.89)	147 (68.37)	0.032699
OHP	14 (20.00)	9 (16.36)	18 (20.00)	41 (19.07)	0.839168
CD/DVD Writer	49 (70.00)	40 (72.73)	46 (51.11)	135 (62.79)	0.010384

The figures in brackets show the respective percentages

Table 15 reveals that cent per cent of the research scholars are using computer from concerned department/university for research purpose. Among the research scholars who use computers, Widows Operating system is used by 91.43 per cent in Kerala University, 94.55 per cent in Mahatma Gandhi University and 85.56 per cent in Calicut University. The p-value (0.190592) indicates that there is no significant association between the level of use of Windows Operating system for research and university. At the same time LINUX Operating system is used by 27.14 per cent of the research scholars in Kerala University, 38.18 per cent of the research scholars in Mahatma Gandhi University and 12.22 per cent of the research scholars in Calicut University.

The p-value (0.001241) indicates that there is significant association between the level of use of Linux Operating system for research and university. Comparatively higher level of use of Linux is seen in Mahatma Gandhi University.

Internet application for research scholars is found among 87.14 per cent of the research scholars in Kerala University, 94.55 per cent in Mahatma Gandhi University and 78.89 per cent in Calicut University. The p-value (0.030412) shows that there is significant association between the level of application of Internet for research and university at 5 per cent level of significance. The highest level of use of internet for research is found Mahatma Gandhi University. Video conferencing facility is used for research by 8.57 per cent of the research scholars in Kerala University, 20.00 per cent in Mahatma Gandhi University and 3.33 per cent of research scholars in Calicut University. The p-value (0.003512) shows that there is significant association between the level of use of video conferencing for research and university. Comparatively higher level of application of video conferencing is found in Mahatma Gandhi University. Edusat facility is used by 24.44 per cent of the research scholars and EMMRC is used by 15.56 per cent of the research scholars in Calicut University.

Printers are used by 61.43 per cent of the research scholars in Kerala University, 72.73 per cent of the research scholars in the Mahatma Gandhi University and 41.11 per cent of the research scholars in Calicut University. The p-value (0.000511) shows that there is significant association between the level of use of printers for research purpose and university. The highest level of use of the printer is seen in Mahatma Gandhi University. Scanner is used by 44.29 per cent of the research scholars in Kerala University, 49.09 per cent of research scholars in Mahatma Gandhi University and 34.44 per cent of the research scholars in Calicut University. The p-value (0.184894) shows that there is no significant association between the level of use of scanner for

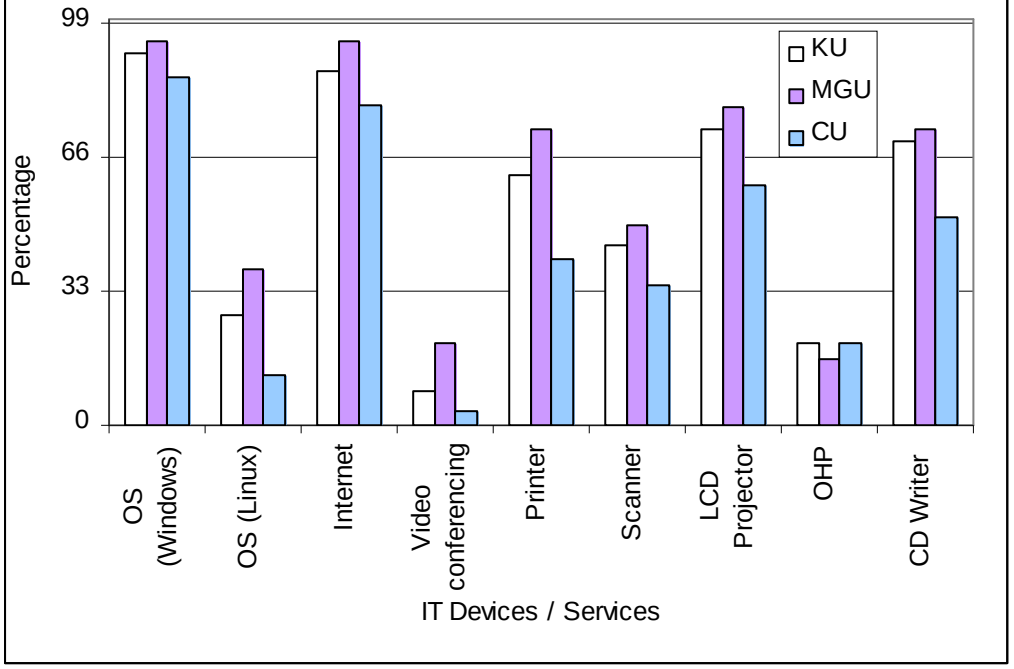
research purpose and university.

Among the research scholars cent per cent in all the three universities use photocopier facility for research. The use of LCD projector for research is found among 72.86 per cent of the research scholars in Kerala University, 78.18 per cent of the research scholars in Mahatma Gandhi University and 58.89 per cent of the research scholars in Calicut University. The p-value (0.032699) shows that there is significant association between the level of use of LCD projector for research and university at 5 pr level of significance level. The highest level of use is found among the research scholars of Mahatma Gandhi University.

The use of OHP for research is comparatively less in universities. Among the research scholars 20.00 per cent in Kerala University, 16.36 per cent in Mahatma Gandhi University and 20.00 per cent in Calicut University are using OHP for research. The p-value (0.839168) shows that there is no significant association between the level of use of OHP for research and university. The application of CD/DVD writer for research is found among 70.00 per cent of the research scholars in Kerala University, 72.73 per cent of the research scholars in Mahatma Gandhi University and 51.11 per cent of the research scholars in Calicut University. The p-value (0.010384) indicates that there is significant association between level of use of CD/DVD writer for research and university. The highest level of application CD/DVD writer for research is found in Mahatma Gandhi University.

The level of application of the IT devices/services such as computer, windows operating system, Internet, photocopier and LCD Projector and CD/DVD writer is high in all the three universities for research. The availability of printer is high in Kerala and Mahatma Gandhi universities. Comparatively higher level of application of Linux, Internet, video conferencing facility, printer, LCD projector and CD/DVD writer is found in Mahatma Gandhi University.

Figure 6
Application of IT Devices / Services for Research



LEVEL OF UTILISATION OF IT DEVICES /SERVICES

Arithmetic mean is used to represent the level of utilization of various IT devices/services among the teachers, students and research scholars. The level utilization has been rated on a five point scale where the minimum and maximum score range from 1 to 5. For grading scoring below 1/3 of the aggregate mean score is rated as low 1/3 to 2/3 as moderate and above 2/3 as high.

- Score in the range of 01 to 1.7 (i.e. below 33 per cent) – low utilization of IT devices / services.
- Score in the range of 1.7 to 3.3 (i.e. 33 per cent to 66 per cent) – moderate utilization of IT devices and services.
- Score in the range of 3.3 – 5 (i.e. 66 per cent to 100 per cent) – high utilization of IT devices and services.

Level of Utilization of IT Devices/Services for Teaching

The level of utilization of Information Technology devices/services for the purpose of effective teaching among the faculty members of the universities are presented in Table 16.

Table 16

Level of Utilization of Computer for Teaching

Purpose of use	KU	MGU	CU	Total	p-value
For preparation, demonstration, presentation	3.24	3.97	3.23	3.48	0.006408
Instructional courseware for teaching, tutorials, drill and practice, simulations and modeling,	3.03	3.35	2.41	2.93	0.000952
Data collection, analysis and report generation (word processing)	3.78	4.24	3.73	3.92	0.068017
To access digital information resources for teaching	2.11	2.81	2.06	2.32	0.003869
Personal and home use	4.26	4.16	3.87	4.10	0.050954

Form the data presented in Table 16, it is clear that the mean scores of the use of computer for preparation, demonstration and presentation for teaching varies between 3.23 and 3.97. The over all mean score is 3.48. This indicates the existence of high level use of computer for preparation, demonstration and presentation among the teachers of Mahatma Gandhi University (Mean score 3.97). There is moderate level of use of computer for the preparation, demonstration and presentation purpose in Kerala University (Mean score =3.24) and in Calicut University (Mean score = 3.23) teaching process. The p-value (0.006408) indicates significant association between the level of use of computer for teaching and university. The Mean score indicates that the highest level of use of computer for preparation, demonstration and presentation among the teachers is the highest in Mahatma Gandhi University.

The overall mean score for the use of computer as instructional courseware for teaching, tutorials, drill and practice, simulations and modeling

is 2.93. The use of computer for this purpose is moderate in Kerala University (Mean score = 3.03) and Calicut University (Mean score = 2.41). The use of computer for this purpose is high in Mahatma Gandhi University (Mean score = 3.35). The p-value (0.000952) shows that there is significant association between the level of use of computer as instructional course ware and university. The highest level of use is found in Mahatma Gandhi University.

From the Table it can also be seen that computers are highly used for data collection, analysis and report generation (Word Processing). The mean score of the use of computer for this purpose among the teachers in Kerala University is 3.78, in Mahatma Gandhi University it is 4.24 and in Calicut University it is 3.73. All these mean scores show high level of use of computer for this purpose. The p-value (0.068017) indicates that there is no significant association between the level of use of computers for data collection, analysis and report generation (word processing) and university.

The mean scores of the use of computers to access digital information resources for teaching range from 2.06 to 2.81. All these mean scores indicate that the level of use of computer for this purpose is only moderate in all the three universities. The p-value (0.003869) shows that there is significant association between the level of use of computer to access digital information resources for teaching and universities. The mean scores show that the highest level of use of computer for this purpose is in Mahatma Gandhi University (Mean score = 2.81).

The mean scores for the personal and home use range from 3.87 to 4.26. This indicates that high level of use of computers for this purpose among the teachers in all the three universities. The p-value (0.050954) indicates that there is no significant association between the level of use of computers and university.

The overall analysis shows that the level of use of computer among the teachers is high for data collection, analysis and report generation (word

processing) and personal and home use in all the three universities. The level of utilization of computers for preparation, demonstration and presentation is also high among the teachers in Mahatma Gandhi University. The level of use is moderate to access digital information resources for teaching in all the three universities.

Level of Utilization of IT Devices/Services for Learning

Level of utilization of information technology devices/services for the purpose of effective learning among the students of the universities are presented in Table 17.

Table 17

Level of Utilization of Computer for Learning

Purpose	KU	MGU	CU	Total	p-value
Course work/learning tool (Drill and practice, tutorial activities, data retrieval	2.58	3.29	2.87	2.91	0.000362
Word processing/report generation	2.88	3.22	1.97	2.69	0.00000
Multimedia presentation	1.59	2.14	1.60	1.78	0.000208
Part of curriculum	1.98	2.43	2.15	2.19	0.118670
To access digital information resources	1.58	1.99	1.42	1.66	0.000387

Form the data presented in Table 17 it is clear that the mean score of the use of computer for course work/learning tool (Drill and practice, tutorial activities, data retrieval) among the student category varies between 2.58 and 3.29. The average mean score is 2.91. This indicates the existence of moderate level of use of computer for course work/ learning tool of the students of all three universities. The p-value (0.000362) indicates that there is significant association between level of utilization of computer for course work/learning and university. The highest level of utilization is seen in Mahatma Gandhi University with mean score of 3.29.

The level of use of computer among the students for word processing / report generation also is moderate (the mean score of Kerala University is 2.88, of Mahatma Gandhi University is 3.22 and of Calicut University is 1.97). The p-value (0.000000) shows significant association between the level of use of computer for this purpose and university. The highest level of utilization is seen among the students of Mahatma Gandhi University.

The data presented in the Table shows that the mean score of the level of use of computer for multimedia presentation varies from 1.59 to 2.14. This

indicates moderate level of use in Mahatma Gandhi University (Mean score = 2.14) and low level of use in Kerala University (Mean score =1.59) and Calicut University (Mean score =1.60). The p-value (0.000208) indicates significant association between the level of use of computer for multimedia presentation and university.

The level of use of computer as part of curriculum is only moderate in all the three universities. The mean score varies between 1.98 and 2.43. The p-value (0.118670) indicates that there is no significant association between level of use of computer as part of curriculum and university.

The mean scores indicate that there is only low level use of computers in universities to access digital resources except in Mahatma Gandhi University. The level of use in Mahatma Gandhi University is moderate (Mean score = 1.99). The p-value (0.000387) shows significant association between the level of use of computer and university in this regard.

The overall analysis shows that the level of use of computer among the students is not high in any of the university taken for the study.

Level of Utilization of IT Devices/Services for Research

Level of utilization of Information Technology devices/services for the purpose of effective research among the research scholars of the major universities are presented in Table 18.

Table 18

Level of Utilization of Computer for Research

Purpose	KU	MGU	CU	Total	p-value
To access high quality databanks as a source for data mining	2.03	2.90	1.81	2.25	0.00000
Knowledge creation: sharing of information (Electronic Publishing, writing books/articles)	1.86	2.31	1.74	1.97	0.00499
Interpretation of collected data and electronic presentation (word processing and spread sheet)	4.00	4.00	3.79	3.93	0.25779
For using research management tool	2.60	2.76	2.12	2.50	0.00577
Design and create multimedia presentation	3.46	3.71	2.87	3.35	0.00011

Higher education institutions are in the knowledge business, since they are involved in knowledge creation and dissemination. The levels of use of computers by the research scholars for various purposes are summarized in Table 18.

The mean scores presented in Table 18 indicates moderate level of utilization of computer for accessing high quality data banks. The mean scores varies between 1.81 and 2.90. The p-value (0.00000) that there is significant association between the level of use of computer for accessing high quality data bank and university. Comparatively high level of use is seen in Mahatma Gandhi University (Mean score = 2.90).

The level of use of computer for knowledge creation and dissemination among the researchers also is moderate. The mean scores indicate that comparatively higher level of use is among the research scholars in Mahatma Gandhi University. The p-value (0.00499) shows that the university wise variation is in knowledge creation is significant at 1 per cent.

High level of use of computer among the research scholars is found for interpretation of collected data and electronic presentation. The mean score is 4.00 in Kerala University and Mahatma Gandhi University. The mean score in Calicut University is 3.79. The p-value (0.25779) indicates no significant association between the level of use of computers and university in this regard.

The researchers use different variety of powerful tools like SPSS, SAS, multivariate statistical analysis for data analysis, drawing structures, etc. It is seen that level of use of computer by the research scholars for research management tool varies between 2.12 to 2.76 in a scale where the maximum score is five. The aggregate mean score is 2.50. This indicates the existence of moderate level of computer use for research management tool. The p-value (0.00577) indicates significant association between the level of use and university. The highest level of computer use (2.76) is seen against Mahatma Gandhi University.

Multimedia is a collection of computer-centered technologies that give a user the capability to access and manipulate text, audio and video. Data presented in the Table shows that University wise computer use/application score varies from 2.87 to 3.71. The level of use of the computer for design and creating multimedia presentation is high in Kerala University (Mean score = 3.46) and Mahatma Gandhi University (Mean score = 3.71). The p-value (0.00010) shows significant association between the level of use of computer and university in this regard. The highest level of use is indicated by the mean score 3.71 against Mahatma Gandhi University.

University wise analysis shows moderate level of utilization of computers to access high quality data banks, knowledge creation and dissemination and for using research management tool. High level of utilization of computers is seen in all the universities only in the case of interpretation of collected data and electronic presentation. The level of utilization of computer for research in designing multimedia presentation is high in Kerala and Mahatma Gandhi universities.

Level of utilization of Communication Technology for Teaching

Level of utilization of communication technology devices/services for the purpose of effective teaching among the teachers of the major universities are presented in Table 19.

Table 19

Level of Utilization of Communication Technology for Teaching

Purpose	KU	MGU	CU	Total	p-value
Internet browsing	3.76	4.09	3.24	3.69	0.002739
E-mail	4.31	4.46	4.18	4.31	0.629548
Video conferencing	1.40	1.76	1.28	1.66	0.102248
Distant teaching / smart class room	1.29	1.54	2.21	1.48	0.026252
For higher studies and scholarship	3.08	3.76	2.91	3.22	0.009833

From the data presented in Table 19 it is clear that the use of communication technology for Internet browsing by the teachers is high in all the universities except in the Calicut University. The highest level of use is indicated by the mean score 4.09 against Mahatma Gandhi University. The p-value (0.002739) confirms significant association between the level of use and university. High level of use is indicated by the mean scores in all the three universities in the case of e-mail also. The p-value (0.629548) indicates no significant association between the level of use and university. The level of utilization of video conferencing facility is low in the universities except in Mahatma Gandhi University (Mean score= 1.76 for Mahatma Gandhi University). However, the p-value (0.102248) indicates there is no significant association between the level of use and university.

Distance learning/smart classroom facility is less used by the teachers in Kerala University (Mean score = 1.29) and Mahatma Gandhi University (Mean score = 1.54). The use is moderate in Calicut University (Mean score = 2.21).

The p-value (0.026252) indicates significant association between the level of use and university in this regard at 5 per cent level of significance.

The level of use of communication technologies for higher studies and scholarships is moderate in Kerala University (Mean score = 3.08) and Calicut University (Mean score = 2.91). The use is high in Mahatma Gandhi University (Mean score = 3.76). The p-value (0.009833) also confirms significant association between the level of use and university.

The mean scores indicate that high level of use among the teachers in all the three universities is found only in the case of e-mail. Higher level of Internet use is found among the teachers of Kerala University and Mahatma Gandhi University. The use of communication technology is high for higher studies and scholarships among the teachers of Mahatma Gandhi University.

Level of Utilization of Communication Technology for Learning

Level of utilization of communication technology devices/services for the purpose of effective learning among the students of the major universities are presented in Table 20.

Table 20

Level of Utilization of Communication Technology for Learning

Purpose	KU	MGU	CU	Total	p-value
Internet browsing	4.09	4.22	4.02	4.11	0.26294
E mail communication	4.03	4.37	3.83	4.07	0.00072
Video conferencing/ interactive class room	1.28	1.53	1.36	1.39	0.03247
Social networks	1.35	1.82	1.52	1.56	0.00053
For higher studies and job seeking	3.90	3.96	3.24	3.70	0.00000

From the data presented in Table 20 it is clear that the use of Internet and e-mail is high among the students in all the three universities. The p-value for the variable internet browsing (0.026294) indicates no significant association with university, but in the case of e- mail the p-value (0.00072) indicates significant association with university. The highest level of e-mail use is indicated against Mahatma Gandhi University (Mean score = 4.37).

The level of utilization of video conferencing / interactive classroom facility among the students is low in all the three universities. The p-value (0.03247) indicates significant association between the level of use and university in this case at 5 per cent level of significance. Comparatively higher level of use is seen Mahatma Gandhi University. The use of social networks is low among students in Kerala University and Calicut University. It is moderate in Mahatma Gandhi University (Mean score = 1.82). The p-value (0.00053) confirms this.

The use of communication technology for higher studies and job seeking is high in Kerala University and Mahatma Gandhi University. It is moderate in Calicut University. The p-value (0.00000) indicates significant association between the level of use and university. The highest level is indicated against

Mahatma Gandhi University (Mean score = 3.96).

The levels of Internet browsing and e-mail communication is higher for learning in all the three universities taken for the study. High level of use of communication technology for higher studies and job seeking is found in Kerala University and Mahatma Gandhi University.

Level of Utilization of Communication Technology for Research

Level of utilization of communication technology devices/services for the purpose of effective research among the research scholars of the major universities are presented in Table 21.

Table 21

Level of Utilization of Communication Technology for Research

Purpose	KU	MGU	CU	Total	p-value
To Browse Internet	4.36	4.36	3.94	4.22	0.00038
For e-mail communication	4.75	4.60	4.34	4.57	0.00001
Data base search	3.39	3.69	2.87	3.32	0.00000
Social networking	1.93	2.85	1.79	2.19	0.00000
Higher studies and fellowship	3.25	4.32	3.87	3.81	0.00000

From the data presented in Table 21 it is clear that among the communication technologies high level of use is indicated by the mean scores against Internet browsing and e-mail communication. The p-value (0.00038) against internet browsing indicates significant association between the level of use and university. The lowest level of use is indicates against Calicut University (Mean score = 3.94). The p-value against e-mail (0.00001) also indicates significant association between the level of use and university. The highest level is indicated against Kerala University (Mean score = 4.75) and lowest level is shows against Calicut University (Mean score = 4.34). The

utilization of data base search facility is high among the research scholars in Kerala University and Mahatma Gandhi University. However, it is only moderate in Calicut University (Mean score = 2.87). The p-value (0.00000) indicates the significant association between the level of use and university. The highest level is seen in Mahatma Gandhi University (Mean score = 3.69).

The level of use of social networking is moderate among the research scholars in all the three universities. The p-value (0.00000) indicates significant association between the level of use and university. Comparatively higher level of use of social networking is found in Mahatma Gandhi University (Mean score = 2.85).

From the Table, it is clear that that the mean score for use of communication technology for higher studies and fellowship is high in Mahatma Gandhi University and Calicut University. It is moderate in Kerala University. The p-value (0.00000) indicates significant association between level of use and university in this case. The highest mean score is indicated against Mahatma Gandhi University.

The Table reveals that the utilization of communication technology for research is high in the case of internet browsing and e-mail communication in all the three universities. The level of use of communication technology for research is high in Kerala and Mahatma Gandhi universities is high in the case of database search as well. For higher studies and fellowship the communication technology is highly used in Mahatma Gandhi and Calicut universities.

Level of Utilization of Information Technology Peripherals for Teaching

Level of utilization of information technology peripheral for the purpose of effective teaching among the teachers of the major universities is presented in Table 22.

Table 22

Level of Utilization of IT Peripherals for Teaching

Purpose	KU	MGU	CU	Total	p-value
As an out put source (Printing, copying, saving, writing on CD/DVD)	3.84	4.01	3.78	3.88	0.555239
Multimedia Presentation tool	3.09	3.66	2.55	3.10	0.000214
Photocopying	3.90	4.47	3.47	3.95	0.000019
To read microforms	1.09	1.30	1.06	1.15	0.059305
Traditional presentation tool	1.48	1.63	1.64	1.58	0.672239

From the data presented in Table 22 it is clear that the application of IT peripherals as an out put source (printing, copying, storing and writing on CD/ DVD) among the teachers varies from 3.78 to 4.01. The highest means score of 4.01 is recorded against Mahatma Gandhi University followed by Kerala University (Mean score = 3.84) and Calicut University (Mean score =3.78). The result shows that application of IT peripherals as an out put source is high in all the three universities taken for the study. The p-value (0.555239) indicates no significant association between the level of use of these IT peripherals and universities.

It is revealed from the Table that the level of use of Multimedia presentation (LCD) varies between 2.55 to 3.66. The mean score in Kerala University is 3.09, in MG University it is 3.66 and in Calicut University 2.55. The p-value (0.000214) indicates significant association between the level of use of multimedia presentation tool and university. The use of photocopying service among the teachers in all the universities is high. The p-value (0.000019) indicates significant association between the level of use of photocopying service and university. The highest level of use is in Mahatma Gandhi University (Mean score 4.47). The level of use of IT based tools to read microforms is low in all the three universities. The p-value (0.059305) indicates no significant association between the level of use and university. The level of use of traditional presentation tools also is low in all the three universities. The p-value (0.672239) indicates no significant association between the level of use of such tools and university.

Among the teachers in all the three universities the use of IT peripheral as an out put source and photocopying service is high. High level of use of multimedia presentation tool is seen in Mahatma Gandhi University. The use of traditional presentation tools and tools to use microforms are low.

Level of Utilization of Information Technology Peripherals for Learning

Level of utilization of information technology peripheral for the purpose of effective learning among the students of the three major universities is presented in Table 23.

Table 23

Level of Utilization of IT Peripherals for Learning

Purpose	KU	MGU	CU	Total	p-value
Xeroxing (Photocopying)	3.83	3.86	2.93	3.54	0.00000
Output source (Printer, CD/DVD Writer)	2.16	2.61	2.04	2.27	0.01687
Digital data source access (CDROMs)	1.74	1.83	1.22	1.60	0.00000
Presentation tool	1.52	1.55	1.24	1.43	0.00134

Table 23 shows that the mean score for the utilization of Xeroxing for learning purpose in Kerala University is 3.83. At the same time it is 3.86 in Mahatma Gandhi University and 2.93 in Calicut University. The p-value (0.00000) indicates the significant association between the level of use of Xeroxing facility and university. The highest level of use is in Mahatma Gandhi University. The use of out put source like printer, CD/DVD writer etc. is moderate among the students in all the three universities. The p-value (0.01687) indicates significant association between the level of use of out put source and university at 5 per cent level of significance. Comparatively higher level of use is in Mahatma Gandhi University (Mean score = 2.61).

The level of use of digital data source access is moderate in Kerala University (Mean score = 1.74) and Mahatma Gandhi University (Mean score = 1.83). Low level is indicated by the mean score 1.22 in Calicut University. The p-value (0.00000) confirms the significant association between the level of use and university.

The mean scores for the level of use for presentation tools, virtual classroom and digital learning are low in all the three universities. However, the p-values indicate significant association between the level of use and university. Comparatively higher level use is in Mahatma Gandhi University.

The overall picture shows that the level of use of IT peripherals except the photocopying facility in Kerala and Mahatma Gandhi universities is not high among the students in the universities in Kerala.

Level of Utilization of Information Technology Peripherals for Research

Level of utilization of information technology peripheral for the purpose of effective research among the research scholars of the three major universities is presented in Table 24.

Table 24

Level of Utilization of IT Peripherals for Research

Purpose	KU	MGU	CU	Total	p-value
Photocopying	3.95	4.03	3.84	3.94	0.07310
Out put source (printer, CD/DVD writer)	3.80	4.17	2.56	3.51	0.00000
Multimedia presentation tool	3.70	3.69	2.63	3.34	0.00000
Access to digital resource (CDROMs)	1.97	2.65	1.62	2.08	0.00000

From Table 24 it is clear that the mean scores of using IT peripherals by research scholars vary between 3.84 and 4.03 in a five point scale. The average mean score is 3.94. This shows the high degree of utilization of photocopying service by the research scholars. The p-value (0.07310) shows no significant association between the level of use and university. The level of use of out put source like printer is high in Kerala University (Mean score = 3.80) and Mahatma Gandhi University (Mean score = 4.17). It is moderate in Calicut University (Mean score= 2.56). The p-value (0.00000) shows significant association between the level of use and university. The highest level of use is in Mahatma Gandhi University.

In the case of multimedia presentation tool also the level of use is high in Kerala University (Mean score = 3.70) and Mahatma Gandhi University (Mean score = 3.69), It is only moderate in Calicut University (Mean score = 2.63). The p-value (0.00000) indicates significant association between the level of use of multimedia presentation tool and university. The highest level of use is in Kerala University. The use of IT peripherals among the research scholars to access digital resource is moderate in all the three universities. The p-value (0.00000) indicates significant association between the level of use and university. Comparatively higher level of use is in Mahatma Gandhi University (Mean score = 2.65).

In all the three universities the level of utilization of photocopying facility is high among the research scholars. The use of output source and multimedia presentation tool is also high in Kerala University and Mahatma Gandhi University.

Level of Utilization of Digital Library Services for Teaching

Level of utilization of digital library services for the purpose of effective teaching among the teachers of the three major universities is presented in Table 25.

Table 25

Level of Utilization of Digital Library Services for Teaching

Purpose	KU	MGU	CU	Total	p-value
Online Public Access Catalogue	4.28	4.41	3.27	3.99	0.000000
Electronic Data Sources Service	1.61	2.07	1.12	1.60	0.000000
Access to E-Journals/ E-Contents	3.71	4.30	3.35	3.79	0.000869
SDI/CAS Services (Online)	1.22	1.59	1.12	1.31	0.000352

Table 25 shows that there is high level of use of OPAC in Kerala University (Mean score = 4.28) and Mahatma Gandhi University (Mean score = 4.41). It is only moderate in Calicut University (Mean score 3.27). The p-value (0.000000) indicates significance association between the level of use of OPAC and university. The highest level of use is in Mahatma Gandhi University. The use of electronic data source service is low in Kerala University (Mean score = 1.61) and in Calicut University (Mean score = 1.12). It is moderate in Mahatma Gandhi University (Mean score = 2.07). The p-value (0.000000) indicates significant association between the level of use of electronic data source and university.

The mean scores indicate that the level of use of e- journals/e-contents is high among the teachers in all the three universities. The p-value (0.000869)

shows significant association between the level of use of e journal/e contents and university. The highest level of use is in Mahatma Gandhi University (Mean score = 4.30). The use of online SDI / CAS is low in all the three universities. The p-value (0.000352) indicates that there is significant association between the level of use and university in this case. Comparatively higher level is seen Mahatma Gandhi University (Mean score = 1.59).

It can be seen from the Table that high level of use among the teachers in all the three universities is found only in the case of e-journals/ e-contents. The use of OPAC is high in Kerala University and Mahatma Gandhi University.

Level of Utilization of Digital Library Services for Learning

Level of utilization of digital library services for the purpose of effective learning among the students of the major universities is presented in Table 26.

Table 26

Level of Utilization of Digital library Services for Learning

Service	KU	MGU	CU	Total	p-value
Online Public Access Catalogue	3.83	3.86	2.92	3.52	0.00000
E journal/E content	2.16	2.61	2.04	2.26	0.00198
SDI/CAS service	1.74	1.83	1.22	1.58	0.00000
Data base search	1.00	1.59	1.13	1.23	0.00000

Table 26 shows that there is high level of use of OPAC in Kerala University (Mean score = 3.83) and Mahatma Gandhi University (Mean score = 3.86). It is only moderate in Calicut University (Mean score 2.92). The p-value (0.000000) indicates significance association between the level of use of OPAC and University. The highest level of use is in Mahatma Gandhi University.

The mean scores indicate that the level of use of e- journals/e-contents is

moderate among the students in all the three universities. The p-value (0.00198) shows significant association between the level of use of e journal/e contents and university. Comparatively higher level of use is in Mahatma Gandhi University (Mean score = 2.61). The use of online SDI / CAS is moderate in Kerala University (Mean score = 1.74) and Mahatma Gandhi University (Mean score = 1.83). It is low in Calicut University (Mean score = 1.22). The p-value (0.00000) indicates that there is significant association between the level of use and university in this case. Comparatively higher level is seen in Mahatma Gandhi University.

The level of use of data base is low among the students in all the three universities. The p-value (0.00000) indicates significant association between the level of use and university. Comparatively higher level of use of data base is in Mahatma Gandhi University (Mean score = 1.59).

It can be seen from the Table that high level of use among the students is found only in the case of OPAC in Kerala University and Mahatma Gandhi University.

Level of Utilization of Digital library Services for Research

Level of utilization of digital library services for the purpose of effective research among the research scholars of the major universities is presented in Table 27.

Table 27

Level of Utilization of Digital Library Services for Research

Purpose	KU	MGU	CU	Total	p-value
Online Public Access Catalogue (OPAC)	4.62	4.33	3.87	4.27	0.00000
E-Journals/contents	4.23	4.32	1.83	3.46	0.00000
SDI/CAS	2.10	2.24	1.00	1.78	0.00000
Data bases	2.80	2.36	1.00	2.05	0.00000

Table 27 shows that there is high level of use of OPAC in all the three universities. The p-value (0.000000) indicates significance association between the level of use of OPAC and university. The highest level of use is in Kerala University (Mean score = 4.62).

The mean scores indicate that the level of use of e- journals/e-contents is high among the research scholars in Kerala University (Mean score = 4.23) and Mahatma Gandhi University (Mean score = 4.32). It is only moderate in Calicut University (Mean score = 1.83). The p-value (0.00000) shows significant association between the level of use of e- journal/e- contents and university. The highest level of use is in Mahatma Gandhi University (Mean score = 4.32). The use of online SDI / CAS is moderate in Kerala University (Mean score = 2.10) and Mahatma Gandhi University (Mean score = 2.24). It is low in Calicut University (Mean score = 1.00). The p-value (0.00000) indicates that there is significant association between the level of use and university in this case. Comparatively higher level is seen Mahatma Gandhi University.

The level of use of data base is moderate among the research scholars of Kerala University (Mean score = 2.80) and Mahatma Gandhi University (Mean score = 2.36). It is low in Calicut University (Mean score =1.00). The p-value (0.00000) indicates significant association between the level of use and university. Comparatively higher level of use of data base is in Kerala University (Mean score = 2.80).

It can be seen from the Table that high level of utilization among the research scholars in all the three universities is found in the case of OPAC. It can also be seen that there is high level of use among the research scholars in Kerala University and Mahatma Gandhi University in the case of e-journal/e-contents.

Satisfaction with Existing IT Devices /Services in the Faculty/University

The satisfaction regarding the present status of IT devices/services is measured to find out the efficacy of the existing system and qualitative and quantitative deficiency of the existing system.

The over all satisfaction with existing information technology devices/ services for the purpose of teaching, learning and research are presented in Table 28 and Figure 7.

Table 28

Satisfaction with Existing IT Devices / Services

Category	KU	MGU	CU	Total
Teachers	54.44	58.57	51.76	54.69
Students	54.21	56.00	47.00	52.21
Research scholars	54.29	65.45	38.89	50.70
Total	54.29	58.33	46.13	52.49

Table 28 reveals that the majority of the teachers in all the three universities are satisfied in the existing IT devices/services. Among the students the majority are satisfied in Kerala University (54.21 per cent) and Mahatma Gandhi University (56.00 per cent) and Mahatma Gandhi University. The majority of research scholars in Kerala University (54.29 per cent) and Mahatma Gandhi University (65.45 per cent) are also satisfied in the existing IT devices/services.

It can be seen from the table that the level of satisfaction with existing IT devices/services is high among the teacher of three universities and in all the students and research scholars in Kerala and Mahatma Gandhi universities.

Figure 7
Satisfaction with Existing IT Devices / Services

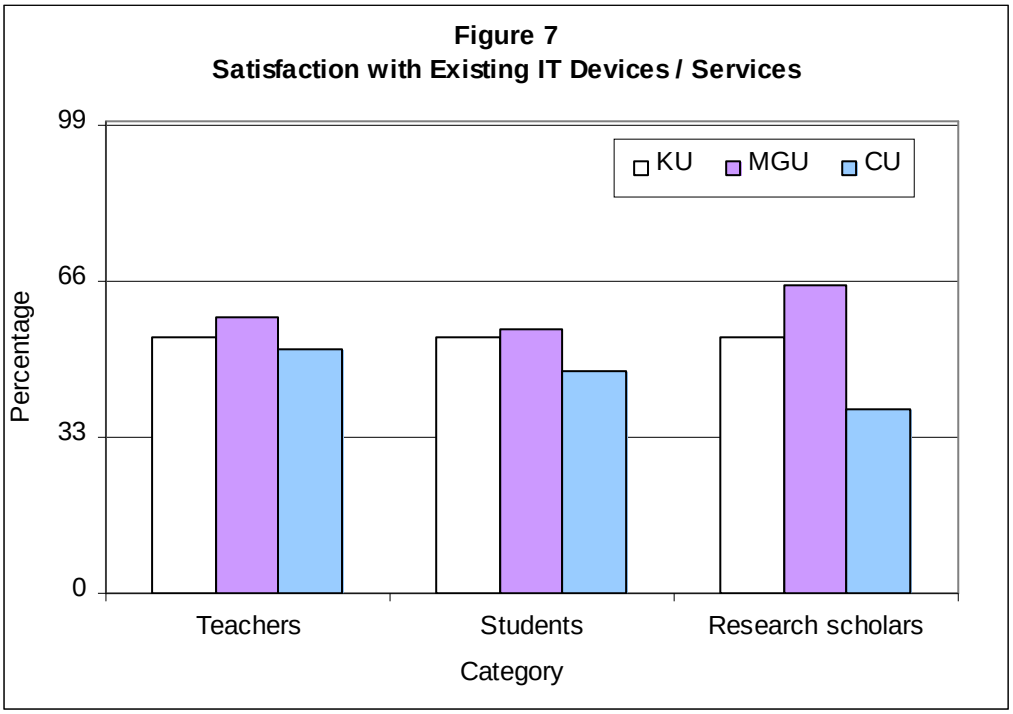


Table 29

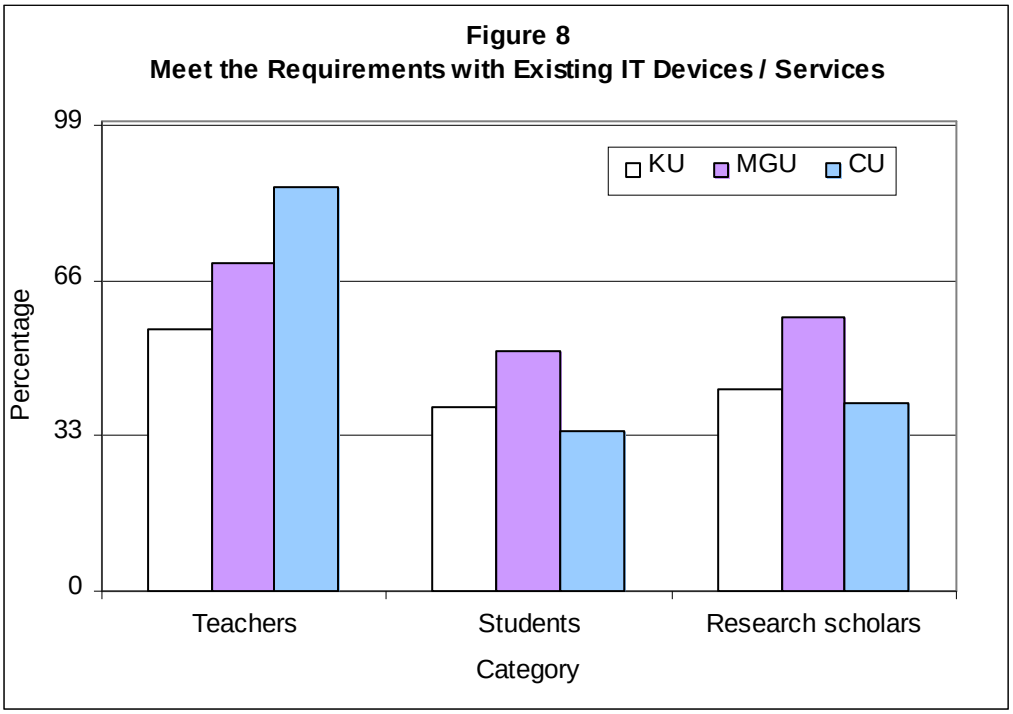
Meeting the Requirements with Existing IT Devices / Services

Category	KU	MGU	CU	Total
Teachers	55.56	70.00	85.88	70.20
Students	38.95	50.86	34.00	40.88
Research scholars	42.86	58.18	40.00	45.58
Total	44.00	56.67	47.20	48.88

The Universities are investing a huge amount for the Information technology devices/services for the modernization of teaching, learning and research process. However, Table 29 and Figure 8 shows that the majority of the students and research scholars in Kerala University and Calicut University are not able to meet the requirements with the existing IT devices/services. It can also be seen from the Table that the majority of the teachers in all the three universities are able to meet their requirements with the existing IT devices/services.

The Table shows that students and research scholars in Kerala and Calicut universities are not able to meet the requirements with the existing IT devices/services. However, the majority of the teachers have opinion that they are able to meet their requirements with the existing IT device/services. The majority of the students and research scholars in Mahatma Gandhi University also have the opinion that they are able to meet the requirements with existing IT devices/ services. This is shown in Figure 8 also.

Figure 8
Meet the Requirements with Existing IT Devices / Services



Satisfaction with the Application of Existing IT Devices / Services

The satisfaction with the application of existing IT devices / services for the purpose of teaching, learning and research are presented in Table 30 and Figure 9.

Table 30

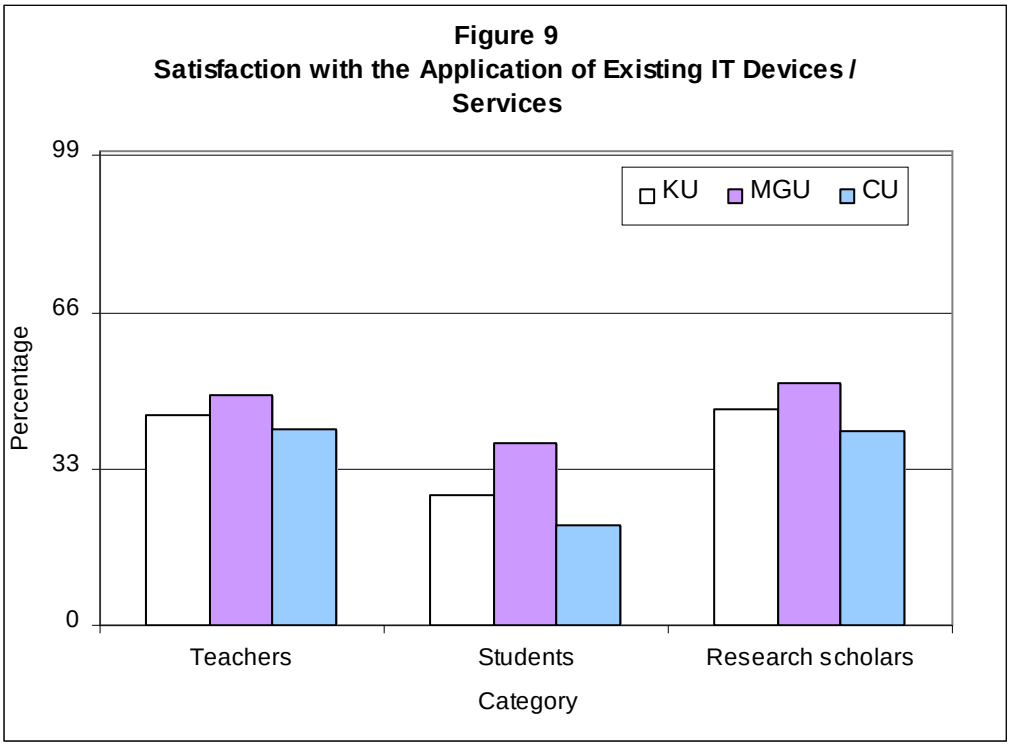
Satisfaction with the Application of Existing IT Devices / Services

Category	KU	MGU	CU	Total
Teachers	44.44	48.57	41.18	44.49
Students	27.37	38.29	21.00	28.50
Research scholars	45.71	50.91	41.11	45.12
Total	35.43	43.00	30.40	35.80

Table 30 reveals that the majority of the teachers and students in all the three universities are not satisfied in the application of IT devices/services in their respective areas. Among the research scholars also, satisfaction in this regard is low except among the slight majority in Mahatma Gandhi University. Even though Universities are having the Information technology devices/services, the academic community from whole category is not satisfied in the application of IT devices/services.

This reveals that the level of application of IT device/services is not optimum in teaching, learning and research process.

Figure 9
Satisfaction with the Application of Existing IT Devices / Services



BARRIERS OF UTILIZATION OF IT DEVICES/ SERVICES

A barrier is any condition that makes it difficult to make progress or to achieve an objective. Adoption of any technology presents a great challenge. This is true in the case of Information technology too. The higher education system especially University system faces a host of issues ranging from providing sufficient infrastructure facilities to accessibility. Adequate departmental infrastructure, education resources in digital format, trained faculty/manpower, technological skill and organizational strategy and policy etc. have to be faced and resolved. The act of integrating technology into teaching, learning and research is a complex process and one may encounter a number of difficulties. These difficulties are known as barriers.

Like books, computer assisted information systems are reservoirs of information and human intelligence. Unless these reservoirs are accessible and

generally available, the information so stored has little or no value, or is useful only to a few. Campus system will become more accessible through information technology, allowing teachers, students and research scholars to interact with the information in varying ways to achieving their mission. There fore it is essential to remove the barriers for optimum utilization of existing Information technology devices/services for teaching, learning and research to achieve the institutional goals.

Barriers of the Utilization of Computer technology for Teaching

Barriers of the utilization of computer technology for the purpose of effective teaching among the teachers of the major universities is presented in Table 31 and Figure 10.

Table 31

Barriers of the Utilization of Computer Technology for Teaching

Barriers	KU	MGU	CU	Chi-square	P value
Lack of adequate departmental infrastructure	62 (68.89)	42 (60.00)	58 (68.24)	1.64823	0.438632
Funding for Information technology	70 (77.78)	51 (72.86)	63 (74.12)	.577307	0.749274
Shortage of trained IT human resources	60 (66.67)	39 (55.71)	65 (76.47)	7.47765	0.023792
Lack of IT training / experience in the use of computer	42 (46.67)	29 (41.43)	46 (54.12)	2.54487	0.280163
Lack of integration of IT in the curriculum / course	58 (64.44)	37 (52.86)	62 (72.94)	6.73538	0.034481
Lack of organization's IT policy, strategy and vision	51 (56.67)	38 (54.29)	53 (62.35)	1.12281	0.570413

The figures in brackets show the respective percentages

Table 31 shows that 68.89 per cent of the teachers in Kerala University, 60.00 per cent in MG University and 68.24 per cent in Calicut University are having the problem of lack of adequate departmental infrastructure for the maximum utilization of existing IT devices/service in the teaching. The p-value

(0.438632) shows that there is no significant association between the level of barrier and university in this regard.

Lack of fund is a major barrier according to the teachers of Kerala University (77.78 per cent), MG University (72.86 per cent) and Calicut University 74.12 per cent) for the utilization of computer technology efficiently and effectively for teaching. The p-value (0.749274) indicates no significant association between the level of barrier and university.

Most of the faculties are equipped with IT devices/services. However, many have not added the necessary technical staff to help faculty members. Shortage of trained human resources is another major barrier for the teachers of Kerala University (66.67 per cent), Mahatma Gandhi University (55.71 per cent) and Calicut University (76.47 per cent). There is significant difference in the shortage of trained human resources among the universities, since the p-value (0.023792) is less than 0.05 which shows significant association between the level of barrier and university.

Eventhough faculty members are willing to use IT devices/service in teaching, there is a need for continuous training, experience and development schemes for effective and efficient usage of Information technology devices. Data presented in the Table 31 indicates that lack of training/experience in the use of computer is one of the barriers among the teachers of Kerala University (46.67 per cent), MG University (41.43 per cent) and Calicut University (54.12 per cent) for optimum utilization of existing technology in teaching. The p-value (0.280163) shows no significant association between the level of barrier and university in this case.

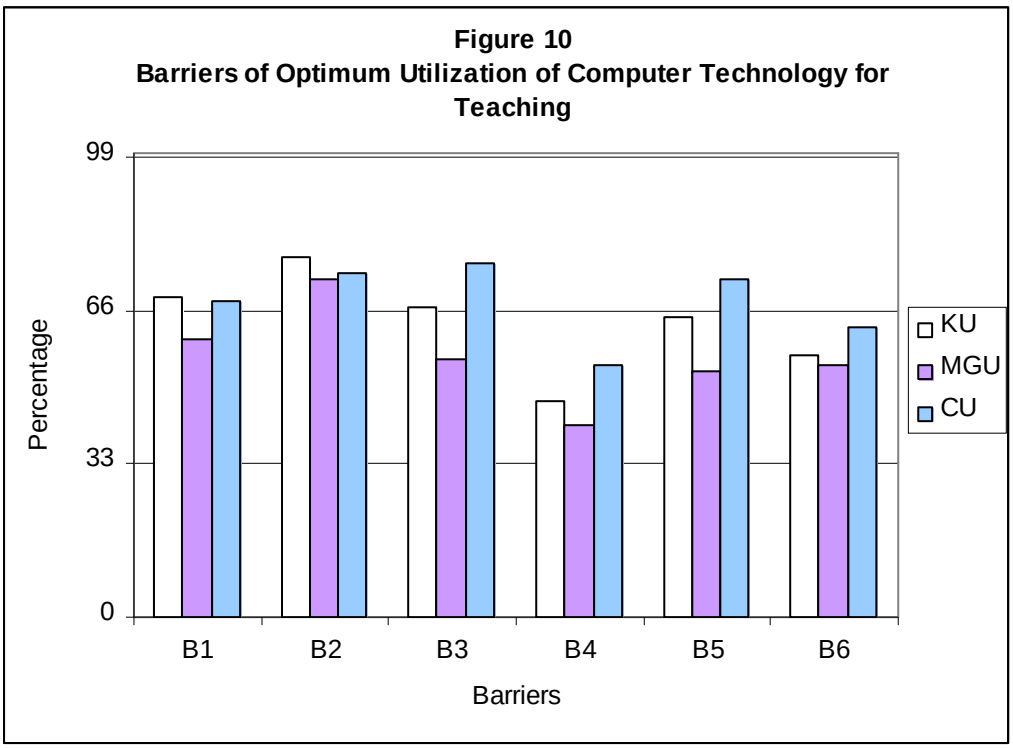
The curriculum and content of courses has to be changed on a continuous basis to reflect changes taking place in the society and the new knowledge that is available. Many universities in Kerala have not changed their curricula for decades. Curriculum planning in higher educational context in Universities has been primarily in the province of individual faculty or small

group of faculty responsible for a particular area or discipline. Lack of integrated Information Technology devices in the curriculum/course is a major obstacle for preventing the optimum utilization of IT devices/services among teachers of Kerala University (64.44 per cent), Mahatma Gandhi University (52.86 per cent) and Calicut University (72.94 per cent). The p-value (0.034481) shows significant association at 5 per cent level in this regard between the level of barrier and university. This barrier is felt more among the teachers of Calicut University.

The Table also shows that 56.67 per cent of teachers in Kerala University, 54.29 per cent of the teachers in MG University and 62.35 per cent of the teachers in Calicut University are of the opinion that lack of organization's IT policy, strategy and vision is a major barrier in the optimum utilization of computer technology for teaching. The p-value (0.570413) indicates no significant association between the level of this barrier and university. This is a critical issue for institutions because without proper planning and strategy expenditure made vacuum regarding overall technology architecture.

The Table reveals that lack of adequate departmental infrastructure, funding for Information Technology, shortage of trained IT human resources, lack of integration of IT in the curriculum / course and lack of organization's IT policy, strategy and vision are the important barriers in all the three universities in the optimum use of computer technology for teaching.

Figure 10
Barriers of Optimum Utilization of Computer Technology for Teaching



B1 : Lack of adequate departmental infrastructure
B2 : Funding for Information technology
B3 : Shortage of trained IT human resources
B4 : Lack of IT training / experience in the use of computer
B5 : Lack of integration of IT in the curriculum / course
B6 : Lack of organization's IT policy, strategy and vision

Barriers of the Utilization of Computer Technology for Learning

Barriers of utilization of computer technology for the purpose of effective learning among the students of the major universities are presented in Table 32 and Figure 11.

Table 32

Barriers of the Utilization of Computer Technology for Learning

Barrier	KU	MGU	CU	Chi-square	p-value
Lack of Accessibility	103 (54.21)	97 (55.43)	124 (62.00)	2.79768	0.246898
Lack of infrastructural facility	151 (79.47)	109 (62.29)	154 (77.00)	15.9369	0.000347
Lack of computer literacy/ know how	93 (48.95)	81 (46.29)	118 (59.00)	6.89879	0.031777
Lack of integration of IT devices / services in the curriculum	128 (67.37)	104 (59.43)	130 (65.00)	2.61080	0.271078
Lack of trained faculty/ man power	141 (74.21)	116 (66.29)	148 (74.00)	3.63826	0.162184
Lack of periodic review of curricula and content	135 (71.05)	110 (62.86)	147 (73.50)	5.35319	0.068813

The figures in brackets show the respective percentages

Table 32 shows that 54.21 per cent of the students in Kerala University, 55.43 per cent in MG University and 62.00 per cent in Calicut University are having the problem of lack of accessibility for the optimum utilization of existing IT devices/service in the learning. The p-value (0.246898) shows that there is no significant association between the level of barrier and university in this regard.

Lack of infrastructure facility is a major barrier for 79.47 per cent of the students in Kerala University, 62.29 per cent in MG University and 77.00 per cent in Calicut University. The p-value (0.000347) shows that there is significant association between the level of barrier and university in this regard. This barrier felt more among the students in Kerala University.

Lack of computer literacy / know how is another major barrier felt by the students of Kerala University (48.95 per cent), MG University (46.29 per cent) and Calicut University 59.00 per cent) for the utilization of computer technology efficiently and effectively for learning. The p-value (0.031777)

indicates significant association between the level of barrier and university at 5 per cent level in this case. Comparatively higher level of this barrier is felt among the students of Calicut University.

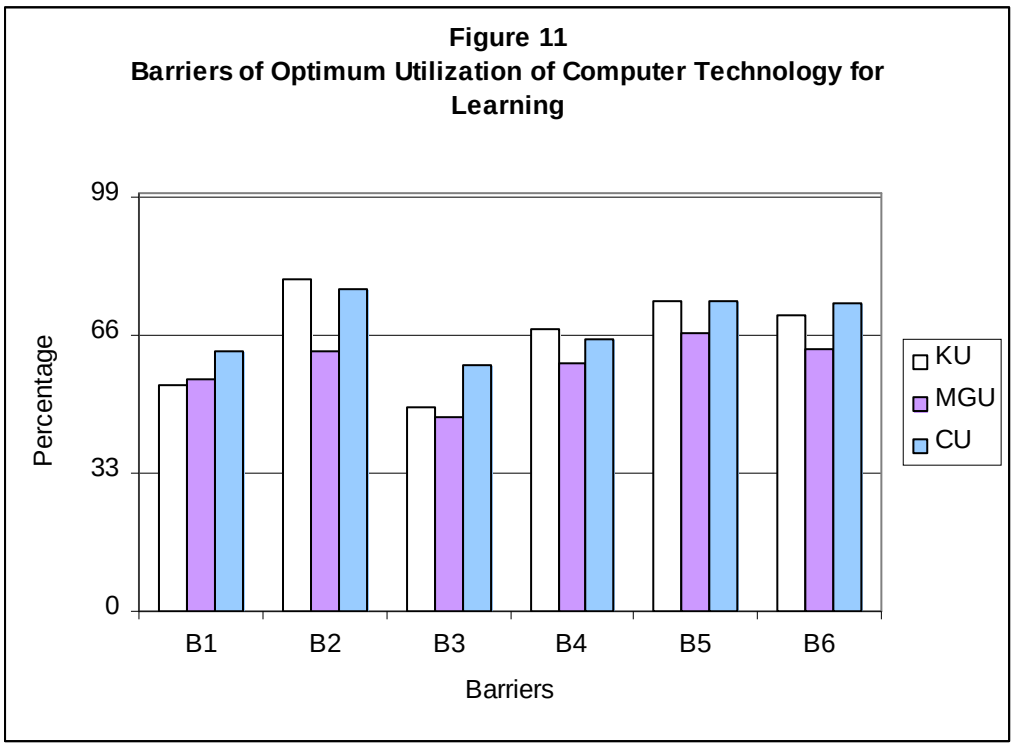
Lack of integration of Information technology devices/services in the curriculum is yet another major obstacle for the optimum utilization of IT devices/services among the students of Kerala University (67.37 per cent), Mahatma Gandhi University (59.43 per cent) and Calicut University (65.00 per cent). The p-value (0.271078) shows no significant association between the level of barrier and university.

Lack of trained faculty/ human resources is a major barrier for the students of Kerala University (74.21per cent), Mahatma Gandhi University (66.29 per cent) and Calicut University (74.00 per cent). The p-value (0.162184) shows no significant association between the level of barrier and university in this regard.

Lack of periodic review of curricula and content is felt as another major barrier among 71.05 per cent of the students in Kerala University, 62.86 per cent of the students in Mahatma Gandhi University and 73.50 per cent of the students in Calicut University. The p-value (0.068813) indicates no significant association between the level of this barrier and university.

Lack of accessibility, lack of infrastructure facility, lack of integration of IT devices/services in curriculum, lack of trained faculty/manpower and lack of periodic revision in curricula and content are found to be the most important barrier among the students in all the three universities.

Figure 11
Barriers of Optimum Utilization of Computer Technology for Learning



B1 : Lack of Accessibility
B2 : Lack of infrastructural facility
B3 : Lack of computer literacy/ know how
B4 : Lack of integration of IT devices / services in the curriculum
B5 : Lack of trained faculty/ man power
B6 : Lack of periodic review of curricula and content

Barriers of Utilization of Computer Technology for Research

Barriers for utilization of computer technology for the purpose of effective research among the research scholars of the major universities are presented in Table 33 and Figure 12.

Table 33

Barriers of Utilization of Computer Technology for Research

Barrier	KU	MGU	CU	Chi-square	p-value
Accessibility	32 (45.71)	23 (41.82)	52 (57.78)	4.16023	0.124933
Lack of adequate departmental and organizational infrastructure	47 (67.14)	35 (63.64)	64 (71.11)	.903004	0.636675
Lack of educational resources in digital format	46 (65.71)	32 (58.18)	63 (70.00)	2.11316	0.347656
Lack of trained faculty/man power	51 (72.86)	37 (67.27)	66 (73.33)	.694188	0.706742
Lack of Organizational Policy and strategy	44 (62.86)	29 (52.73)	62 (68.89)	3.81665	0.148346

The figures in brackets show the respective percentages

Table 33 shows that 45.71 per cent of the research scholars in Kerala University, 41.82 per cent in MG University and 57.78 per cent in Calicut University are having the problem of lack of accessibility for the optimum utilization of existing IT devices/service in research. The p-value (0.124933) shows that there is no significant association between the level of barrier and university in this regard.

Lack of adequate departmental and organizational infrastructure is a major barrier for 67.14 per cent of the research scholars in Kerala University, 63.64 per cent in MG University and 71.11per cent in Calicut University. The p-value (0.636675) shows that there is no significant association between the level of barrier and university in this regard.

Lack of educational resources in digital format is a major barrier in the use of IT devices/services for 65.71 per cent of the research scholars in Kerala University, 58.18 per cent of the research scholars in Mahatma Gandhi

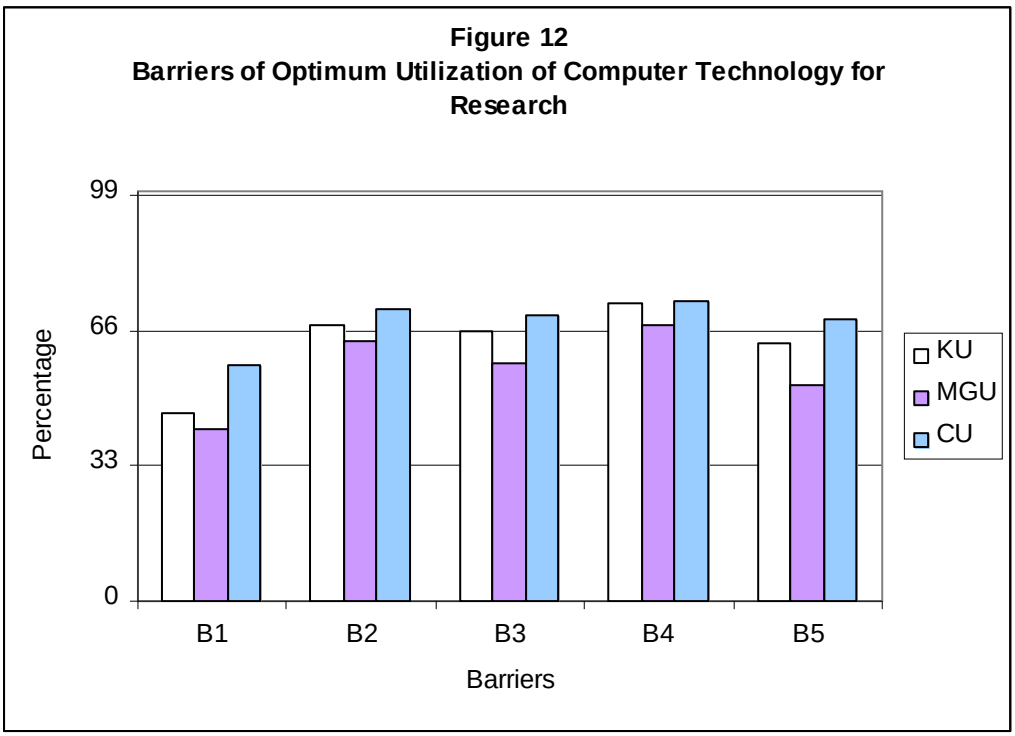
University and 70.00 per cent in Calicut University. The p-value (0.347656) indicates no significant association between the level of barrier and university in this case.

Lack of trained faculty/ human resources is the major barrier for the research scholars of Kerala University (72.86per cent), Mahatma Gandhi University (67.27 per cent) and Calicut University (73.33 per cent). The p-value (0.706742) shows no significant association between the level of barrier and university in this regard.

Lack of organizational information technology policy and strategy is a barrier for maximum utilization IT devices/services for 62.86 per cent of the research scholars of Kerala University, 52.73 per cent of the research scholars in MG University and 68.89 per cent of the research scholars in Calicut University. The p-value (0.148346) indicates no significant association between the level of this barrier and university.

Lack of adequate departmental and organizational infrastructure, lack of educational resources in digital format, lack of trained faculty/ human resources and lack of organizational policy and strategy are the major barriers for the utilization of the computer technology for research.

Figure 12
Barriers of Optimum Utilization of Computer Technology for Research



B1 : Accessibility
B2 : Lack of adequate departmental and organizational infrastructure
B3 : Lack of educational resources in digital format
B4 : Lack of trained faculty/man power
B5 : Lack of Organizational Policy and strategy

Barriers of Optimum Utilization of Communication Technology

Communication and Information Technologies are increasingly being explored as a means of improving teaching in the University faculty. Communication and Information technologies will provide increased opportunities in acquiring and disseminating information because of the availability of Internet-based technologies which can help to reduce the communication barriers over large distance and time.

Barriers of Utilization of Communication Technology for Teaching

Barriers of utilization of communication technology for the purpose of effective teaching among the teachers of the major universities are presented in Table 34 and Figure 13.

Table 34

Barriers of Optimum Utilization of Communication Technology for Teaching

Barriers	KU	MGU	CU	Chi-square	P value
Accessibility	59 (65.56)	41 (58.57)	51 (60.00)	.958934	0.619118
Lack of / experience /training	55 (61.11)	34 (48.57)	48 (56.47)	2.52788	0.282553
Information overload	59 (65.56)	41 (58.57)	60 (70.59)	2.45047	0.293702
Lack of infrastructure	63 (70.00)	48 (68.57)	62 (72.94)	.378922	0.827406
Lack of high quality digital/ syllabus based content	62 (68.89)	47 (67.14)	63 (74.12)	1.01038	0.603395

The figures in brackets show the respective percentages

It can be seen from Table 34 that 65.56 per cent of the teachers in Kerala University, 58.57per cent in MG University and 60.00 per cent in Calicut University are having the problem of accessibility for the maximum utilization of existing communication technology in the teaching. The p-value (0.619118) shows that there is no significant association between the level of barrier and university in this regard.

Data presented in the Table 34 indicates that lack of experience /training in the use of communication technology is one of the barriers among the teachers of Kerala University (61.11 per cent), MG University (48.57per cent) and Calicut University (56.47 per cent) for maximum utilization of existing technology in teaching. The p-value (0.282553) shows no significant association between the level of barrier and university in this case.

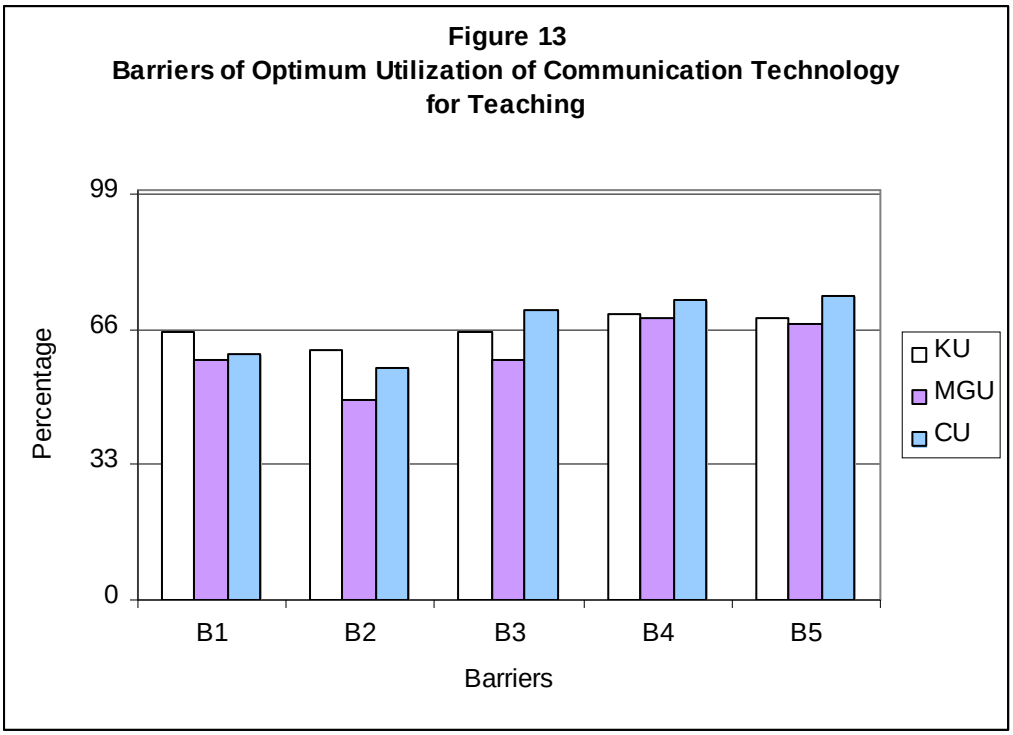
Information overload is a major barrier for 65.56 per cent of the teachers in Kerala University, 58.57 per cent of the teachers in Mahatma Gandhi University and 70.59 per cent of the teachers in Calicut University. The p-value (0.293702) indicates that there is no significant association between the level of this barrier and university.

Lack of infrastructure facility is a major barrier for 70.00 per cent of the teachers in Kerala University, 68.57 per cent in MG University and 72.94 per cent in Calicut University. The p-value (0.827406) shows that there is no significant association between the level of this barrier and university.

Lack of high quality digital / syllabus based content is an important barrier to 68.89 per cent of the teachers in Kerala University, 67.14 per cent of teachers in Mahatma Gandhi University and 74.12 per cent of the teachers in Calicut University. The p-value (0.603395) shows no significant association between the level of this barrier and university.

The Table reveals that accessibility, information overload, lack of infrastructure and lack of high quality digital /syllabus based contents are the important barriers among the teachers in all the three universities for optimum utilization of communication technologies.

Figure 13
Barriers of Optimum Utilization of Communication Technology for Teaching



B1 : Accessibility
B2 : Lack of / experience /training
B3 : Information overload
B4 : Lack of infrastructure
B5 : Lack of high quality digital/ syllabus based content

Barriers of Utilization of Communication Technology for Learning

Barriers of the utilization of communication technology for the purpose of effective learning among the students of the major universities are presented in Table 35 and Figure 14.

Table 35

Barriers of Optimum Utilization of Communication Technology for Learning

Barrier	KU	MGU	CU	Chi-square	p-value
Limited access to the Internet	109 (57.37)	95 (54.29)	133 (66.50)	6.40198	0.040735
Lack of infrastructural facilities	142 (74.74)	131 (74.86)	139 (69.50)	1.83482	0.399563
Lack of know how/ skill/ experience/ training	82 (43.16)	74 (42.29)	98 (49.00)	2.07428	0.354479
Information over load	121 (63.68)	133 (76.00)	147 (73.50)	8.20317	0.016555
Non availability of full text	136 (71.58)	145 (82.86)	151 (75.50)	6.59641	0.036962
Non availability of syllabus based resources	129 (67.89)	127 (72.57)	129 (64.50)	2.80896	0.245510
Unauthentic information	146 (76.84)	146 (83.43)	151 (75.50)	3.87957	0.143752

The figures in brackets show the respective percentages

Table 35 reveals that 57.37 per cent of the students in Kerala University, 54.29 per cent in MG University and 66.50 per cent in Calicut University are having the problem of limited access to internet for the maximum utilization of existing communication technology in the learning. The p-value (0.040735) shows that there is significant association between the level of barrier and university in this regard. The level of this barrier is the highest in Calicut University.

Lack of infrastructure facility is another major barrier for 74.74 per cent of the students in Kerala University, 74.86 per cent in MG University and 69.50 per cent in Calicut University. The p-value (0.399563) shows that there is no significant association between the level of this barrier and university.

Lack of know how / skill/ experience /training in the use of communication technology is one of the barriers among the students of Kerala University (43.16 per cent), MG University (42.29per cent) and Calicut University (49.00 per cent) for maximum utilization of existing technology in learning. The p-value (0.354479) shows no significant association between the

level of barrier and university in this case.

Information overload is a major barrier for 63.68 per cent of the students in Kerala University, 76.00 per cent of the students in Mahatma Gandhi University and 73.50 per cent of the students in Calicut University. The p-value (0.016555) indicates that there is significant association between the level of this barrier and university. The level of this barrier is highest in Mahatma Gandhi University.

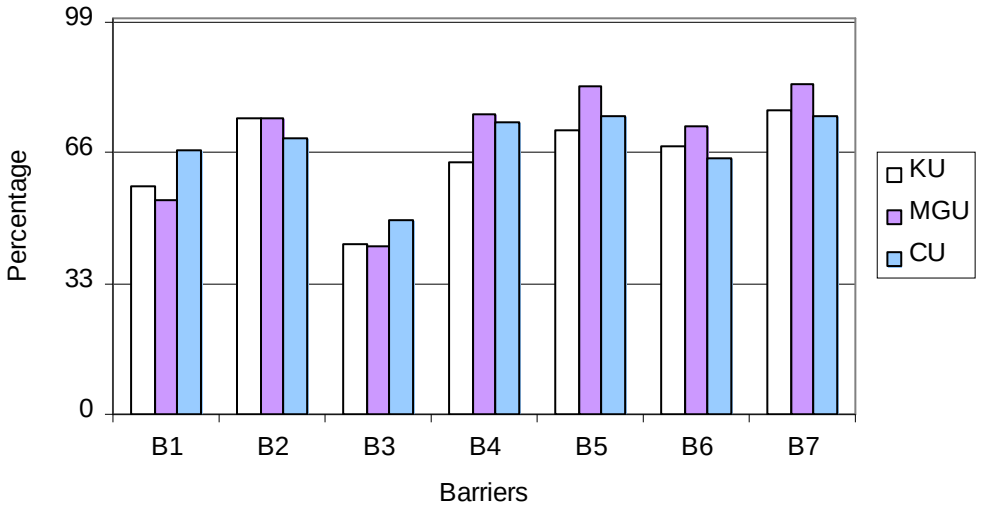
Non availability of full text is an important barrier to 71.58 per cent of the students in Kerala University, 82.86 per cent of the students in Mahatma Gandhi University and 75.50 per cent of the students in Calicut University. The p-value (0.036962) indicates that there is significant association between the level of this barrier and university at 5 per cent level of significance. The highest level of barrier in this case is in Mahatma Gandhi University.

Non availability of syllabus based resources is an important barrier to 67.89 per cent of the students in Kerala University, 72.57 per cent of the students in Mahatma Gandhi University and 64.50 per cent of the students in Calicut University. The p-value (0.245510) shows no significant association between the level of this barrier and university.

Unauthentic information is a major barrier to 76.84 per cent of the students in Kerala University, 83.43 per cent of the students in Mahatma Gandhi University and 75.50 per cent of the students in Calicut University. The p-value (0.143752) indicates no significant association between the level of this barrier and university.

Limited access to the Internet, lack of infrastructure facilities, information over load, non availability of full text, non availability of syllabus based resources and unauthentic information are the important barriers for the students in utilizing the communication technology for learning in all the three universities.

Figure 14
Barriers of Optimum Utilization of Communication Technology for Learning



B1 : Limited access to the Internet
B2 : Lack of infrastructural facilities
B3 : Lack of know how/ skill/ experience/ training
B4 : Information over load
B5 : Non availability of full text
B6 : Non availability of syllabus based resources
B7 : Unauthentic information

Barriers of Utilization of Communication Technology for Research

Barriers of the utilization of communication technology for the purpose of effective research among the research scholars of the major universities are presented in Table 36 and Figure 15.

Table 36

Barriers of Optimum Utilization of Communication Technology for Research

Barrier	KU	MGU	CU	Chi-square	p-value
Limited/restricted access to the Internet	38 (54.29)	31 (56.36)	54 (60.00)	.546795	0.760792
Lack of infrastructure facilities	53 (75.71)	28 (50.91)	46 (51.11)	11.8939	0.002617
Lack of know how/ experience/training	32 (45.71)	26 (47.27)	49 (54.44)	1.38441	0.500478
Information over load	47 (67.14)	32 (58.18)	64 71.11)	2.58066	0.275194
Non availability of full text	49 (70.00)	35 (63.64)	53 (58.89)	1.59282	0.450953
Non availability of research based resources.	48 (68.57)	39 (70.91)	69 (76.67)	1.39686	0.497373
Unauthentic information	55 (78.57)	39 (70.91)	71 (78.89)	1.41216	0.493583

The figures in brackets show the respective percentages

Table 36 reveals that 54.29 per cent of the research scholars in Kerala University, 56.36 per cent in MG University and 60.00per cent in Calicut University are having the problem of limited/restricted access to internet for the optimum utilization of existing communication technology in the research. The p-value (0.760792) shows that there is no significant association between the level of barrier and university in this regard.

Lack of infrastructure facility is another major barrier for 75.71 per cent of the research scholars in Kerala University, 50.91 per cent in MG University and 51.11 per cent in Calicut University. The p-value (0.002617) shows that there is significant association between the level of this barrier and university. The highest level of barrier in this regard is in Kerala University.

Lack of know how / experience /training in the use of communication technology is one of the barriers among the research scholars of Kerala University (45.71 per cent), MG University (47.27 per cent) and Calicut University (54.44 per cent) for maximum utilization of existing technology in research. The p-value (0.500478) shows no significant association between the level of barrier and university in this case.

Information overload is a major barrier for 67.14 per cent of the research scholars in Kerala University, 58.18 per cent of the research scholars in Mahatma Gandhi University and 71.11 per cent of the research scholars in Calicut University. The p-value (0.275194) indicates that there is no significant association between the level of this barrier and university.

Non-availability of full text is an important barrier to 70.00 per cent of the research scholars in Kerala University, 63.64per cent of the research scholars in Mahatma Gandhi University and 58.89 per cent of the research scholars in Calicut University. The p-value (0.450953) indicates that there is no significant association between the level of this barrier and university.

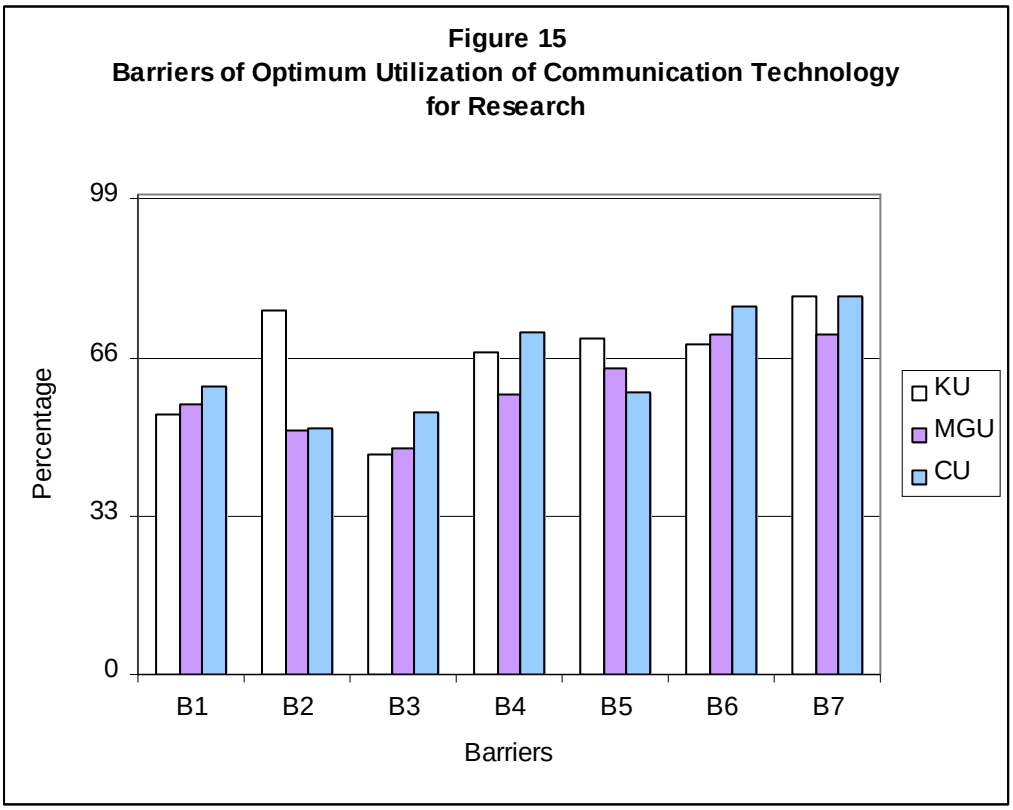
Non-availability of research based resources is an important barrier to 68.57 per cent of the research scholars in Kerala University, 70.91 per cent of the research scholars in Mahatma Gandhi University and 76.67per cent of the research scholars in Calicut University. The p-value (0.497373) shows no significant association between the level of this barrier and university.

Unauthentic information is a major barrier to 78.57 per cent of the research scholars in Kerala University, 70.91 per cent of the research scholars in Mahatma Gandhi University and 78.89per cent of the research scholars in Calicut University. The p-value (0.493583) indicates no significant association between the level of this barrier and university.

Limited /restricted access to the Internet, lack of infrastructure facilities, information over load, non availability of full text, non availability of research based resources and unauthentic information are the important barriers for

research scholars in utilizing the communication technology for research.

Figure 15
Barriers of Optimum Utilization of Communication Technology for Research



B1 : Limited/restricted access to the Internet
B2 : Lack of infrastructure facilities
B3 : Lack of know how/ experience/training
B4 : Information over load
B5 : Non availability of full text
B6 : Non availability of research based resources.
B7 : Unauthentic information

Barriers of Utilization of IT Peripherals

Information technology peripherals are creating new ways for improving teaching, learning and research in the Universities and are providing increased opportunities in acquiring and disseminating information.

Barriers of Utilization of Information Technology Peripherals for Teaching

Barriers of the utilization of information technology peripherals for the purpose of effective teaching among the teachers of the major universities are presented in Table 37 and Figure 16.

Table 37

Barriers of Optimum Utilization of IT Peripherals for Teaching

Barriers	KU	MGU	CU	Chi-square	P value
Lost novelty of one way communication	41 (45.56)	31 (44.29)	50 (58.82)	4.26845	0.118353
Lack of up-gradation and maintenance of the peripherals	67 (74.44)	49 (70.00)	69 (81.18)	2.68039	0.261810
Shortage of trained IT staff	70 (77.78)	51 (72.86)	64 (75.29)	.518838	0.771501
Rapid development in the technology	51 (56.67)	38 (54.29)	53 (62.35)	1.12281	0.570413

The figures in brackets show the respective percentages

Table 37 shows that lost novelty of one way communication devices such as television, radio, OHP etc., is a major barrier for the utilization of IT peripherals for teaching according to 45.56 per cent of the teachers in Kerala University, 44.29 per cent of the teachers in Mahatma Gandhi University and 58.82 per cent of the teachers in Calicut University. The p-value (0.118353) indicates no significant association between the level of this barrier and university.

Lack of up-gradation and maintenance of the peripherals is an important barrier to 74.44 per cent of teachers in Kerala University, 70.00 per cent of the teachers in Mahatma Gandhi University and 81.18 per cent of the teachers in Calicut University. The p-value (0.261810) shows that there is no significant association between the level of this barrier and university.

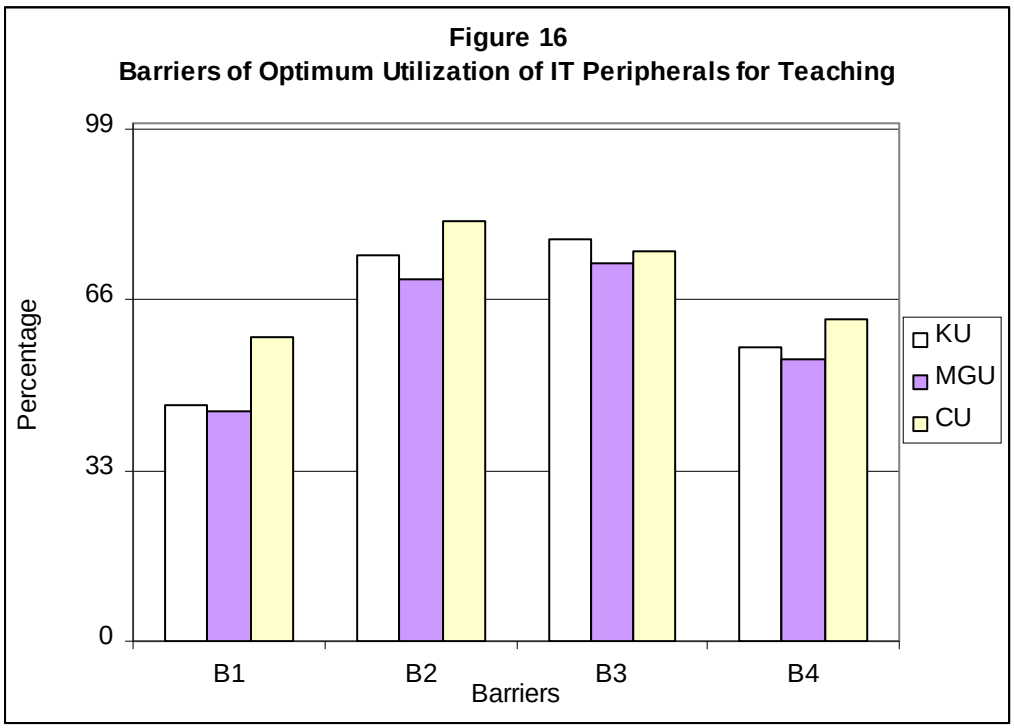
Shortage of trained IT staff is regarded as an important barrier by 77.78 per cent of the teachers in Kerala University, 72.86 per cent of the teachers in Mahatma Gandhi University and 75.29 per cent of the teachers in Calicut

University. The p-value (0.771501) shows that there is no significant association between the level of this barrier and university.

Rapid development in the technology is found to be a major barrier among 56.67 per cent of the teachers in Kerala University, 54.29 per cent of the teachers in Mahatma Gandhi University and 62.35 per cent of the teachers in Calicut University. The p-value (0.570413) indicates no significant association between the level of this barrier and university.

Lack of up-gradation and maintenance of the peripherals, shortage of trained IT staff and rapid development in the technology are the important barriers for utilizing the IT peripherals for teaching in all the three universities.

Figure 16
Barriers of Optimum Utilization of IT Peripherals for Teaching



B1 : Lost novelty of one way communication
B2 : Lack of up-gradation and maintenance of the peripherals
B3 : Shortage of trained IT staff
B4 : Rapid development in the technology

Barriers of Utilization of Information Technology Peripherals for Learning

Barriers of the utilization of information technology peripherals for the purpose of effective learning among the students of the major universities are presented in Table 38 and Figure 17.

Table 38

Barriers of Optimum Utilization of IT Peripherals for Learning

Barrier	KU	MGU	CU	Chi-square	p-value
Lost novelty of one way communication	112 (58.95)	94 (53.71)	140 (70.00)	11.0619	0.003966
Lack of up-gradation and maintenance of the peripherals	133 (70.00)	131 (74.86)	153 (76.50)	2.27442	0.320725
Shortage of trained IT staff	148 (77.89)	122 (69.71)	169 (84.50)	11.7819	0.002767
Rapid development in the technology	168 (88.42)	155 (88.57)	181 90.50)	.542446	0.762448

The figures in brackets show the respective percentages

Table 38 shows that lost novelty of one way communication devices is a major barrier for the utilization of IT peripherals for learning according to 58.95 per cent of the students in Kerala University, 53.71 per cent of the students in Mahatma Gandhi University and 70.00 per cent of the students in Calicut University. The p-value (0.003966) indicates significant association between the level of this barrier and university. The highest level of this barrier is felt by students of Calicut University.

Lack of up-gradation and maintenance of the peripherals is an important barrier to 70.00 per cent of students in Kerala University, 74.86 per cent of the students in Mahatma Gandhi University and 76.50 per cent of the students in Calicut University. The p-value (0.320725) shows that there is no significant association between the level of this barrier and university.

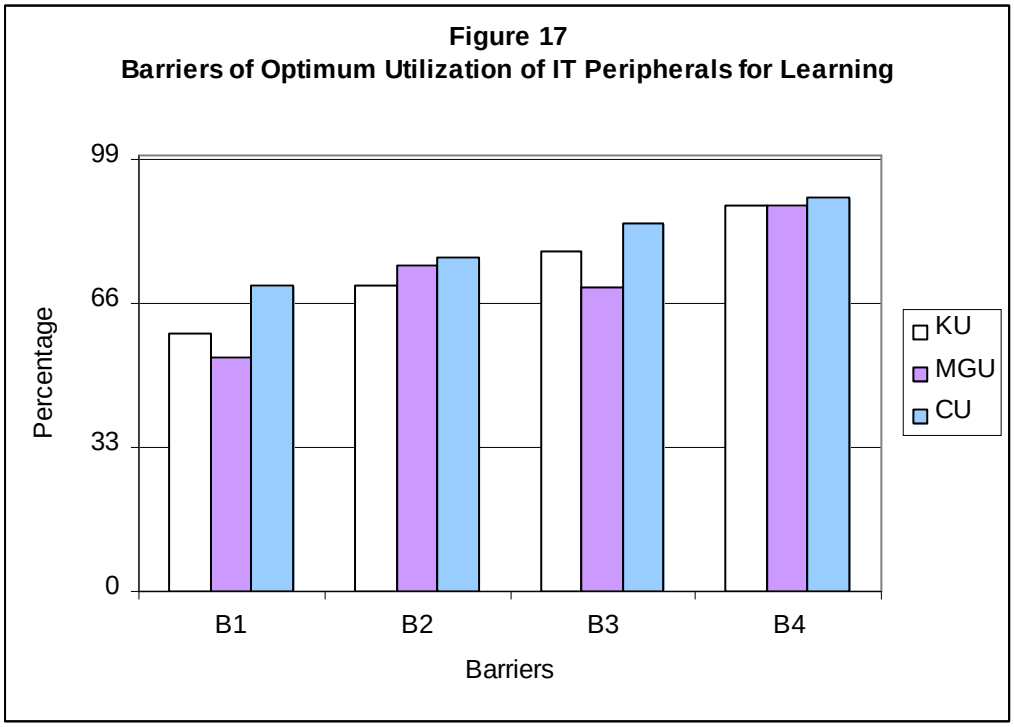
Shortage of trained IT staff is regarded as an important barrier by 77.89 per cent of the students in Kerala University, 69.71 per cent of the students in Mahatma Gandhi University and 84.50 per cent of the students in Calicut University. The p-value (0.002767) shows that there is significant association between the level of this barrier and university. The highest level of this barrier is found in Calicut University.

Rapid development in the technology is found to be a major barrier among 88.42 per cent of the students in Kerala University, 88.57 per cent of the

students in Mahatma Gandhi University and 90.50 per cent of the students in Calicut University. The p-value (0.762448) indicates no significant association between the level of this barrier and university.

Lost novelty of one way communication, lack of up-gradation and maintenance of the peripherals, shortage of trained IT staff and rapid development in the technology are the important barriers for utilizing the IT peripherals for learning.

Figure 17
Barriers of Optimum Utilization of IT Peripherals for Learning



B1 : Lost novelty of one way communication
B2 : Lack of up-gradation and maintenance of the peripherals
B3 : Shortage of trained IT staff
B4 : Rapid development in the technology

Barriers of Utilization of Information Technology Peripherals for Research

Barriers of the utilization of information technology peripherals for the purpose of effective research among the research scholars of the major universities are presented in Table 39 and Figure 18.

Table 39

Barriers of Optimum Utilization of IT Peripherals for Research

Barrier	KU	MGU	CU	Chi-square	p-value

Lost novelty of one way communication	34 (48.57)	25 (45.45)	49 (54.44)	1.21817	0.543853
Lack of up-gradation and maintenance of the peripherals	40 (57.14)	29 (52.73)	62 (68.89)	4.37112	0.112431
Shortage of trained IT staff	38 (54.29)	23 (41.82)	60 (66.67)	8.73406	0.012696
Rapid development in the technology	58 (82.86)	41 (74.55)	62 (68.89)	4.08921	0.129448

The figures in brackets show the respective percentages

Table 39 shows that lost novelty of one way communication devices is a major barrier for the utilization of IT peripherals for research according to 48.57 per cent of the research scholars in Kerala University, 45.45 per cent of the research scholars in Mahatma Gandhi University and 54.44 per cent of the research scholars in Calicut University. The p-value (0.543853) indicates no significant association between the level of this barrier and university.

Lack of up-gradation and maintenance of the peripherals is an important barrier to 57.14 per cent of research scholars in Kerala University, 52.73 per cent of the research scholars in Mahatma Gandhi University and 68.89 per cent of the research scholars in Calicut University. The p-value (0.112431) shows that there is no significant association between the level of this barrier and university.

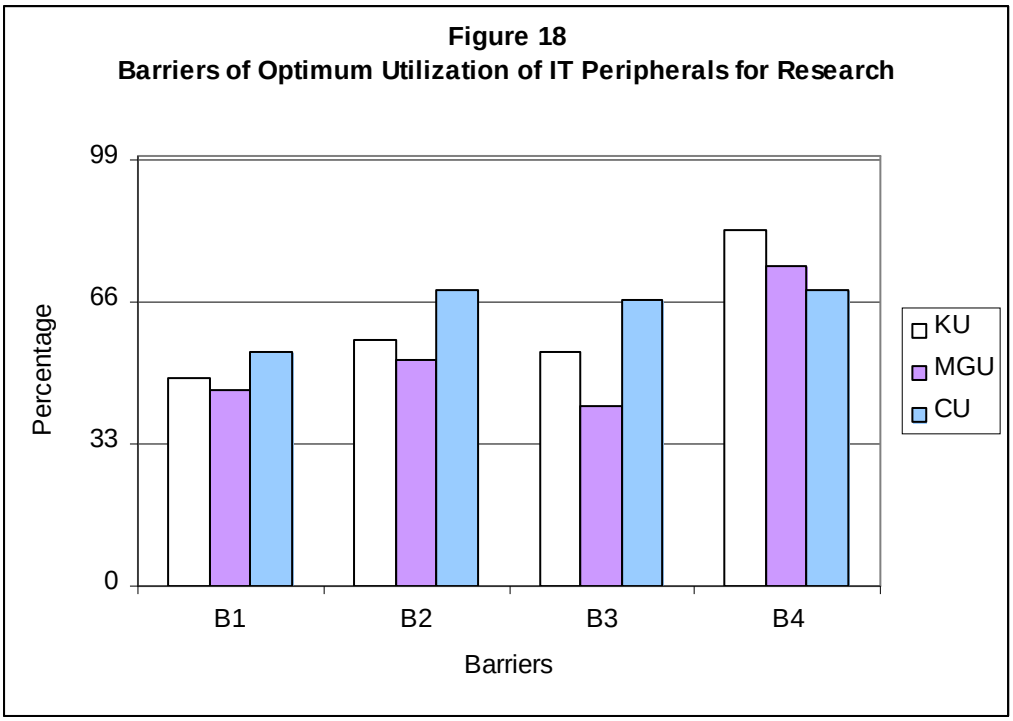
Shortage of trained IT staff is regarded as an important barrier by 54.29 per cent of the research scholars in Kerala University, 41.82 per cent of the research scholars in Mahatma Gandhi University and 66.67 per cent of the research scholars in Calicut University. The p-value (0.012696) shows that there is significant association between the level of this barrier and university at 5 per cent level. The highest level of this barrier is found in Calicut University.

Rapid development in the technology is found to be a major barrier among 82.86 per cent of the research scholars in Kerala University, 74.55 per cent of the research scholars in Mahatma Gandhi University and 68.89 per cent of the research scholars in Calicut University. The p-value (0.129448) indicates no significant association between the level of this barrier and university.

Lack of up-gradation and maintenance of the peripherals and rapid development in the technology are the important barriers for utilizing the IT

peripherals for research. Lost novelty of one way communication is another important barrier in Calicut University in the optimum utilization of IT peripherals. The barrier of shortage of trained IT staff is also high in Kerala and Calicut universities.

Figure 18
Barriers of Optimum Utilization of IT Peripherals for Research



B1 : Lost novelty of one way communication
B2 : Lack of up-gradation and maintenance of the peripherals
B3 : Shortage of trained IT staff
B4 : Rapid development in the technology

Barriers of Utilization of Library Services

Universities are beginning to integrate the traditional library and its services with computer and communication technology. This integration can be seen in new organizational structures as well as in the design and construction of new services which provide new ways of accessing and retrieving information resources.

The study examines the important barriers affecting the utilization of library services extended by the University libraries to teachers, student and research scholars in the context of the application of Information technology devices/services.

Barriers of Utilization of Library Services for Teaching

Barriers of the utilization of library services for the purpose of effective teaching among the teachers of the major universities are presented in Table 40 and Figure 19.

Table 40

Barriers of Optimum Utilization of Library Services for Teaching

Barriers	KU	MGU	CU	Chi-square	P value
Lack of infrastructural facilities	47 (52.22)	34 (48.57)	58 (68.24)	7.22702	0.026968
Dearth of accessibility / user education	44 (48.89)	33 (47.14)	62 (72.94)	13.9758	0.000924
Lack of relevant digital resources	51 (56.67)	40 (57.14)	67 (78.82)	11.6811	0.002910
Lack of marketing IT enabled library products/ services	60 (66.67)	39 (55.71)	64 (75.29)	6.61015	0.036709

The figures in brackets show the respective percentages

The data presented in Table 40 reveals that 52.22 per cent of the teachers from Kerala University, 48.57 per cent in Mahatma Gandhi University and 68.24 per cent of the teachers from Calicut University have the problem of lack of infrastructure facilities for utilizing the library services effectively. The p-value (0.026968) shows significant association between the level of this barrier and university. The result indicates that this problem is predominantly reported among the teachers of Calicut University.

Dearth of accessibility /user education is the major barrier for accessing the library products/services among the teachers of Kerala University (48.49 per cent), Mahatma Gandhi University (47.14 per cent) and Calicut University (72.94 per cent). The p-value (0.000924) shows significant association between the level of this barrier and university. The highest level of this barrier is found

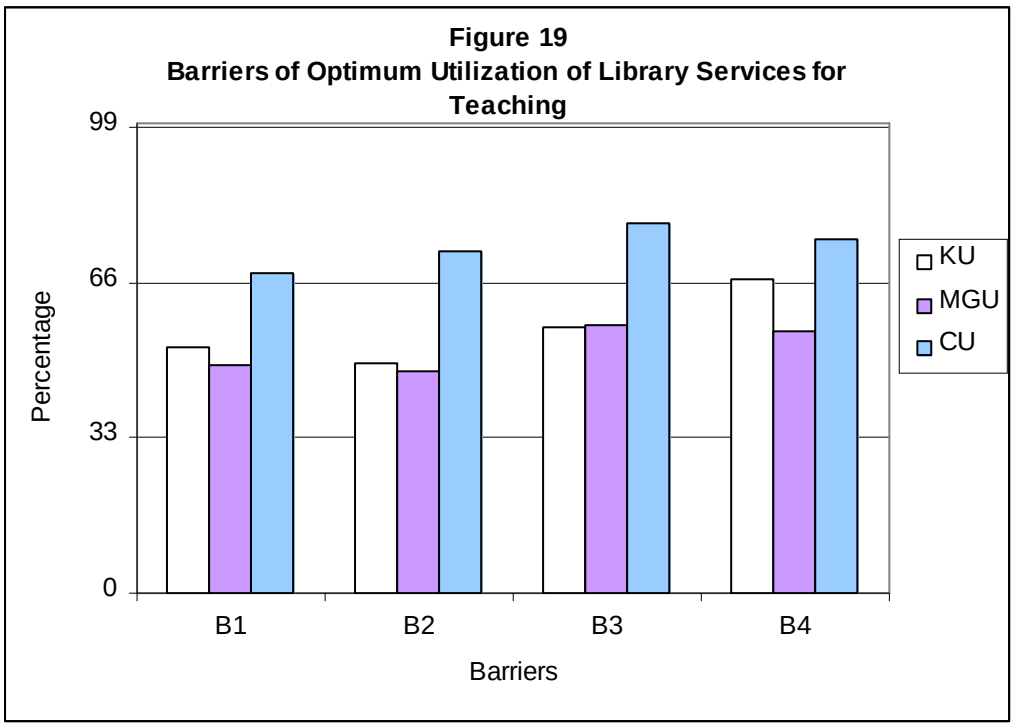
among the teachers of Calicut University.

It is also seen from the Table that lack of relevant digital resources is a major barrier for maximum utilization of library services among the teachers of Kerala University (56.67 per cent), MG University (57.14 per cent) and Calicut University (78.22 per cent). The p-value (0.002910) shows that there is significant association between the level of this barrier and university. The highest level of this barrier is found in Calicut University.

Lack of marketing IT enabled products/services is one of the major barriers for utilizing the library service among the teachers of Kerala University (66.67 per cent), MG University (55.71 per cent) and Calicut University (75.29 per cent). The p-value (0.036709) shows significant association between the level of this barrier and university at 5 per cent level. The highest level of this barrier is found in Calicut University.

Lack of relevant digital resources and lack of marketing IT enabled library products/services are some of the major barriers in all the three universities for the effective utilization of the library services for teaching. Lack of infrastructure facilities is another important barrier in Kerala and Calicut universities. Dearth of accessibility/ user education also is an important barrier in Calicut University. The barriers are higher in Calicut University.

Figure 19
Barriers of Optimum Utilization of Library Services for Teaching



B1 : Lack of infrastructural facilities
B2 : Dearth of accessibility / user education
B3 : Lack of relevant digital resources
B4 : Lack of marketing IT enabled library products/services

Barriers of Utilization of Library Services for Learning

Barriers of the utilization of library services for the purpose of effective learning among the students of the major universities are presented in Table 41 and Figure 20.

Table 41

Barriers of Optimum Utilization of Library Services for Learning

Barrier	KU	MGU	CU	Chi-square	p-value
Lack of infrastructural facilities	142 (74.74)	125 (71.43)	167 (83.50)	8.33003	0.015538
Dearth of accessibility / user education	150 (78.95)	121 (69.14)	175 (87.50)	17.8733	0.000132
Lack of relevant digital resources	135 (71.05)	105 (60.00)	160 (80.00)	18.2787	0.000108
Lack of marketing IT enabled library products/services	162 (85.26)	120 (68.57)	164 (82.00)	11.7063	0.002874

The figures in brackets show the respective percentages

Table 41 reveals that 74.74 per cent of the students from Kerala University, 71.43 per cent in Mahatma Gandhi University and 83.50 per cent of the students from Calicut University have the problem of lack of infrastructure facilities for utilizing the library services effectively. The p-value (0.015538) shows significant association between the level of this barrier and university. The result indicates that highest problem is reported among the students of Calicut University.

Dearth of accessibility /user education is the major barrier for accessing the library products/services among the students of Kerala University (78.95 per cent), Mahatma Gandhi University (69.14 per cent) and Calicut University (87.50 per cent). The p-value (0.000132) shows significant association between the level of this barrier and university. The highest level of this barrier is found among the students of Calicut University.

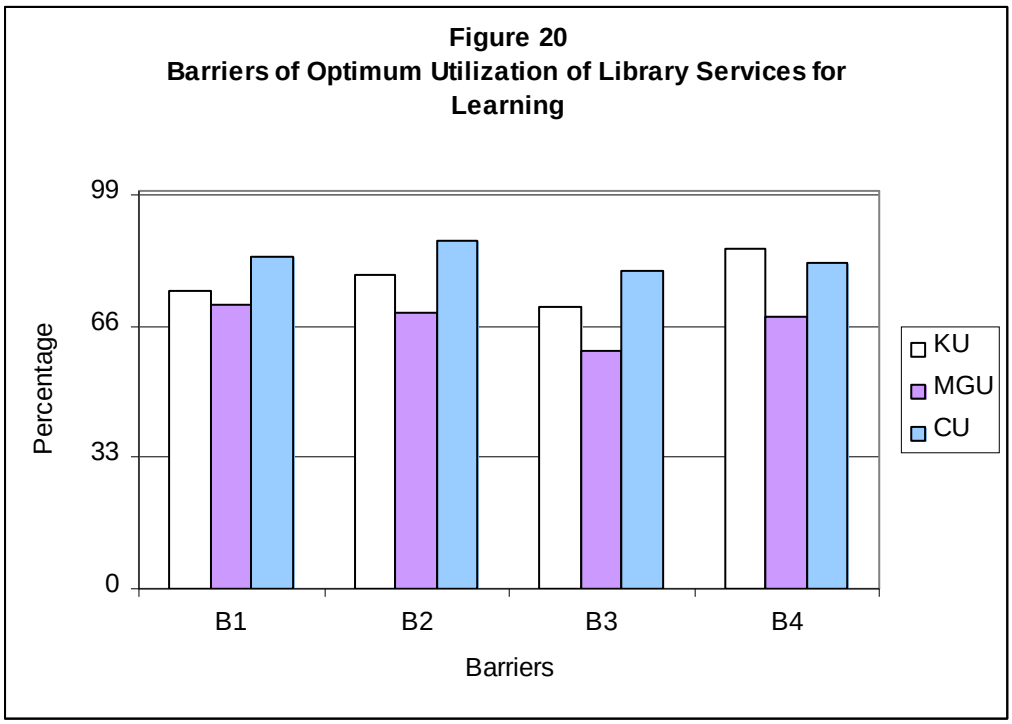
It is also seen from the Table that lack of relevant digital resources is a major barrier for maximum utilization of library services among the students of Kerala University (71.05 per cent), MG University (60.00 per cent) and Calicut University (80.00 per cent). The p-value (0.000108) shows that there is significant association between the level of this barrier and university. The highest level of this barrier is found in Calicut University.

Lack of marketing IT enabled products/services is one of the major barriers for utilizing the library service among the students of Kerala

University (85.26 per cent), MG University (68.57 per cent) and Calicut University (82.00 per cent). The p-value (0.002874) shows significant association between the level of this barrier and university. The highest level of this barrier is found in Kerala University.

Lack of infrastructural facilities, dearth of accessibility / user education, lack of relevant digital resources and lack of marketing IT enabled library products/services are the major barriers in all the three universities for the effective utilization of the library services for learning.

Figure 20
Barriers of Optimum Utilization of Library Services for Learning



B1 : Lack of infrastructural facilities
B2 : Dearth of accessibility / user education
B3 : Lack of relevant digital resources
B4 : Lack of marketing IT enabled library products/services

Barriers of Utilization of Library Services for Research

Barriers of the utilization of library services for the purpose of effective research among the research scholars of the major universities are presented in Table 42 and Figure 21.

Table 42

Barriers of Utilization of Library Services for Research

Barrier	KU	MGU	CU	Chi-square	p-value
Lack of infrastructural facilities	39 (55.71)	36 (65.45)	46 (51.11)	2.86781	0.238392
Dearth of accessibility / user education	38 (54.29)	28 (50.91)	60 (66.67)	4.29214	0.116960
Lack of relevant digital resources	45 (64.29)	35 (63.64)	67 (74.44)	2.64559	0.266404
Lack of marketing IT enabled library products/services	46 (65.71)	27 (49.09)	55 (61.11)	3.69259	0.157838

The figures in brackets show the respective percentages

Table 42 reveals that 55.71 per cent of the research scholars in Kerala University, 65.45 per cent in Mahatma Gandhi University and 51.11per cent in Calicut University have the problem of lack of infrastructure facilities for utilizing the library services effectively. The p-value (0.238392) shows no significant association between the level of this barrier and university.

Dearth of accessibility /user education is the major barrier for accessing the library products/services among the research scholars of Kerala University (54.29 per cent), Mahatma Gandhi University (50.91 per cent) and Calicut University (66.67 per cent). The p-value (0.116960) shows no significant association between the level of this barrier and university.

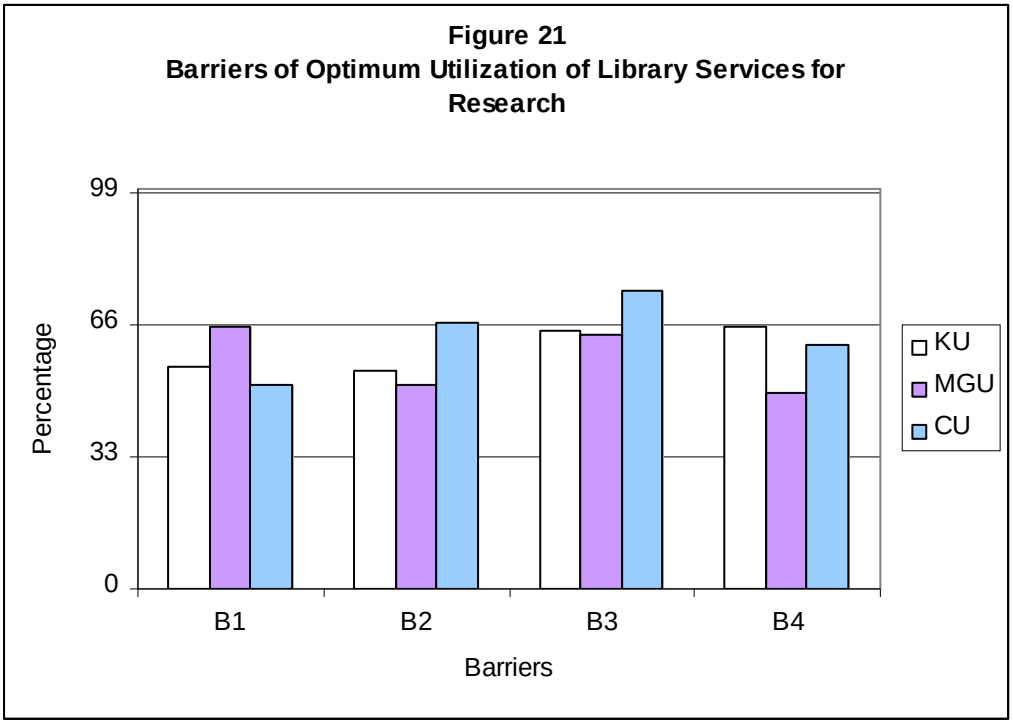
The Table also reveals that lack of relevant digital resources is a major barrier for maximum utilization of library services among the research scholars of Kerala University (64.29 per cent), MG University (63.64 per cent) and Calicut University (74.44 per cent). The p-value (0.266404) shows that there is no significant association between the level of this barrier and university.

Lack of marketing IT enabled products/services is one of the major barriers for utilizing the library service among the research scholars of Kerala University (65.71 per cent), MG University (49.09 per cent) and Calicut University (61.11 per cent). The p-value (0.157838) shows no significant association between the level of this barrier and university.

Lack of infrastructural facilities, dearth of accessibility / user education

and lack of relevant digital resources are the major barriers in all the three universities in general for the effective utilization of the library services for research.

Figure 21
Barriers of Optimum Utilization of Library Services for Research



B1 : Lack of infrastructural facilities
B2 : Dearth of accessibility / user education
B3 : Lack of relevant digital resources
B4 : Lack of marketing IT enabled library products/services

The data analysed in this chapter reveals the important information regarding the introduction, application and utilization of IT devices/services for teaching, learning and research. Conclusions are drawn from the analysed data and suggestions are given on the basis of the results obtained from analysis.

* * *

FINDINGS, CONCLUSION AND SUGGESTIONS

This chapter presents the methodology in retrospect, major findings, conclusion, tenability of hypotheses, suggestion and suggestions for further research.

METHODOLOGY IN RETROSPECT

The Problem of the Study

The present study is stated as **"A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDUCATIONAL CONTEXT IN KERALA"**

VARIABLES

The study variables used in the present study are:

1. Availability

2. Application

3. Utilization

4. Satisfaction

5. Barriers

The following are the classificatory variables

1. University (Kerala University, Mahatma Gandhi University and Calicut University)
2. Category of academic community (teachers, students and research scholars).

OBJECTIVES

The following are the important objectives of the study.

1. To understand the availability of Information Technology devices/ services for teaching, learning and research in the universities in Kerala.
2. To examine the existing level of application of various Information Technology devices/services for teaching, learning and research process in the higher educational context in Kerala.
3. To examine the level of utilization of Information Technology devices/ services for teaching, learning and research.
4. To know the levels of barriers in utilizing the existing Information Technology devices/services efficiently and effectively among the teachers, students and research scholars of the universities in Kerala.
5. To examine whether there exists significant difference among the universities in Kerala in the availability, application and utilization of Information Technology devices/ services in teaching, learning and research.

HYPOTHESES

The hypotheses of the study are:

1. There is high level of availability of Information Technology devices/services for teaching, learning and research in the universities in Kerala as a result of the introduction of Information Technology.
2. The level of application of various Information Technology devices/service for teaching, learning and research process in the higher educational context in Kerala is high.
3. There is high level of utilization of Information Technology devices/services for teaching, learning and research.
4. The level of barriers of the utilization of existing Information Technology devices/ services efficiently and effectively among the

teachers, students and research scholars of the universities in Kerala is high.

5. Significant difference exists among the universities in Kerala in the application and utilization of Information Technology devices/services in teaching, learning and research.

TOOLS

1. Questionnaire on Introduction, Application and Utilization of Information Technology for Teaching
2. Questionnaire on Introduction, Application and Utilization of Information Technology for Learning
3. Questionnaire on Introduction, Application and Utilization of Information Technology for Research

SAMPLE

For the present study the investigator decided to limit the size of sample to a total of 1025 respondents from three Universities (Kerala University 350, Mahatma Gandhi University 300 and Calicut University 375).

STATISTICAL TECHNIQUES

1. Percentage Analysis
2. Chi-square test
3. Arithmetic Mean
4. Analysis of Variance

MAJOR FINDINGS

The important findings of the study are the following:

1. The availability of computer, network, Internet, printer, scanner, photocopier, OHP and CD/DVD Writer is high in all the three universities. The availability of Internet is the highest in Calicut University. The availability of network, photocopier, LCD projector and CD/DVD writer is significantly high in Mahatma Gandhi University. The availability Video conferencing facility also is comparatively high in Mahatma Gandhi University.

2. The majority of students get computer, network facility, Internet, printer facility and photocopier facility for learning in all three universities taken for the study. The availability of OHP and CD/DVD writer also is high in Kerala and Mahatma Gandhi Universities. The availability of Edusat and EMMRC is high in Calicut University. The level of the availability of network, Internet, videoconferencing facility, photocopier facility, LCD projector, OHP and CD/DVD writer is comparatively high in Mahatma Gandhi University. The level of availability of printer facility is the highest in Calicut University.

3. The majority of the research scholars in all the three universities taken for the study get computer, network facility, Internet facility, printer facility, scanner, photocopier, OHP and CD/DVD writer for research purpose. The availability of network facility and videoconferencing facility is comparatively higher in Mahatma Gandhi University. The availability of LCD projector and OHP is higher in Kerala University.

4. The level of application of the IT devices/services such as computer, windows operating system, Internet, printer, scanner, photocopier and CD/DVD writer is high in all the three universities for teaching. Comparatively higher level of application of Internet, videoconferencing facility, photocopier, LCD projector and CD/DVD writer is found in Mahatma Gandhi University.

5. The level of application of the IT devices/services such as computer, windows operating system, Internet and photocopier are high in all the three universities for learning. Comparatively higher level of application of Internet, videoconferencing facility, printer, LCD projector and CD/DVD writer is found in Mahatma Gandhi University.

6. The majority of the teachers and students in all the three universities are of the opinion that IT devices/services are not integrated in the curriculum.

7. The level of application of the IT devices/services such as computer, windows operating system, Internet, photocopier, LCD Projector and CD/DVD writer is high in all the three universities for research. The availability of printer is high in Kerala and MG Universities. Comparatively higher level of application of Linux, Internet, videoconferencing facility, printer, LCD projector and CD/DVD writer is found in Mahatma Gandhi University.

8. The level of use of computer among the teachers is high for data collection and report generation/word processing and personal and home use in all the three universities. The level of utilisation of computer for preparation, demonstration and presentation is also high among teachers in Mahatma Gandhi University. The level of use is moderate to access digital information resources for teaching in all the three universities.

9. The level of use of computer among the students is not high in any of the university taken for the study.

10. University wise analysis shows moderate level of utilisation of computers to access high quality data banks, knowledge creation and dissemination and for using research management tool. High level of utilisation of computers is seen in all the universities only in the case

of interpretation of collected data and electronic presentation. The level of utilisation of computer for research in designing multimedia presentation is high in Kerala and Mahatma Gandhi University.

11. The mean scores indicate that high level of use among the teachers in all the three universities is found only in the case of e-mail. Higher level of Internet use is found among the teachers of Kerala University and Mahatma Gandhi University. The use of communication technology is high for higher studies and scholarships among the teachers of Mahatma Gandhi University.

12. The level of Internet browsing and e-mail communication is higher for learning in all the three universities taken for the study. High level of use of communication technology for higher studies and job seeking is found in Kerala University and Mahatma Gandhi University.

13. The utilization of communication technology for research is high in the case of Internet browsing and e-mail communication in all the three universities. The level of use of communication technology for research is high in Kerala and MG Universities in the case of database search as well. For higher studies and fellowship the communication technology is highly used in Mahatma Gandhi and Calicut Universities.

14. Among the teachers in all the three universities, the use of IT peripheral as an out put source and photocopying service is high. High level of use of multimedia presentation tool is also seen in Mahatma Gandhi University. The use of traditional presentation tools and tools to use microforms are low.

15. The level of use of IT peripherals except the photocopying facility in Kerala and Mahatma Gandhi Universities is not high among the students in the universities in Kerala.

16. In all the three universities, the level of utilization of photocopying facility is high among the research scholars. The use of out put source and multimedia presentation tool is also high in Kerala University and Mahatma Gandhi University.

17. The high level of use among the teachers in all the three universities is found only in the case of e-journals/ e-contents. The use of OPAC is high in Kerala University and Mahatma Gandhi University.

18. The high level of use among the students is found only in the case of OPAC in Kerala University and Mahatma Gandhi University.

19. A high level of use among the research scholars in all the three universities is found in the case of OPAC. It can also be seen that there is high level of utilisation among the research scholars in Kerala University and Mahatma Gandhi University in the case of e-journal/e-contents.

20. The level of satisfaction with existing IT devices / services is among the teachers in all the three universities and students and research scholars in Kerala and Mahatma Gandhi Universities.

21. Students and research scholars in Kerala and Calicut Universities are not able to meet the requirements with the existing IT devices/services. However, the majority of the teachers have the opinion that they are able to meet their requirements with the existing IT device/services. The majority students and research scholars in Mahatma Gandhi University also have the opinion that they are able to meet their requirements with existing IT devices/services

22. The level of application of IT device/services is not optimum in the teaching, learning and research processes.

23. The Lack of adequate departmental infrastructure, funding for Information Technology, shortage of trained IT human resources, lack

of integration of IT in the curriculum /course and lack of organization's IT policy, strategy and vision are the important barriers in all the three universities in making optimum use of computer technology for teaching.

24. Lack of accessibility, lack of infrastructure facility, lack of integration of IT devices/services in curriculum, lack of trained faculty/manpower and lack of periodic revision in curricula and content are found to be the most important barriers among the students in all the three universities.

25. Lack of adequate departmental and organizational infrastructure, lack of educational resources in digital format, lack of trained faculty/man power and lack of organizational policy and strategy are the major barriers for the utilization of the computer technology for research.

26. The accessibility, information overload, lack of infrastructure and lack of high quality digital /syllabus based contents are the important barriers among the teachers in all the three universities for optimum utilization of communication technologies.

27. Limited access to the Internet, lack of infrastructure facilities, information over load, non-availability of full text, non-availability of syllabus based resources and unauthentic information are the important barriers for the students in utilizing the communication technology for learning in all the three universities.

28. Limited /restricted access to the Internet, lack of infrastructure facilities, information over load, non availability of full text, non availability of research based resources and unauthentic information are the important barriers for research scholars in utilizing the communication technology for research.

29. Lack of up gradation and maintenance of the peripherals, shortage of trained IT staff and rapid development in the technology are the important barriers for utilizing the IT peripherals for teaching in all the three universities.

30. Lost novelty of one way communication, lack of up gradation and maintenance of the peripherals, shortage of trained IT staff and rapid development in the technology are the important barriers for utilizing the IT peripherals for learning.

31. Lack of up gradation and maintenance of the peripherals and rapid development in the technology are the important barriers for utilizing the IT peripherals for research. Lost novelty of one way communication is another important barrier in Calicut University in the optimum utilisation of IT peripherals. The barrier of shortage of trained IT staff is also high in Kerala and Calicut Universities.

32. Lack of relevant digital resources and lack of marketing IT enabled library products/services are the major barriers in all the three universities for the effective utilization of the library services for teaching. Lack of infrastructure facility is another important barrier facility is another important barrier in Kerala and Calicut Universities. Dearth of accessibility and user education is also an important barrier in Calicut University. The barriers are higher in Calicut University.

33. Lack of infrastructure facilities, dearth of accessibility / user education, lack of relevant digital resources and lack of marketing IT enabled library products/services are the major barriers in all the three universities for the effective utilization of the library services for learning.

34. Lack of infrastructure facilities, dearth of accessibility / user education and lack of relevant digital resources are the major barriers in all the

three universities in general for the effective utilization of the library services for research.

CONCLUSION

It is clear from the analysis that the availability of IT devices/ services taken for the study is at high level in teaching, learning and research in the universities.

The application of IT devices/ services is high in the case of more than half of the items taken for the study in all the three universities in teaching. But in the case of learning the application of only less than half of the IT devices/ services is high in all the three universities taken for the study. In total the application of IT device/services for research also is high.

The mean scores of the utilization of computer in the universities in Kerala disclose that the level of utilisation is not high in more than half of the cases taken for the study in teaching except Mahatma Gandhi University. In learning and research the level of utilization is moderate in more than half of the cases taken for the study. The level of utilisation of communication technology is either low or moderate among teachers in more than half of the cases taken for the study in Kerala and Calicut Universities. However, this is high in more than half of the cases taken for the study in Mahatma Gandhi University. The level of utilization of communication technology is high among the students in more than half of the cases taken for the study in Kerala and Mahatma Gandhi Universities. However, the utilization of communication technology for learning is not high in more than half of the cases taken for the study in Calicut University. It is high in more than half of the cases in Kerala University, Mahatma Gandhi University and Calicut University in research. The level of utilisation of IT peripherals for teaching and learning is either low or moderate in more than half of the cases taken for the study in all the three universities except Mahatma Gandhi University in teaching. At the same time the level of utilisation of IT peripherals for research is high in more than half of the cases taken for the study in Kerala and Mahatma Gandhi Universities. The level of utilisation of digital library service is high for teaching in half of the

cases taken for the study in Kerala and Mahatma Gandhi Universities. In the case of learning the level of utilisation of digital library service is either low or moderate in more than half of the cases taken for the study. The utilisation of digital library services is either moderate or high in the case of research in Kerala and Mahatma Gandhi Universities.

The Lack of adequate departmental infrastructure, funding for Information Technology, shortage of trained IT human resources, lack of integration of IT in the curriculum / course and lack of organization's IT policy, strategy and vision are the important barriers in all the three universities in making optimum use of computer technology for teaching.

Lack of accessibility, lack of infrastructure facility, lack of integration of IT devices/services in curriculum, lack of trained faculty/manpower and lack of periodic curricula and content are the most important barrier among the students in all the three universities.

Lack of adequate departmental and organizational infrastructure, lack of educational resources in digital format, lack of trained faculty/man power and lack of organizational policy and strategy are the major barriers in the optimum utilization of the computer technology for research.

The accessibility, information overload, lack of infrastructure and lack of high quality digital /syllabus based contents are the important barriers among the teachers in all the three universities for optimum utilization of communication technologies.

Limited access to the Internet, lack of infrastructure facilities, information over load, non-availability of full text, non-availability of syllabus based resources and unauthentic information are the important barriers for students in utilizing the communication technology for learning.

Limited /restricted access to the Internet, lack of infrastructure facilities, information over load, non availability of full text, non availability of research

based resources and unauthentic information are the important barriers for research scholars in utilizing the communication technology for research.

Lack of up-gradation and maintenance of the peripherals and rapid development in the technology are the important barriers for utilizing the IT peripherals common for teaching, learning and research.

The most important barrier for the optimum utilisation of library services for teaching, learning and research in common is the lack of relevant digital resources. Students face more number of barriers as compared to teachers and research scholars in the optimum utilisation of library services.

The level of application and utilisation of IT devices/ services in teaching, learning and research vary greatly according to university except for the utilization of IT peripherals for teaching.

TENABILITY OF HYPOTHESES

The tenability of the hypotheses of the study is tested on the basis of the result obtained from the statistical analysis of the collected data.

The first hypothesis states that 'There is high level of availability of Information Technology devices/services for teaching, learning and research in the universities in Kerala as a result of the introduction of Information Technology'. Findings numbers 1, 2 and 3 reveal that there is high level of availability of IT devices/ services for teaching, learning and research.

Hence the hypothesis is fully substantiated.

The second hypothesis states that 'The level of application of various IT devices/service for teaching, learning and research process in the higher educational context in Kerala is high'.

Findings number 4 shows high level of application of the majority of the IT devices/ services taken for the study in teaching. However, finding number 5 shows high level of application of IT devices/ services only in the

case of less than half of the cases taken for the study in learning. Finding number 7 shows that there is high level of application of IT devices/services in research in more than half of the cases taken for the study in Kerala and Mahatma Gandhi Universities. In Calicut University high level of application of IT devices/services is found in half of the cases.

Hence the hypothesis is partially substantiated.

The third hypothesis states that 'There is high level of utilization of Information Technology devices/service for teaching, learning and research'.

Finding numbers 8 to 19 do not show high level of utilisation of IT devices/ services in teaching learning and research in the majority of the cases in all the three universities taken for the study.

Hence the hypothesis is not substantiated.

The fourth hypothesis states that 'The level of barriers of the utilisation of existing Information Technology devices/ services efficiently and effectively among the teachers, students and research scholars of the Universities in Kerala is high'.

Finding numbers 23 to 30 and 33 to 34 reveal that the levels of the majority of the barriers taken for the study are high. Finding numbers 31 and 32 show that the levels of barriers of half of the cases taken for the study in all the three universities are high.

Hence, the hypothesis is almost fully substantiated.

The fifth hypothesis states that 'Significant difference exists among the universities in Kerala in the application and utilization of IT devices/services in teaching learning and research'.

Table numbers 12, 13 and 15 to 27 show significant difference among the universities in the application and utilisation of IT devices/ services as confirmed by the p-value against each item in the tables.

Hence the hypothesis is almost fully substantiated.

IMPLICATIONS AND SUGGESTIONS

The availability of the IT devices/ services is high in teaching, learning and research in all the three universities taken for the study. This may be because the universities in Kerala are spending huge amount for buying the IT devices/services.

The application of IT devices/ services is high in the universities in Kerala in teaching and research. But in the case of learning the application of the IT devices/ services is low/ moderate. This reveals that even though the university departments have invested heavily on IT devices/ services, these are not properly applied in learning. The non-integration of IT devices/ services may be a reason for low level of application of IT devices/ services for learning.

The findings of the study do not show high level of utilisation of IT devices/ services in teaching learning and research in all the universities in the majority of the cases.

A high level of utilisation of computer for teaching is seen in the case of report generation and personal and home use in general. In the case of research high level of utilisation of computer in all the universities is seen only in the case of interpretation of data and electronic presentation.

Among the communication technologies e-mail communication only is used highly by teachers, research scholars and students in all the universities. This technology is highly used for Internet browsing among the teachers in Kerala and Mahatma Gandhi Universities. Students and researchers in all the universities use Internet technology highly. The high level of utilisation of IT peripherals is limited to taking computer outputs and photocopying in the case of teaching and photocopying in research in all the universities.

The utilisation of digital library service is limited to e-journal/ e-content access in the case of teachers in all the universities and also OPAC in Kerala and Mahatma Gandhi Universities. OPAC is the only highly used digital library service used by the students although limited to Kerala and MG Universities. In the case of research scholars OPAC is the highly used services. In Kerala and MG Universities the use of e-journals/e-contents is high. All these reveal that the utilisation of existing IT devices/ services is not up to the optimum level in the universities in Kerala for teaching, learning and research.

The lack of adequate departmental infrastructure, funding for Information technology, shortage of trained IT human resources, lack of integration of IT in the curriculum/ course and lack of organization's IT policy, strategy and vision are the important barriers in all the three universities in making optimum use of computer technology for teaching.

Lack of accessibility, lack of infrastructure facility, lack of integration of IT devices/services in curriculum, lack of trained faculty/ human resource and lack of periodic curricula revision and contents are the most important barrier among the students in all the three universities.

This calls for the attention of the authorities to provide proper departmental infrastructure, funding, trained man power and integration of IT in curriculum. The curriculum is to be re-structured and a proper re-engineering of the present and future man power is the need of the hour.

Lack of adequate departmental and organizational infrastructure, lack of educational resources in digital format, lack of trained faculty/man power and lack of organizational policy and strategy are the major barriers for the optimum utilization of the computer technology for research. Proper organisational policy is the very foundation of the application of modern technology especially in higher education institutions like university.

The accessibility, information overload, lack of infrastructure and lack of high quality digital /syllabus based contents are the important barriers

among the teachers in all the three universities for optimum utilization of communication technologies.

Limited or restricted access is one of the major barriers in utilising the communication technology for teaching, learning and research in the universities in Kerala. In the era of Right to Information and Information for all, all the restrictions on free access to digital information need to be removed.

Lack of up-gradation and maintenance of the peripherals and rapid development in the technology are the important barriers for utilizing the IT peripherals common for teaching, learning and research. This reveals that even though huge amounts are spent on acquiring IT devices/ services, their proper up-gradation in tune with the technological advancement and adequate maintenance of the existing peripherals are not seriously looked upon by the university administrators in Kerala.

Lack of relevant digital resources is the most important barrier for the optimum utilisation of library services for teaching, learning and research in common. In the era of technology and information society, the pattern of acquiring information has undergone drastic changes. For generating better output from the higher education system relevant digital information resources are to be made available to the academic community comprising of teachers, students and research scholars.

SUGGESTIONS FOR FURTHER RESEARCH

The end of one research may be the starting point of another research. The investigator feels that various studies can be conducted in the related areas of the present study. Some of the areas where future studies can be conducted are suggested here.

1. A study on the application of information technology related devices/ services in the higher education system in Kerala comprising of all the universities and colleges can be conducted.
2. The prospects of application of ICT on distance education can be conducted.
3. A study on the problems and prospects of utilising digital library facilities can be conducted.
4. A study on the possibility of application of ICT for the professional development of librarians can be conducted.
5. A similar study can be conducted on the professional education environment.

* * *

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Appendix -I

QUESTIONNAIRE ON INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY FOR TEACHING

Dear Sir/Madam,

This questionnaire is intended to collect data in connection with a research study on the topic **"A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDCUATIONAL CONTEXT IN KERALA"** for the requirement for the award of Ph.D in Library and Information Science. Kindly fill in the appropriate column by putting a tick mark [✓] against the relevant items and writing appropriate details. I seek your valuable co-operation in obtaining the necessary information. I assure that the data collected from you will be used only for academic purposes.

Thanking you,

Yours sincerely

Abdul Salam M.P.

Part I

Respondents identification

1. Name ……..
2. Category Professor ☐ Reader ☐ Lecturer ☐
3. Name of the University Kerala ☐ MG ☐ Calicut ☐
4. Faculty Science ☐ Non Science ☐
5. Gender Male ☐ Female ☐
6. Age ☐ years

Part II

Information regarding Availability of IT devices / services in your Department / University

1. Computer Available ☐ Not available ☐
2. Network Available ☐ Not available ☐
3. Internet Available ☐ Not available ☐
4. 4. Video conferencing Available ☐ Not available ☐

5. 5. Edusat	Available ☐	Not available ☐
6. 6. EMMRC	Available ☐	Not available ☐
7. Printer	Available ☐	Not available ☐
8. Scanner	Available ☐	Not available ☐
9. Photocopier	Available ☐	Not available ☐
10. LCD Projector	Available ☐	Not available ☐
11. OHP	Available ☐	Not available ☐
12. CD Writer	Available ☐	Not available ☐

Part III

Information regarding Application/use of IT devices / services in your Department/University

1. Computer	Using ☐	Not using ☐

If using

2. Operating system

Windows	Using ☐	Not using ☐
Linux	Using ☐	Not using ☐
3. Internet	Using ☐	Not using ☐
4. Video conferencing	Using ☐	Not using ☐
5. Edusat	Using ☐	Not using ☐
6. EMMRC	Using ☐	Not using ☐
7. Printer	Using ☐	Not using ☐
8. Scanner	Using ☐	Not using ☐
9. Photocopier	Using ☐	Not using ☐
10. LCD Projector	Using ☐	Not using ☐
11. OHP	Using ☐	Not using ☐
12. CD Writer	Using ☐	Not using ☐

Integration of IT devices/services in Curriculum

` Part of curriculum Not part of curriculum (Box)

Part IV

Level of Utilisation of Computer for Teaching

Purpose of use	Very high	High	Average	Poor	Very poor
For preparation, demonstration, presentation					
Instructional courseware for teaching: tutorials, drill and practice simulations and modeling,					
Data collection and report generation/word processing					
To access digital information resources for teaching					
Personal and home use					

Level of Utilization of Communication Technology for Teaching

Purpose	Very high	High	Average	Poor	Very poor
Internet browsing					
Email					
Videoconferencing					
Distant teaching / smart class room					
For higher studies and scholarship					

Level of Utilization of Information Technology Peripherals for Teaching

Purpose	Very high	High	Average	Poor	Very poor
As an out put source (Printing, copying, saving, writing on CD)					
Multimedia Presentation tool					
Photocopying					
To read microforms					
Traditional presentation tool					

Level of Utilization of Digital Library Services for Teaching

Purpose	Very high	High	Average	Poor	Very poor
Online Public Access Catalogue					
Electronic Data Sources Service					
E-Journals/ E-Contents					
Online SDI/CAS Services					

Part V

Satisfaction with existing IT devices/services in the Department/University

1. Are you satisfied with existing IT devices / services Yes ☐ No ☐

2. Are you able to meet the requirements with existing IT devices / services Yes ☐ No ☐

3. Are you satisfied with the application of existing IT devices / services in your area Yes ☐ No ☐

Part VI

Information regarding Barriers of Utilization of existing IT devices/service

Barriers of utilization of Computer Technology for Teaching

Barriers	**Yes**	**No**
Lack of adequate departmental infrastructure		
Funding for Information technology		
Shortage of trained IT man power		
Lack of IT training / experience in the use of computer		
Lack of integration IT in the curriculum / course		
Lack of organization's IT policy, strategy and vision		

Barriers of Utilization of Communication Technology for Teaching

Barriers	**Yes**	**No**
Accessibility		
Lack of experience /training		
Information overload		

Lack of infrastructure		
Lack of high quality digital/ syllabus based content		

Barriers of Utilization of Information Technology Peripherals for Teaching

Barriers	**Yes**	**No**
Lost novelty of one way communication		
Lack of upgradation and maintenance of the peripherals		
Shortage of trained IT staff		
Rapid developments in the technology		

Barriers of Utilization of Library Services for Teaching

Barriers	**Yes**	**No**
Lack of infrastructural facilities		
Dearth of accessibility / user education		
Lack of relevant digital resources		
Lack of marketing IT enabled library products/services		

Any suggestions regarding the optimum utilization of existing IT devices and services for teaching.

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Appendix II

QUESTIONNAIRE ON INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY FOR LEARNING

Dear Friend,

This questionnaire is intended to collect data in connection with a research study on the topic **" A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDCUATIONAL CONTEXT IN KERALA"** for the requirement for the award of Ph.D in Library and Information Science. Kindly fill in the appropriate column by putting a tick mark [✓] against the relevant items and writing appropriate details. I seek your valuable co-operation in obtaining the necessary information. I assure that the data collected from you will be used only for academic purposes.

Thanking you,

Yours sincerely

Abdul Salam M.P.

Part I

Respondents identification

1. Name ……..
2. Department Science ☐ Arts ☐ Commerce ☐
3. Name of the University Kerala ☐ MGU ☐ Calicut ☐
4. Gender Male ☐ Female ☐
5. Age ☐ years

Part II

Information regarding availability of IT devices / services in your Department/University

1. Computer Available ☐ Not available ☐
2. Network Available ☐ Not available ☐
3. Internet Available ☐ Not available ☐
4. Video conferencing Available ☐ Not available ☐
5. Edusat Available ☐ Not available ☐

6.	EMMRC	Available ☐	Not available ☐
7.	Printer	Available ☐	Not available ☐
8.	Scanner	Available ☐	Not available ☐
9.	Photocopier	Available ☐	Not available ☐
10.	LCD Projector	Available ☐	Not available ☐
11.	OHP	Available ☐	Not available ☐
12.	CD Writer	Available ☐	Not available ☐

Part III

Information regarding Application/use of IT devices / services in your Department/University

1.	Computer	Using ☐	Not using ☐
2.	If using:		
	Operating system		
	Windows	Using ☐	Not using ☐
	Linux	Using ☐	Not using ☐
3	Internet	Using ☐	Not using ☐
4	Video conferencing	Using ☐	Not using ☐
5	Edusat	Using ☐	Not using ☐
6	EMMRC	Using ☐	Not using ☐
7	Printer	Using ☐	Not using ☐
8	Scanner	Using ☐	Not using ☐
9	Photocopier	Using ☐	Not using ☐
10	LCD Projector	Using ☐	Not using ☐
11	OHP	Using ☐	Not using ☐
12	CD Writer	Using ☐	Not using ☐

Integration of IT devices/services in curriculum

Part of curriculum Not part of curriculum

Part IV

Level of Utilisation of Computer for Learning

Purpose of use	Very	High	Average	Poor	Very

	high				poor
Course work/learning tool (Drill and practice, tutorial activities, data retrieval)					
Word processing/report generation					
Multimedia presentation tool					
Part of curriculum					
Access to digital information resources					

Level of Utilization of Communication Technology for Learning

Purpose	Very high	High	Average	Poor	Very poor
Internet Browsing					
E mail communication					
Video conferencing/ interactive class room					
Social network					
For higher studies and seeking Job					

Level of Utilization of Information Technology Peripherals for Learning

Purpose	Very high	High	Average	Poor	Very poor
Xeroxing (Photocopying)					
Output source (Printer, CD Writer)					
Digital data source access (CDROMs)					
Presentation tool (LCD/OHP)					

Level of Utilization of Digital Library Services for Learning

Purpose	Very high	High	Average	Poor	Very poor
Online Public Access Catalogue					
E journal/E content					

Online SDI/CAS service					
Access to data base					

Part V

Satisfaction with existing IT devices/services in the faculty/university

1. Are you satisfied with existing IT devices / services Yes ☐ No ☐

2. Are you able to meet the requirements with existing IT devices / services Yes ☐ No ☐

3. Are you satisfied with the application of existing IT devices / services in your area Yes ☐ No ☐

Part V

Information Regarding Barriers of Utilization of existing IT devices/service

Barriers of utilization of Computer Technology for Learning

Barriers	**Yes**	**No**
Lack of Accessibility		
Lack of infrastructure facility		
Lack of computer literacy/know how		
Lack of integration of IT devices/services in the curriculum		
Lack of trained faculty/man power		
Lack of periodic review of curricula and content		

Barriers of Utilization of Communication Technology for Learning

Barriers	**Yes**	**No**
Limited access to the Internet		
Lack of infrastructure facilities		
Lack of know how/skill/experience/training		
Information over load		
Non availability of full text		
Non availability of syllabus based resources		

Unauthentic information		

Barriers of Utilization of Information Technology Peripherals for Learning

Barriers	**Yes**	**No**
Lost novelty of one way communication		
Lack of upgradation and maintenance of the peripherals		
Shortage of trained IT staff		
Rapid developments in the technology		

Barriers of Utilization of Library Services for Learning

Barriers	**Yes**	**No**
Lack of infrastructure facilities		
Dearth of accessibility / user education		
Lack of relevant digital resources		
Lack of marketing IT enabled library products/services		

Any suggestions regarding the optimum utilization of existing IT devices and services for learning .

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Appendix III
QUESTIONNAIRE ON INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY FOR RESEARCH

Dear Friend,

This questionnaire is intended to collect data in connection with a research study on the topic **" A STUDY OF THE INTRODUCTION, APPLICATION AND UTILIZATION OF INFORMATION TECHNOLOGY IN HIGHER EDCUATIONAL CONTEXT IN KERALA"** for the requirement for the award of Ph.D in Library and Information Science. Kindly fill in the appropriate column by putting a tick mark [✓] against the relevant items and writing appropriate details. I seek your valuable co-operation in obtaining the necessary information. I assure that the data collected from you will be used only for academic purposes.

Thanking you,

Yours sincerely

Abdul Salam M.P.

Part I

Identification of the respondent

1. Name ……..
2. Department Science ☐ Arts ☐ Commerce ☐
3. Name of the University Kerala ☐ MGU ☐ Calicut ☐
4. Gender Male ☐ Female ☐
5. Age ☐ years

Part II

Information regarding Availability of IT devices / services in your Department/University

1.	Computer	Available ☐	Not available ☐
2.	Network	Available ☐	Not available ☐
3.	Internet	Available ☐	Not available ☐
4.	Video conferencing	Available ☐	Not available ☐
5.	Edusat	Available ☐	Not available ☐
6.	EMMRC	Available ☐	Not available ☐
7.	Printer	Available ☐	Not available ☐
8.	Scanner	Available ☐	Not available ☐
9.	Photocopier	Available ☐	Not available ☐
10.	LCD Projector	Available ☐	Not available ☐

11. OHP Available ☐ Not available ☐

12. CD Writer Available ☐ Not available ☐

Part III

Information regarding Application/use of IT devices / services in your Department/University

1. Computer Using ☐ Not using ☐

If using

2. Operating system

Windows Using ☐ Not using ☐

Linux Using ☐ Not using ☐

3 Internet Using ☐ Not using ☐

4 Video conferencing Using ☐ Not using ☐

5 Edusat Using ☐ Not using ☐

6 EMMRC Using ☐ Not using ☐

7 Printer Using ☐ Not using ☐

8 Scanner Using ☐ Not using ☐

9 Photocopier Using ☐ Not using ☐

10 LCD Projector Using ☐ Not using ☐

11 OHP Using ☐ Not using ☐

12 CD Writer Using ☐ Not using ☐

Part IV

Level of Utilisation of Computer for Research

Purpose of use	Very high	High	Average	Poor	Very poor
To access high quality databanks as a source for data mining					
Knowledge creation: sharing of information (Electronic Publishing, writing books/articles)					
Interpretation of collected data and electronic presentation (word processing and spread sheet)					
For using research management tool					
Design and create multimedia presentation					

Level of Utilization of Communication Technology for Research

Purpose	Very high	High	Average	Poor	Very poor
To Browse INTERNET					
For E mail communication					

Data bank search					
Social networking					
Higher studies and fellowship					

Level of Utilization of Information Technology Peripherals for Research

Purpose	Very high	High	Average	Poor	Very poor
Photocopying					
Out put source (printer, CD Writer)					
Multimedia presentation tool					
Access to digital resource(CDRROMs)					

Level of utilization of digital library services for Research

Purpose	Very high	High	Average	Poor	Very poor
Online Public Access Catalogue (OPAC)					
E-Journals/contents					
Online SDI/CAS					
Data base search					

Part V

Satisfaction with existing IT devices/services in the Department/University

1. Are you satisfied with existing IT devices / services Yes ☐ No ☐
2. Are you able to meet the requirements with existing IT devices / services Yes ☐ No ☐
3. Are you satisfied with the application of existing IT devices / services in your area Yes ☐ No ☐

Part VI

Information regarding Barriers of Utilization of existing IT devices/service

Barriers of Utilization of Computer Technology for Research

Barriers	**Yes**	**No**
Accessibility		
Lack of adequate departmental and organizational infrastructure		
Lack of educational resources in digital format		
Lack of trained faculty/man power		
Lack of Organizational Policy and strategy		

Barriers of Utilization of Communication Technology for Research

Barriers	Yes	No
Limited/restricted access to the Internet		
Lack of infrastructure facilities		
Lack of know how/ experience/training		
Information over load		
Non-availability of full text		
Non-availability of research based resources.		
Unauthentic information		

Barriers of Utilization of Information Technology Peripherals for Research

Barriers	Yes	No
Lost novelty of one way communication		
Lack of upgradation and maintenance of the peripherals		
Shortage of trained IT staff		
Rapid developments in the technology		

Barriers of Utilization of Library Services for Research

Barriers	Yes	No
Lack of infrastructure facilities		
Dearth of accessibility / user education		
Lack of relevant digital resources		
Lack of marketing IT enabled library products/services		

Any suggestions regarding the optimum utilization of existing IT devices and services for research

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